APPENDIX 1.0

Notice of Preparation, Responses to the NOP, Scoping Meeting Information, and Public Workshops

Notice of Preparation of Draft Environmental Impact Report for the Santa Clarita Area Plan (One Valley, One Vision)

NOTICE OF PREPARATION

Lead Agency:		Consulting Firm:	
Agency Name	County of Los Angeles Regional Planning Department	*Name*	Impact Sciences
Street Address	320 W. Temple St., Room 1352	*Street Address*	803 Camarillo Street, Suite A
City/State/Zip	Los Angeles, California 90012	*City/State/Zip*	Camarillo, California 93012
Contact	Mr. Mitch Glaser	*Contact*	Ms. Judith Charles
Telephone	(213) 974-6476	*Telephone*	(805) 437-1900

SUBJECT: Notice of Preparation of Draft Environmental Impact Report for the Santa Clarita Valley Area Plan (One Valley, One Vision)

One Valley, One Vision (OVOV) is a joint effort between the County of Los Angeles (County), City of Santa Clarita (City), and Santa Clarita Valley (Valley) residents and businesses to create a single vision and guidelines for the future growth of the Valley and the preservation of natural resources. The result of this project will be an Area Plan document and Environmental Impact Report (EIR) for the buildout of the entire Santa Clarita Valley Planning Area (Planning Area). The Planning Area includes the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce, and the future Newhall Ranch, and the City and its four communities of Canyon Country, Newhall, Saugus, and Valencia (see attached July 10, 2008, Preliminary Land Use Map).

Realizing that development within both jurisdictions can have regional implications, the County and City have jointly endeavored to prepare planning policies and guidelines to guide future development within the Santa Clarita Valley. The result of this work effort will require the adoption of two separate documents. The County will adopt a new Area Plan to replace the Santa Clarita Valley Area Plan and prepare its own EIR, while the City will adopt a new General Plan and EIR.

We need to know the views of your agency as to the scope and content of the environmental information, which is germane to your agency's statutory responsibilities in connection with the proposed project. Your agency may need to use the County's OVOV Area Plan EIR prepared by our agency when preparing your permit or other approval for the project.

Planning Area

The Planning Area combines two geographical areas, the City corporate limits and the unincorporated area of the County within Santa Clarita Valley as described above. The Planning Area was defined mutually by the County and City and represents the area for which both jurisdictions have joint interest in planning. The Planning Area is located in southern California at the northernmost portion of Los Angeles County (North County). It is situated at the convergence of Los Angeles and Ventura counties, approximately 35 miles northwest of downtown Los Angeles.

Project Background

In 2000, the County and City kicked-off Phase I of the OVOV process by conducting a series of citizen and stakeholder workshops to solicit feedback from the community regarding their vision for the future of the Santa Clarita Valley. Phase II of the OVOV included development of a community-guided Vision Statement and Guiding Principles. The Vision Statement and 35 Guiding Principles developed during Phase II, served as tools to guide the development of the Area Plan goals and policies and the Area Plan Land Use Map.

Phase III of OVOV included the creation of a Technical Background Report (TBR) that has been used as a starting point to evaluate future buildout of the Planning Area by providing a snapshot of current population, jobs, housing, infrastructure, community services, health and safety, and environmental conditions within the Planning Area. Phase IV of OVOV will culminate in the preparation of the preferred land use plan for the Planning Area in coordination with areawide circulation planning. Phases V and VI will complete the preparation of the various state-mandated elements and the Program Environmental Impact Report.

Project Description

The County is preparing a comprehensive update to its Area Plan and an associated EIR for the proposed Planning Area. Development within the County and City shall be consistent with the OVOV's Vision and Guiding Principles, which are intended to sustain and enhance environmental resources, economic vitality, and the social well being of its residents. The following Area Plan elements are either available or will soon be available on the City's website www.santa-clarita.com/vgp:

- Draft Safety Element
- Draft Conservation and Open Space Element
- Draft Land Use Element
- Draft Circulation and Noise Elements (available 9/16/08)

Land Use Element and Map

The Land Use Element is generally considered to be the most representative of and essential to the Area Plan, because it guides and directs the physical development of the community. This element constitutes the required Land Use Element for the City's General Plan; in addition, it forms the land use component of the Area Plan adopted for the Santa Clarita Valley by the County. It designates the general location of eight land uses–residential, commercial, mixed use, industrial, public and institutional, transportation, communication, and utilities; open space and recreation, and non-urban / agriculture. The Land Use Element addresses the permitted density and intensity of the various land use designation as reflected on the General Land Use Map and it forms the land use component of the Area Plan adopted for the Santa Clarita Valley. The following is a brief description of the Land Use Map Designations.

- **Residential:** Residential uses include dwelling units developed at various densities and with varying housing types, including single-family detached, single-family attached (condominiums), multiple-family (apartments), mobilehome parks, and senior housing. Special residential uses include live-work units and group living facilities.

- **Commercial:** Commercial development includes both retail and offices providing goods and services to the general public, and wholesale and service uses provided to businesses. Commercial uses also include food services, personal services, automobile services, entertainment and hospitality services, and regional commercial uses such as big box retailers and auto malls.

- **Mixed Use:** The mixed use category generally includes commercial retail, office, and service uses intermingled with higher density residential uses, within a master-planned complex designed to ensure that residents are not adversely impacted by commercial traffic or operations, and that businesses benefit from the proximity of customers living nearby. The benefits of mixed-use development include a reduction in vehicle trips by residents to shopping areas, and the proximity of residents to employment-generating uses.

- **Industrial:** The industrial category includes heavy manufacturing, less intensive industrial uses that are typically located in business parks, and research and development complexes. Light industrial activities include warehousing, wholesale trade, and some assembly. Heavy industrial uses include fabrication and assembly of large items, resource extraction, processing of raw or recycled materials, and businesses that use or generate hazardous materials.

- **Public and Institutional:** Government buildings, libraries, schools, fire stations, museums, cultural and community centers, and other similar public uses are typical of this category. In addition, private schools, churches, convalescent care and other social care facilities, private meeting and convention facilities, and similar uses are included. Special uses in this category include correctional facilities.

- **Transportation, Communication, and Utilities:** This category includes freeways and major arterials, railroads, park and ride lots, truck terminals, airports, communication facilities, electric power and natural gas facilities, solid waste and liquid waste disposal, transfer facilities, reservoirs and pumping stations, treatment plants, and similar uses.

- **Open Space and Recreation:** This category includes the Angeles National Forest and land used for agriculture, private and public recreational facilities, and local and regional parks. Golf courses and water bodies are also included.

- **Non-Urban/Agriculture:** Non-urban lands are used for low-density residential uses on large lots, in areas characterized by rural development interspersed with natural open space. Agricultural lands are used for grazing, horticulture, row, field, and tree crops, and limited keeping of livestock, horses and other large animals.

- **Specific Plan:** The Specific Plan designation indicates those lands in the planning area governed by a Specific Plan. Allowable land uses and intensity of development are those permitted by the Specific Plan.

Circulation Element

The Circulation Element plans for the continued development of efficient, cost-effective and comprehensive transportation systems that are consistent with regional plans, local needs, and the Valley's community character. A comprehensive transportation network of streets and highways, multi-use trails, bus transit, commuter rail, and airport facilities provides mobility options to Valley residents and businesses. The Circulation Element contains a map showing major transportation facilities within the Santa Clarita Valley,

including streets and highways, rail and public transit routes, stations and terminals, and airport facilities.

Noise Element

The Noise Element contains maps and policies to ensure that residents are not exposed to health risks or nuisances due to noise generated from freeways and high-volume roadways, airports, industrial and recreational uses, special events, and other uses emitting loud sounds. Policies in the Noise Element address sound attenuation measures, such as setbacks, noise barriers, and buffering, to protect the public health, safety, and welfare,.

Open Space and Conservation Element

The Open Space and Conservation Element contains maps and policies to ensure preservation of an open space greenbelt around most portions of the Santa Clarita Valley, in addition to preserving water quality, historic and cultural resources, scenic views, and providing recreational facilities to enhance the quality of life for Valley residents. Significant Ecological Areas (SEAs) are ecologically important fragile land and water areas that are valuable as plant and animal communities and are often important to the preservation of threatened or endangered species. SEAs as designated by the County will be presented on a map included in the Open Space and Conservation Element.

Safety Element

The Safety Element contains maps and policies to ensure that residents are not exposed to health risks due to air pollution, earthquakes, wildland fires, or other environmental hazards, and that adequate provisions are made for crime prevention, law enforcement, and fire protection services.

Potential Environmental Effects

Potential environmental effects that will be addressed in the EIR include effects to the following:

• Aesthetics	• Land Use / Planning
• Agricultural Resources	• Mineral Resources
• Air Quality	• Noise
• Biological Resources	• Population / Housing
• Climate Change	• Public Services
• Geology / Soils	• Recreation
• Cultural Resources	• Transportation / Traffic
• Hazards / Hazardous Materials	• Utilities / Service Systems
• Hydrology / Water Quality	

Further refinement of the scope of technical issues to be addressed will be occurring through the planning process, including input received in response to this NOP.

Intended Uses of the EIR

The County will use the EIR to consider the environmental effects, mitigation measures, and alternatives, when reviewing the proposed Area Plan approval. The EIR will serve as the CEQA compliance document for adoption of the Area Plan. It will also serve as the programmatic environmental document that may be referenced in implementing future actions in the Area Plan. Subsequent project-level activities identified in the Area Plan will be examined in the light of the program EIR to determine whether an additional environmental document must be prepared prior to project approval and implementation.

Where to Respond with Comments

Due to the time limits mandated by State law, your response must be sent at the earliest possible date, but not later than 30 days after receipt of this notice. As such, the comment period for the Notice of Preparation begins on July 25, 2008, and ends on August 25, 2008. Please send your written responses to Mitch Glaser at 320 W. Temple

Street, Room 1354, Los Angeles, CA 90012. We would appreciate the name of a contact person in your agency.

Scoping Meeting

To help assist and promote local participation, a Scoping Meeting (see attached Scoping Meeting Notice) will be held to present the proposed project and to solicit suggestions from the public and responsible agencies on the content of the Draft EIR. This meeting will be held on August 4, 2008, 6:00 pm in the Council Chambers of Santa Clarita City Hall, 23920 Valencia Blvd., Santa Clarita, California 91355.

Project Title: One Valley, One Vision

Date:

_____

Title: Mitch Glaser, Supervising Regional Planner
Telephone: (213) 974-6476

Scoping Meeting Notes Summary of Verbal Comments and Flyer; dated August 12, 2008

IMPACT SCIENCES, INC.
803 Camarillo Springs Road, Suite A
Camarillo, California 93012
Telephone: (805) 437-1900 Fax: (805) 437-1901
www.impactsciences.com

Offices in Southern California, Bay Area, and Sacramento Valley

MEMORANDUM

TO: Jeff Hogan, Senior Planner **Job. No.** 0112.020

FROM: Susan Tebo, Associate Principal

DATE: August 12, 2008

SUBJECT: One Valley-One Vision Scoping Meeting Comments

On August 4, 2008, the City of Santa Clarita and County of Los Angeles conducted a scoping hearing to solicit comments regarding the proposed update to the City of Santa Clarita General Plan and unincorporated Los Angeles County Area Plan, commonly known as One Valley-One Vision (OV-OV). The scoping comment period ends on August 28, 2008. Listed below are the comments made at the scoping meeting:

- Keep equestrian trails open.
- Preserve special standards districts for Alderbrook, Placerita Canyon, Sand Canyon, Happy Valley planning areas.
- There must be consideration for bicycle and pedestrian transportation. Of concern is access to roads, bus, rail and nighttime security lighting (Happy Valley and Sand Canyon).
- There should be a reference to existing Community Service Districts and Special Standards Districts (include all districts).
- An overlay of wildlife corridors should be shown.
- There should be a section on greenhouse gases and climate change.
- Mineral Resources and mining resources should be discussed.
- Existing parks and trails need to be discussed.
- There should be floodway/floodplain and fire overlay maps prepared illustrating hazard areas.
- SEA's should be shown on an overlay.
- The Draft EIR will have a 120-day review period.
- A Development Monitoring System (DMS) needs to be adopted.
- Alternative energy sources should be encouraged (if not required)—such as wind and solar.
- Financial incentives to encourage solar energy should be pursued.
- The General Plan amendment process should be clearly defined and how the changes affect the different elements of the Plan.
- Input from adjacent communities should be solicited on the land use plan.
- There is a concern regarding "urban villages."
- There was a suggestion that workshops to inform the community of changes to the land use plan should be conducted.

- Impacts of urban center and transition of land uses should be discussed.
- Flood channels should not be lined in concrete. Placerita Creek should remain recreational .
- Concern was voiced regarding the destruction of ridgelines and oak trees. Specific language should be included to restrict destruction of ridgelines and to require oak relocations.
- There is a concern with the revision to the General Plan "opening up" the codes .
- There is a perception that the developer has flexibility and more development opportunity with the use of Specific Plans.
- There was a request to see a comparison of changes from old to new.
- A request was made to compare the County General Plan overlay to the City General Plan-where does the new General Plan begin and end with relationship to the County's new Area Plan.
- A concern was voiced regarding the overall changes proposed for the General Plan.
- Low-income residents should be targeted: teachers, government workers and police.
- Advancements in water planning should be explored including conservation.
- The Smiser Specific Plan was mentioned noting a concern that when it is rezoned—that it be rezoned with certainty. There was discussion that Specific Plans allow too much leeway. More restrictions need to be included in the Specific Plans-particularly in the Calgrove Corridor-Santa Clarita Valley Gateway).
- There was a concern with growth in the community.
- The City should implement a "feathering" method of developing a transitioning zone between new and existing developments. If there is not room for "feathering" then square footage should be limited.
- There is a concern with focusing low incomes in high density areas.
- All existing waterways should be shown in the General Plan.
- There is a concern that high density areas not be limited to low-income residents.
- With regard to the Circulation Element, when was the last time that the traffic model was updated? New traffic counts should be taken because commute patterns have shifted. Solid traffic assumption must be used in the traffic analysis. The freeway must be considered in the traffic analysis.
- The Circulation Element should show one-two alternative roads outside of the Valley.
- An income vs. cost of housing analysis needs to be prepared-fiscal analysis.
- Identify land use areas for mitigation banking.
- Energy efficiency and green building should be investigated.
- Cultural resources need to be addressed in terms of public facilities for art/cultural uses.
- Workforce housing and inclusionary zoning must be addressed.
- The hospital and public health facilities must be addressed.
- Impacts occur when urban villages are situated adjacent to existing neighborhoods. This concept must be monitored (land use and traffic) in order to keep safety and harmony in existing neighborhoods.
- A concern was voiced regarding placing future high density in rural areas.
- There needs to be a balance between urban and non-urban areas.
- Traffic and open space must be looked at integrally when considering the trail connection to open space areas.

- The City should consider using language found in the Santa Barbara and Pasadena General Plans with regard to the importance of public input and the role that the public has in this process
- The Circulation Element must address the I-5/405 bottleneck.
- There needs to be a "reality check" of roadways at buildout conditions. The EIR must consider that not all roadways will be built at the time of development buildout.
- How will people located in the unincorporated areas of the County be noticed? All property owners would be notified of new proposed zoning.
- Better out-reach for the General Plan is needed.
- Senior housing and an aging population is a critical issue which needs to be addressed.
- Low-income housing for seniors will be needed in the future.
- Water supply in the Calgrove corridor needs to be addressed. It was stated that water quality is poor in this area.
- The floodplain in the Calgrove area needs to be addressed.
- There is concern with the Lyons Canyon project located in unincorporated Los Angeles County and its impact at the I-5/Calgrove interchange. This project should be reviewed in combination with the proposed Smiser project.
- Local residents do not want to see the City develop as a "Century City." Restrictions and limitations on height should be required. No more than 4-5 stories.
- Development should be buffered around wildlife corridors and open space areas.
- There is a concern with the known contaminated areas in the City: NTS, Whitaker-Bermite, High Shear, Kaiser Century. The General Plan should designate these sites as Brownfield sites.
- Traffic mitigation for urban villages must be analyzed on new on/off-ramps to SR-14 and I-5.
- The General Plan should specifically address Agua Dulce. This discussion should include statements acknowledging that the area is dependent upon water wells. Consequently, the water supply must be protected. Furthermore, commercial projects proposed for this area must be studied closely—especially gas stations that could possibly impact the water source.
- The Agua Dulce area could use commercial use code enforcement attention.
- Placerita Canyon is already a village.
- North Newhall Specific Plan area has taken away 20% of this community.
- What are the alternatives of the General Plan? Would the existing General Plan be an Alternative?
- Urban Villages should include trails to existing neighborhoods.
- Golf carts should be allowed on trails.
- Examine the possibility of providing energy alternatives.
- What percentage of this effort is under the jurisdiction of the City and County?
- The City should become self-reliant for water and energy as much as possible.
- There is a concern with freeway levels of traffic in neighborhoods.

Environmental Impact Report Scoping Meeting
For the Joint Valleywide General Plan
August 4th, 2008, 6:00PM

Please join the City of Santa Clarita and the County of Los Angeles for the Environmental Impact Report (EIR) scoping meeting, for OVOV, the Joint Valleywide General Plan and provide input on the General Plan project and environmental issues.

August 4th, 2008, 6:00 p.m.

City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 91355
Council Chambers

Find out more at www.santa-clarita.com/vgp

Contact:
Mitch Glaser
Principal Planner
(213) 974-6476

Contact:
Jeff Hogan, AICP
Senior Planner
(661) 255-4330

Ventura County Office of Agricultural Commissioner Comment on NOP; dated August 8, 2008

Office of
AGRICULTURAL COMMISSIONER
P.O. Box 889, Santa Paula, CA 93061
815 East Santa Barbara Street
Telephone: (805) 933-2926 Ext. 228
FAX: (805) 525-8922

Agricultural Commissioner
Henry S. Gonzales

Chief Deputy
Susan Johnson

August 8, 2008

Mitch Glaser
County of Los Angeles
Department of Regional Planning
320 West Temple Street, Room 1352
Los Angeles, CA 90012

Subject: Notice of Preparation - One Valley One Vision, Update to Santa Clarita Valley-wide Area Plan for Los Angeles County

Dear Mr. Glaser:

Thank you for the opportunity to comment on the scope and content for the environmental document for the One Valley One Vision project. The comment deadline is August 26, 2008.

Project Description: The One Valley One Vision (OVOV) is a joint effort between the County of Los Angeles, City of Santa Clarita, and Santa Clarita Valley residents and businesses to create a single vision and guidelines for the future growth of the valley and the preservation of natural resources. The Area Plan will include the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce and the future Newhall Ranch; and the City of Santa Clarita and its four communities of Canyon Country, Newhall, Saugus and Valencia. The County will adopt a new Area Plan to replace the Santa Clarita Valley Area Plan, and prepare its own EIR; and the City of Santa Clarita will adopt a new General Plan and EIR. There will be two EIRs that evaluate portions of the project.

Comments: The Ventura County Agricultural Commissioner's staff comments on the following topics: Agricultural Soils, Water, Air Quality/ Microclimates, Pests and Diseases, and Land Use Incompatibility. Ventura County evaluates projects according to the thresholds and methodologies set forth in the Ventura County Initial Study Assessment Guidelines. The Guidelines are viewable at: www.ventura.org/planning under "Ordinances and Regulations." The Ventura County Agricultural Commissioner's staff recognizes that other jurisdictions may use different thresholds of significance in their evaluations.

Agricultural Soils. This evaluation pertains to the amount of farmland that will be

converted to a non-agricultural use. Farmland is identified and classified on the Department of Conservation Farmland Mapping and Monitoring Program Important Farmland Inventory. The scope and content of the One Valley One Vision EIRs should include identifying the classes of farmland soils, their locations, and the number of acres of each class that are intended to be converted to non-agricultural uses. The EIRs may propose mitigation measures that can be uniformly applied. The Ventura County Agricultural Commissioner's Office is currently evaluating proposals for standard mitigation measures from existing uniformly applied policies that limit the loss of agricultural soils in Ventura County. Los Angeles County and City jurisdictions may have uniformly applied policies that could serve as standard mitigation measures. If Los Angeles County and the City jurisdictions deem that the amount farmland to be converted to urban uses under One Valley One Vision is significant with unavoidable environmental effects, the EIRs should include consideration and adoption of a Statement of Overriding Considerations pursuant to CEQA for each EIR. This will allow the proponents of individual projects to cite the One Valley One Vision EIRs as having previously identified and considered the loss of agricultural soils as each subsequent project is evaluated.

Agricultural Water. This evaluation pertains to the effects on the local area's quantity from the conversion of agricultural water to non-agricultural uses as well as on water quality in discharges and run-off. The Ventura County Initial Study Guidelines to do not quantify a general significance threshold for water quantity; the evaluation is case-by-case. The significance threshold for agricultural water quality aims to identify and reduce Total Dissolved Solids (TDS) to no greater than 1200 milligrams per liter in the impact area. The Ventura County Water Resources Division also evaluates the effects of projects on this resource. The scope and content of the One Valley One Vision EIRs should include these subjects.

Agricultural Air Quality and Microclimates. This evaluation pertains to increased dust or harmful emissions from new non-agricultural projects or a decrease in solar access on adjacent farmland from new tall structures. The Ventura County Initial Study Guidelines thresholds of significance for increased dust and decreased solar access are 10 percent, respectively. The Ventura County Air Pollution Control District also evaluates the effects of new projects on this resource. The scope and content of the One Valley One Vision EIR should include these subjects.

Agricultural Pests and Diseases. This evaluation pertains to the introduction of agricultural pests or diseases into nearby agricultural areas. The Ventura County Initial Study Guidelines do not quantify a significance threshold; the evaluation is case-by-case. The analysis considers the types of new uses that will be permitted adjacent to existing agricultural land and focuses on reducing vectors and dust from any new uses.

Land Use Incompatibility. This evaluation pertains to the introduction of incompatible uses adjacent to agricultural areas. The Ventura County Initial Study Guidelines consider most human intensive uses within 300 feet of irrigated agriculture to pose a significant effect on agricultural resources. Mitigation measures may include site re-design with extended setbacks and/or other measures such as fencing and vegetative screening. The Ventura County Agricultural Policy Advisory Committee (APAC) adopted the Agricultural/Urban Buffer Policy in July 2006 to provide application and design standards for such measures. The Buffer Policy is viewable at: www.ventura.org/agcommissioner under "Land Use Planning." The policy includes an optional 150-foot extended setback with a vegetative barrier as an alternative to the policy standard 300-foot setback. Distances are measured from new structures or human intensive outdoor areas on the project site to the common lot boundary line with the off-site adjacent farmland. This allows the farm property owner to have maximum use of his farmland. The APAC Buffer Policy may be updated to include a set of reduction and waiver criteria that have been used in APAC's project evaluations. These include small project parcel size, un-farmable areas immediately adjacent to the project site, extensive existing vegetative screening, etc. The scope and content of the One Valley One Vision EIRs should include this topic.

This communication has been reviewed by Ventura County Chief Deputy Agricultural Commission Susan Johnson.

Thank you for the opportunity to comment.

If you have any questions about this response, please contact me at the telephone number or email address below.

Thank you.

Sincerely,

Rita Graham
Agricultural Land Use Planner
(805) 933-2926 Ext. 228
rita.graham@ventura.org

OVOV Noise Element Questions, submitted by Bob Werner;
dated February 17, 2009

OVOV NOISE ELEMENT QUESTIONS
Submitted by: Bob Werner 2/17/09

1. Where is the Traffic Analysis that this element is based on?

2. How far from the roads were the noise measurements in Exhibit N-5a taken?

3. Exhibit N-5a legend states that 'Leq' is used, and the explanatory text says that 'Noise measurements were made of the short-term Leq values.' (page N-13)
CNEL, which is the parameter used in this element (page N-9), is a '24-hour, time-weighted energy average noise level…'.
CNEL is used in the Appendix starting on page N-36 for future planning.
Please clarify the correlation between what appears to be a 'snapshot' measurement (Leq) used for current conditions, and future planning estimates, which are based on CNEL.

4. How did Newhall Ave. between Sierra Hwy and Valle del Oro go from 49,000 ADT (in the Masters College raffic analysis of 2008) in the interim year to 40,000 ADT in this noise analysis?
Notably, for Sierra Hwy between Newhall Ave and Dockweiler, the ADTs are 9,000 (Masters College traffic analysis) and 23,000 (OVOV).
Sierra Hwy between Dockweiler and Placerita Canyon is 26,000 (Masters College traffic analysis) and 39,000 (OVOV).
These numbers are very different, and need explanation, especially because the traffic volume on Sierra Highway is far higher in the OVOV, but far lower on Newhall Ave in the same OVOV.

5. How does Newhall Ave 'NW of Valle del Oro' have 33,000 ADT (OVOV) when Newhall Ave from Sierra Hwy to Valle del Oro has 40,000 ADT?
Under current conditions, there is more traffic west of VDO on Newhall Ave (50,000 ADT vs. 45,000 according to the Masters College traffic analysis of 2008).
There will certainly not be a decrease of traffic on Newhall Ave. west of VDO, because some of the traffic diverted off Sierra Hwy onto Dockweiler will go down VDO and back to Newhall Ave.

6. How are you going to fit 23,000 ADTs on Newhall Ave between Market and Lyons?

7. The 'current general plan freeway noise contour distances for freeways' has 316,000 ADTs on SR-14 between I-5 and Placerita Canyon.
The 'proposed general plan freeway noise contour distances for freeways' has 230,000 ADTs for the same stretch of road.
Where did 86,000 ADTs go?

8. Dockweiler Drive has 2 segments in all the lists:

	Current GP	OVOV

Dockweiler from Sierra Hwy to mid-section	25,000	24,000
Dockweiler from mid-section to mid-section	22,000	18,000

Where is this 'mid-section' and what happens to the 6,000 ADTs that just disappear?

9. On page N26, the proposed policy for residential development in the I-5 corridor 'prohibits residential buildings within 150 feet from the I-5 CENTERLINE' (emphasis added).
The California Air Resources Board has recommended that residences be located 500 feet from the EDGE OF THE FREEWAY (emphasis added).
Estimating the width of I-5 at 200 feet in the Santa Clarita valley, the OVOV policy would permit residential development only 50 feet from the edge of the roadway, instead of the 500 feet recommended.
How can this difference be justified?

Ventura County Public Works Agency, Transportation Department,
Comment on NOP; dated August 14, 2008

PUBLIC WORKS AGENCY
TRANSPORTATION DEPARTMENT
Traffic, Advance Planning & Permits Division

M E M O R A N D U M

DATE: August 14, 2008

TO: Resource Management Agency, Planning Division
Attention: Kari Finley

FROM: Nazir Lalani, Deputy Director

SUBJECT: **REVIEW OF DOCUMENT 08-032, ONE VALLEY ONE VISION – SANTA CLARITA VALLEYWIDE AREA PLAN UPDATE (OVOV)**.
Notice of Preparation of a Draft Environmental Impact Report (NOP) for the Santa Clarita Valley-Wide Area Plan Update
Lead Agency – **County of Los Angeles**

Pursuant to your request, the Public Works Agency -- Transportation Department has reviewed the Notice of Preparation of a Draft Environmental Impact for the Santa Clarita Valleywide Area Plan Update.

The OVOV is a comprehensive update to the Santa Clarita Valley-Wide Area Plan to establish common guidelines for new development that will lead to greater cooperation and an enhanced quality of life for residents of Santa Clarita Valley.

Our comments are as follows:

1. We generally concur with the comments in the NOP for those areas under the purview of the Transportation Department. However, no project specific impacts on County of Ventura roadways were identified in the NOP.

2. The cumulative impacts of this project, when considered with the cumulative impacts of all other approved (or anticipated) development projects in the Santa Clarita Valley, are potentially significant on the roads in the County of Ventura.

3. It is recommended that the environmental document address the potential adverse impacts on County of Ventura roads in the area.

Our review is limited to the impacts this project may have on Ventura County's Regional Road Network.

Please call me at 654-2080 if you have questions.

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City Comments

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, REGIONAL PLANNING
IGR/CEQA BRANCH
100 MAIN STREET, MS # 16
LOS ANGELES, CA 90012-3606
PHONE: (213) 897-6696
FAX: (213) 897-1337

Flex your power!
Be energy efficient!

IGR/CEQA No. 080808AL, NOP
One Valley One Vision
County Project No. R2007-01226
Vic. LA-05/126/14
SCH # 2008071133

September 15, 2008

Mr. Jeff Hogan
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

Dear Mr. Hogan:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above referenced project. The One Valley One Vision, OVOV, project is a comprehensive update to the Santa Clarita Valley wide Area Plan to establish common guidelines for new development that will lead to greater cooperation and an enhanced quality of life for residents of Santa Clarita Valley.

The OVOV is a joint effort between the County of Los Angeles, City of Santa Clarita, and Santa Clarita Valley residents and businesses to create a single vision and guidelines for the future growth of the Valley and the preservation of natural resources. The result of the work effort will require the County to adopt a new Area Plan to replace the Santa Clarita Valley Area Plan and prepare its own Environmental Impact Report, EIR, while the City will adopt a new General Plan and EIR.

The California Department of Transportation (Caltrans) as the State agency responsible for planning, operations, and maintenance of State highways, shares similar transportation goals with the both County of Los Angeles and City of Santa Clarita. We are pleased with the comprehensive planning approach both local government agencies are pursuing and present the following comments:

"Caltrans is particularly interested in the transportation planning roles of local general plans and suggests that the following areas be emphasized.

- Coordination of planning efforts between local agencies and Caltrans.
- Preservation of transportation corridors for future system improvements; and
- Development of coordinated transportation system management plans that achieve the maximum use of present and proposed infrastructure."

RECEIVED
PLANNING DIVISION
SEP 17 2008
CITY OF SANTA CLARITA

Circulation Element

It is widely known that Southern California highways are heavily congested especially during morning and evening peak periods. We realize that to improve mobility there is the need for capacity enhancing improvements as well as other innovative alternatives. The State highway facilities that provide regional access to the subject Santa Clarita Valley Area and are therefore likely to be impacted by future development activity are Interstate 5 (I-5), State Route 14 (SR-14), and State Route 126 (SR-126).

Interstate 5

- The *Golden State Gateway Coalition website (http://www.goldenstategateway.org/?p=7#q6) provides the following information:*

"....In the northern Los Angeles County, the I-5 currently carries more than 200,000 vehicles every day. This includes more than 19,000 trucks. These daily numbers add up to a staggering 73 Million vehicles – including 7 Million trucks – every year. As commerce and population growth occur in Southern California, these numbers will increase...."

" ...The I-5 freeway is already nearly at capacity, with Los Angeles County's population expected to grow by 3 million in the next 2 decades, it would soon be beyond its capacity without major improvements. Traffic is projected to increase by 65% in the next 10 years and 114% in the next 20 years. Airport passenger and cargo traffic in the Los Angeles-southern Kern County region is expected to double in the next 2 decades, while seaport traffic is expected to triple...."

State Route 14

- Existing daily traffic volumes along the SR 14 corridor range from 137,000 ADT between I-5 to San Fernando Rd., to 30,900 ADT between Avenue I and Kern County Line, per Caltrans District 7, SR 14 Transportation Concept Report, September 2003.

- Currently, an operating deficiency exists on SR14 between I-5 and San Fernando Rd. The level of service on this segment is F0 during the AM peak period on the southbound side of the route and F0 during the PM peak period on the northbound side of the route (Caltrans District 7, SR 14 Transportation Concept Report, September 2003).

- SR 14 is designated as a Super Truck Route (STR). SR 14 is also part of the Surface Transportation Assistance Act (STAA) truck network, which provides freeway access for oversized trucks. Regional truck traffic is expected to increase by 40% by 2020, with virtually no capacity available to handle this additional volume (Caltrans District 7, SR 14 Transportation Concept Report, September 2003).

State Route 126

SR-126 functions as a terminal access route to the national network for the Surface Transportation Assistance Act (STAA) for trucks. Truck volume in 2001 ranged from 4% to 30% of ADT in Los Angeles County, and 4.5% to 10% of ADT in Ventura County (Caltrans District 7, SR 126 Transportation Concept Report, November 2004).

New development will increase use of local and regional roadways and the circulation element can identify strategies the County and the City will pursue to maintain good levels of service. We understand that mitigating cumulative traffic impacts may present some challenges. Given that the Los Angeles County's Congestion Management Program debit and credit system has been suspended, we recommend the County consider an alternate local funding plan towards regional transportation improvements. We request the County consider implementing a funding program to contribute to improvements on the State highway system, including impacted I-5, SR-14, SR-126, and on/off ramps. Local funding efforts may include a region or community wide traffic impact program. When local matching funds are offered, public funds may become available and improvements may be streamlined and/or expedited. County of Los Angeles and City of Santa Clarita may take this opportunity to include policies that allow it to procure funds towards regional transportation improvements such as additional mixed flow lanes, High Occupancy Lanes (HOV), and truck lanes on I-5; as well as modifications to I-5/SR-14 interchange.

Procuring funds toward freeway segments, freeway interchanges, freeway on/off-ramps, as well as for bus and rail transit facilities should also be in the goals of the local government agencies. A local funding strategy may provide a fair and predictable mechanism for individual developments to address their individual and cumulative transportation impacts to State facilities and satisfactory comply with the California Environmental Quality Act (CEQA).

Other traffic mitigation alternatives may include vehicular demand reducing strategies, such as incentives for commuters to use transit i.e. park-and-ride lots, discounts on monthly bus and rail passes, vanpools, etc.

To avoid delays and any misunderstandings in the traffic impact analysis, we request to be involved in its development. We may provide assistance in our areas of expertise such as transportation modeling, mainline freeway analysis, system and corridor planning, environmental and community impact assessment, as well as identifying critical operational deficiencies affecting freeway congestion, speed, and delay.

For State thresholds and guidance on the preparation of acceptable traffic studies, please refer to the Statewide Guide for the preparation of Traffic Impact Studies at:

http://www.dot.ca.gov/hq/traffops/developserv/operationalsystems/reports/tisguide.pdf

If significant impacts were anticipated on the State highway system, Caltrans would work with the local governments to identify appropriate traffic mitigation measures.

We remind you that traffic impact studies that are in compliance with Los Angeles County's Congestion Management Program (Metro's CMP), are not necessary satisfactory to Caltrans, the agency with jurisdiction over State highway facilities. The thresholds for significance on State highway facilities may be different than those applied in the CMP.

Land Use Element and Other Elements

As you are aware, there is a critical relationship between land use and transportation. The quality of the State transportation system operation can affect the quality of the local circulation system operation. The Circulation Element of the General Plan needs to be consistent with the Land-Use and Housing Elements of the General Plan. During the past couple decades, population and economic growth has been strong in Los Angeles County, and projections show that this growth will continue. In addition to planning for highway improvements, we recommend that vehicle-trip reducing strategies be implemented through land-use decisions.

We recommend that special attention be given to the jobs-and-housing balance concept. Communities with predominantly residential allocations should be encouraged to set aside areas for office, commercial/retail, and open space uses. Benefits of balanced communities include: reduction of long morning and evening commutes on State highways, shorter trips which in turn would reduce the consumption of fuel and air pollutants. It may also change direction of trips. Instead of most traffic traveling in one direction during peak periods, some trips may be diverted in the opposite direction. Other land use strategies may include Transit-Oriented Developments (TODs).

- We encouraged the application of the State Regional Blueprint Program, SCAG's Compass Blueprint Program, and transportation planning principles in their General Plan update:

  - **California Regional Blueprint Planning Program (http://calblueprint.dot.ca.gov)**

    The Regional Blueprint Planning Program is intended to better inform regional and local decision-making, through pro-active engagement of all segments of the population as well as critical stakeholders in the community, business interests, academia, builders, environmental advocates, and to foster consensus on a vision and preferred land use pattern. It is anticipated that the regional blueprint planning grants will build capacity for regional collaboration and integrated planning that will in turn enable regions to plan to accommodate all their future growth, thereby reducing need for sprawl.

    The grants for regional collaborative decision-making will lead to adoption of blueprint plans that will:

    1. Foster a more efficient land use pattern that (a) supports improved mobility and reduced dependency on single-occupant vehicle trips, (b) accommodates an adequate supply of housing for all incomes, (c) reduces impacts on valuable habitat, productive farmland, and air quality, (d) increases resource use efficiency, and (e) results in safe and vibrant neighborhoods.

    2. Provide consumers more housing and transportation choices.

    3. Improve California's economic competitiveness and quality of life.

    4. Reduce costs and time needed to deliver transportation projects through informed early public and resource agency involvement.

5. Secure local government and community support, including that of under-represented groups, to achieve the resulting comprehensive vision through including innovative computer models and public involvement activities.

6. Establish a process for public and stakeholder engagement that can be replicated to build awareness of and support for critical infrastructure and housing needs.

- **SCAG Compass Blueprint Program (http://www.compassblueprint.org/about)**
  Compass Blueprint is a new way to look at how the region grows. The Compass Blueprint Growth Vision is a response, supported by a regional consensus, to the land use and transportation challenges facing Southern California now and in the coming years.

The *Growth Vision encourages:*

- Focusing growth in existing and emerging centers and along major transportation corridors
- Creating significant areas of mixed-use development and walkable communities
- Targeting growth around existing and planned transit stations
- Preserving existing open space and stable residential areas

Housing Element
As we indicated previously, continued high growth is expected for Los Angeles County, which will have impacts to our State transportation facilities. We ask that efforts be made to provide affordable housing for all income levels to ensure that substantial numbers of employees can afford to purchase homes and live in proposed residential projects.

We look forward to reviewing the traffic study. Again, we would welcome an opportunity to participate in its development.

If you have any questions, please feel free to contact me at (213) 897-6696 or Alan Lin the project coordinator at (213) 897-8391 and refer to IGR/CEQA No. 080808AL.

Sincerely,

ELMER ALVAREZ
IGR/CEQA Program Manager

cc: Scott Morgan, State Clearinghouse

COUNTY OF LOS ANGELES
Public Health

JONATHAN E. FIELDING, M.D., M.P.H.
Director and Health Officer

JONATHAN E. FREEDMAN
Acting Chief Deputy

Environmental Health
ANGELO J. BELLOMO, REHS
Director of Environmental Health

ALFONSO MEDINA, REHS
Director of Environmental Protection Bureau

KEN MURRAY, CHIEF R.E.H.S.
Solid Waste Management Program/Local Enforcement Agency
5050 Commerce Drive
Baldwin Park, California 91706
TEL (626) 430-5540 · FAX (626) 813-4839

www.lapublichealth.org

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August 13, 2008

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SEP 09 2008

CITY OF SANTA CLARITA

Jeff Hogan
AICP Senior Planner
City of Santa Clarita
23920 Valencia Blvd., suite 302
Santa Clarita, CA 91355

SUBJECT: Notice of Preparation of Draft Environmental Impact Report for the One Valley, One Vision General Plan EIR.

Dear Mr. Hogan:

The Los Angeles County Solid Waste Management Program is the Local Enforcement Agency (LEA) for the City of Santa Clarita (City). As the LEA, it is our responsibility to enforce the requirements of the California Code of Regulations (CCR) Title 14 and Title 27. The proposed EIR is intended to comply with the requirements of the California Environmental Quality Act (CEQA) by providing an analysis of the plans' potentially significant environmental impacts. Within the scope of our review, we will consider the impact(s) and the mitigation measures the plan will have on the management of solid waste within the City and the plan area. Upon reviewing the Notice of Preparation for the proposed EIR, we have the following comments:

Solid Waste

The development of this plan will increase the generation of solid waste in the Santa Clarita Valley area. This will create a negative impact on the solid waste management infrastructure within Los Angeles County. Mitigation measures must be identified so as to provide a solution for the increase in solid waste generation. The plan must consider that landfills and other solid waste facilities in the Los Angeles County have a limit on the tonnage received per day and hours of operation, and no new landfills are expected to be created in the Los Angeles County area.

At the present time there are no transfer stations or materials recovery facilities (MRF) in the Santa Clarita area to help process the solid waste stream. How will this issue be mitigated?

Consider the following:

a. How much solid waste per household or establishment will be generated as a result of the planned development, and how much solid waste will be diverted/recycled?

b. Where will the waste be taken for disposal, and is there a plan to convert or divert the residual waste into a useable resource such as energy, compost, or fuels?

c. How will hazardous wastes that are extracted from the solid waste stream be disposed?

Traffic

As a result of the planned development, a traffic analysis needs to describe how the roads and traffic patterns will accommodate the additional waste collection vehicles. The traffic analysis needs to describe the safe and adequate circulation of waste collection vehicles throughout the Valley and how it will impact the traffic flow in the area. The increased vehicle impacts on the roads should also be addressed in the noise and emissions sections as well.

Land use

Within the land use studies, information needs to include surveys in the proposed planning areas to determine if such areas have been used as a solid waste or hazardous waste disposal area in the past, and if any such area is within 1,000 feet of a planned development, a post-closure land use plan must be developed as required by CCR Title 27.

If the General Plan for the proposed Planning Area includes the construction of a solid waste processing facility such as a transfer station or a materials recovery facility (MRF), all environmental documents pertaining to the construction of these must be submitted to the LEA for review and approval. Failure to do so will result in the delay of permit issuance.

Thank you for giving our office the opportunity to provide comments on this project, if you have any questions please call me at 626-430-5540.

Sincerely,

Nelly Castellanos, REHS III
Solid Waste Management Program

Parks Designation Description

Calgrove Corridor Coalition

August 26, 2008

Mr. Hogan, AICP
Senior Planner
City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 9135

Re: Calgrove Corridor Coalition Request for Clarification-Notice of Preparation of Land Use L-33

Dear Mr. Hogan;

The Calgrove Corridor Coalition is asking for clarification on the Land Use Element/Parks section, and requesting clarification response dates for such changes.

We previously printed the Land Use section dated DRAFT July, 2008 on L-33 and it stated:

"The City has adopted a standard of five acres per 1000 residents and the County has adopted a standard of three acres per 1000."

Today, August 26, 2008 we were looking up information and noticed that the PARKS section L-34 is dated July 28, 2008 and now states:

" In the past, the City the County have both, adopted a standard of three acres per 1000 residents."

We would appreciate your prompt response.

Annette Lucas

Annette Lucas, Co-chair
Calgrove Corridor Coalition

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Background Section ends with a needs assessment which identifies current deficiencies in park area and facilities.

Table PR-6 shows that developed City and County parks within the City of Santa Clarita presently provide 172 acres (28 percent) of the park acreage needed to meet its goal of 605.82. City parks account for one quarter of the existing acreage; only 10 percent of the goal. Based upon the 5/1,000 standard, City and County parks which serve the entire planning area, including the City, are presently providing 249 acres (38 percent) of the improved parkland needed to meet the planning area's requirement of 654 acres. These park sites also often have unbuilt housing that adds population. When unimproved parkland is considered, the deficiency of parkland decreases to 538 acres and 310 acres for the City and planning area, respectively. Schools are not considered as public parkland since public use is restricted. However, for evaluation purposes only, when school sites are used for park purposes, the deficiency between improved recreational open space and the amount of park space required to meet the 5 acres/1,000 person standard, narrows to 221 acres for the entire planning area.

PARK FACILITIES NEEDS ASSESSMENT

School facilities and lands have become valuable financial assets for school districts. School sites have been closed and sold or leased for alternative uses to help generate additional financial resources. Long-term reliance on school grounds for open space and parkland purposes can lead to significant future parkland and facility deficiencies.

The National Recreation and Parks Association (NRPA) has developed park standards that can act as a guide for the development of park facilities. The Santa Clarita park facilities needs assessment is based on a standard of 5 acres of parkland per 1,000 persons.

Enrollment is estimated at 1,000 students. The Master's College is planning a facility expansion on the current campus.

The challenge to provide additional school facilities needed to support new development will be met through on-going cooperation between the City, County, and school districts. Master-planned communities, such as Newhall Ranch, provide for school sites and funding mechanisms in their specific plans. As infill occurs in other portions of the planning area, however, it will be necessary to explore all options to alleviate over-crowding. Policies have been included in the General Plan to address coordination of land use planning with school facility planning.

Parks

The provision of adequate park space and facilities to serve residents is not only required by State planning law, but is recognized as necessary to provide for public health and quality of life. Parkland provides recreational and aesthetic benefits as well as increased environmental quality, through maintenance of open space, permeable land area for surface water infiltration and percolation, trees and vegetation for habitat, and the economic benefits of increased property values. The Land Use Element is required to consider the number, size, and distribution of parklands and facilities to ensure that these public amenities will be adequate to serve the ultimate population level at build-out of uses permitted by the Land Use Map.

Based on a 2003 GIS inventory, the Valley contains over 14,000 acres of parkland, including both local and regional parks located within City and County areas; however, much of this parkland consists of natural open space and is not developed for active recreational uses. There are four State Parks located within the Planning Area, totaling about 12,950 acres: Castaic Lake Recreation Area, Placerita Canyon State Park, Vasquez Rocks State Park, and the Santa Clarita Woodlands. In addition, recreational facilities within the Angeles National Forest and Los Padres National Forest lands within and adjacent to the planning area are available for public use by Valley residents. A more detailed discussion of specific park locations and acreage is contained in the Conservation and Open Space Element.

In addition to parkland, the Valley contains an integrated trail system traversing both City and County areas and available for use by equestrians, hikers, joggers, and cyclists. Long-term plans call for a continuous trail along the Santa Clara River, to be completed as right-of-way is acquired. Schools also provide land and facilities for recreational use on a limited basis, through joint use agreements.

Developed parkland in the planning area accommodates a variety of organized sports, including soccer, baseball, tennis, volleyball, basketball, and a skateboard park. Facilities also include picnic areas and playgrounds. A 58-acre Sports Complex was constructed by the City within a former industrial complex in 2002, with an aquatic center added in 2003. Future expansion plans include multi-purpose fields, a second gymnasium, an expanded skate park, and other amenities. The County has constructed a 53-acre sports complex in Castaic. Both the City and County operate recreational programs at their park facilities. Passive recreational areas include conservancy land located in Towsley Canyon and the Water Conservatory Garden and Learning Center owned by Castaic Lake.

The City has adopted a standard of five acres per 1000 residents and the County has adopted a standard of three acres per 1000. Based on these standards and without considering improvements or distribution of facilities, the planning area has adequate overall parkland acreage to serve the existing population. However, more parks to handle specific recreational

amenities. The County has constructed a 53-acre sports complex in Castaic. Both the City and County operate recreational programs at their park facilities. Passive recreational areas include conservancy land located in Towsley Canyon and the Water Conservatory Garden and Learning Center owned by Castaic Lake.

In the past, the City and County have both , adopted a standard of three acres per 1000 residents. Based on these standards and without considering improvements or distribution of facilities, the planning area has adequate overall parkland acreage to serve the existing population. However, more parks to handle specific recreational needs, such as ball fields for youth, are needed to better serve the existing population and future growth. Within the City, there are only about 1.5–2 acres of developed parkland per 1000 population. Another issue for park development is distribution of park facilities, as many local parks are concentrated within master planned communities, and outlying areas have access to fewer local parks. There is a need for additional regional parks with ball fields throughout the Valley, as both City and County residents are active park users in this family-oriented community.

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It is anticipated that future dedications of parkland will be made from new developments in the planning area as development occurs. In addition, both the City and the County are planning for a variety of new parks to serve the growing population's recreational needs.

The City and County will continue to explore joint use opportunities with school districts, utility corridors, and other service providers and agencies to expand parkland and recreational facilities, including trails and playfields. It will be critical in the future to identify sources of funding and reserve lands for future parkland as the planning area continues to develop, in order to provide adequate parkland for all residents.

Libraries

The County of Los Angeles operates all public libraries in the planning area, including the Main Branch in Valencia, the Jo Anne Darcy Branch in Canyon Country, the Newhall Branch, and a bookmobile that serves the communities of Castaic, Acton, Agua Dulce, Val Verde, and the Friendly Valley senior community. The County's system contains over eight million items in its collections and provides inter-library loan programs with other local and national libraries. Santa Clarita library branches also maintain local and regional history collections.

In addition to the public libraries, schools provide library facilities to their students. Both Cal Arts and The Master's College provide libraries for students, and College of the Canyons opens their library to both students and the general public.

Based on the County Library's service guidelines, the area and number of items within the Santa Clarita branches are not meeting service level standards. As population increases based on growth anticipated by the General Plan, it will be necessary to increase funding to support library development. In order to meet the library needs of new development in the Valley, both the City and County assess a development impact fee for library construction. Other funding sources include property taxes, bond measures, and voter-approved special taxes.

In 2008 the City Council approved purchase of three parcels on San Fernando Road so that the City can move ahead with plans to build a new public library in Downtown Newhall. Along with the new community center, this new library facility is part of the plan to revitalize Downtown Newhall.

Local Government Offices

STATE OF CALIFORNIA

GOVERNOR'S OFFICE *of* PLANNING AND RESEARCH

STATE CLEARINGHOUSE AND PLANNING UNIT

ARNOLD SCHWARZENEGGER
GOVERNOR

CYNTHIA BRYANT
DIRECTOR

Notice of Preparation

July 29, 2008

To: Reviewing Agencies

Re: One Valley, One Vision General Plan EIR
SCH# 2008071133

Attached for your review and comment is the Notice of Preparation (NOP) for the One Valley, One Vision General Plan EIR draft Environmental Impact Report (EIR).

Responsible agencies must transmit their comments on the scope and content of the NOP, focusing on specific information related to their own statutory responsibility, within 30 days of receipt of the NOP from the Lead Agency. This is a courtesy notice provided by the State Clearinghouse with a reminder for you to comment in a timely manner. We encourage other agencies to also respond to this notice and express their concerns early in the environmental review process.

Please direct your comments to:

Jeff Hogan
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

with a copy to the State Clearinghouse in the Office of Planning and Research. Please refer to the SCH number noted above in all correspondence concerning this project.

If you have any questions about the environmental document review process, please call the State Clearinghouse at (916) 445-0613.

Sincerely,

Scott Morgan
Project Analyst, State Clearinghouse

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AUG 05 2008
CITY OF SANTA CLARITA

Attachments
cc: Lead Agency

1400 10th Street P.O. Box 3044 Sacramento, California 95812-3044
(916) 445-0613 FAX (916) 323-3018 www.opr.ca.gov

State Clearinghouse Data Base

SCH# 2008071133
Project Title One Valley, One Vision General Plan EIR
Lead Agency Santa Clarita, City of

Type NOP Notice of Preparation

Description The City is preparing a comprehensive update to its General Plan and an associated EIR for the proposed Planning Area. Development within the City and County shall be consistent with the OVOV's Vision and Guiding Principles, which are intended to sustain and enhance environmental resources, economic vitality, and the social well being of its residents. The following seven General Plan elements are either available or will soon be available on the City's website wwww.santa-clarita.com/vgp:

- Draft Safety Element
- Draft Conservation and Open Space Element
- Draft Circulation and Noise Elements (available 9/16/08)
- Draft Housing Element (available 10/21/08)

Lead Agency Contact

Name Jeff Hogan
Agency City of Santa Clarita
Phone (661) 255-4330 **Fax**
email
Address 23920 Valencia Boulevard, Suite 302
City Santa Clarita **State** CA **Zip** 91355

Project Location

County Los Angeles
City Santa Clarita
Region
Cross Streets
Lat / Long
Parcel No.
Township **Range** **Section** **Base**

Proximity to:

Highways
Airports
Railways
Waterways
Schools
Land Use Residential, Commercial, Mixed Use, Industrial, Public and Institutional, Transportation, Communication, and Utilities, Open Space and Recreation, Non-Urban/Agriculture, Specific Plan

Project Issues Aesthetic/Visual; Agricultural Land; Air Quality; Biological Resources; Other Issues; Geologic/Seismic; Toxic/Hazardous; Water Quality; Archaeologic-Historic; Landuse; Minerals; Noise; Population/Housing Balance; Public Services; Recreation/Parks; Traffic/Circulation

Reviewing Agencies Resources Agency; Department of Conservation; California Energy Commission; Cal Fire; Department of Parks and Recreation; Department of Water Resources; Department of Fish and Game, Region 5; Department of Health Services; Office of Emergency Services; Native American Heritage Commission; State Lands Commission; Caltrans, Division of Aeronautics; California Highway Patrol; Department of Housing and Community Development; Caltrans, District 7; Regional Water Quality Control Board, Region 4

Date Received 07/29/2008 **Start of Review** 07/29/2008 **End of Review** 08/27/2008

Note: Blanks in data fields result from insufficient information provided by lead agency.

NOP Distribution List

County: Los Angeles **SCH#** [illegible]

Resources Agency

- [■] **Resources Agency** Nadell Gayou
- [ ] **Dept. of Boating & Waterways** David Johnson
- [ ] **California Coastal Commission** Elizabeth A. Fuchs
- [ ] **Colorado River Board** Gerald R. Zimmerman
- [■] **Dept. of Conservation** Sharon Howell
- [■] **California Energy Commission** Dale Edwards
- [■] **Cal Fire** Allen Robertson
- [ ] **Office of Historic Preservation** Wayne Donaldson
- [■] **Dept of Parks & Recreation** Environmental Stewardship Section
- [ ] **Central Valley Flood Protection Board** Mark Herald
- [ ] **S.F. Bay Conservation & Dev't. Comm.** Steve McAdam
- [■] **Dept. of Water Resources** Resources Agency Nadell Gayou
- [ ] _____ Conservancy

Fish and Game

- [ ] **Depart. of Fish & Game** Scott Flint Environmental Services Division
- [ ] **Fish & Game Region 1** Donald Koch
- [ ] **Fish & Game Region 1E** Laurie Harnsberger
- [ ] **Fish & Game Region 2** Jeff Drongesen
- [ ] **Fish & Game Region 3** Robert Floerke
- [ ] **Fish & Game Region 4** Julie Vance
- [■] **Fish & Game Region 5** Don Chadwick Habitat Conservation Program
- [ ] **Fish & Game Region 6** Gabrina Gatchel Habitat Conservation Program
- [ ] **Fish & Game Region 6 I/M** Gabrina Getchel Inyo/Mono, Habitat Conservation Program
- [ ] **Dept. of Fish & Game M** George Isaac Marine Region

Other Departments

- [ ] **Food & Agriculture** Steve Shaffer Dept. of Food and Agriculture
- [ ] **Depart. of General Services** Public School Construction
- [ ] **Dept. of General Services** Robert Sleppy Environmental Services Section
- [■] **Dept. of Public Health** Veronica Malloy Dept. of Health/Drinking Water

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- [ ] **Governor's Office of Planning & Research** State Clearinghouse
- [■] **Native American Heritage Comm.** Debbie Treadway
- [ ] **Public Utilities Commission** Ken Lewis
- [ ] **Santa Monica Bay Restoration** Guangyu Wang
- [■] **State Lands Commission** Marina Brand
- [ ] **Tahoe Regional Planning Agency (TRPA)** Cherry Jacques

Business, Trans & Housing

- [■] **Caltrans - Division of Aeronautics** Sandy Hesnard
- [ ] **Caltrans - Planning** Terri Pencovic
- [■] **California Highway Patrol** Shirley Kelly Office of Special Projects
- [■] **Housing & Community Development** Lisa Nichols Housing Policy Division

Dept. of Transportation

- [ ] **Caltrans, District 1** Rex Jackman
- [ ] **Caltrans, District 2** Marcelino Gonzalez
- [ ] **Caltrans, District 3** Jeff Pulverman
- [ ] **Caltrans, District 4** Tim Sable
- [ ] **Caltrans, District 5** David Murray
- [ ] **Caltrans, District 6** Moses Stites
- [■] **Caltrans, District 7** Vin Kumar
- [ ] **Caltrans, District 8** Dan Kopulsky
- [ ] **Caltrans, District 9** Gayle Rosander
- [ ] **Caltrans, District 10** Tom Dumas
- [ ] **Caltrans, District 11** Jacob Armstrong
- [ ] **Caltrans, District 12** Ryan P. Chamberlain

Cal EPA

Air Resources Board

- [ ] Airport Projects Jim Lerner
  - [ ] Transportation Projects Ravi Ramalingam
  - [ ] Industrial Projects Mike Tollstrup
- [ ] **California Integrated Waste Management Board** Sue O'Leary
- [ ] **State Water Resources Control Board** Regional Programs Unit Division of Financial Assistance
- [ ] **State Water Resources Control Board** Student Intern, 401 Water Quality Certification Unit Division of Water Quality
- [ ] **State Water Resources Control Board** Steven Herrera Division of Water Rights
- [ ] **Dept. of Toxic Substances Control** CEQA Tracking Center
- [ ] **Department of Pesticide Regulation**

Regional Water Quality Control Board (RWQCB)

- [ ] **RWQCB 1** Cathleen Hudson North Coast Region (1)
- [ ] **RWQCB 2** Environmental Document Coordinator San Francisco Bay Region (2)
- [ ] **RWQCB 3** Central Coast Region (3)
- [■] **RWQCB 4** Teresa Rodgers Los Angeles Region (4)
- [ ] **RWQCB 5S** Central Valley Region (5)
  - [ ] **RWQCB 5F** Central Valley Region (5) Fresno Branch Office
  - [ ] **RWQCB 5R** Central Valley Region (5) Redding Branch Office
- [ ] **RWQCB 6** Lahontan Region (6)
  - [ ] **RWQCB 6V** Lahontan Region (6) Victorville Branch Office
- [ ] **RWQCB 7** Colorado River Basin Region (7)
- [ ] **RWQCB 8** Santa Ana Region (8)
- [ ] **RWQCB 9** San Diego Region (9)

- [ ] **Other** _____

Last Updated on 07/24/2008

August 5, 2008

Jason Smisko, Senior Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, CA 91355

Dear Jason:

I am writing in followup to the July 14 Public Discussion of the One Valley One Vision Draft Land Use Element of the General Plan.

Although you mentioned to Leon Worden and myself following the meeting that Special Standards were to remain for Placerita Canyon east of the MWD right of way, I believe that more needs to be acknowledged. West of the MWD was also part of the Original Special Standards designation. As several Placerita Canyon residents commented, the existence of Special Standards for Placerita Canyon needs to be emphasized in the Planning Document. While Placerita Canyon is presented as a rural residential area...equestrian oriented on page L-11, nowhere is this to be found in the Land Use Goals, section. LU 1.2.6. Instead Placerita Canyon is described only as "eclectic..... providing an orderly connection to Newhall through the Downtown Newhall Specific Plan".

I would like to suggest that the wording in Section LU 1.2.6 for Placerita Canyon be amended to reflect the preservation of the rural equestrian character governed by Special Standards, keeping the unique community nature at the forefront when considering development of the North Newhall Specific Plan and connections thereof.

Simply put, if as the plan says, the Santa Clarita Valley is a Valley of Villages, then Placerita Canyon is a village onto itself, roots lying deep from years of history and reflective of passion for the lifestyle that it represents. It is my conviction that any future planning on currently vacant land here should reflect the characteristics of this canyon, including incorporation of Special Standards, as any development indeed becomes the Placerita Gateway, the gateway into Placerita Canyon.

Sincerely,

Linda

Linda Tarnoff
21618 Oak Orchard Road
Newhall 91321
HaveAHunchRanch@aol.com

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AUG 11 2008
CITY OF SANTA CLARITA

c. Planning Commissioners

WATER RECLAMATION
SOLID WASTE MANAGEMENT

COUNTY SANITATION DISTRICTS
OF LOS ANGELES COUNTY

1955 Workman Mill Road, Whittier, CA 90601-1400
Mailing Address: P.O. Box 4998, Whittier, CA 90607-4998
Telephone: (562) 699-7411, FAX: (562) 699-5422
www.lacsd.org

STEPHEN R. MAGUIN
Chief Engineer and General Manager

July 30, 2008

File No: SCV-00.04-00

Mr. Mitch Glaser
Countywide Studies Section
Los Angeles County
Department of Regional Planning
320 West Temple Street
Los Angeles, CA 90012

RECEIVED
PLANNING DIVISION
AUG 05 2008
CITY OF SANTA CLARITA

Dear Mr. Glaser:

One Valley One Vision, County Project No. R2007-01226

The County Sanitation Districts of Los Angeles County (Districts) received a Notice of Preparation of a Draft Environmental Impact Report for the subject project on July 28, 2008. We offer the following comments regarding sewerage service:

1. Portions of the project area are outside the jurisdictional boundaries of the Districts and will require annexation into the Santa Clarita Valley Sanitation District before sewerage service can be provided to any proposed development. For a copy of the Districts' Annexation Information and Processing Fees sheets, go to www.lacsd.org, Will Serve Program, Obtain Will Serve Letter, and click on the appropriate link on page 2. For more specific information regarding the annexation procedure and fees, please contact Ms. Donna Kitt at extension 2708.

2. The Districts own, operate, and maintain only the large trunk sewers that form the backbone of the regional wastewater conveyance system. Local collector and/or lateral sewer lines are the responsibility of the jurisdiction in which they are located. As such, the Districts cannot comment on any deficiencies in the local sewerage system within the project area except to state that presently no deficiencies exist in Districts' facilities that serve the Santa Clarita Valley.

3. The District operates two water reclamation plants (WRPs), the Saugus WRP and the Valencia WRP, which provide wastewater treatment in the Santa Clarita Valley. These facilities are interconnected to form a regional treatment system known as the Santa Clarita Valley Joint Sewerage System (SCVJSS). The SCVJSS has a design capacity of 28.1 mgd and currently processes an average flow of 21 mgd.

4. For a copy of the Districts' average wastewater generation factors, go to www.lacsd.org, Information Center, Will Serve Program, Obtain Will Serve Letter, and click on the appropriate link on page 2.

Recycled Paper

5. The Districts are authorized by the California Health and Safety Code to charge a fee for the privilege of connecting (directly or indirectly) to the Districts' Sewerage System or increasing the strength or quantity of wastewater attributable to a particular parcel or operation already connected. This connection fee is a capital facilities fee that is imposed in an amount sufficient to construct an incremental expansion of the Sewerage System to accommodate any proposed development. Payment of a connection fee will be required before a permit to connect to the sewer is issued. For a copy of the Connection Fee Information Sheet, go to www.lacsd.org, Information Center, Will Serve Program, Obtain Will Serve Letter, and click on the appropriate link on page 2. For more specific information regarding the connection fee application procedure and fees, please contact the Connection Fee Counter at extension 2727.

6. In order for the Districts to conform to the requirements of the Federal Clean Air Act (CAA), the design capacities of the Districts' wastewater treatment facilities are based on the regional growth forecast adopted by the Southern California Association of Governments (SCAG). Specific policies included in the development of the SCAG regional growth forecast are incorporated into clean air plans, which are prepared by the South Coast and Antelope Valley Air Quality Management Districts in order to improve air quality in the South Coast and Mojave Desert Air Basins as mandated by the CAA. All expansions of Districts' facilities must be sized and service phased in a manner that will be consistent with the SCAG regional growth forecast for the counties of Los Angeles, Orange, San Bernardino, Riverside, Ventura, and Imperial. The available capacity of the Districts' treatment facilities will, therefore, be limited to levels associated with the approved growth identified by SCAG. As such, this letter does not constitute a guarantee of wastewater service, but is to advise you that the Districts intend to provide this service up to the levels that are legally permitted and to inform you of the currently existing capacity and any proposed expansion of the Districts' facilities.

If you have any questions, please contact the undersigned at (562) 908-4288, extension 2717.

Very truly yours,

Stephen R. Maguin

Ruth I. Frazen
Customer Service Specialist
Facilities Planning Department

RIF:rf

c: W. Hogan, City of Santa Clarita
D. Kitt

Doc #: 1081284.1

NATIVE AMERICAN HERITAGE COMMISSION
915 CAPITOL MALL, ROOM 364
SACRAMENTO, CA 95814
(916) 653-6251
Fax (916) 657-5390
www.nahc.ca.gov
ds_nahc@pacbell.net

RECEIVED
PLANNING DIVISION
AUG 0 7 2008
CITY OF SANTA CLARITA

July 31, 2008

Mr. Jeff Hogan
CITY OF SANTA CLARITA
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

Mr. Mitch Glaser
County of Los Angeles Department of Regional Planning
320 West Temple Street, Room 1354
Los Angeles, CA 90012

Re: SCH# 2008071133; and SCH#2008071119; CEQA Notice of Preparation (NOP) draft Environmental Impact Report (DEIR) for the One Valley, One Vision General Plan; City of Santa Clarita; County of Los Angeles Regional Planning #R2007-01226; Los Angeles County, California

Dear Mr.Hogan and Mr. Glaser:

Thank you for the opportunity to comment on the above-referenced document. The Native American Heritage Commission is the state agency designated for the protection of California's Native American cultural resources. The California Environmental Quality Act (CEQA) requires that any project that causes a substantial adverse change in the significance of an historical resource, that includes archeological resources, is a 'significant effect' requiring the preparation of an Environmental Impact Report (EIR per the California Code of Regulations § 15064.5(b)(c) (CEQA Guidelines). In order to comply with this provision, the lead agency is required to assess whether the project will have an adverse impact on these resources within the 'area of potential effect (APE),' and if so, to mitigate that effect. To adequately assess the project-related impacts on historical resources, the Commission recommends the following action:

√ Contact the appropriate California Historic Resources Information Center (CHRIS). Contact information for the 'Information Center' nearest you is available from the State Office of Historic Preservation in Sacramento (916/653-7278). The record search will determine:

- If a part or the entire (APE) has been previously surveyed for cultural resources.
- If any known cultural resources have already been recorded in or adjacent to the APE.
- If the probability is low, moderate, or high that cultural resources are located in the APE.
- If a survey is required to determine whether previously unrecorded cultural resources are present.

√ If an archaeological inventory survey is required, the final stage is the preparation of a professional report detailing the findings and recommendations of the records search and field survey.

- The final report containing site forms, site significance, and mitigation measurers should be submitted immediately to the planning department. All information regarding site locations, Native American human remains, and associated funerary objects should be in a separate confidential addendum, and not be made available for pubic disclosure.
- The final written report should be submitted within 3 months after work has been completed to the appropriate regional archaeological Information Center.

√ Contact the Native American Heritage Commission (NAHC) for:

* A Sacred Lands File (SLF) search of the project area and information on tribal contacts in the project vicinity who may have information on cultural resources in or near the APE. Please provide us site identification as follows: USGS 7.5-minute quadrangle citation with name, township, range and section. This will assist us with the SLF.

- Also, we recommend that you contact the Native American contacts on the attached list to get their input on the effect of potential project (e.g. APE) impact. In many cases a culturally-affiliated Native American tribe or person will be the only source of information about the existence of a cultural resource.

√ Lack of surface evidence of archeological resources does not preclude their subsurface existence.

- Lead agencies should include in their mitigation plan provisions for the identification and evaluation of accidentally discovered archeological resources, per California Environmental Quality Act (CEQA)

§15064.5 (f) of the California Code of Regulations (e.g. CEQA Guidelines). In areas of identified archaeological sensitivity, a certified archaeologist and a culturally-affiliated Native American Monitor, with knowledge of cultural resources, are recommended to monitor all ground-breaking construction activities.

Lead agencies should include in their mitigation plan provisions for the disposition of recovered artifact, in consultation with culturally-affiliated tribes.

√ Lead agencies should include provisions for discovery of Native American human remains or unmarked cemeteries in their mitigations plans.

- CEQA Guidelines §15064.5(d) requires the lead agency to work with the Native Americans identified by this Commission if the Initial Study identifies the presence or likely presence of Native American human remains within the APE. CEQA Guidelines provide for agreements with Native American groups, identified by the NAHE, to ensure the appropriate and dignified treatment of Native American human remains and any associated grave goods.
- Health and Safety Code §7050.5, Public Resources Code §5097.98 and CEQA Guidelines §15064.5(d) mandate procedures to be followed in the event of an accidental discovery of any human remains in a location other than a dedicated cemetery.

√ Lead agencies should consider avoidance, as defined in CEQA Guidelines §15370 when significant cultural resources are discovered during the course of project planning or execution.

Please feel free to contact me at (916) 653-6251 if you have any questions.

Sincerely,

Dave Singleton
Program Analyst

Attachment: Native American Contact List.

Cc: State Clearinghouse

Native American Contacts
Los Angeles County
July 31, 2008

Charles Cooke
32835 Santiago Road
Acton , CA 93510
(661) 733-1812 - cell
suscol@intox.net
Chumash
Fernandeno
Tataviam
Kitanemuk

Beverly Salazar Folkes
1931 Shadybrook Drive
Thousand Oaks , CA 91362
805 492-7255
(805) 558-1154 - cell
Chumash
Tataviam
Fe∓rnandeño

Fernandeno Tataviam Band of Mission Indians
William Gonzalaes, Cultural/Environ Depart
601 South Brand Boulevard, Suite 102
San Fernando , CA 91340
ced@tataviam.org
(818) 837-0794 Office
(818) 581-9293 Cell
(818) 837-0796 Fax
Fernandeno
Tataviam

LA City/County Native American Indian Comm
Ron Andrade, Director
3175 West 6th Street, Rm. 403
Los Angeles , CA 90020
(213) 351-5324
(213) 386-3995 FAX

Tongva Ancestral Territorial Tribal Nation
John Tommy Rosas, Tribal Admin.
,
tattnlaw@gmail.com
310-570-6567
Gabrielino Tongva

San Fernando Band of Mission Indians
John Valenzuela, Chairperson
P.O. Box 221838
Newhall , CA 91322
tsen2u@msn.com
(661) 753-9833 Office
(760) 885-0955 Cell
(760) 949-1604 Fax
Fernandeño
Tataviam
Serrano
Vanyume
Kitanemuk

Randy Guzman - Folkes
1931 Shadybrook Drive
Thousand Oaks , CA 91362
ndnrandy@hotmail.com
(805) 905-1675 - cell
Chumash
Fernandeño
Tataviam
Shoshone Paiute
Yaqui

This list is current only as of the date of this document.

Distribution of this list does not relieve any person of statutory responsibility as defined in Section 7050.5 of the Health and Safety Code, Section 5097.94 of the Public Resources Code and Section 5097.98 of the Public Resources Code.

This list is only applicable for contacting local Native Americans with regard to cultural resources for the propose SCH#2008071133; and SCH#2008071119; CEQA Notice of Preparation (NOP); draft Environmental Impact Report (DEIR) for the One Valley, One Vision (Los Angeles County #R2007-01226)' City of Santa Clarita; County of Los Angeeles, California.

GOVERNOR'S OFFICE OF EMERGENCY SERVICES
DISASTER ASSISTANCE PROGRAMS BRANCH
3650 SCHRIEVER AVENUE
MATHER, CALIFORNIA 95655
PHONE: (916) 845-8101 FAX: (916) 845-8381

August 1, 2008

Jeff Hogan
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

RE: Notice of Preparation for a Draft Environmental Impact Report for the One Valley, One Vision General Plan Update, SCH# 2008071133

Dear Mr. Hogan:

Thank you for the opportunity to comment on your Notice of Preparation for a Draft Environmental Impact Report (DEIR) for the city's general plan update. In preparing the general plan and accompanying DEIR, the city should examine the sections of state planning law that involve potential hazards the city may face. For your information, I have underlined specific sections of state planning law where identification and analysis of hazards are discussed (see Attachment A).

Prior to the release of the draft general plan or within the DEIR, city staff or your consultants should examine each of the requirements in state planning law and determine if there are hazard issues within the community which the general plan should address. A table in the DEIR (or general plan) which identifies these specific issues and where they are addressed in the general plan would be helpful in demonstrating the city has complied with these requirements. If the DEIR determines that state planning law requirements have not been met, it should recommend that these issues be addressed in the general plan as a mitigation measure.

We note that state planning law includes a requirement for consultations with state agencies in regard to information related to hazards. OES would be happy to share all available information at our disposal to facilitate the city's ability to comply with state planning and environmental laws.

If you have any questions about these comments, please contact Andrew Rush at (916) 845-8269 or andrew.rush@OES.ca.gov.

Sincerely,

Dennis Castrillo
Environmental Officer

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PLANNING DIVISION
AUG 0 6 2008
CITY OF SANTA CLARITA

cc: State Clearinghouse

Attachment A

Hazards and State Planning Law Requirements
(All citations are from the Government Code)

65302. Seven mandated elements

The general plan shall consist of a statement of development policies and shall include a diagram or diagrams and text setting forth objectives, principles, standards, and plan proposals. The plan shall include the following elements:

(a) A land use element which designates the proposed general distribution and general location and extent of the uses of the land for housing, business, industry, open space, including agriculture, natural resources, recreation, and enjoyment of scenic beauty, education, public buildings and grounds, solid and liquid waste disposal facilities, and other categories of public and private uses of land. The land use element shall include a statement of the standards of population density and building intensity recommended for the various districts and other territory covered by the plan. The land use element shall identify areas covered by the plan that are subject to flooding and shall be reviewed annually with respect to those areas. The land use element shall designate, in a land use category that provides for timber production, those parcels of real property zoned for timberland production pursuant to the California Timberland Productivity Act of 1982, Chapter 6.7 (commencing with Section 51100) of Part 1 of Division 1 of Title 5.

(g) A safety element for the protection of the community from any unreasonable risks associated with the effects of seismically induced surface rupture, ground shaking, ground failure, tsunami, seiche, and dam failure; slope instability leading to mudslides and landslides; subsidence, liquefaction and other seismic hazards identified pursuant to Chapter 7.8 (commencing with Section 2690) of the Public Resources Code, and other geologic hazards known to the legislative body; flooding; and wildland and urban fires. The safety element shall include mapping of known seismic and other geologic hazards. It shall also address evacuation routes, peakload water supply requirements, and minimum road widths and clearances around structures, as those items relate to identified fire and geologic hazards. Prior to the periodic review of its general plan and prior to preparing or revising its safety element, each city and county shall consult the Division of Mines and Geology of the Department of Conservation and the Office of Emergency Services for the purpose of including information known by and available to the department and the office required by this subdivision.

(d) A conservation element for the conservation, development, and utilization of natural resources including water and its hydraulic force, forests, soils, rivers and other waters, harbors, fisheries, wildlife, minerals, and other natural resources. That portion of the conservation element including waters shall be developed in coordination with any countywide water agency and with all district and city agencies which have developed, served, controlled or conserved water for any purpose for the county or city for which the plan is prepared. Coordination shall include the discussion and evaluation of any water supply and demand information described in Section 65352.5, if that information has been submitted by the water agency to the city or county. The conservation element may also cover:

(1) The reclamation of land and waters.

(2) Prevention and control of the pollution of streams and other waters.

(3) Regulation of the use of land in stream channels and other areas required for the accomplishment of the conservation plan.

(4) Prevention, control, and correction of the erosion of soils, beaches, and shores.

(5) Protection of watersheds.

(6) The location, quantity and quality of the rock, sand and gravel resources.

(7) Flood control.

65302.3. Consistency with airport land use plans

(a) The general plan, and any applicable specific plan prepared pursuant to Article 8 (commencing with Section 65450), shall be consistent with the plan adopted or amended pursuant to Section 21675 of the Public Utilities Code.

65302.6. Development of a local hazard mitigation plan

(a) A city, county, or a city and county may adopt with its safety element pursuant to subdivision (g) of Section 65302 a local hazard mitigation plan (HMP) specified in the federal Disaster Mitigation Act of 2000 (P. L. 106-390). The hazard mitigation plan shall include all of the following elements called for in the federal act requirements:
(1) An initial earthquake performance evaluation of public facilities that provide essential services, shelter, and critical governmental functions.
(2) An inventory of private facilities that are potentially hazardous, including, but not limited to, multiunit, soft story, concrete tilt-up, and concrete frame buildings.
(3) A plan to reduce the potential risk from private and governmental facilities in the event of a disaster.

65560. Definitions (Open-Space Lands)

(a) "Local open-space plan" is the open-space element of a county or city general plan adopted by the board or council, either as the local open-space plan or as the interim local open-space plan adopted pursuant to Section 65563.

(b) "Open-space land" is any parcel or area of land or water which is essentially unimproved and devoted to an open-space use as defined in this section, and which is designated on a local, regional or state open-space plan as any of the following:

(1) Open space for the preservation of natural resources including, but not limited to, areas required for the preservation of plant and animal life, including habitat for fish and wildlife species; areas required for ecologic and other scientific study purposes; rivers, streams, bays and estuaries; and coastal beaches, lakeshores, banks of rivers and streams, and watershed lands.

(2) Open space used for the managed production of resources, including but not limited to, forest lands, rangeland, agricultural lands and areas of economic importance for the production of food or fiber; areas required for recharge of ground water basins; bays, estuaries, marshes, rivers and streams which are important for the management of commercial fisheries; and areas containing major mineral deposits, including those in short supply.

(3) Open space for outdoor recreation, including but not limited to, areas of outstanding scenic, historic and cultural value; areas particularly suited for park and recreation purposes, including access to lakeshores, beaches, and rivers and streams; and areas which serve as links between major recreation and open-space reservations, including utility easements, banks of rivers and streams, trails, and scenic highway corridors.

(4) Open space for public health and safety, including, but not limited to, areas which require special management or regulation because of hazardous or special conditions such as earthquake fault zones, unstable soil areas, flood plains, watersheds, areas presenting high fire risks, areas required for the protection of water quality and water reservoirs and areas required for the protection and enhancement of air quality.

Calgrove Corridor Coalition

August 16, 2008

Mr. Jeff Hogan, AICP
Senior Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, CA 91355

Re: *Calgrove Corridor Coalition* Request for Clarification – Notice of Preparation of Draft Environmental Impact Report for the One Valley, One Vision General Plan EIR

Dear Mr. Hogan,

This is a follow to your recent letter to the *Calgrove Corridor Coalition* requesting our response to the above One Valley, One Vision Notice of Preparation.

After preliminary review of the Land Use section of the July 2008 OVOV draft, we are requesting clarification and additional information in order to provide our reply.

Specifically, we are requesting that the City of Santa Clarita Planning Department provide us a side by side comparison of the existing and proposed land use development standards for all zoning designations. To the extent there are new zoning designations, please also provide this information. This comparison should include all general requirements for the zones, such as:

1. Floor area ratio
2. Setback from right-of-way
3. Building and structure height
4. Structure setback from residential zones or uses
5. Parking requirements
6. Setbacks for public and semi-public uses from residential property uses

We request that this information be provided to us by end of business on Wednesday, August 20, 2008, in order for us to respond by the NOP deadline of August 25, 2008.

Respectfully,

Annette Lucas and Glenda Bona, co-chairs
Calgrove Corridor Coalition

CC Bob Kellar, Mayor
Ken Pulskamp, City Manager
Paul Brotzman, Director of Planning

August 25, 2008
To: Jeff Hogan, Senior Planner
From: Valerie Thomas
661.755.3793
Bionic1@sbcglobal.net
Re: One Valley One Vision Scoping Meeting Comments

General Comments:

1. Santa Clarita's original General Plan was authored by many citizens who worked diligently for nearly two years listening to community groups before they finalized their vision for the City. There were then community meetings at which ordinary citizens could offer comments and changes. Only after this process was completed, was a formal EIR implemented. One Valley One Vision has been drawn up primarily by City and County staff with occasional meetings with developers and major civic groups. No neighborhood meetings have been held to solicit their vision for the City over the next decade. The process needs to involve ordinary citizens and established neighborhoods before any further formalizing of One Valley One Vision is done.
2. This whole process is flawed by the inconsistency of dates for cutting off comments: Senior City Planner Hogan gives August 25 as the cutoff date for comments; Impact Sciences, Inc. gives August 28, 2008 as the cutoff date.
3. Santa Clarita's original General Plan was designed for a lower population at buildout than that being considered under One Valley One Vision. What state law requires acceptance of the higher population level? Have citizens' concerns been addressed in this discrepancy? Has the process addressed how the additional population will affect resources such as water availability, air quality, etc.?
4. Any changes made in regard to any of the planning elements should be made with the least disruption possible to existing neighborhoods and then only with discussions and negotiations with the affected neighborhoods.
5. Santa Clarita should demand as Los Angeles (city) does, that when a developer proposes a project, he lays the entire proposal out. That way, a developer would not be able to get permits for small parts of a project thus spending money and "vesting" so he is more likely to be able to get permits for a larger project than would otherwise have been permitted.

Air Quality

1. The Santa Clarita Valley (both City and County areas) frequently has the worst air quality in the Los Angeles County basin. OVOV needs to address planning/development/traffic circulation standards to ameliorate these conditions.

Hydrology

1. FEMA has been actively surveying the Santa Clarita Valley and drawing up new maps. While these maps are still preliminary, in many cases, FEMA foresees the likelihood of more disastrous flooding possibilities. Neither the City of Santa Clarita nor Los Angeles County should be allowed to request changes in these proposed designations or have development approved in these areas until the maps have been through the full public hearing process and formally adopted.
2. Santa Clarita has an ordinance that prohibits any land use that affects the flow of water either upstream or downstream of the project. That law needs to be a provision of One

Valley One Vision and it needs to be implemented stringently with severe financial consequences for any developer whose project creates flooding.

3. In addition to concerns about flooding, recharge needs to be addressed. Since the Santa Clarita Valley gets 50% of its water supplies from local underground sources, areas designated by FEMA as Floodways and Floodplains need to be preserved to allow for recharge into the local aquifers.

Land Use/Planning

1. The proposed One Valley One Vision Land Use Planning Map shows several areas (such as The Avenues and the North Newhall area) in the Valley designated as SP (Specific Plan). None of those plans have been adopted. The neighborhoods have not been consulted about these proposed changes; full plans have not been presented either to the neighborhoods or to any of the planning entities.
2. Per Land Use Policy LU 1.2.6: "In Placerita Canyon, preserve the eclectic neighborhood character, encourage provision of needed infrastructure through implementation of the North Newhall Specific Plan." Under the Present UDC, Placerita Canyon is a Special Standards District designed to preserve the rural equestrian nature of the area. The North Newhall Specific Plan has **not** been approved, despite the presumptive language of the Land Use element. Nor has Santa Clarita City staff consulted Placerita Canyon residents regarding these proposed changes.
3. No existing neighborhood should have its established zoning and nature disrupted to accommodate new neighborhoods.
4. Traffic flow needs to be analyzed at buildout and at the heaviest possible times – peak traffic hours and when school is in session to determine a given neighborhood can accommodate the projected development.
5. Santa Clarita should demand as Los Angeles (city) does, that when a developer proposes a project, he lays out the entire proposal. That way, a developer would not be able to get permits for small parts of a project thus spending money and "vesting" so he is more likely to be able to get permits for a larger project than would otherwise have been permitted.

Transportation/Traffic

1. Analyze traffic flows at projected buildout.
2. Do traffic counts at the heaviest traffic times; in school zones, do the traffic count when schools are in session not during vacation times.
3. Use peak hour times to measure traffic flow, or at least run peak hour analyses and 24-hour averages so Staff and the community can make a fair evaluation.
4. Make sure no existing neighborhoods are unequally impacted with changes in the circulation element such as Benz Road.

August 25, 2008
To: Jeff Hogan, Senior Planner
From: Valerie Thomas
661.755.3793
Bionic1@sbcglobal.net
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4. Make sure no existing neighborhoods are unequally impacted with changes in the circulation element such as Benz Road.

DEPARTMENT OF TRANSPORTATION
DIVISION OF AERONAUTICS – M.S.#40
1120 N STREET
P. O. BOX 942873
SACRAMENTO, CA 94273-0001
PHONE (916) 654-4959
FAX (916) 653-9531
TTY 711

Flex your power!
Be energy efficient!

August 13, 2008

RECEIVED
PLANNING DIVISION
AUG 28 2008
CITY OF SANTA CLARITA

Mr. Jeff Hogan
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

Dear Mr. Hogan:

City of Santa Clarita's Notice of Preparation of a Draft Environmental Impact Report for One Valley, One Vision General Plan; SCH# 2008071133

The California Department of Transportation (Caltrans), Division of Aeronautics (Division), reviewed the above-referenced document with respect to airport-related noise and safety impacts and regional aviation land use planning issues pursuant to the California Environmental Quality Act (CEQA). The Division has technical expertise in the areas of airport operations safety and airport land use compatibility. We are a funding agency for airport projects and we have permit authority for public-use and special-use airports and heliports. The following comments are offered for your consideration.

The proposal is for the One Valley, One Vision General Plan, a joint effort between the City of Santa Clarita and the County of Los Angeles. The Santa Clarita Valley Planning Area includes the City of Santa Clarita and its four communities of Canyon Country, Newhall, Saugus, and Valencia. It also includes the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce, and the future Newhall Ranch. The Agua Dulce Airpark airport is located within the proposed planning area.

In accordance with State law, California Public Utilities Code (PUC) Section 21676 *et seq.*, prior to the amendment of a general plan or specific plan, or the adoption or approval of a zoning ordinance or building regulation within the planning boundary established by the airport land use commission (ALUC), the local agency shall first refer the proposed action to the Los Angeles County ALUC.

The proposal should also be coordinated with Agua Dulce Airpark staff to ensure its compatibility with future as well as existing airport operations.

General plans and elements must clearly demonstrate intent to adhere to ALUC policies to ensure compliance with compatibility criteria. Direct conflicts between mapped land use designations in a general plan and the ALUC criteria must be eliminated. A general plan needs to include (at the very least) policies committing the county to adopt compatibility criteria essential to ensuring that such conflicts will be avoided. The criteria do not necessarily need to be spelled out in the general plan. There are a number of ways for a city or county to address the airport consistency issue, including:

- Incorporating airport compatibility policies into the update.
- Adopting an airport-combining zoning ordinance.
- Adopting an "Airport Element" into the general plan.
- Adopting the airport compatibility plan as a "stand alone" document or as a specific plan.

CEQA, Public Resources Code 21096, requires the California Airport Land Use Planning Handbook (Handbook) be utilized as a resource in the preparation of environmental documents for projects within airport land use compatibility plan boundaries or if such a plan has not been adopted, within two nautical miles of an airport. The Handbook provides a "General Plan Consistency Checklist" in Table 5A and a "Possible Airport Combining Zone Components" in Table 5B. The Handbook is a resource that should be applied to all public use airports and is available on-line at http://www.dot.ca.gov/hq/planning/aeronaut/documents/ALUPHComplete-7-02rev.pdf.

Since communities vary greatly in size and character from urban to rural, the level of noise deemed acceptable in one community is not necessarily the same for another community. Federal and State regulations regarding aircraft noise do not establish mandatory criteria for evaluating the compatibility of proposed land use development around airports (with the exception of the 65 dB CNEL "worst case" threshold established in the State Noise Standards for the designated "noise problem" airports). For most airports in California, 65 dB CNEL is considered too high a noise level to be appropriate as a standard for land use compatibility planning. This is particularly the case for evaluating new development in the vicinity of the airport. The 60 dB CNEL, or even 55 dB CNEL, may be more suitable for new development around most airports. For a further discussion of how to establish an appropriate noise level for a particular community, please refer to Chapter 7 of the Caltrans Handbook, available at http://www.dot.ca.gov/hq/planning/aeronaut/documents/ALUPHComplete-7-02rev.pdf.

Sound insulation, buyer notification and avigation easements are typical noise mitigation measures. These measures, however, do not change exterior aircraft noise levels. Noise mitigation measures are not a substitute for good land use compatibility planning for new development.

The planned height of buildings, antennas, and other objects should be checked with respect to Federal Aviation Regulation (FAR) Part 77 criteria if development is close to the airport, particularly if situated within the runway approach corridors. General plans must include policies restricting the heights of structures to protect airport airspace. To ensure compliance with FAR Part 77 "Objects Affecting Navigable Airspace," submission of a Notice of Proposed Construction or Alteration (Form 7460-1) to the Federal Aviation Administration (FAA) may be required. Form 7460-1 is available on-line at https://oeaaa.faa.gov/oeaaa/external/portal.jsp and should be submitted electronically.

Education Code Section 17215 requires a school site investigation by the Division prior to acquisition of land for a proposed school site located within two miles of an airport runway. Our recommendations are submitted to the State Department of Education for use in determining acceptability of the site. This should be a consideration prior to designating residential uses in the vicinity of an airport. The Division's school site evaluation criteria is available on-line at http://www.dot.ca.gov/hq/planning/aeronaut/regulations.html.

Business and Professions Code Section 11010 and Civil Code Sections 1102.6, 1103.4, and 1353 address buyer notification requirements for lands around airports and are available on-line at http://www.leginfo.ca.gov/calaw.html. Any person who intends to offer subdivided lands, common interest developments and residential properties for sale or lease within an airport influence area is required to disclose that fact to the person buying the property.

Land use practices that attract or sustain hazardous wildlife populations on or near airports can significantly increase the potential for wildlife-aircraft collisions. The FAA recommends that landfills, wastewater treatment facilities, surface mining, wetlands and other uses that have the potential to attract wildlife, be restricted in the vicinity of an airport. FAA Advisory Circular (AC150/5200-33B) entitled "Hazardous Wildlife Attractants on or Near Airports" addresses these issues. For further information, please refer to the FAA website http://wildlife-mitigation.tc.faa.gov/public_html/index.html.

The protection of airports from incompatible land use encroachment is vital to California's economic future. Agua Dulce Airpark is an economic asset that should be protected through effective airport land use compatibility planning and awareness. Although the need for compatible and safe land uses near airports in California is both a local and a state issue, airport land use commissions and airport land use compatibility plans are key to protecting an airport and the people residing and working in the vicinity of an airport. Consideration given to the issue of compatible land uses in the vicinity of an airport should help to relieve future conflicts between airports and their neighbors.

These comments reflect the areas of concern to the Division with respect to airport-related noise and safety impacts and regional airport land use planning issues. We advise you to contact our Caltrans District 7 office concerning surface transportation issues.

Thank you for the opportunity to review and comment on this proposal. If you have any questions, please call me at (916) 654-5314.

Sincerely,

Sandy Hesnard

SANDY HESNARD
Aviation Environmental Specialist

c: State Clearinghouse, Los Angeles County ALUC, Agua Dulce Airpark

STATE OF CALIFORNIA ARNOLD SCHWARZENEGGER, *Governor*

PUBLIC UTILITIES COMMISSION
320 WEST 4TH STREET, SUITE 500
LOS ANGELES, CA 90013

August 21, 2008

Mitch Glaser
Los Angeles County
320 West Temple Street, Room 1354
Los Angeles, CA 90012

Jeff Hogan
City of Santa Clarita
23920 Valencia Blvd. Suite 302
Santa Clarita, CA 91355

Dear Sirs:

Re: SCH# 2008071119; One Valley One Vision

The California Public Utilities Commission (Commission) has jurisdiction over the safety of highway-rail crossings (crossings) in California. The California Public Utilities Code requires Commission approval for the construction or alteration of crossings and grants the Commission exclusive power on the design, alteration, and closure of crossings.

The Commission is in receipt of the *Notice of Completion & Environmental Document Transmittal-NOP* from the State Clearinghouse. As the state agency responsible for rail safety within California, we recommend that the County/City add language to the general plan update so that any future planned development adjacent to or near Metrolink's Antelope Valley Line tracks is planned with the safety of the rail corridor in mind. New developments may increase traffic volumes not only on streets and at intersections, but also at at-grade highway-rail crossings. This includes considering pedestrian circulation patterns/destinations with respect to railroad right-of-way

Mitigation measures to consider include, but are not limited to, the planning for grade separations for major thoroughfares, improvements to existing at-grade highway-rail crossings due to increase in traffic volumes and continuous vandal resistant fencing or other appropriate barriers to limit the access of trespassers onto the railroad right-of-way.

If you have any questions, please contact Varouj Jinbachian, Senior Utilities Engineer at 213-576-7081, vsj@cpuc.ca.gov, or me at rxm@cpuc.ca.gov, 213-576-7078.

Sincerely,

Rosa Muñoz, PE
Utilities Engineer
Rail Crossings Engineering Section
Consumer Protection & Safety Division

C: Elizabeth Mahoney, SCRRA

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PLANNING DIVISION
AUG 28 2008
CITY OF SANTA CLARITA

Metropolitan Transportation Authority
One Gateway Plaza
Los Angeles, CA 90012-2952
213.922.2000 Tel
metro.net

Metro

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AUG 01 2008
CITY OF SANTA CLARITA

July 28, 2008

Mr. Jeff Hogan, AICP, Senior Planner
City of Santa Clarita
23920 Valencia Blvd, Suite 302
Santa Clarita, CA 91355

Dear Mr. Hogan:

Thank you for the opportunity to comment on the Notice of Preparation (NOP) for the One Valley, One Vision project. This letter conveys recommendations from the Los Angeles County Metropolitan Transportation Authority (Metro) concerning issues that are germane to our agency's statutory responsibilities in relation to the proposed project.

A Traffic Impact Analysis (TIA), with highway, freeway, and transit components, is required under the State of California Congestion Management Program (CMP) statute. The CMP TIA Guidelines are published in the "2004 Congestion Management Program for Los Angeles County", Appendix D. The geographic area examined in the TIA must include the following, at a minimum:

1. All CMP arterial monitoring intersections, including monitored freeway on/off-ramp intersections, where the proposed project will add 50 or more trips during either the a.m. or p.m. weekday peak hour (of adjacent street traffic); and
2. Mainline freeway-monitoring locations where the project will add 150 or more trips, in either direction, during either the a.m. or p.m. weekday peak hour.

Among the required steps for the analysis of development-related impacts to transit are:

3. Evidence that in addition to Metro, all affected Municipal transit operators received the NOP for the Draft EIR;
4. A summary of the existing transit services in the area;
5. Estimated project trip generation and mode assignment for both morning and evening peak periods;
6. Documentation on the assumptions/analyses used to determine the number and percentage of trips assigned to transit;
7. Information on facilities and/or programs that will be incorporated into the development plan that will encourage public transit usage and transportation demand management (TDM) policies and programs; and
8. An analysis of the expected project impacts on current and future transit services along with proposed project mitigation.

Metro looks forward to reviewing the Draft EIR. If you have any questions regarding this response, please call me at 213-922-6908 or by email at chapmans@metro.net. Please send the Draft EIR to the following address:

Metro CEQA Review Coordination
One Gateway Plaza MS 99-23-2
Los Angeles, CA 90012-2952
Attn: Susan Chapman

Sincerely,

Susan Chapman
Program Manager, Long Range Planning

Michael A. Naoum
27301 Eaglehelm Drive
Santa Clarita, CA 91387
661-252-9275
310-267-4821

August 4, 2008

Mr. Jason Smisko
Sr. Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, California 91355

Dear Mr. Smisko:

Since adequate community input time was not offered at the One Valley One Vision meeting on July 15, 2008, attached are my comments regarding the draft Land Use Element plan as well as comments on the Housing Element meeting. Kindly forward a copy of this letter to the Planning Commission.

One Valley One Vision – Land Use Element. Overall, I feel the Land Use Element fails to adequately take into account the existing suburban quality of the City, geographic distances between jobs and housing, the lack of existing density and a constrained road network including I5 and SR14 when trying to become an "urban center" with public transit oriented transportation. It offers developers plenty of flexibility but does not provide to the community the best, most rigorous, highest value planning tool. I'd suggest that the City develop more of a best practices approach rather than just using State minimums as our standards. We should be looking at communities like Westlake Village for standards – not the San Fernando Valley.

- While you indicated the General Plan should be general in nature, there are sometimes specific unapproved items mentioned in the plan that are troubling and should be removed. For example:
    - Part 1D indicates that the existing Canyon Country Metrolink station is planned to be relocated. This should be deleted since it is showing specificity in what should be a general plan.

- Part 1E identifies areas such as Val Verde and Halsey Canyon developed as low-density rural areas based on their residents' desire for retreat from high-intensity urban centers. Special use areas Sand and Placerita Canyon should be added to that list.

- The land use element shows a desire to preserve open space but would appear to allow dense "villages" in areas deemed to be floodplains, Significant Ecological Areas, desirable open areas and wildlife corridors.

  This is inconsistent with Guiding Principal 6b in the One Valley One Vision document dated 11/9/01 which states "a. Uses and improvements (within the Santa Clara River corridor and its major tributaries" shall be limited to those that benefit the community's use of the river in its natural state." And "b. Development on properties adjacent to, but outside the defined primary river corridor shall be: - located and designed to protect the river's water quality, plants, and animal habitats, controlling the density of uses, drainage runoff (water treatment) and other relevant elements".

  Furthermore, objective LU 1.2 states that the City will "maintain the distinctive community character of villages and neighborhoods throughout the planning area by establishing densities and design guidelines appropriate to the particular needs and goals of each area...." policy LU 1.2.5 states that "In Sand Canyon, ensure compatibility of development with existing rural, equestrian lots and the adjacent National Forest land; provide additional recreational trail links; and protect the Santa Clara River from incompatible development." This is contrary to the City's statement in the Land use element that the Canyon Country Metrolink station will be relocated to a high density village proposed in the Santa Clara riverbed just below Sand Canyon.

- While village concepts are promoted, the concept is new and there is no evidence that villages, especially large scale ones, far away from the bulk of the jobs in the City and tied principally to Metrolink for transportation will work to relieve congestion. If I am looking to live in a high density community served by public transit, why would I want to sit on a train for an hour just to live in Santa Clarita? If I want high density, I'll live in a truly urban area and minimize my commute time and dollars. Additionally, unless one works in downtown Los Angeles, or near the train stations in Glendale or Burbank, Metrolink is not a very efficient form of transportation.

- Having high density, low and moderate income housing, far from the major job centers employing these residents (Valencia Industrial Center and Magic Mountain) doesn't seem rational – especially when considering that a bus trip from Canyon Country to the Valencia Industrial Center takes between 60 and 90 minutes (when leaving from the closest Soledad stop that would be near the proposed new Canyon Country Metrolink location envisioned for a high density urban village development).

- Village concepts are supported by the City because of reduced land use and potentially traffic impacts if adjacent to functional public transit. Why is it that the County is allowing villages without being linked to public transit?

- The City is allowing greater density without a corresponding requirement for an increase in open or public spaces or any offsetting benefit for the public at large. Infill and villages with higher densities are promoted as a way to reduce land use (in theory to allow for more open space). Under the proposed plan, there is no offset required by the developers receiving these density bonuses to provide a funding mechanism to set aside those opens spaces the City is selling as so important to preserve and touting as a carrot arising from promoting higher density villages and infill projects. Creating these offsets and funding mechanisms is much like allowing the transfer of air rights among parcels in downtown areas where a higher building is allowed on one parcel based on the development rights purchased from another parcel – thus creating an open or public space.

- My vision of an urban center is an area with high quality, close (meaning walkable-within 1/4th mile) public transportation, with high density residential areas, incorporating jobs, amenities, retail and entertainment so that the use of cars is unattractive. I'm pessimistic that can be accomplished here.

- The transportation infrastructure needed for true urban centers in Santa Clarita will never be economic because of the lack of density and sprawling geography. We don't have the necessary density and can't get it without essentially starting the City over with density throughout the Santa Clarita valley. Santa Clarita is not Downtown Los Angeles or the Wilshire Corridor and we shouldn't be viewing developments in the same way they can. While the City has made great strides with providing Public Transportation to work and a few entertainment destinations, Public Transportation does not work for most folks in our lower density car oriented community.

- There appears to be an unwillingness to require project improvements that could add costs for development interests. The City should be looking at a number of avenues to improve the quality of life for all residents and stakeholders, not just be concerned with keeping costs at a minimum for developers and businesses. Some examples contained in the Land Use Element include:

    - Policy LU 6.1.2 designates the Santa Clara River corridor along with its major tributaries as Open Space and restricts development within 50 feet of the stream banks. THIS IS THE STATE MINIMUM! Between allowing bank stabilization and this minimal setback, the City is being disingenuous when it says it will "maintain the natural beauty of the City's rivers and streams. All too often the bike and walking trails are closed for long periods of time because CLWA is installing a new water line in the same, limited space. We should increase this setback to 250 feet to reduce the amount of bank stabilization and fill required and to allow for uses other than a walking and biking path along river

and stream areas. Open space doesn't need to be limited to just what the City buys.

- The City could be requiring employers of a certain size (say 100 employees) to provide showers for employees using bicycles. Instead, policy LU 5.1.3 has little to no teeth. It says the City will "require safe secure, clearly illuminated walkways and bicycle facilities in all commercial and business centers." A bicycle facility could be viewed as a post a bike could be locked to. Other cities require these facilities. Why can't we?

- The City could be requiring buildings to meet LEED requirements under LU 7.1.3 rather than just "encourage development of energy-efficient buildings". The State just revised energy efficiency codes. There is no reason why the City can't be more of a leader on this than a follower!

To summarize my input on the Land Use Element, I'd like to see the Element better blend with the currently developed areas of the City (since it is mostly built out), require more than minimums for code and setback requirements, and better preserve and be clearer over what the real plan is when there are conflicts between land use, open space, environmental, transportation, safety and infrastructure goals. This will avoid some of the double talk that exists in the current document.

In terms of the **Housing Element**, I'd like to see inclusionary requirements for low and moderate income housing – especially if the area's these developments may go must be designated in the land use plan as having 30 units per acre zoning. While the City has provided this density allowance in the past, developers have not done their part to include this element, instead choosing the market rate pricing approach.

It is clear we can't depend on developers' benevolence to accomplish this State mandated requirement. We must require developers to set aside units to meet this low income requirement especially since the density has been increased providing them an opportunity to build more units with lower per unit land costs. Additionally, since the lower income housing is needed primarily to support workers in the Valencia Industrial Center, the higher density housing should be in close proximity to those jobs. This will reduce the demand on our transportation infrastructure. Other areas of the community could be considered for Senior Housing since Seniors burden on the transportation infrastructure occurs during non-peak hours.

If you have questions or want clarification, please feel free to call.

Respectfully,

Michael Naoum

cc: Commissioner Burkhart
Commissioner Berger
Commissioner Ostrom
Commissioner Trautman
Commissioner Kennedy
Planning Manager Webber

Jeff Hogan

From: Jason Smisko
Sent: Monday, August 11, 2008 11:22 AM
To: Jeff Hogan; 'Judith Charles'; 'stebo@impactsciences.com'; 'Glaser, Mitch'
Subject: FW: OVOV EIR Scoping Meeting

Comment for the records.

From: CHARLES O'CONNELL [mailto:chuckoconnell@prodigy.net]
Sent: Friday, August 08, 2008 9:27 PM
To: Jason Smisko
Subject: OVOV EIR Scoping Meeting

Hi Jason- Good scoping meeting on Monday night. My input is as follows: The One Valley One Vision EIR should address the following- 1) adequacy of highway-freeway facilities to handle future demand as the population almost doubles; alternate routes should be available should the 5/14 freeway be devastated by another quake and just to handle future demand . At the very least , we need an extension of Reseda Blvd [or similar highway] over the hills to the SFV and possibly the tunnel extending San Fernando Road through to Roxford in Sylmar. 2) The adequacy of hospital facilities to meet the needs of increased population is a MUST. The expansion of HMNMH as presently proposed is INADEQUATE to meet future needs. CJO'Connell, PE, 25018 Smokewood Way, Stevenson Ranch, CA 91381 .

U.S. Department of Homeland Security
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA. 94607-4052

FEMA

August 18, 2008

RECEIVED
PLANNING DIVISION
AUG 22 2008
CITY OF SANTA CLARITA

Jeff Hogan, AICP, Senior Planner
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, California 91335

Dear Mr. Hogan:

This is in response to your request for comments on the Notice of Preparation of Draft Environmental Impact Report for One Valley, One Vision General Plan Environmental Impact Report.

Please review the current effective Flood Insurance Rate Maps (FIRMs) for the City of Santa Clarita (Community 060729), Map revised September 29, 1989. Please note that the City of Santa Clarita, Los Angeles County, California is a participant in the National Flood Insurance Program (NFIP). The minimum, basic NFIP floodplain management building requirements are described in Vol. 44 Code of Federal Regulations (44 CFR), Sections 59 through 65.

A summary of these NFIP floodplain management building requirements are as follows:

- All buildings constructed within a riverine floodplain, (i.e., Flood Zones A, AO, AH, AE, and A1 through A30 as delineated on the FIRM), must be elevated so that the lowest floor is at or above the Base Flood Elevation level in accordance with the effective Flood Insurance Rate Map.

- If the area of construction is located within a Regulatory Floodway as delineated on the FIRM, any ***development*** must not increase base flood elevation levels. **The term *development* means any man-made change to improved or unimproved real estate, including but not limited to buildings, other structures, mining, dredging, filling, grading, paving, excavation or drilling operations, and storage of equipment or materials.** A hydrologic and hydraulic analysis must be performed *prior* to the start of development, and must demonstrate that the development would not cause any rise in base flood levels. No rise is permitted within regulatory floodways.

- All buildings constructed within a coastal high hazard area, (any of the "V" Flood Zones as delineated on the FIRM), must be elevated on pilings and columns, so that the lowest horizontal structural member, (excluding the pilings and columns), is elevated to or above the base flood elevation level. In addition, the posts and pilings foundation and the structure attached thereto, is anchored to resist flotation, collapse and lateral movement due to the effects of wind and water loads acting simultaneously on all building components.

- Upon completion of any development that changes existing Special Flood Hazard Areas, the NFIP directs all participating communities to submit the appropriate hydrologic and hydraulic data to FEMA for a FIRM revision. In accordance with 44 CFR, Section 65.3, as soon as practicable, but not later than six months after such data becomes available, a community shall notify FEMA of the changes by submitting technical data for a flood map revision. To obtain copies of FEMA's Flood Map Revision Application Packages, please refer to the FEMA website at http://www.fema.gov/business/nfip/forms.shtm.

Please Note:

Many NFIP participating communities have adopted floodplain management building requirements which are more restrictive than the minimum federal standards described in 44 CFR. Please contact the local community's floodplain manager for more information on local floodplain management building requirements. The City of Santa Clarita floodplain manager can be reached by calling Christina Monde, Floodplain Coordinator, at (661) 255-4959.

If you have any questions or concerns, please do not hesitate to call Cynthia McKenzie of the Mitigation staff at (510) 627-7190.

Sincerely,

Gregor Blackburn, CFM, Branch Chief
Floodplain Management and Insurance Branch

cc:
Christina Monde, Floodplain Coordinator, Department of Public Works, City of Santa Clarita
Rick Sun, P. E., Los Angeles County, Department of Public Works, Watershed Management Division
Garret Tam Sing/Salomon Miranda, State of California, Department of Water Resources, Southern District
Cynthia McKenzie, Floodplanner, CFM, DHS/FEMA Region IX
Alessandro Amaglio, Environmental Officer, DHS/FEMA Region IX

DEPARTMENT OF CONSERVATION

DIVISION OF LAND RESOURCE PROTECTION

801 K STREET • MS 18-01 • SACRAMENTO, CALIFORNIA 95814

PHONE 916 / 324-0850 • **FAX** 916 / 327-3430 • **TDD** 916 / 324-2555 • **WEBSITE** conservation.ca.gov

August 28, 2008

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PLANNING DIVISION
SEP 04 2008
CITY OF SANTA CLARITA

Mr. Jeff Hogan, Senior Planner
City of Santa Clarita
23920 Valencia Boulevard, Suite 302
Santa Clarita, CA 91355

Dear Mr. Hogan:

Subject: Notice of Preparation Environmental Impact Report - One Valley, One Vision General Plan SCH #2008071133

The Department of Conservation's (Department) Division of Land Resource Protection (Division) has reviewed the Notice for the referenced project. The Division monitors farmland conversion on a statewide basis and administers the California Land Conservation (Williamson) Act and other agricultural land conservation programs. We offer the following comments and recommendations with respect to the project's impacts on agricultural land and resources.

The project involves the Santa Clarita Valley Planning Area, which encompasses the City of Santa Clarita and the communities of Canyon Country, Newhall, Saugus, Valencia, Stevenson Ranch, Castaic, Val Verde, Agua Dulce and the future Newhall Ranch in Los Angeles County. The joint effort between the City, County and residents is to guide future growth in the Valley and preserve natural resources.

Agricultural Setting of the Project

The Draft Environmental Impact Report (DEIR) should describe the project setting in terms of the actual and potential agricultural productivity of the land. The Division's Important Farmland Map for the County should be utilized to identify land within the project site and surrounding land that may be impacted. In addition, we recommend including the following items of information to characterize the agricultural land resource setting of the project.

- Describe current and past agricultural use of the project area. Include data on the types of crops grown, crop yields and farm gate sales values.
- Describe the full agricultural resource value of the soils of the site. We recommend the use of economic multipliers to assess the total contribution of the site's potential or actual agricultural production to the local, regional and state economies. University of California Cooperative Extension Service, Natural Resources Conservation Service and the United States Department of Agriculture (USDA) are good sources of economic multipliers.

Other forms of mitigation may be appropriate, including directing a mitigation fee to invest in supporting the commercial viability of the remaining agricultural land in the project area, County or region through a mitigation bank that invests in agricultural infrastructure, water supplies, marketing, etc.

Information about agricultural conservation easements is available on the Department's website or by contacting the Division at the address and phone number listed below. The Department's website address is:

http://www.conservation.ca.gov/dlrp/index.htm

Thank you for the opportunity to comment on the DEIR. If you have questions on our comments, or require technical assistance or information on agricultural land conservation, please contact the Division at 801 K Street, MS 18-01, Sacramento, California 95814; or, phone (916) 324-0850.

Sincerely,

Brian Leahy
Assistant Director

State of California - The Resources Agency ARNOLD SCHWARZENEGGER, Governor

DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov
South Coast Region
4949 Viewridge Avenue
San Diego, CA 92123
(858) 467-4201

RECEIVED
PLANNING DIVISION
SEP 04 2008
CITY OF SANTA CLARITA

August 28, 2008

Mr. Jeff Hogan
City of Santa Clarita
23920 Valencia Blvd, Suite 302
Santa Clarita, California 91355

Subject: **Notice of Preparation of Draft Environmental Impact Report for the One Valley, One Vision General Plan EIR, Los Angeles County**

Dear Mr. Hogan:

The Department of Fish and Game (Department) has reviewed the above-referenced Notice of Preparation (NOP) of a Draft Environmental Impact Report (DEIR) for the One Valley, One Vision General Plan relative to impacts to biological resources. The Department understands the result of the project will be a comprehensive update of its Area Plan document and EIR for the buildout of the entire Santa Clarita Valley Planning Area. The Planning Area includes the City of Santa Clarita and its four communities Canyon Country, Newhall, Saugus, and Valencia and the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce, and the future Newhall Ranch. The Department supports the goal of the County and City working together to develop one seamless plan in order to address current and future needs for the public and for the conservation of the valuable natural resources within the planning area. The Department also understands that the work effort will require the adoption of two separate documents. The City will adopt a new General Plan and EIR, while the County will adopt a new Area Wide Plan to replace the Santa Clarita Valley Area Wide Plan and prepare its own EIR.

The California Wildlife Action Plan, a recent Department guidance document, identified the following stressors affecting wildlife and habitats within the project area: 1) growth and development; 2) water management conflicts and degradation of aquatic ecosystems; 3) invasive species; 4) altered fire regimes; and 5) recreational pressures. The Department looks forward to working with the City of Santa Clarita to minimize impacts to fish and wildlife resources with a focus on these stressors.

The following statements and comments have been prepared pursuant to the Department's authority as Trustee Agency with jurisdiction over natural resources affected by the project (CEQA Section 15386) and pursuant to our authority as a Responsible Agency under the California Environmental Quality Act (CEQA), Section 15381 over those aspects of the proposed project that come under the purview of Fish and Game Code Section 1600 et seq. regarding impacts to streams and lakes.

The Department's general concerns regarding potential impacts to biological resources from project implementation are direct and indirect impacts to the Santa Clara River watershed and the associated vegetation communities and wildlife. Special attention should be given to the South Coast Missing Linkages Project, specifically the San Gabriel Mountains to Castaic Range is critical for preserving ecosystem processes in the South Coast Ecoregion. This and other

linkages are absolutely critical in establishing a protected area network for the South Coast Ecoregion.

The linkage is extremely diverse, supporting 20 distinct natural communities. Habitat types in the linkage include Coastal sage scrub, chaparral, coast live oak woodlands in canyons, and high quality riparian scrub and woodlands at lower elevations. In the eastern portion of the linkage there is a shift to a xeric landscape characterized by desert scrub, with scattered juniper and Joshua tree woodlands. Among the sensitive natural communities that occur are alluvial fan sage scrub, southern cottonwood willow riparian forest, southern riparian scrub, southern sycamore alder riparian, freshwater marsh, coast live oak riparian forest, vernal pool, mainland holly-leaved cherry woodland, valley needlegrass grassland, and coastal sage scrub. These habitats are among the rarest and most sensitive ecosystem types in the United States. Conservation of parcels within the linkage will contribute to the preservation of these communities. The Department recommends that the areas within the linkage be considered as high priority open space within this planning document for the City and County.

While each of the vegetation communities is important in their own right, it is also important that the natural hydrology of the linkage remain intact. The Santa Clara River is a prominent feature, draining 3,108 km^2 (1,200 mi^2) of the San Gabriel, Castaic, Santa Susana, and Sierra Madre mountains and cutting transversely through the linkage along Soledad Canyon. As one of the last free flowing natural riparian systems left in southern California, the Santa Clara River supports a diversity of aquatic, semi-aquatic, and terrestrial organisms. The essential habitats in the upper watershed and headwater streams in the planning area are largely intact, providing breeding sites, traveling routes, and other resources for wildlife; natural flood control; recharge of groundwater basins; nutrient cycling; and helping to sustain the river to its estuary in Ventura County. Many species that depend on low-elevation habitats are now federally and or state-listed as endangered, threatened, or sensitive.

Riparian zones and associated buffers rank highly and many of the tributary drainages are in an undisturbed state. However, some parcels within the flood plain of the Santa Clara River have been impacted by development and would therefore benefit from conservation and restoration. This restoration would have an added benefit of expanding habitat for several special status species, including the unarmored threespined stickleback (*Gasterosteus aculeatus williamsoni*), a federal and state endangered species and state Fully Protected species. Two other native fish are also present in the planning area, the federally threatened and state species of special concern Santa Ana sucker (*Catostomus santaanae*) and the state species of special concern arroyo chub (*Gila orcutti*) also occur here.

The Department recognizes the opportunities for better communication and planning between the City, the County, and your constituents as a result of this project. However, the Department wants to ensure that resource conservation remains a high priority and the redrafting of the General Plan and the Area Specific Plan doesn't reduce priority open space opportunity within the planning area while trying to accommodate the proposed development needs and meet the needs of the many special interest groups.

To enable Department staff to adequately review and comment on the proposed project we recommend the following information, where applicable, be included in the Draft Environmental Impact Report:

1. A complete, recent assessment of flora and fauna within and adjacent to the project area, with particular emphasis upon identifying endangered, threatened, and locally unique species and sensitive habitats (Attachment 1).

a. A thorough recent assessment of rare plants and rare natural communities, following the Department's Guidelines for Assessing Impacts to Rare Plants and Rare Natural Communities.

b. A complete, recent assessment of sensitive fish, wildlife, reptile, and amphibian species. Seasonal variations in use of the project area should also be addressed. Recent, focused, species-specific surveys, conducted at the appropriate time of year and time of day when the sensitive species are active or otherwise identifiable, are required. Acceptable species-specific survey procedures should be developed in consultation with the Department and U.S. Fish and Wildlife Service.

c. Rare, threatened, and endangered species to be addressed should include all those which meet the California Environmental Quality Act (CEQA) definition (see CEQA Guidelines, Section 15380).

d. The Department's Biogeographic Data Branch in Sacramento should be contacted at (916) 322-2493 (www.dfg.ca.gov/biogeodata) to obtain current information on any previously reported sensitive species and habitats, including Significant Natural Areas identified under Chapter 12 of the Fish and Game Code. Also, any Significant Ecological Areas SEAs) or Environmentally Sensitive Habitats (ESHs) or any areas that are considered sensitive by the local jurisdiction that are located in or adjacent to the project area must be addressed.

2. A thorough discussion of direct, indirect, and cumulative impacts expected to adversely affect biological resources, with specific measures to offset such impacts. This discussion should focus on maximizing avoidance, and minimizing impacts.

a. CEQA Guidelines, Section 15125(a), direct that knowledge of the regional setting is critical to an assessment of environmental impacts and that special emphasis should be placed on resources that are rare or unique to the region.

b. Project impacts should also be analyzed relative to their effects on off-site habitats and populations. Specifically, this should include nearby public lands, open space, adjacent natural habitats, and riparian ecosystems. Impacts to and maintenance of wildlife corridor/movement areas, including access to undisturbed habitat in adjacent areas are of concern to the Department and should be fully evaluated and provided. The analysis should also include a discussion of the potential for impacts resulting from such effects as increased vehicle traffic, outdoor artificial lighting, noise and vibration.

c. A cumulative effects analysis should be developed as described under CEQA Guidelines, Section 15130. General and specific plans, as well as past, present, and anticipated future projects, should be analyzed relative to their impacts on similar plant communities and wildlife habitats.

d. Impacts to migratory wildlife affected by the project should be fully evaluated including proposals to remove/disturb native and ornamental landscaping and other nesting habitat for native birds. Impact evaluation may also include such elements as migratory butterfly roost sites and neo-tropical bird and waterfowl stop-over and staging sites. All migratory nongame native bird species are protected by international treaty under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (50 C.F.R. Section 10.13). Sections 3503, 3503.5 and 3513 of the California Fish and Game Code prohibit take of birds and

their active nests, including raptors and other migratory nongame birds as listed under the MBTA.

e. Impacts to all habitats from City or County required Fuel Modification Zones (FMZ). Areas slated as mitigation for loss of habitat shall not occur within the FMZ.

f. Proposed project activities (including disturbances to vegetation) should take place outside of the breeding bird season (February 1- September 1) to avoid take (including disturbances which would cause abandonment of active nests containing eggs and/or young). If project activities cannot avoid the breeding bird season, nest surveys should be conducted and active nests should be avoided and provided with a minimum buffer as determined by a biological monitor (the Department recommends a minimum 500-foot buffer for all active raptor nests).

3. A range of alternatives should be analyzed to ensure that alternatives to the proposed project are fully considered and evaluated. A range of alternatives which avoid or otherwise minimize impacts to sensitive biological resources including wetlands/riparian habitats, alluvial scrub, coastal sage scrub, should be included. Specific alternative locations should also be evaluated in areas with lower resource sensitivity where appropriate.

a. Mitigation measures for project impacts to sensitive plants, animals, and habitats should emphasize evaluation and selection of alternatives which avoid or otherwise minimize project impacts. Compensation for unavoidable impacts through acquisition and protection of high quality habitat elsewhere should be addressed with off-site mitigation locations clearly identified.

b. The Department considers Rare Natural Communities as threatened habitats having both regional and local significance. Thus, these communities should be fully avoided and otherwise protected from project-related impacts (Attachment 2).

c. The Department generally does not support the use of relocation, salvage, and/or transplantation as mitigation for impacts to rare, threatened, or endangered species. Department studies have shown that these efforts are experimental in nature and largely unsuccessful.

4. A California Endangered Species Act (CESA) Permit must be obtained if the project has the potential to result in "take" of species of plants or animals listed under CESA, either during construction or over the life of the project. CESA Permits are issued to conserve, protect, enhance, and restore State-listed threatened or endangered species and their habitats. Early consultation is encouraged, as significant modification to the proposed project and mitigation measures may be required in order to obtain a CESA Permit. Revisions to the Fish and Game Code, effective January 1998, require that the Department issue a separate CEQA document for the issuance of a CESA permit unless the project CEQA document addresses all project impacts to listed species and specifies a mitigation monitoring and reporting program that will meet the requirements of a CESA permit. For these reasons, the following information is requested:

a. Biological mitigation monitoring and reporting proposals should be of sufficient detail and resolution to satisfy the requirements for a CESA Permit.

b. A Department-approved Mitigation Agreement and Mitigation Plan are required for plants listed as rare under the Native Plant Protection Act.

5. The Department opposes the elimination of watercourses (including concrete channels) and/or the canalization of natural and manmade drainages or conversion to subsurface drains. All wetlands and watercourses, whether intermittent, ephemeral, or perennial, must be retained and provided with substantial setbacks which preserve the riparian and aquatic habitat values and maintain their value to on-site and off-site wildlife populations. The Department recommends a minimum natural buffer of 100 feet from the outside edge of the riparian zone on each side of drainage.

   a. The Department requires a Streambed Alteration Agreement (SAA), pursuant to Section 1600 et seq. of the Fish and Game Code, with the applicant prior to any direct or indirect impact to a lake or stream bed, bank or channel or associated riparian resources. The Department's issuance of a SAA may be a project that is subject to CEQA. To facilitate our issuance of the Agreement when CEQA applies, the Department as a responsible agency under CEQA may consider the local jurisdiction's (Lead Agency) document for the project. To minimize additional requirements by the Department under CEQA the document should fully identify the potential impacts to the lake, stream or riparian resources and provide adequate avoidance, mitigation, monitoring and reporting commitments for issuance of the Agreement. Early consultation is recommended, since modification of the proposed project may be required to avoid or reduce impacts to fish and wildlife resources.

Thank you for this opportunity to provide comment. Please contact Mr. Dan Blankenship, Staff Environmental Scientist, at (661) 259-3750 if you should have any questions and for further coordination on the proposed project.

Sincerely,

Edmund J. Pert
Regional Manager
South Coast Region

cc: Helen Birss
Dan Blankenship
Betty Courtney
Scott Harris
Chron file
State Clearinghouse

Guidelines for Assessing the Effects of Proposed Projects on Rare, Threatened, and Endangered Plants and Natural Communities

State of California
THE RESOURCES AGENCY
Department of Fish and Game
December 9, 1983
Revised May 8, 2000

The following recommendations are intended to help those who prepare and review environmental documents determine **when** a botanical survey is needed, **who** should be considered qualified to conduct such surveys, **how** field surveys should be conducted, and **what** information should be contained in the survey report. The Department may recommend that lead agencies not accept the results of surveys that are not conducted according to these guidelines.

1. Botanical surveys are conducted in order to determine the environmental effects of proposed projects on all rare, threatened, and endangered plants and plant communities. Rare, threatened, and endangered plants are not necessarily limited to those species which have been "listed" by state and federal agencies but should include any species that, based on all available data, can be shown to be rare, threatened, and/or endangered under the following definitions:

A species, subspecies, or variety of plant is "endangered" when the prospects of its survival and reproduction are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, over-exploitation, predation, competition, or disease. A plant is "threatened" when it is likely to become endangered in the foreseeable future in the absence of protection measures. A plant is "rare" when, although not presently threatened with extinction, the species, subspecies, or variety is found in such small numbers throughout its range that it may be endangered if its environment worsens.

Rare natural communities are those communities that are of highly limited distribution. These communities may or may not contain rare, threatened, or endangered species. The most current version of the California Natural Diversity Database's List of California Terrestrial Natural Communities may be used as a guide to the names and status of communities.

2. It is appropriate to conduct a botanical field survey to determine if, or to the extent that, rare, threatened, or endangered plants will be affected by a proposed project when:

a. Natural vegetation occurs on the site, it is unknown if rare, threatened, or endangered plants or habitats occur on the site, and the project has the potential for direct or indirect effects on vegetation; or
b. Rare plants have historically been identified on the project site, but adequate information for impact assessment is lacking.

3. Botanical consultants should possess the following qualifications:

a. Experience conducting floristic field surveys;
b. Knowledge of plant taxonomy and plant community ecology;
c. Familiarity with the plants of the area, including rare, threatened, and endangered species;
d. Familiarity with the appropriate state and federal statutes related to plants and plant collecting; and,
e. Experience with analyzing impacts of development on native plant species and communities.

4. Field surveys should be conducted in a manner that will locate any rare, threatened, or endangered species that may be present. Specifically, rare, threatened, or endangered plant surveys should be:

a. Conducted in the field at the proper time of year when rare, threatened, or endangered species are both evident and identifiable. Usually, this is when the plants are flowering.

When rare, threatened, or endangered plants are known to occur in the type(s) of habitat present in the project

area, nearby accessible occurrences of the plants (reference sites) should be observed to determine that the species are identifiable at the time of the survey.

b. Floristic in nature. A floristic survey requires that every plant observed be identified to the extent necessary to determine its rarity and listing status. In addition, a sufficient number of visits spaced throughout the growing season are necessary to accurately determine what plants exist on the site. In order to properly characterize the site and document the completeness of the survey, a complete list of plants observed on the site should be included in every botanical survey report.

c. Conducted in a manner that is consistent with conservation ethics. Collections (voucher specimens) of rare, threatened, or endangered species, or suspected rare, threatened, or endangered species should be made only when such actions would not jeopardize the continued existence of the population and in accordance with applicable state and federal permit requirements. A collecting permit from the Habitat Conservation Planning Branch of DFG is required for collection of state-listed plant species. Voucher specimens should be deposited at recognized public herbaria for future reference. Photography should be used to document plant identification and habitat whenever possible, but especially when the population cannot withstand collection of voucher specimens.

d. Conducted using systematic field techniques in all habitats of the site to ensure a thorough coverage of potential impact areas.

e. Well documented. When a rare, threatened, or endangered plant (or rare plant community) is located, a California Native Species (or Community) Field Survey Form or equivalent written form, accompanied by a copy of the appropriate portion of a 7.5 minute topographic map with the occurrence mapped, should be completed and submitted to the Natural Diversity Database. Locations may be best documented using global positioning systems (GPS) and presented in map and digital forms as these tools become more accessible.

5. Reports of botanical field surveys should be included in or with environmental assessments, negative declarations and mitigated negative declarations, Timber Harvesting Plans (THPs), EIR's, and EIS's, and should contain the following information:

a. Project description, including a detailed map of the project location and study area.
b. A written description of biological setting referencing the community nomenclature used and a vegetation map.
c. Detailed description of survey methodology.
d. Dates of field surveys and total person-hours spent on field surveys.
e. Results of field survey including detailed maps and specific location data for each plant population found. Investigators are encouraged to provide GPS data and maps documenting population boundaries.
f. An assessment of potential impacts. This should include a map showing the distribution of plants in relation to proposed activities.
g. Discussion of the significance of rare, threatened, or endangered plant populations in the project area considering nearby populations and total species distribution.
h. Recommended measures to avoid impacts.
i. A list of all plants observed on the project area. Plants should be identified to the taxonomic level necessary to determine whether or not they are rare, threatened or endangered.
j. Description of reference site(s) visited and phenological development of rare, threatened, or endangered plant(s).
k. Copies of all California Native Species Field Survey Forms or Natural Community Field Survey Forms.
l. Name of field investigator(s).
m. References cited, persons contacted, herbaria visited, and the location of voucher specimens.

Sensitivity of Top Priority Rare Natural Communities in Southern California

Sensitivity rankings are determined by the Department of Fish and Game, California Natural Diversity Data Base and based on either number of known occurrences (locations) and/or amount of habitat remaining (acreage). The three rankings used for these top priority rare natural communities are as follows:

S1.# Fewer than 6 known locations and/or on fewer than 2,000 acres of habitat remaining.

S2.# Occurs in 6-20 known locations and/or 2,000-10,000 acres of habitat remaining.

S3.# Occurs in 21-100-known locations and/or 10,000-50,000 acres of habitat remaining.

The number to the right of the decimal point after the ranking refers to the degree of threat posed to that natural community regardless of the ranking. For example:

S1.1 = very threatened
S2.2 = threatened
S3.3 = no current threats known

Sensitivity Rankings (February 1992)

Rank	Community Name
S1.1	Mojave Riparian Forest
	Sonoran Cottonwood Willow Riparian
	Mesquite Bosque
	Elephant Tree Woodland
	Crucifixion Thorn Woodland
	Allthorn Woodland
	Arizonan Woodland
	Southern California Walnut Forest
	Mainland Cherry Forest
	Southern Bishop Pine Forest
	Torrey Pine Forest
	Desert Mountain White Fir Forest
	Southern Dune Scrub
	Southern Coastal Bluff Scrub
	Maritime Succulent Scrub
	Riversidean Alluvial Fan Sage Scrub
	Southern Maritime Chaparral
	Valley Needlegrass Grassland
	Great Basin Grassland
	Mojave Desert Grassland
	Pebble Plains
	Southern Sedge Bog
	Cismontane Alkali Marsh

S1.2	Southern Foredunes
	Mono Pumice Flat
	Southern Interior Basalt Flow Vernal Pool
S2.1	Venturan Coastal Sage Scrub
	Diegan Coastal Sage Scrub
	Riversidean Upland Coastal Sage Scrub
	Riversidean Desert Sage Scrub
	Sagebrush Steppe
	Desert Sink Scrub
	Mafic Southern Mixed Chaparral
	San Diego Mesa Hardpan Vernal Pool
	San Diego Mesa Claypan Vernal Pool
	Alkali Meadow
	Southern Coastal Salt Marsh
	Coastal Brackish Marsh
	Transmontane Alkali Marsh
	Coastal and Valley Freshwater Marsh
	Southern Arroyo Willow Riparian Forest
	Southern Willow Scrub
	Modoc-Great Basin Cottonwood Willow Riparian
	Modoc-Great Basin Riparian Scrub
	Mojave Desert Wash Scrub
	Engelmann Oak Woodland
	Open Engelmann Oak Woodland
	Closed Engelmann Oak Woodland
	Island Oak Woodland
	California Walnut Woodland
	Island Ironwood Forest
	Island Cherry Forest
	Southern Interior Cypress Forest
	Bigcone Spruce-Canyon Oak Forest
S2.2	Active Coastal Dunes
	Active Desert Dunes
	Stabilized and Partially Stabilized Desert Dunes
	Stabilized and Partially Stabilized Desert Sandfield
	Mojave Mixed Steppe
	Transmontane Freshwater Marsh
	Coulter Pine Forest
	Southern California Fellfield
	White Mountains Fellfield
S2.3	Bristlecone Pine Forest
	Limber Pine Forest

SCOPE
Santa Clarita Organization for Planning and the Environment
TO PROMOTE, PROTECT AND PRESERVE THE ENVIRONMENT, ECOLOGY
AND QUALITY OF LIFE IN THE SANTA CLARITA VALLEY
POST OFFICE BOX 1182, SANTA CLARITA, CA 91386

8-29-08

Jeff Hogan
City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 91355

Mitch Glaser
County of LA, Dept. of Regional Planning
320 W. Temple St.
Los Angeles, CA 90012

Re: Notice of Preparation for the DEIR to Update the Couty and City of Santa Clarita General Plan
Delivered via email. Hard copy to follow by regular mail.

Dear Mr. Hogan and Mr. Glaser:

Thank you for the opportunity to provide input into the future contents of this environmental report. We request in advance that the public be granted at least a 120-day review period for this important planning document so that everyone has adequate time to evaluate and discuss its contents.

General Plan Comments

One issue that many of our members have brought to our attention is a concern that the melding of the City and County Plans will produce weaker protections for the planning process and the environment. Currently the County of Los Angeles must adhere to a Development Monitoring System (General Plan Amendment SP 86-173). Since this System was put in place as a result of a Court ordered settlement agreement, we do not believe that the County may just arbitrarily ignore this amendment. Nor may they exclude it from any update.

In the past, SCOPE has requested many times that the City adopt a similar plan amendment in order to more effectively analyze the capacity of existing infrastructure to support new growth. The City has refused. That refusal has resulted in such absurdities as the G& L Office Expansion EIR not discussing the sufficiency of the sewer capacity to handle the proposed office expansion. After the Sanitation District brought this problem to the Council's attention in a comment letter, G&L responded with a requirement to merely do a "study" after the office expansion is approved. A Development Monitoring System would ensure that expensive infrastructure needs such as sewer systems are paid for by the developers or at least all provisions to provide such required infrastructure are properly funded so that the existing residents may continue to depend on their current level of service.

We therefore request that the City include the County of Los Angeles' Development Monitoring System into any combined plan as a mitigation requirement for the additional growth for which the plan will provide.

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The City also does not have adequate protection for Significant Ecological Areas. This LA County General Plan designation has strict planning regulations to which developers must adhere whenever development is proposed in a SEA, including the requirement of producing an EIR. The City merely has an overlay designation that has not provided any real protection for these areas and the open space habitat they were meant to conserve. Evidence of this is clearly visible in the City's approval of all the development in the floodplain of the Santa Clara River and the loss of the endangered species that currently existed in those areas. Any melding of the two general plans must include the County's SEA regulations.

It also appears that the County has a much stronger Oak Tree Protection Ordinance. We request that this stronger ordinance be adhered to in any melding of the two planning jurisdictions.

To summarize, where one planning jurisdiction's regulations include stronger protections for the resources and the existing community, those regulations should be the controlling ordinance for any melded plan.

NOP Comments

Climate Change
The DEIR must include a section on the effects to global warming from any increase in the number of housing units. Information for calculating these impacts is available from the Attorney General's Office, the California Air Resources Board and the Association of Pollution Control Officers. Feasible mitigation measures may also be obtained from these agencies and other groups.

A "Green" Building ordinance should be developed and required as mitigation for greenhouse gas production caused by additional proposed growth. This ordinance should include standards that will increase energy and water efficiency and encourage the use of alternative energy sources such as wind and solar energy.

Floodplains
The DEIR must address the cumulative impacts of the loss of floodplain on downstream land uses and habitat, including increased velocity and erosion produced by concrete banks and the impacts of such banking on water quality (increases to pH levels as identified by the Regional Water Quality Board). The Plan must update its floodplain designation maps to comply with current state and federal laws. The Maps that are most protective of our local streams and the Santa Clara River should be used for this update. Good flood plain protection will improve water quality and water supply as well as provide habitat for native wildlife.

Water Supply
The DEIR should contain a Water Element that discusses how water will be provided for any future proposed growth. This discussion should disclose impacts to the Sacramento Delta and any other proposed areas of origin for new water sources. It should also fully and accurately disclose all impediments to obtaining additional water from those sources including supply reductions from climate change, impacts to endangered species and water quality degradation both in the area of origin and locally. This section should disclose water supply during a dry, normal and wet year

so that planners and the public may easily be apprised of the worst case scenario for which they must plan.

This section should include information on the water quality of our existing water sources. Information on the alluvial aquifer should include a discussion of the Chloride problem and how additional growth will impact the sanitation districts' ability to comply with the new Chloride Total Maximum Daily Load (TMDL) regulation that will go into effect soon. It should include full disclosure of the industrial contamination currently affecting many of the high producing wells in the Saugus aquifer. This disclosure should not only address ammonium perchlorate pollution and its health risk to children, but also the many additional cancer causing Volatile Organic Compounds in this water source.

Additional state water to supply new growth will increase chloride levels in the effluent produced by the Sanitation Plants. This section should fully disclose the impacts on the Chloride TMDL of increased growth.

This section should indicate from where the water supply for increased growth will come.

A drought tolerant landscape ordinance should be developed and required as mitigation. Recycled water systems should be required for open space and landscaped areas in all new development. Water retention systems such as roof to underground cistern storage systems, downspout disconnection to storm drain and lot contouring to retain rainfall on site and encourage recharge of the local aquifers should also be required for any new development.

Air Quality
The DEIR should clearly disclose the poor air quality that already exists in this valley due to high ozone and particulate matter pollution, and its impacts on increased asthma rates, especially in children. Further reductions in air quality due to additional proposed growth must be disclosed and mitigated.

Health Hazards
Contaminated sites must be fully disclosed and designated as such in the General Plan for the health, safety and welfare of the public. Estimated clean up time for such areas must be included in the DEIR.

Education
Planning for school sites should not include locations next to or on contaminated sites and freeways. It is a well-established fact that air pollutants are extremely high in areas adjacent to freeways.

Piece-mealing the General Plan Updates
State law requires an update to a City or County General Plan every ten years. The update to the Santa Clarita Plan is five years overdue, yet the City and the County continue to approve projects based on this plan and where needed to ensure project approval, merely amends the offending section for the developer.

Also, over the past several years the City of Santa Clarita has updated individual elements of the General Plan. These updates included changes to the Air Quality, Noise, Housing, and Parks and Open Space Elements.

We believe both these practices should not be allowed, as they constitute piece-mealing that is not allowed under CEQA, and seem to be a means of intentionally avoiding the requirement to provide an EIR for a General Plan Update.

Thank you in advance for your attention to these comments. We request that you provide our group with a hard copy as well as a disc of the DEIR when it becomes available so that we can circulate it to our members that may or may not have computer capabilities.

Sincerely,

Lynne Plambeck
President

Calgrove Corridor Coalition

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August 28, 2008

Mr. Jeff Hogan, AICP
Senior Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, CA 91355

Re: ***Calgrove Corridor Coalition*** **Response - Notice of Preparation of Draft Environmental Impact Report for the Land Use Element of One Valley, One Vision (OVOV)**

Dear Mr. Hogan,

At the request of the City of Santa Clarita, the Calgrove Corridor Coalition (CCC) is providing comment on the Notice of Preparation (NOP) for the Land Use Element of the OVOV. However, we are doing so without having received information we requested from the City which would have precisely defined the differences between the current and proposed Land Use designations.

Because the changes in Land Use designations have not been disclosed, we believe that the process of review for this draft EIR is flawed, and that the information contained in this draft is incomplete and misleading.

Without full and complete disclosure of the definitional changes, the residents of our Valley are not equipped to comprehend the impacts of the new Land Use definitions when contemplating issues and preparing comments. ***The burden is upon the drafters of this plan to provide the necessary information so the public can make an informed decision about this very important issue.*** This has not been done, and the importance of this concern cannot be understated.

In consideration of the above, the following outlines the CCC's preliminary response to specific aspects of the Land Use Element. Please note that we believe our response is consistent with the vision for gateway projects as outlined in the City's current General Plan - that higher density developments are not consistent with gateway locations such as the Smiser Ranch property.

Aesthetics
The Smiser Ranch property is located at the I-5 entrance to the City Santa Clarita, and is the first view of our Valley traveling northward through the Newhall Pass. Concerns about aesthetics regarding this property are therefore highly important and due special consideration.

We wish to point out the language in the existing General Plan, that states we "*continue the established pattern of attractive greenbelts, golf courses, open space, including the protection of adjacent significant ecological areas and entertainment/recreational amenities along I-5 ... and to strengthen and enhance the image of the city as a pleasant and fun place to live, work, visit and play.*"

These elements of the existing General Plan must be preserved. The Specific Plan (SP) designation for the Smiser Ranch property does not come close to doing this - in fact, it eliminates all existing zoning limitations. The height and density concerns of the many residential neighborhoods which comprise the CCC membership is a critical consideration that has not been properly addressed by the SP designation.

Air Quality
In the past the South Coast Air Quality Management District (SCAQMD) has found that the Santa Clarita Valley is already out of compliance with their standards. With increased density, traffic, and circulation, there will be additional negative impacts on air quality. Construction activities will also create a negative impact.

1. Has the SCAQMD addressed their concerns about the air quality in our Valley?
2. Has this been addressed in the draft NOP?

The public has a right to review the SCAQMD comments to the draft EIR prior to commenting on this section.

Hydrology
The uncertainty about future availability of water within the Southern California area should also be viewed as a potential constraint to development. The SCV also relies on local ground water supplies for domestic, commercial and agricultural uses - preservation and conservation of these resources must be paramount in the minds of land use planners. Existing and proposed land uses and operations must consider the consequences of degradation to ground water or surface water that is used to replenish the ground water supplies.

Land Use and Planning
As stated in our earlier comments regarding aesthetics, the SP designation is inappropriate for the Smiser Ranch property because it is extremely vague and not in compliance with the guiding principles of OVOV. The guiding principles state that "multi-family housing development's building massing shall complement the characteristics of surrounding single-family residential neighborhoods" such as those that surround the Smiser property. The SP designation does not preserve such requirements.

Also, the guiding principles state "the Santa Clara River corridor and its major tributaries shall be preserved as open space to accommodate storm water flows and protect critical plant and animal species." We note that the South Fork of the Santa Clara River flows through the Smiser property. In fact, the applicability of SP to the Smiser property may be in question; once CalTrans completes its plans to expand I-5 and in the process require land within the Smiser property boundaries, the remaining parcel may be too small to meet the 30-acre SP minimum.

Population and Housing

We disagree with the OVOV vision for population growth in the Santa Clarita Valley. The stated numbers are simply too large and do not support the quality of life requirements of most who live here - note that high-density housing in our Valley currently represents highest areas of crime.

The City's original General Plan was created in collaboration with many citizens and neighborhood groups throughout the Valley. This process took nearly two years of hard work prior to finalizing the current vision of the City. In contrast, the current draft EIR was developed primarily by the City and County staff with only occasional meetings with developers and major civic groups. The City and County need to go back to the residents of our community to seek input about ***their*** vision of the future of the Santa Clarita Valley, including population and housing goals, which we believe are significantly different than proposed in the City's OVOV view.

Recreation

The City has an alarming and growing deficit with its General Plan objectives for the development of parks. Even with the currently planned increase of 210 acres of parks, the city will still fall significantly short of its current park objectives. We are now aware of a significant, last minute change to the objectives which results in a decrease in the city's park objectives by 40%, from 5 acres per 1000 residents to 3 acres per 1000 residents. This is unacceptable. Also, the City's Guiding Principles state that parkland will be developed "with priority on locations that are not now adequately served." This designation fits the areas adjacent to and surrounding the Smiser property. The City must address the existing parkland deficit, but not by reducing the current parkland objectives. The CCC requests that this issue be considered as plans for the Smiser Ranch property progress.

Transportation and Traffic

Traffic in the Newhall Pass, especially at Calgrove Boulevard, is already problematic and poses many challenges for the residents of the surrounding communities. An SP designation for the Smiser Ranch property would only increase congestion. We believe larger roads and freeways are not the answer. Also, the draft EIR does not address what happens when there are major incidents on the I-5, which occur with discouraging regularity. When an accident takes place on I-5 in the vicinity of the Newhall Pass, it seriously impacts all the communities in the Calgrove Corridor. For example, during the most recent truck tunnel accident, traffic was at a standstill on both The Old Road and Wiley Canyon. In a major disaster such as an earthquake or fire, we have significant concerns about the ability of the existing road infrastructure to handle traffic and/or evacuation.

Conclusion

The Calgrove Corridor Coalition does not support launching any section of the EIR until all sections of the Draft EIR have been completed, including zoning definitional changes, and presented to the residents of Santa Clarita. Not only have circulation and housing elements not been presented to the public, we strongly feel that our community's ability to provide comment should be left open at least sixty (60) days after the final the staff presentations.

Respectfully,

Annette Lucas Glenda Bona

Annette Lucas and Glenda Bona
Co-chairs
Calgrove Corridor Coalition

cc: Bob Kellar, Mayor
Ken Pulskamp, City Manager
Paul Brotzman, Director of Planning

COUNTY OF LOS ANGELES

FIRE DEPARTMENT

1320 NORTH EASTERN AVENUE
LOS ANGELES, CALIFORNIA 90063-3294

(323) 890-4330

P. MICHAEL FREEMAN
FIRE CHIEF
FORESTER & FIRE WARDEN

August 19, 2008

Jason Smisko, Senior Planner
City of Santa Clarita
23920 Valencia Boulevard, Suite 300
Santa Clarita, CA 91355

Dear Mr. Smisko:

NOTICE OF PREPARATION, NORTH NEWHALL SPECIFIC PLAN STAGE I: LYONS AVENUE AT-GRADE CROSSING, SANTA CLARITA (FFER #200800131)

The Notice of Preparation has been reviewed by the Planning Division, Land Development Unit, Forestry Division, and Health Hazardous Materials Division of the County of Los Angeles Fire Department. The following are their comments:

RECEIVED
PLANNING DIVISION

AUG 27 2008

CITY OF SANTA CLARITA

PLANNING DIVISION:

1. We do not have comments at this time.

LAND DEVELOPMENT UNIT:

1. We do not have comments at this time.

FORESTRY DIVISION – OTHER ENVIRONMENTAL CONCERNS:

1. The statutory responsibilities of the County of Los Angeles Fire Department, Forestry Division include erosion control, watershed management, rare and endangered species, vegetation, fuel modification for Very High Fire Hazard Severity Zones or Fire Zone 4, archeological and cultural resources, and the County Oak Tree Ordinance. Potential impacts in these areas should be addressed in the Draft Environmental Impact Report.

HEALTH HAZARDOUS MATERIALS DIVISION:

1. There are no comments at this time.

If you have any additional questions, please contact this office at (323) 890-4330.

Very truly yours,

FRANK VIDALES, ACTING CHIEF, FORESTRY DIVISION
PREVENTION SERVICES BUREAU

FV:lj

County of Los Angeles Public Library
7400 East Imperial Hwy., P.O. Box 7011, Downey, CA 90241-7011
(562) 940-8461, TELEFAX (562) 803-3032

Library

MARGARET DONNELLAN TODD
COUNTY LIBRARIAN

August 25, 2008

RECEIVED
PLANNING DIVISION
AUG 29 2008
CITY OF SANTA CLARITA

Jeff Hogan, AICP
Senior Planner
City of Santa Clarita
23920 Valencia Blvd, Suite 302
Santa Clarita, CA 91355

Dear Mr. Hogan:

NOTICE OF PREPARATION OF DRAFT ENVIRONMENTAL IMPACT REPORT FOR THE ONE VALLEY, ONE VISION GENERAL PLAN

This is to provide you with written comments on the Notice of Preparation of Draft Environmental Impact Report (EIR) for the One Valley, One Vision (OVOV) General Plan for the entire Santa Clarita Valley Planning Area. As indicated in the document you provided, the Santa Clarita Valley Planning Area includes the four communities in the City of Santa Clarita – Canyon Country, Newhall, Saugus, and Valencia – and the County communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce, and the future Newhall Ranch.

Service Level Guidelines

The County Library's current service level guidelines are a minimum of 0.50 gross square foot of library facility space per capita, 2.75 items (books and other libraries materials) per capita, and 1.0 public access computer per 1,000 people served. Additional facility planning guidelines include 4 parking spaces per 1,000 gross square feet of building size, and a land-to-facility size ratio of 4:1.

Existing Facilities and Resources (books and other library materials)

The County Library operates all public libraries within the Santa Clarita Valley. There are four community libraries in the Santa Clarita Valley Planning Area: three permanent facilities, plus one mobile library, the Santa Clarita Valley Bookmobile.

Library	Facility Size (sq. ft)	Collection Size (items)
Canyon Country Jo Anne Darcy	12,864	100,082
Newhall	4,842	50,278
Valencia	23,966	215,024
Santa Clarita Valley Bookmobile		10,512
Total – Santa Clarita Valley	**41,672**	**375,896**

Based on a valley-wide population of 213,857 (2000 U.S. Census), the combined facility space and collection of books and library materials for these libraries do not currently meet the County Library's service level guidelines in providing library services to the existing residents of the Santa Clarita Valley. These libraries have a combined shortage of a minimum of 65,257 sq. ft. of facility space and 212,211 items (books and other library materials).

Population growth would create additional demand for library services and would adversely affect the service capacity of the County libraries within the Santa Clarita Valley to adequately serve the existing residents in these service areas. In addition, the non-residential component of the OVOV General Plan could also have a potential, though indeterminable, impact on library services. People who work, but do not live, in the Santa Clarita Valley are likely to use local libraries during their time at work or while commuting to and from work.

Planned Service Improvements in the Santa Clarita Valley Area – New or Expanded Library Facilities

Castaic Library: This new library is located at 27971 Sloan Canyon Road, Castaic, CA 91384. The size of this library is 6,985 sq. ft. and is scheduled to open in the fall of 2008.

Acton/Agua Dulce Library: This new library is located at 33792 Crown Valley Road, Acton, CA 93510. The size of this library is 11,343 sq. ft. and is scheduled to open in late 2009. The Acton/Agua Dulce Library will serve the communities of Agua Dulce and Acton.

Canyon Country Jo Anne Darcy Library Expansion: The County Library is developing a plan to occupy an additional 4,500 sq. ft. of space in the existing building under the current lease with the City of Santa Clarita. No formal agreement between the City and County has been reached regarding occupancy of the additional space and a schedule for the required renovation work has not yet been established.

Newhall Library Replacement: As your City is aware, the City is planning to replace the existing Newhall Library with a larger facility as part of the Downtown Newhall Specific Plan project. Completion of that project by the City will expand the available library service capacity.

County Library Facilities Mitigation Fee

The County of Los Angeles applies a library facilities mitigation fee on new residential projects in all unincorporated areas served by the County of Los Angeles Public Library (*Los Angeles County Code,* Chapter 22.72). In order to mitigate the impact of residential projects on library services, the developer, or its successor in interest, will be required to pay the library facilities mitigation fee that is in effect at the time building permits for projects are issued. The OVOV Santa Clarita Valley Planning Area is located in the Library's Planning Area 1 (Santa Clarita Valley). The current mitigation fee for this area, which is adjusted annually based on changes in the Consumer Price Index, is $790 per residential unit. The fees are not levied on non-residential development projects.

If you have any questions or need additional information, please contact Malou Rubio at (562) 940-8450.

Sincerely,

Terri Maguire
Chief Deputy County Librarian

TM:DF:MR
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c: David Flint, Assistant Director, Finance and Planning
Malou Rubio, Staff Services
Robert Seal, Public Services Administration

Michael A. Naoum
27301 Eaglehelm Drive
Santa Clarita, CA 91387
661-252-9275
310-267-4821

November 9, 2008

Mr. Jason Smisko
Sr. Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, California 91355

Dear Mr. Smisko:

Since adequate community input time was not offered at the One Valley One Vision meeting on July 15, 2008, attached are my comments regarding the draft Land Use Element plan as well as comments on the Housing Element meeting. Kindly forward a copy of this letter to the Planning Commission.

One Valley One Vision – Land Use Element. Overall, I feel the Land Use Element fails to adequately take into account the existing suburban quality of the City, geographic distances between jobs and housing, the lack of existing density and a constrained road network including I5 and SR14 when trying to become an "urban center" with public transit oriented transportation. It offers developers plenty of flexibility but does not provide to the community the best, most rigorous, highest value planning tool. I'd suggest that the City develop more of a best practices approach rather than just using State minimums as our standards. We should be looking at communities like Westlake Village for standards – not the San Fernando Valley.

- While you indicated the General Plan should be general in nature, there are sometimes specific unapproved items mentioned in the plan that are troubling and should be removed. For example:
    - Part 1D indicates that the existing Canyon Country Metrolink station is planned to be relocated. This should be deleted since it is showing specificity in what should be a general plan.

- Part 1E identifies areas such as Val Verde and Halsey Canyon developed as low-density rural areas based on their residents' desire for retreat from high-intensity urban centers. Special use areas Sand and Placerita Canyon should be added to that list.

- The land use element shows a desire to preserve open space but would appear to allow dense "villages" in areas deemed to be floodplains, Significant Ecological Areas, desirable open areas and wildlife corridors.

  This is inconsistent with Guiding Principal 6b in the One Valley One Vision document dated 11/9/01 which states "a. Uses and improvements (within the Santa Clara River corridor and its major tributaries" shall be limited to those that benefit the community's use of the river in its natural state." And "b. Development on properties adjacent to, but outside the defined primary river corridor shall be: - located and designed to protect the river's water quality, plants, and animal habitats, controlling the density of uses, drainage runoff (water treatment) and other relevant elements".

  Furthermore, objective LU 1.2 states that the City will "maintain the distinctive community character of villages and neighborhoods throughout the planning area by establishing densities and design guidelines appropriate to the particular needs and goals of each area...." policy LU 1.2.5 states that "In Sand Canyon, ensure compatibility of development with existing rural, equestrian lots and the adjacent National Forest land; provide additional recreational trail links; and protect the Santa Clara River from incompatible development." This is contrary to the City's statement in the Land use element that the Canyon Country Metrolink station will be relocated to a high density village proposed in the Santa Clara riverbed just below Sand Canyon.

- While village concepts are promoted, the concept is new and there is no evidence that villages, especially large scale ones, far away from the bulk of the jobs in the City and tied principally to Metrolink for transportation will work to relieve congestion. If I am looking to live in a high density community served by public transit, why would I want to sit on a train for an hour just to live in Santa Clarita? If I want high density, I'll live in a truly urban area and minimize my commute time and dollars. Additionally, unless one works in downtown Los Angeles, or near the train stations in Glendale or Burbank, Metrolink is not a very efficient form of transportation.

- Having high density, low and moderate income housing, far from the major job centers employing these residents (Valencia Industrial Center and Magic Mountain) doesn't seem rational – especially when considering that a bus trip from Canyon Country to the Valencia Industrial Center takes between 60 and 90 minutes (when leaving from the closest Soledad stop that would be near the proposed new Canyon Country Metrolink location envisioned for a high density urban village development).

- Village concepts are supported by the City because of reduced land use and potentially traffic impacts if adjacent to functional public transit. Why is it that the County is allowing villages without being linked to public transit?

- The City is allowing greater density without a corresponding requirement for an increase in open or public spaces or any offsetting benefit for the public at large. Infill and villages with higher densities are promoted as a way to reduce land use (in theory to allow for more open space). Under the proposed plan, there is no offset required by the developers receiving these density bonuses to provide a funding mechanism to set aside those opens spaces the City is selling as so important to preserve and touting as a carrot arising from promoting higher density villages and infill projects. Creating these offsets and funding mechanisms is much like allowing the transfer of air rights among parcels in downtown areas where a higher building is allowed on one parcel based on the development rights purchased from another parcel – thus creating an open or public space.

- My vision of an urban center is an area with high quality, close (meaning walkable-within 1/4th mile) public transportation, with high density residential areas, incorporating jobs, amenities, retail and entertainment so that the use of cars is unattractive. I'm pessimistic that can be accomplished here.

- The transportation infrastructure needed for true urban centers in Santa Clarita will never be economic because of the lack of density and sprawling geography. We don't have the necessary density and can't get it without essentially starting the City over with density throughout the Santa Clarita valley. Santa Clarita is not Downtown Los Angeles or the Wilshire Corridor and we shouldn't be viewing developments in the same way they can. While the City has made great strides with providing Public Transportation to work and a few entertainment destinations, Public Transportation does not work for most folks in our lower density car oriented community.

- There appears to be an unwillingness to require project improvements that could add costs for development interests. The City should be looking at a number of avenues to improve the quality of life for all residents and stakeholders, not just be concerned with keeping costs at a minimum for developers and businesses. Some examples contained in the Land Use Element include:

    - Policy LU 6.1.2 designates the Santa Clara River corridor along with its major tributaries as Open Space and restricts development within 50 feet of the stream banks. THIS IS THE STATE MINIMUM! Between allowing bank stabilization and this minimal setback, the City is being disingenuous when it says it will "maintain the natural beauty of the City's rivers and streams. All too often the bike and walking trails are closed for long periods of time because CLWA is installing a new water line in the same, limited space. We should increase this setback to 250 feet to reduce the amount of bank stabilization and fill required and to allow for uses other than a walking and biking path along river

and stream areas. Open space doesn't need to be limited to just what the City buys.

- The City could be requiring employers of a certain size (say 100 employees) to provide showers for employees using bicycles. Instead, policy LU 5.1.3 has little to no teeth. It says the City will "require safe secure, clearly illuminated walkways and bicycle facilities in all commercial and business centers." A bicycle facility could be viewed as a post a bike could be locked to. Other cities require these facilities. Why can't we?

- The City could be requiring buildings to meet LEED requirements under LU 7.1.3 rather than just "encourage development of energy-efficient buildings". The State just revised energy efficiency codes. There is no reason why the City can't be more of a leader on this than a follower!

To summarize my input on the Land Use Element, I'd like to see the Element better blend with the currently developed areas of the City (since it is mostly built out), require more than minimums for code and setback requirements, and better preserve and be clearer over what the real plan is when there are conflicts between land use, open space, environmental, transportation, safety and infrastructure goals. This will avoid some of the double talk that exists in the current document.

In terms of the **Housing Element**, I'd like to see inclusionary requirements for low and moderate income housing – especially if the area's these developments may go must be designated in the land use plan as having 30 units per acre zoning. While the City has provided this density allowance in the past, developers have not done their part to include this element, instead choosing the market rate pricing approach.

It is clear we can't depend on developers' benevolence to accomplish this State mandated requirement. We must require developers to set aside units to meet this low income requirement especially since the density has been increased providing them an opportunity to build more units with lower per unit land costs. Additionally, since the lower income housing is needed primarily to support workers in the Valencia Industrial Center, the higher density housing should be in close proximity to those jobs. This will reduce the demand on our transportation infrastructure. Other areas of the community could be considered for Senior Housing since Seniors burden on the transportation infrastructure occurs during non-peak hours.

If you have questions or want clarification, please feel free to call.

Respectfully,

Michael Naoum

cc: Commissioner Burkhart
Commissioner Berger
Commissioner Ostrom
Commissioner Trautman
Commissioner Kennedy
Planning Manager Webber

Michael Naoum
27301 Eaglehelm Drive
Santa Clarita, CA 91387
661-252-9275

October 25, 2008

Santa Clarita Planning Commissioners
C\O Jason Smisko

Dear Commissioners:

Since traffic in Santa Clarita is usually cited as the most important issue by City residents, it behooves us to be diligent in our understanding, analysis and evaluation of the Circulation Element. One should ask if the traffic impacts shown in the plan are acceptable to you as a resident and user and if the approaches to have more walking, biking, taking local buses and commuting on trains will really work given our geographic dispersion, job locations for residents and road network.

Below are my comments on the October 2008 Circulation Element Draft.

- Only the 14 is an E Level of Service for the CMP roadways today. Under the new General Plan, all of the CMP roadways will be an E level of service including the I5, State Route 14, Sierra Highway, Magic Mountain Parkway, San Fernando Road (Newhall\Railroad) and SR 126 (page C-7 of the element). LOS E means significant delays and **average travel speeds of 33% or less of the free flow speed**. This doesn't align with Commissioner Ostroms' desire to have roads be at an A or B LOS. How would we evacuate the City if there were ever a need to do so?

- The Element had no statement on the Newhall Pass Level of Service either today or under build-out. Like it or not, 80% of our working residents must pass through it daily.

- There is a disconnect between the planned village locations and job centers. If we are looking to reduce traffic within the City, the village locations should be at or very close to the job centers identified in the Circulation element. Having folks commute from a village in Canyon Country to west Valencia doesn't make much sense.

- There is no "what if" included that identifies what happens to traffic if all planned roads are not built. As Mr. Smisko indicated, all of the planned roads have been on the map for some time (and many unbuilt for some time i.e. Via Princessa to

Wiley Canyon). 5 new bridges over the Santa Clara River are required while only 1 in the past 15 years had been built with one under construction.

- The Element indicates "the City minimizes cut-through traffic through circles, chokers and diverters". I'd like to see City Staff identify one location where we have each of these elements. They don't exist today and should not be mentioned in the Element as if we have them.

- The traffic model identified many needed improvements. Will new development be enough to fund these improvements? If not, how will they be funded? Assuming we have 5 new major roads with bridges over the River and they cost half of the cross valley connector ($125,000,000 each, along with 15 intersection improvements at $4,000,000 each (eminent domain) we have $685 million in today's costs. This doesn't include the cost of the other improvements mentioned (more parking at train stations, re-striping and widening projects, bus turnouts, bike paths, more buses, etc). We could well be looking at a $1 Billion plus price tag by the time this is said and done.

- There is no carbon footprint or greenhouse gas analysis. This needs to be present in this Plan. Analysis tools are available. The Element comment that standards and regulations concerning compliance with AB 32 are still being developed is no excuse to not use evaluation tools already in place to see if the City's plan will achieve the reductions required under AB 32. Standards and regulations like seismic codes constantly change – because they change is not a reason to ignore them. A tool developed by the California Air Resources Board, the Lawrence Berkley Lab and the California Energy Commission can be found at coolcalifornia.org. It's not like these are fly by night organizations.

- What are the assumptions used to drive the traffic study in the plan? Are we assuming that all new residents will work here? What are the assumed levels of bus and train ridership versus now? Why will the ratios change?

- Re-striping of 5 roads will eliminate bike lanes. Why aren't there plans to reinstate these if bicycling is identified as an important element of the plan?

- Are we ready to use eminent domain to improve our major intersections?

- Two of our major arterials will require at grade crossings which Metrolink has been reluctant to approve.

- How will bus turnouts be built on right of ways already completely full of concrete and asphalt (think Soledad)?

- While we are identifying that we want a pedestrian friendly community, with many of the road widening projects, the sidewalk will be immediately adjacent to the road. Furthermore, as a frequent pedestrian, crossing six and eight lane roads

is not very much fun. It will be difficult to put pedestrian safe islands in roads that will need to be wall to wall traffic lanes.

- The Element indicates that more turn signals will be put in place. While this may make turns safer, it also causes excess emissions because cars that could turn if the intersection is clear are not allowed to resulting in more idling.

- Page C-31 refers to truck parking regulations. What are they? I continue to see trucks parked long term on our roads.

- Figure C-4 shows an existing helipad at Henry Mayo. I keep reading this is not operational any longer and is contingent on the new master plan being approved. If not operational, it should be removed.

- Page C-41 identifies that bike racks have been installed on all buses. This is not true. Bike racks have not been installed on Express buses going to Lancaster\Palmdale, Van Nuys, Warner Center, Century City and Los Angeles.

- Policy C.3.1.6 says to "Promote the provision of showers and lockers" for bicyclists while Policy C.6.2.3 says "showers and changing rooms should be required". Which is it? If important, they should be required.

Please keep these items in mind when it comes time for your approval or disapproval of OVOV.

Sincerely,

Michael Naoum

Jeff Hogan

From: Jason Smisko
Sent: Monday, November 10, 2008 10:00 AM
To: Jeff Hogan; 'Judith Charles'; 'Susan Tebo'
Subject: FW: ONE VALLEY ONE VIEW

NOP Comment

From: Sandi Franco [mailto:sfranco@firstam.com]
Sent: Monday, November 10, 2008 9:58 AM
To: Bob Kellar; Ken Pulskamp; Jason Smisko
Subject: ONE VALLEY ONE VIEW

The future of Santa Clarita lays in your hands. Please do the right thing. We do not need to develop every piece of property (what little is left) to the point where it is over developed. Keeping density down in future projects will help protect the way of life we have now and for the future. We are already over burdened in our schools and on our roads.
If we continue on the path we seem to be heading down, Santa Clarita will no longer be a desirable place to live and raise a family.

Sandi Franco
Marketing Assistant
First American Home Warranty

7833 Haskell Ave., Van Nuys, CA 91406
Direct: 818 781 5050 Ext 7842
Mobile: 661 916 4564
Fax: 888 955 3557
Tollfree: 800 698 0422
Email: sfranco@firstam.com
Web: www.firstam.com/warranty

Jeff Hogan

From: Jason Smisko
Sent: Wednesday, November 19, 2008 10:31 AM
To: Jeff Hogan; 'Judith Charles'; 'Susan Tebo'
Subject: FW: OVOV

Since this came in electronically during the OVOV workshops, perhaps we should include it as a comment received during the NOP.

From: gmarndt@aol.com [mailto:gmarndt@aol.com]
Sent: Monday, November 10, 2008 7:53 PM
To: Jason Smisko
Subject: OVOV

I would like to express my concerns along with my neighbors over the General Plan changes for our valley. Density is not a solution to tax problems and budget shortfalls. Our roads, schools, freeways, fill in the blank are all overcrowded with the plan the way it is now. The Smiser Ranch property along with Hamburger Hill and the shopping centers of Stevensen Ranch will be the final straw that sends me and my tax dollars moving out of this beautiful city. The whole reason I moved here, OPEN SPACE!!!! You saw where greed got our country andthe banking system. This will have a similar ending. NO,NO,NO on higher density in SCV. We will be watching your vote and then we will vote.

Gary and Sherrie Arndt and the neighbors on DeWolfe Road in Newhall

---

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Thomas M. Surak

23712 Adamsboro Drive
Newhall, CA 91321

January 7, 2009

Mr. Jason Smisko, Senior Planner

City of Santa Clarita

Email: jsmisko@santa-clarita.com

Mr. Paul Novak, Planning Deputy

County of Los Angeles

Email: sosuna@lacbos.org

Re: Notice of Preparation - One Valley, One Vision

Dear Mr. Smisko and Mr. Novak:

I am pleased to be able to provide the following comments regarding the draft OVOV documents. In general, the documents appear to be deficient in many areas. They do not offer Santa Clarita residents the same protections and promises which currently exist in the General Plan. Also, as having participated in many aspects of the OVOV process, I can testify to the fact that it was overly cumbersome, often confusing and not at all conducive to inviting full participation by all interested parties. Several of my specific issues and concerns are discussed below. I expect similar comments will be submitted by other residents, which will require additional public participation before the OVOV process can move forward. I can only hope that this will lead to timely and successful resolution of all issues.

The City has not made a proper showing for why it is proposing significant revisions the existing General Plan. The City's flyer, "OVOV Facts and Benefits" which was widely circulated to the public, clearly states that the build-out population estimates adopted for the 1991 General Plan maxed at 521,977 people, and that the OVOV estimates a build-out population range of 444,000 to 485,000. The obvious yet unanswered question is then, "Why are increases in zoning densities, in many cases significant ones, being proposed for the OVOV?" The City cannot legitimately argue that the increased density is to accommodate non-residential development because most OVOV commercial zoning definitions allow for extremely high density (e.g., a minimum of 11 units per acre) residential use. These "commercial zone" residential densities overwhelm those of the surrounding neighborhoods, and such development can only be perceived as detrimental to nearby residents. As further discussed below, the City's concept of a "Valley of Villages" as laid out in the OVOV is not consistent with the principle of enhancing established neighborhoods, nor with development consistent with neighborhood community character, which are both key objectives stated in the OVOV.

Page L-39 of the current General Plan makes it clear that the land use designations adopted in 1991 "should not be construed as temporary holding categories awaiting higher density designations in the

future." It further states, "The Plan has looked at development suitability within the entire Santa Clarita Valley and applies designations for anticipated, long-term future development." The draft OVOV clearly makes a mockery of this promise. OVOV zoning densities are drastically increased throughout the valley.

Also, many new zoning categories are overly broad with respect to allowable types of applicable development. For example, the Regional Commercial, Community Commercial and Neighborhood Commercial zoning designations all allow for mixed use (i.e., residential) development, even though the OVOV also has separate "Mixed Use" zoning designations which more clearly convey the ability to allow such proposed developments. The General Plan is clear when it states "surrounding characteristics, preservation of neighborhood integrity and compatibility with existing uses shall also be taken into consideration in connection with new development proposals." The guiding theme of the OVOV, "A Valley of Villages", casts these neighborhood protections aside by requiring increasing density projects which are entirely inconsistent with the characteristics of surrounding neighborhoods.

The City's concept of a "Valley of Villages" conveniently avoids discussion on the subject of different housing types having different public service requirements. For example, persistent crime hotspots in the Santa Clarita Valley are highly correlated with housing density, e.g., the largest crime problems are associated with higher density housing near downtown Newhall and in Canyon Country. The OVOV does not consider or address additional financial and emotional costs which will be imposed upon existing residents as a consequence of increased crime associated with the OVOV's high density housing proposals.

The OVOV undermines existing neighborhood protections from such high density projects. These protections are inherent in the 1991 General Plan, which many who have since settled into Santa Clarita relied on when making their decision to move here. Without a showing of benefits to existing neighborhoods, one can readily conclude that the OVOV is primarily designed to provide developers an opportunity to further increase their profit opportunities through increased zoning densities. Such opportunities are properly restricted under the existing General Plan through its embedded protections provided to residents of Santa Clarita, and these protections must be maintained.

Some basic elements of the OVOV which must be understood to ensure full participation in the OVOV process were not (and may still not be) clearly communicated to the public. For example, the proposed zoning designation of the Smiser property located in my neighborhood near Calgrove & Wiley Canyon was recently (and unknowingly) revised. At the November public workshops which showcased the draft OVOV, the Smiser property zoning designation was clearly identified as Community Commercial. A completely new zoning designation for this property, Mixed Use – Neighborhood (MXN), has just recently been brought to my attention. However, one cannot readily determine that there has been a new zoning designation by reviewing the revised December 19 Preliminary Land Use map posted for public review, which is the key document for purposes of OVOV review and understanding. The blue and white striped color designation assigned to this MXN zoning designation on the map completely blends in with the blue and white stripe used to assumedly delineate the city boundary which is adjacent to the Smiser property. No reasonable person could have been expected to learn of this zoning change through periodic review of this map, yet that is what was expected from those attempting to participate in the OVOV process. I can only assume that this color scheme selection was just a coincidence and unintentional. However, it does illustrate one of the many unnecessary difficulties OVOV participants have had to overcome in order to properly become engaged in the OVOV process.

Another example of confusion derives directly from the exclusion of a critical clarification in the General Plan from the OVOV zoning definitions. The General Plan clarifies that appropriate project intensity "is generally expected to be between the low and mid-point of the allowable floor area ratio (FAR) range". Comparisons made by City Staff in documents and at public meetings which suggested that allowable city development under the General Plan and the OVOV were equivalent did not incorporate the lower FAR range clarification embedded in the General Plan, and thus overstated allowable development

under the General Plan. Stated another way, the OVOV will allow for much denser development even at similar FAR since it no longer requires project intensity to be at the lower end of the allowable FAR range. Unless the above clarification regarding a lower appropriate project intensity is incorporated into the OVOV, representations made regarding comparable allowable development under the General Plan and the OVOV were incorrect because they minimized impacts under the OVOV, and were likely to have diminished public participation in the OVOV process.

Also, there is language throughout the OVOV which lessens the certainty of limiting future development to the designated zoning. For example, page I-3 states "all subsequent planning and development decisions within the Santa Clarita Valley planning area shall be determined to be consistent with these documents, except as provided herein for any land use applications pending during the plan preparation and adoption process." This caveat completely undermines the ability of citizens to fully appreciate what is capable of being developed in their neighborhoods and other areas where they may have special concerns and interests, and effectively disengages many from actively participating in the OVOV process. In addition, this caveat is not consistent with public representations which have made. Please refer to an October 5, 2008 article in "The Signal" titled, "SCV ponders 'one vision' for growth" which quotes both of you as well as Paul Brotzman. This article includes the following statement: "Though general plans by definition are general, the state mandated documents must include a map that describes exactly what type of development can occur on every inch of land." I do not recall any clarification or rebuttal to this statement having been made by City or County staff. I also believe many more residents have read "the Signal" for information on the OVOV than have read through the several hundred pages of draft OVOV documents. The development flexibility being sought in the OVOV which I cited above does not comply with this statement. Therefore information provided to the majority of residents regarding the development flexibility sought within the OVOV is misleading at best. The City and County cannot assume that residents fully comprehend this development flexibility. Therefore the OVOV cannot be allowed move forward with this intended flexibility without further public disclosure and discussion.

The OVOV inadequately addresses how existing deficiencies in City parks and recreation facilities will be met. The OVOV states, "The Land Use Element is the City's and County's long-term blueprint for development of property to meet Santa Clarita Valley's future needs for ... parks, open space...including location for future uses within the planning area." It furthermore states, "The provision of adequate park space and facilities to serve residents is not only required by State planning law, but is recognized as necessary to provide for public health and quality of life." The OVOV further recognizes that "another issue for park development is distribution of park facilities, as many local parks are concentrated within master planned communities, and outlying areas have access to fewer local parks." The OVOV confirms that the City has a "standard" (the term "requirement" is used in the 1991 General Plan, which I interpret as the true intent) of five acres of park facilities per 1000 residents, and yet the City currently has "only about 1.5-2 acres of developed parkland per 1000 population", which is essentially unchanged from when the General Plan was adopted in 1991. (In fact, as of October 2008 the true ratio is 1.4 acres of parkland per 1000 population as stated by the City of Santa Clarita Parks, Recreation, and Community Services Commission, which increases the magnitude of the existing parkland deficiency.) In essence, notwithstanding the claims that significant parkland has been added since 1991, due to corresponding population growth there has been no significant progress made towards meeting the parkland "target" in almost two decades. This is especially true in areas which were identified as being underserved throughout that timeframe, which will have to be met through land acquisition using "additional funding sources." This is because the State's Quimby Act which has been used to acquire the majority of parkland added since 1991 only provides parkland (and only at an below "target" three acres per 1000 population) for residents of new developments.

The OVOV ignores the critical additional parkland requirement (per Policy LU 3.4.1) by stating that the Conservation and Open Space element "will not serve as a park master plan but will instead focus on broad policy issues relating to park planning." The OVOV just defers on this issue by identifying as City Task 8.1, "Complete and adopt a revised Park and Recreation Master Plan for the City by 2009." This is unacceptable. The OVOV must fully coordinate with the park master plan on a detailed level; by not

doing so, the OVOV invites development of remaining open areas which must be preserved for future parkland to meet the adopted parkland "target." This need for coordination holds especially true in areas which have an identified parkland deficiency and minimal remaining acreage which can help meet that deficiency. In fact, the Final Draft of the Parks, Recreation and Open Space Master Plan Update states, "Priority should be given to meeting the current (park) acreage deficit of 612 acres." However, the OVOV not only lacks any priority with respect to additional parkland in the OVOV, there are inherent barriers to the creation of additional parkland created by the OVOV.

For example, the Calgrove/Wiley Canyon neighborhood was identified in the existing General Plan as being "severely underserved" with respect to parks (this neighborhood is similarly identified as having a "service area gap" in the Final Draft of the Parks, Recreation and Open Space Master Plan Update, which I take as a euphemism). The only remaining undeveloped land which can be used for a neighborhood park in the Calgrove/Wiley Canyon area is the Smiser property. However, not only does the latest OVOV zoning of the Smiser property not include any reference to parkland, it instead proposes to increase the density allowed for development of that property! By increasing the allowable build densities on remaining undeveloped property such as Smiser, the OVOV increases the residual value of properties which are most suitable for helping close the significant gap between target and actual park acreage. Thus the OVOV will create further barriers to meeting the park master plan objectives by unnecessarily increasing the future cost of acquiring acreage for parkland. This will undermine the ability of and likely preclude the City from meet existing, let alone future, parkland needs under the prescribed "target".

The environmental aspect of the OVOV addresses climate issues only from a macro perspective; the issue of microclimate changes which are common with increased "urbanized" development such as that contemplated by the OVOV is ignored. Microclimate issues must be incorporated into the EIR study process to provide a complete and proper assessment of potential impacts from the build out proposed by the OVOV. Also, there is a lack of focus on increased noise associated with increased urban development, both during and after construction, as proposed in the OVOV. The importance of this issue cannot be ignored since increased noise pollution has the ability to undermine the tranquility that residents of Santa Clarita currently appreciate and will continue to expect in the future.

Please feel free to contact me for further clarification on the above.

Sincerely,

Thomas M. Surak

Calgrove Corridor Coalition

RECEIVED
PLANNING DIVISION
DEC 29 2008
CITY OF SANTA CLARITA

December 29, 2008

Jason Smisko, Senior Planner
City of Santa Clarita
23920 Valencia Boulevard
Santa Clarita, CA 91355

Re: ***Calgrove Corridor Coalition*** **Response - Notice of Preparation of One Valley, One Vision**

Dear Mr. Smisko,

This is the second NOP response from Calgrove Corridor Coalition (CCC). After receiving inaccurate and conflicting deadline dates, we now understand that the final date for NOP comments is December 31, 2008. We believe the OVOV process remains flawed and has not been transparent for the residents of Santa Clarita, and that public notification of revisions is almost non-existent when changes are made to the draft document.

CCC has repeatedly asked to be notified when changes are made to the draft OVOV document, particularly when the changes involve the Land Use Element or the Smiser property. We cannot support the OVOV draft when City staff leaves the research of revisions up to the public.

Early in the process, members of our leadership team met with Planning Director Paul Brotzman and we were assured that it was not the intent of the City to increase the density for the Smiser property. We are very concerned that the current document does not reflect prior commitments made by staff to maintain the current density.

Our coalition has repeatedly seen changes in the OVOV document that could potentially more than triple the density for the Smiser property. In the December 8, 2008 OVOV revision, the designation of Mixed Use Neighborhood (MXN) integrates characteristics of 2 other Land Use Elements -

- Neighborhood Commercial (NC) - allows a 35' height limit and not to exceed 75 % development coverage
- Community Commercial (CC) - allows a 50' height limit and development coverage of 80%

NC and CC have vastly different use requirements. Each of the 3 designations (NC, CC and MXN) includes the language, "except as otherwise permitted by the reviewing authority pursuant to discretionary review as prescribed by the unified development code." We are concerned that these vagaries will allow developers to see the land use elements as a negotiable moving target.

Not only are we disappointed that the changes are not being communicated, as promised, we are gravely concerned that the designations do not reflect our input about density. CCC does not support OVOV in its current state and our organization is looking for a land use description that enhances the existing neighborhood and provides an inviting entrance to our city. We support the commitment made by Paul Brotzman that the zoning designation would limit development to floor area ratio of no more than .375 and we look forward to a positive outcome.

Respectfully,

Annette Lucas and Glenda Bona, co-chairs
Calgrove Corridor Coalition

cc:

Mitch Glaser, Principal Planner
Ken Pulskamp, City Manager
Jeff Hogan, Associate Senior Planner
Paul Brotzman, Director of Community Development
Susan Tebo, Impact Sciences
Frank Ferry, Mayor
Bob Kellar, City Council Member
Marsha McLean, City Council Member
Laurie Ender, City Council Member
Laurene Weste, City Council Member

Friends of the Santa Clara River Comment on NOP;
dated August 25, 2008

Friends of the Santa Clara River

660 Randy Drive, Newbury Park, California 91320-3036 • (805) 498-4323

August 25, 2008

Mr. Mitch Glaser, Supervising Regional Planner
Los Angeles County Dept. of Regional Planing
320 West Temple Street Room 1354
Los Angeles, CA 90012

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California Native Plant Society
L.A./Santa Monica Mountains Chapter

Santa Clarita Organization for Planning the Environment (SCOPE)

Sierra Club
Angeles Chapter
Los Padres Chapter

Surfrider Foundation

Audubon Society
Ventura Chapter

Ventura County Environmental Coalition

Re: One Valley One Vision Notice of Preparation

Dear Mr. Glaser,

Friends of the Santa Clara River submit the following comments on the subject project.

The Santa Clarita area has seen vast development over the last two decades and continues to develop at a very rapid pace. Much of this development has encroached on the floodplain of the Santa Clara River and its tributaries. Yet, no agency - state, federal or other - has adequately analyzed the cumulative impacts of this massive floodplain development that continues unabated and is a part of many projects now on the drawing board or in some phase of approval.

The One Valley One Vision EIR must remedy this situation and finally provide a substantive analysis of these impacts to the river ecosystem.

Moreover, all of this floodplain development has placed thousands of homes within the path of potential flooding. The flooding problems associated with surging rivers and creeks, brought on by the 2005 rains in southern California, are well described in the Ventura County Star article of February 6, 2005 – "Rain-swollen rivers not easy to repair". Flood damage occurred in Santa Clarita during these floods.

Southern California rivers are among the "flashiest" in the world. Flows during the worst flood events tend to be very high compared to average flows. The Ventura River and Santa Clara Rivers, for example, show peak discharges over 30 times the mean annual flow for floods having a recurrence interval of 25 years. A major lesson to be learned from these facts is that these rivers, as well as many of their tributaries, are dangerous by nature and very difficult to tame.

Efforts to control flooding through extensive channelization do not have a promising history. A prime example of the failure of such projects is that of the San Lorenzo River, which runs through downtown Santa Cruz. The

channel was straightened, deepened and widened in response to public demand for extensive flood control measures after 1955 flood damage. All vegetation was removed from the banks to reduce roughness and channel walls were lined with rock and concrete. In less than 10 years the channel had filled with 12 million cubic feet of sediment, and could only handle a 25-year flood (4% chance of occurring in a given year). Millions of dollars had not only destroyed the river but failed to do much for flood protection.

There is a new floodplain management philosophy that is being increasingly adopted by communities across the country that works with nature, not against it. Wetlands are being protected and allowed to serve as natural flood basins. Such measures are of particular importance in southern California, which has lost over 90% of its wetlands. **OVOV, since it is a "vision" of what the valley should become, should include such measures.**

Thank you for your consideration of these comments.

Sincerely,

Ron Bottorff

Ron Bottorff, Chair

Ventura County Air Pollution Control District Comment on NOP;
dated August 26, 2008

VENTURA COUNTY
AIR POLLUTION CONTROL DISTRICT
Memorandum

TO: Kari Finley/Dawnyelle Addison, Planning DATE: August 26, 2008

FROM: Alicia Stratton

SUBJECT: Request for Review of Notice of Preparation for a Draft Environmental Impact Report (DEIR) for the One Valley One Vision Project, Los Angeles County Department of Regional Planning (Reference No. 08-032)

Air Pollution Control District staff has reviewed the subject project, which is a comprehensive update to the Santa Clarita Valleywide Area Plan to establish common guidelines for new development that will lead to greater cooperation and an enhanced quality of life for residents of the Santa Clarita Valley. The result of the project will be an Area Plan document and EIR for the buildout of the entire Santa Clarita Valley Planning Area. The Planning Area combines two geographic areas, the City corporate limits and the unincorporated area of the County within Santa Clarita Valley. It is situated at the convergence of Los Angeles and Ventura Counties.

The South Coast Air Quality Management District has jurisdiction over air quality in Los Angeles County, however, future development the Planning Area and its proximity to Ventura County could adversely impact Ventura County residents. District staff recommends the air quality section of the DEIR evaluate all potential air quality impacts to Ventura County that may result from the project. Specifically, the air quality assessment should consider reactive organic compound, nitrogen oxide emissions and particulate matter from all project-related motor vehicles and construction equipment.

If you have any questions, please call me at (805) 645-1426.

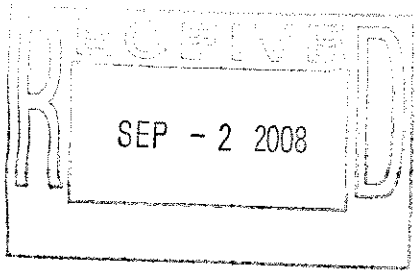
Caltrans Comment on NOP; dated August 28, 2008

DEPARTMENT OF TRANSPORTATION
DISTRICT 7, REGIONAL PLANNING
IGR/CEQA BRANCH
100 MAIN STREET, MS # 16
LOS ANGELES, CA 90012-3606
PHONE: (213) 897-6696
FAX: (213) 897-1337

Flex your power!
Be energy efficient!

IGR/CEQA No. 080733AL, NOP
One Valley One Vision
County Project No. R2007-01226
Vic. LA-05/126/14
SCH # 2008071119

August 28, 2008



Mr. Mitch Glaser
Department of Regional Planning
Los Angeles County
320 West Temple Street
Los Angeles, CA 90012

Dear Mr. Glaser:

Thank you for including the California Department of Transportation (Caltrans) in the environmental review process for the above referenced project. The One Valley One Vision, OVOV, project is a comprehensive update to the Santa Clarita Valley wide Area Plan to establish common guidelines for new development that will lead to greater cooperation and an enhanced quality of life for residents of Santa Clarita Valley.

The OVOV is a joint effort between the County of Los Angeles, City of Santa Clarita, and Santa Clarita Valley residents and businesses to create a single vision and guidelines for the future growth of the Valley and the preservation of natural resources. The result of the work effort will require the County to adopt a new Area Plan to replace the Santa Clarita Valley Area Plan and prepare its own Environmental Impact Report, EIR, while the County will adopt a new General Plan and EIR.

The California Department of Transportation (Caltrans) as the State agency responsible for planning, operations, and maintenance of State highways, shares similar transportation goals with the both County of Los Angeles and City of Santa Clarita. We are pleased with the comprehensive planning approach both local government agencies are pursuing and present the following comments:

"Caltrans is particularly interested in the transportation planning roles of local general plans and suggests that the following areas be emphasized.

- Coordination of planning efforts between local agencies and Caltrans.
- Preservation of transportation corridors for future system improvements; and
- Development of coordinated transportation system management plans that achieve the maximum use of present and proposed infrastructure."

Circulation Element

It is widely known that Southern California highways are heavily congested especially during morning and evening peak periods. We realize that to improve mobility there is the need for capacity enhancing improvements as well as other innovative alternatives. The State highway facilities that provide regional access to the subject Santa Clarita Valley Area and are therefore likely to be impacted by future development activity are Interstate 5 (I-5), State Route 14 (SR-14), and State Route 126 (SR-126).

Interstate 5

- The *Golden State Gateway Coalition website (http://www.goldenstategateway.org/?p=7#q6) provides the following information:*

"....In the northern Los Angeles County, the I-5 currently carries more than 200,000 vehicles every day. This includes more than 19,000 trucks. These daily numbers add up to a staggering 73 Million vehicles – including 7 Million trucks – every year. As commerce and population growth occur in Southern California, these numbers will increase...."

" ...The I-5 freeway is already nearly at capacity, with Los Angeles County's population expected to grow by 3 million in the next 2 decades, it would soon be beyond its capacity without major improvements. Traffic is projected to increase by 65% in the next 10 years and 114% in the next 20 years. Airport passenger and cargo traffic in the Los Angeles-southern Kern County region is expected to double in the next 2 decades, while seaport traffic is expected to triple...."

State Route 14

- Existing daily traffic volumes along the SR 14 corridor range from 137,000 ADT (between I-5 to San Fernando Rd.) to 30,900 ADT (between Avenue I and Kern County Line) (Caltrans District 7, SR 14 Transportation Concept Report, September 2003).

- Currently, an operating deficiency exists on SR14 between I-5 and SR 126. The level of service on this segment is F0 during the AM peak period on the southbound side of the route and F0 during the PM peak period on the northbound side of the route (Caltrans District 7, SR 14 Transportation Concept Report, September 2003).

- SR 14 is designated as a Super Truck Route (STR). SR 14 is also part of the Surface Transportation Assistance Act (STAA) truck network, which provides freeway access for oversized trucks. Regional truck traffic is expected to increase by 40% by 2020, with virtually no capacity available to handle this additional volume (Caltrans District 7, SR 14 Transportation Concept Report, September 2003).

State Route 126

SR-126 functions as a terminal access route to the national network for the Surface Transportation Assistance Act (STAA) for trucks. Truck volume in 2001 ranged from 4% to 30% of ADT in Los Angeles County, and 4.5% to 10% of ADT in Ventura County (Caltrans District 7, SR 126 Transportation Concept Report, November 2004).

New development will increase use of local and regional roadways and the circulation element can identify strategies the County and the City will pursue to maintain good levels of service. We understand that mitigating cumulative traffic impacts may present some challenges. Given that the Los Angeles County's Congestion Management Program debit and credit system has been suspended, we recommend the County consider an alternate local funding plan towards regional transportation improvements. Local funding efforts may include a region or community wide traffic impact program. We request the County consider implementing a funding program to contribute to improvements on the State highway system, including impacted I-5, SR-14, SR-126, and on/off ramps. When local matching funds are offered, public funds may become available and improvements may be streamlined and/or expedited. County of Los Angeles and City of Santa Clarita may take this opportunity to include policies that allow it to procure funds towards regional transportation improvements such as additional mixed flow lanes, High Occupancy Lanes (HOV), and truck lanes on I-5; as well as modifications to I-5/SR-14 interchange.

Procuring funds toward freeway segments, freeway interchanges, freeway on/off-ramps, as well as for bus and rail transit facilities should also be in the goals of the local government agencies. A local funding strategy may provide a fair and predictable mechanism for individual developments to address their individual and cumulative transportation impacts to State facilities and satisfactory comply with the California Environmental Quality Act (CEQA).

Other traffic mitigation alternatives may include vehicular demand reducing strategies, such as incentives for commuters to use transit i.e. park-and-ride lots, discounts on monthly bus and rail passes, vanpools, etc.

Caltrans requests inclusion in the environmental review process of land use projects within County and City General Plan areas and in all projects that have the potential to significantly impact traffic conditions on State highways. To avoid delays and any misunderstandings in the traffic impact analysis, we request to be involved in its development. We may provide assistance in our areas of expertise such as transportation modeling, mainline freeway analysis, system and corridor planning, environmental and community impact assessment, as well as identifying critical operational deficiencies affecting freeway congestion, speed, and delay.

For State thresholds and guidance on the preparation of acceptable traffic studies, please refer to the Statewide Guide for the preparation of Traffic Impact Studies at:

http://www.dot.ca.gov/hq/traffops/developserv/operationalsystems/reports/tisguide.pdf

If significant impacts were anticipated on the State highway system, Caltrans would work with the local governments to identify appropriate traffic mitigation measures.

We remind you that traffic impact studies that are in compliance with Los Angeles County's Congestion Management Program (Metro's CMP), are not necessary satisfactory to Caltrans, the agency with jurisdiction over State highway facilities. The thresholds for significance on State highway facilities may be different than those applied in the CMP.

Land Use Element and Other Elements

As you are aware, there is a critical relationship between land use and transportation. The quality of the State transportation system operation can affect the quality of the local circulation system operation. The Circulation Element of the General Plan needs to be consistent with the Land-Use and Housing Elements of the General Plan. During the past couple decades, population and economic growth has been strong in Los Angeles County. Projections show that this growth will continue.

We recommend that special attention be given to the jobs-and-housing balance concept. Communities with predominantly residential allocations should be encouraged to set aside areas for office, commercial/retail, and open space uses. Benefits of balanced communities include: reduction of long morning and evening commutes on State highways, shorter trips which in turn would reduce the consumption of fuel and air pollutants. It may also change direction of trips. Instead of most traffic traveling in one direction during peak periods, some trips may be diverted in the opposite direction. Other land use strategies may include Transit-Oriented Developments (TODs).

- We encouraged the application of the State Regional Blueprint Program's and SCAG's Compass Blueprint Program's land use and transportation planning principles in their General Plan update:

  - **California Regional Blueprint Planning Program (http://calblueprint.dot.ca.gov)**

    The Regional Blueprint Planning Program is intended to better inform regional and local decision-making, through pro-active engagement of all segments of the population as well as critical stakeholders in the community, business interests, academia, builders, environmental advocates, and to foster consensus on a vision and preferred land use pattern. It is anticipated that the regional blueprint planning grants will build capacity for regional collaboration and integrated planning that will in turn enable regions to plan to accommodate all their future growth, thereby reducing need for sprawl.

    1. The grants for regional collaborative decision-making will lead to adoption of blueprint plans that will:

    2. Foster a more efficient land use pattern that (a) supports improved mobility and reduced dependency on single-occupant vehicle trips, (b) accommodates an adequate supply of housing for all incomes, (c) reduces impacts on valuable habitat, productive farmland, and air quality, (d) increases resource use efficiency, and (e) results in safe and vibrant neighborhoods.

    3. Provide consumers more housing and transportation choices.

    4. Improve California's economic competitiveness and quality of life.

    5. Reduce costs and time needed to deliver transportation projects through informed early public and resource agency involvement.

6. Secure local government and community support, including that of under-represented groups, to achieve the resulting comprehensive vision through including innovative computer models and public involvement activities.

7. Establish a process for public and stakeholder engagement that can be replicated to build awareness of and support for critical infrastructure and housing needs.

- **SCAG Compass Blueprint Program (http://www.compassblueprint.org/about)**
  Compass Blueprint is a new way to look at how the region grows. The Compass Blueprint Growth Vision is a response, supported by a regional consensus, to the land use and transportation challenges facing Southern California now and in the coming years.

The *Growth Vision encourages:*

- Focusing growth in existing and emerging centers and along major transportation corridors
- Creating significant areas of mixed-use development and walkable communities
- Targeting growth around existing and planned transit stations
- Preserving existing open space and stable residential areas

Housing Element
As we indicated previously, continued high growth is expected for Los Angeles County, which will have impacts to our State transportation facilities. We ask that efforts be made to provide affordable housing for all income levels to ensure that substantial numbers of employees can afford to purchase homes and live in proposed residential projects.

We look forward to reviewing the traffic study. Again, we would welcome an opportunity to participate in its development.

If you have any questions, please feel free to contact me at (213) 897-6696 or Alan Lin the project coordinator at (213) 897-8391 and refer to IGR/CEQA No. 080733AL.

Sincerely,

ELMER ALVAREZ
IGR/CEQA Program Manager

cc: Scott Morgan, State Clearinghouse

South Coast Air Quality Management District Comment on NOP; dated July 31, 2008

South Coast
Air Quality Management District
21865 Copley Drive, Diamond Bar, CA 91765-4178
(909) 396-2000 • www.aqmd.gov

AUG 19 2008

July 31, 2008

Mr. Mitch Glaser
Countywide Studies Section
Los Angeles County
320 West Temple Street
Los Angeles, CA 90012

Dear Mr. Glaser:

Notice of Preparation of a Draft Environmental Impact Report (Draft EIR) for the One Valley One Vision Plan

The South Coast Air Quality Management District (SCAQMD) appreciates the opportunity to comment on the above-mentioned document. The SCAQMD's comments are recommendations regarding the analysis of potential air quality impacts from the proposed project that should be included in the draft environmental impact report (EIR). Please send the SCAQMD a copy of the Draft EIR upon its completion. **In addition, please send with the draft EIR all appendices or technical documents related to the air quality analysis and electronic versions of all air quality modeling and health risk assessment files. Without all files and supporting air quality documentation, the SCAQMD will be unable to complete its review of the air quality analysis in a timely manner. Any delays in providing all supporting air quality documentation will require additional time for review beyond the end of the comment period.**

Air Quality Analysis

The SCAQMD adopted its California Environmental Quality Act (CEQA) Air Quality Handbook in 1993 to assist other public agencies with the preparation of air quality analyses. The SCAQMD recommends that the Lead Agency use this Handbook as guidance when preparing its air quality analysis. Copies of the Handbook are available from the SCAQMD's Subscription Services Department by calling (909) 396-3720. Alternatively, the lead agency may wish to consider using the California Air Resources Board (CARB) approved URBEMIS 2007 Model. This model is available on the SCAQMD Website at: www.urbemis.com.

The Lead Agency should identify any potential adverse air quality impacts that could occur from all phases of the project and all air pollutant sources related to the project. Air quality impacts from both construction (including demolition, if any) and operations should be calculated. Construction-related air quality impacts typically include, but are not limited to, emissions from the use of heavy-duty equipment from grading, earth-loading/unloading, paving, architectural coatings, off-road mobile sources (e.g., heavy-duty construction equipment) and on-road mobile sources (e.g., construction worker vehicle trips, material transport trips). Operation-related air quality impacts may include, but are not limited to, emissions from stationary sources (e.g., boilers), area sources (e.g., solvents and coatings), and vehicular trips (e.g., on- and off-road tailpipe emissions and entrained dust). Air quality impacts from indirect sources, that is, sources that generate or attract vehicular trips should be included in the analysis.

The SCAQMD has developed a methodology for calculating PM2.5 emissions from construction and operational activities and processes. In connection with developing PM2.5 calculation methodologies, the SCAQMD has also developed both regional and localized significance thresholds. The SCAQMD requests that the lead agency quantify PM2.5 emissions and compare the results to the recommended PM2.5 significance thresholds. Guidance for calculating PM2.5 emissions and PM2.5 significance thresholds can be found at the following internet address: http://www.aqmd.gov/ceqa/handbook/PM2_5/PM2_5.html.

In addition to analyzing regional air quality impacts the SCAQMD recommends calculating localized air quality impacts and comparing the results to localized significance thresholds (LSTs). LST's can be used in addition to the recommended regional significance thresholds as a second indication of air quality impacts when preparing a CEQA document. Therefore, when preparing the air quality analysis for the proposed project, it is recommended that the lead agency perform a localized significance analysis by either using the LSTs developed by the SCAQMD or performing dispersion modeling as necessary. Guidance for performing a localized air quality analysis can be found at http://www.aqmd.gov/ceqa/handbook/LST/LST.html.

It is recommended that lead agencies for projects generating or attracting vehicular trips, especially heavy-duty diesel-fueled vehicles, perform a mobile source health risk assessment. Guidance for performing a mobile source health risk assessment ("Health Risk Assessment Guidance for Analyzing Cancer Risk from Mobile Source Diesel Idling Emissions for CEQA Air Quality Analysis") can be found on the SCAQMD's CEQA web pages at the following internet address: http://www.aqmd.gov/ceqa/handbook/mobile_toxic/mobile_toxic.html. An analysis of all toxic air contaminant impacts due to the decommissioning or use of equipment potentially generating such air pollutants should also be included.

Mitigation Measures

In the event that the project generates significant adverse air quality impacts, CEQA requires that all feasible mitigation measures that go beyond what is required by law be utilized during project construction and operation to minimize or eliminate significant adverse air quality impacts. To assist the Lead Agency with identifying possible mitigation measures for the project, please refer to Chapter 11 of the SCAQMD CEQA Air Quality Handbook for sample air quality mitigation measures. Additional mitigation measures can be found on the SCAQMD's CEQA web pages at the following internet address: www.aqmd.gov/ceqa/handbook/mitigation/MM_intro.html Additionally, SCAQMD's Rule 403 – Fugitive Dust, and the Implementation Handbook contain numerous measures for controlling construction-related emissions that should be considered for use as CEQA mitigation if not otherwise required. Other measures to reduce air quality impacts from land use projects can be found in the SCAQMD's Guidance Document for Addressing Air Quality Issues in General Plans and Local Planning. This document can be found at the following internet address: http://www.aqmd.gov/prdas/aqguide/aqguide.html. In addition, guidance on sitting incompatible land uses can be found in the California Air Resources Board's Air Quality and Land Use Handbook: A Community Perspective, which can be found at the following internet address: http://www.arb.ca.gov/ch/handbook.pdf. Pursuant to state CEQA Guidelines §15126.4 (a)(1)(D), any impacts resulting from mitigation measures must also be discussed.

Data Sources

SCAQMD rules and relevant air quality reports and data are available by calling the SCAQMD's Public Information Center at (909) 396-2039. Much of the information available through the Public Information Center is also available via the SCAQMD's World Wide Web Homepage (http://www.aqmd.gov).

The SCAQMD is willing to work with the Lead Agency to ensure that project-related emissions are accurately identified, categorized, and evaluated. Please call Gordon Mize, Ph.D., Air Quality Specialist, CEQA Section, at (909) 396-3302 if you have any questions regarding this letter.

Sincerely,

Steve Smith

Steve Smith, Ph.D.
Program Supervisor, CEQA Section
Planning, Rule Development and Area Sources

SS:GM:AK
LAC080729-02AK
Control Number

Ventura County Watershed Protection District Comment on NOP; dated August 26, 2008

VENTURA COUNTY
WATERSHED PROTECTION DISTRICT
PLANNING AND REGULATORY DIVISION
800 South Victoria Avenue, Ventura, California 93009
Sergio Vargas. Deputy Director - 805 650-4077

DATE: August 26, 2008

TO: Kari Finley, Resource Management

FROM: Sergio Vargas, P.E.
Deputy Director – Planning and Regulatory Division

SUBJECT: RMA 08-032.One Valley One Vision –
Santa Clarita Valleywide Area Plan Update

The Watershed Protection District has reviewed the above Notice of Preparation and our comments are as follows:

Thank you for the opportunity to allow us to comment on the Notice of Preparation for One Valley One Vision – Santa Clarita Valleywide Area Plan Update.

The areas within our purview that we would like to see special studies done will be in the Land Use Element and Safety Element in the EIR Section:

Potential Environmental Effects

- **Hydrology**
- **Hydraulic Hazards – Erosion and Siltation**
- **Water Quality**
- **Groundwater Quantity/Quality/Water Supply**

The Hydrologic, Hydraulic and Drainage Studies

This element would necessitate a comprehensive Drainage Study that will provide a clear understanding of the cumulative impact of the buildout of the entire Santa Clarita Valley Planning Area (Planning Area) to County of Los Angeles, city of Santa Clarita, Santa Clarita Valley and the effect it will have to the common waterway between our counties. The EIR should also incorporate mitigation measure that would eliminate increase in runoff and increase in erosion.

Water Quality

The document should consider both the temporary and permanent impacts to water quality resulting from both construction impacts and runoff from newly developed area. Some examples of impacts are erosion, siltation, and release runoff from paved and landscaped areas.

End of Text

Ventura County Watershed Protection District Comment on NOP; dated September 2, 2008

Ventura County

Watershed Protection District

Groundwater Section

MEMORANDUM

DATE: **September 2, 2008**

TO: **Kari Finley, RMA - Planning Division**

FROM: **Rick Viergutz, WPD – Groundwater Section**

SUBJECT: **RMA 08-032, Notice of Preparation - One Valley One Vision – Santa Clarita Valleywide Area Plan Update**

The Watershed Protection District – Groundwater Section has reviewed the above Notice of Preparation and has provided the following comments:

The Draft Environmental Impact Report (DEIR) discussion needs to address the following:

1) How will surface water and groundwater quantity and quality entering Ventura County from the area covered by the OVOV area plan change over time? The time interval discussed should include now, through build out of the project. Elements included in the time interval should include changes in surface water and groundwater quantity and quality.

RV:gl

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Agua Dulce Town Council Comment on NOP; dated September 11, 2008

AGUA DULCE TOWN COUNCIL

33201 Agua Dulce Canyon Road * Box Number 8 * Agua Dulce, CA 91390
Website: www.AguaDulce-ca.com

- **Donal MacAdam, President**
  (661) 268-7402
  janicepeterson@aguadulcevineyards.com
- **Marilyn Garner, Corresponding Secretary**
  (661) 904-1323
  marilynmerlot@sbcglobal.net
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- **Jim Jennings**
  (661) 268-1464
  jjennings3570@sbcglobal.net

September 11, 2008

Mr. Mitch Glaser mglaser@planning.lacounty.gov
Los Angeles County Department of Regional Planning
320 West Temple Street, Room 1352
Los Angeles, CA 90012

RE: One Valley, One Vision Project (OVOV)
Environmental Review Comment

Dear Mr. Glaser:

The Agua Dulce Town Council requests Los Angeles County Regional Planning reference the Agua Dulce Community Standards District and its authority in One Valley, One Vision (OVOV) General Plan Environmental Impact Report (EIR). We appreciate the opportunity to comment on issues to be included in the EIR.

Respectfully,

Donal MacAdam

Donal MacAdam, President
Agua Dulce Town Council - 2008

Cc: Rosalind Wayman, 5th District Senior Deputy rwayman@lacbos.org

Los Angeles County Department of Public Works Comment on NOP; dated September 22, 2008

COUNTY OF LOS ANGELES

DEPARTMENT OF PUBLIC WORKS

"To Enrich Lives Through Effective and Caring Service"

DEAN D. EFSTATHIOU, Acting Director

900 SOUTH FREMONT AVENUE
ALHAMBRA, CALIFORNIA 91803-1331
Telephone: (626) 458-5100
http://dpw.lacounty.gov

ADDRESS ALL CORRESPONDENCE TO:
P.O. BOX 1460
ALHAMBRA, CALIFORNIA 91802-1460

IN REPLY PLEASE
REFER TO FILE: LD-1

September 22, 2008

TO: Mitch Glasser
County Wide Studies Section
Department of Regional Planning

FROM: Steve Burger
Land Development Division
Department of Public Works

NOTICE OF PREPARATION (NOP)
FOR AN ENVIRONMENTAL IMPACT REPORT (EIR)
ONE VALLEY ONE VISION
PROJECT NO. R2007-01226

We reviewed the NOP for the proposed subject project and concur that an EIR is required. The following comments are for your consideration and relate to the environmental document only:

Hazards–Geotechnical/Soils/Geology

All or portions of the City of Santa Clarita (including communities of Canyon Country, Newhall, Saugus, and Valencia), unincorporated communities of Stevenson Ranch, Castaic, Val Verde, Agua Dulce, and the future Newhall Ranch are located within potentially liquefiable areas per the State of California Seismic Hazard Zones Map-Whitaker Peak, Sleepy Valley, Val Verde, Newhall, Mint Canyon, Agua Dulce, Simi Valley East, Oat Mountain, and San Fernando Quadrangles. All geotechnical issues discussed in the NOP should be addressed in the EIR. Geotechnical reports should be included in the EIR as necessary.

If you have any question regarding soils and geology, please contact Jeremy Wan at (626) 458-4972.

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Services–Traffic/Access

The proposed Circulation Element plans for the continued development of efficient, cost-effective, and comprehensive transportation systems, which are consistent with regional plans, local needs, and the Valley's community character. It also identifies and promotes techniques for improving mobility beyond planning for construction of new streets and highways. Below are comments on the Circulation Element pertaining to traffic studies, neighborhood traffic calming, geometric design, and traffic signal operation. We recommend that you set up a meeting with the consultant and the City of Santa Clarita in order to reconcile these comments.

- The header on the document reads as "City of Santa Clarita General Plan," which is not representative of the One Valley One Vision Valleywide General Plan concept.

- Page C-3, second bullet–Per the Los Angeles County Highway Plan, State Route 126 west of the I-5 Freeway is classified as an expressway not a freeway.

- Page C-6, Intersection Capacity–Instead of expressing level of service exclusively in terms of delay, the County expresses level of service in terms of delay for unsignalized intersections and in terms of delay or volume-to-capacity ratios for signalized intersections.

- Page C-8, second paragraph–While the Congestion Management Plan states that local jurisdictions may define acceptable levels of service up to E, the County General Plan does not specify an acceptable level of service.

- Page C-11, Arterials and Collectors in the Santa Clarita Valley–The County General Plan does not specify an acceptable level of service; thus, the list of roadways not operating at level of service E or better should be revised to a list of roadways that are operating at or exceeding capacity. A capacity of 2,800 vehicles per through lane, assuming a 50-50 directional split and excluding turn lanes, should be used when determining the roadway capacity.

- Page C-11, Major Roadway Improvements Underway as of 2007–Hasley Canyon Road at I-5 Freeway Interchange improvement project should be included in this list.

- Page C-12, Transportation Management System–Public Works recently completed a traffic signal timing analysis of the traffic signals in the unincorporated area of the Santa Clarita Valley. Traffic signals at 22 intersections along The Old Road, Stevenson Ranch Parkway, Pico Canyon Road, and Copper Hill Drive were retimed to improve the overall progression of traffic. Synchronizing the signals and improving the operation and safety of the roadway significantly reduces delay and the potential for collisions, thereby alleviating motorist frustration, reducing air pollution, and decreasing vehicle operational costs.

  In addition to the above synchronized routes, Public Works is currently working on a communications analysis to install the appropriate communications device enabling the traffic signals in the unincorporated area of Santa Clarita to be monitored and controlled from our traffic signal control system located in the Traffic Management Center in Alhambra. This traffic signal control system provides for continuous monitoring of traffic conditions and will provide once-per-second monitoring of traffic signals. Traffic signal monitoring provides our engineering staff with immediate notification of signal malfunctions, thereby enabling faster and more efficient maintenance responses. The system also enables traffic signal timing to be controlled and coordinated from remote workstations to adjust to actual traffic conditions.

  Since the ultimate goal of a transportation management system is to enable monitoring via a traffic control system, it would be the County's desire to have all future signals connected to our system. Therefore, we would recommend that all future signal installations include the provision of communications to the County's central system. This communications could be via hardwire methods such as fiber optics or wireless radios, which are currently being deployed Countywide in other areas.

  To enable both Public Works and the City to work together to coordinate the operation of their traffic signals, we have begun discussions with City staff about connecting the City's traffic control system to the County's Information Exchange Network (IEN). The IEN is an advanced traffic management system and network capable of sharing information and control of various traffic control systems and field devices between agencies. The IEN is currently being deployed Countywide and will improve regional traffic flow with the exchange of traffic signal data among multiple agencies and will provide a coordinated response to traffic congestion and incidents. This will enable the City of Santa Clarita's traffic signal data to be incorporated into the IEN and to enable the City to receive data

from other agencies currently connected to the IEN. Additionally, the City of Santa Clarita will receive data from traffic signals in the unincorporated area and the neighboring City of Los Angeles area.

- Page C-16, Level of Service Standard–While the CMP states that local jurisdictions may define acceptable levels of service up to E, the County General Plan does not specify an acceptable level of service. Instead, the County determines whether the traffic generated by a project alone or cumulatively with other related projects, when added to existing traffic volumes, exceeds certain capacity thresholds of an intersection.

- Page C-16, Standard Cross Sections–The cross sections for the City of Santa Clarita and the County do not match and a standard should be agreed upon.

- Page C-42, Street and Highway System–We recommend that the design of circulation plans for proposed schools take into account any conflicts during drop-off/pick-up hours with morning and afternoon peak-hour traffic congestion in the surrounding area. This includes a careful review of a school's location to ensure that bicycle and pedestrian access are encouraged and if vehicles are anticipated to be used for drop-off/pick-up that the queuing created does not conflict with overall circulation.

- Page C-43, Objective C 2.2–We recommend that consistent standards are adopted in the implementation of Americans with Disabilities Act requirements such as curb ramp design, accessible pedestrian signal, etc.

- Page C-44, Objective C 2.2–We recommend the design plans for traffic signal modifications or new installations include the upgrade of poles for future left-turn phasing when warranted and the installation of a time base unit for future coordination.

- Page C-44, Objective C 2.3–Policy C2.3.4 is mislabeled as Policy C2.4.3.

- Page C-46, Objective C 3.2–Policy C3.2.3 is mislabeled as Policy C3.3.3.

- Page C-50, Objective C 6.1–We recommend the use of commuter bikeway signage.

- Page C-51, Objective C 7.1–We do not recommend the use of refuge islands for medians 4 feet wide or less.

- The County also has a program to reduce cut-through traffic through neighborhood streets. The information is available on Public Works' website at http://dpw.lacounty.gov/TNL/NTMP/Page_01.cfm.

- We also agree that a priority should be given to provide a healthy and safe circulation system to address safe pedestrian walkways and bikeways. Given this priority, typical roadway cross sections recommended by the City of Santa Clarita with wider pedestrian paths (Figures 4.4-3 and 4.4-4) are preferred. Other traffic-calming measures such as bulb outs, raised medians, narrower streets, pedestrian islands for wide roadways, and road diet-type of improvements should be considered for implementation to reduce pedestrian crash risk.

If you have any further questions regarding traffic/access, please contact Ron Matsuoka of our Traffic Studies Section at (626) 300-4709.

Services-Sewage Disposal

- The draft EIR should include discussion for the collection and disposal of the waste water that would be generated by the proposed project, especially its potential impact on the available capacity of the existing local sewer lines for both peak dry and wet weather flows pursuant with Statewide General Waste Discharge Requirements, Order No. 2006-0003. The draft EIR should also include discussion on the impact of the proposed project on the existing local and trunk sewer facilities.

- The City of Santa Clarita owns and Public Works' Consolidated Sewer Maintenance District is responsible for the operation and maintenance of the local sewer collection system within the City and the unincorporated Los Angeles County. All sewer construction within the project area shall comply with Public Works' Sewer Design standards.

If you have any question regarding sewer, please contact May Hong at (626) 300-3382.

Other-Environmental Safety

1. Solid Waste

   - Solid waste generated in the County of Los Angeles currently exceeds the available permitted daily landfill capacity. The proposed project will increase the generation of solid waste and negatively impact the Solid Waste Management infrastructure. Therefore, the proposed environmental document should identify what measures will be implemented to mitigate the impact. Mitigation measures may include waste reduction and recycling programs and development of infrastructure in the project to facilitate recycling.

   - School Districts are encouraged to take advantage of special County programs to encourage waste diversion by calling 1(888) CLEAN LA or visiting www.888CleanLA.com.

2. Hazardous Waste

   - The existing Hazardous Waste Management infrastructure in the County of Los Angeles is inadequate to handle the hazardous waste currently being generated. The proposed project may generate hazardous waste and/or household hazardous waste, which could adversely impact existing Hazardous Waste Management infrastructure. This issue should be addressed and mitigation measures provided. Mitigation measures may include, but are not limited to, providing new homeowners with educational materials on the proper management and disposal of household hazardous waste. The project proponent may contact Public Works for available educational materials by calling 1(888) CLEAN LA.

   - If any excavated soil is contaminated, or classified as hazardous waste by an appropriate agency, the soil must be managed and disposed of in accordance with applicable Federal, State, and local laws and regulations.

3. Storage Space for Recyclables

   The California Solid Waste Reuse and Recycling Access Act of 1991, as amended, requires each development project to provide an adequate storage area for collection and removal of recyclable materials. The environmental document should include/discuss standards to provide adequate recyclable storage areas for collection/storage of recyclable and green waste materials for this project.

4. Construction and Demolition Recycling Comment

   Construction projects with a total value of over $100,000 and demolition and grading projects in the County's unincorporated areas are required to recycle or reuse 50 percent of the construction and demolition debris generated per the County's Construction and Demolition Debris Recycling and Reuse Ordinance. A Recycling and Reuse Plan must be submitted to and approved by Public Works' Environmental Programs Division before a construction, demolition, or grading permit may be issued.

5. Building and Safety Issues

   - The Los Angeles County Building Code, Section 110.4, requires that buildings or structures adjacent to or within 200 feet (60.96 m) of active, abandoned, or idle oil or gas well(s) be provided with methane gas protection systems. If the project site contains or lies within 200 feet of active, abandoned, or idle oil or gas wells, this issue should be addressed and mitigation measure provided, and Public Works' Environmental Programs Division must be contacted for issuance of necessary permits.

   - The Los Angeles County Building Code, Section 110.3, requires that a building or structure located on or within 1,000 feet (304.8 m) of a landfill containing decomposable material must be protected against landfill gas intrusion. The project site contains landfills, so this issue should be addressed and mitigation measures provided. The discussion should include subsurface lateral migration of landfill gas, migration detection, and control and protection systems for affected enclosed buildings and structures. Public Works' Environmental Programs Division must be contacted for issuance of necessary permits.

6. Underground Storage Tanks/Industrial Waste/Stormwater Comments

   - Should any operation within the subject project include the construction, installation, modification, or removal of underground storage tanks, industrial waste treatment or disposal facilities, and/or storm water treatment facilities, Public Works' Environmental Programs Division must be contacted for required approvals and operating permits.

   - Food service establishments may be required to provide a grease treatment device and will be subject to review and approval by Public Works' Environmental Programs Division.

- All development and redevelopment projects which fall into one of the Standard Urban Stormwater Mitigation Plan project types, characteristics, or activities, must obtain Standard Urban Stormwater Mitigation Plan approval by the appropriate agency.

7. Supplemental Comments

   A number of landfill closures have been experienced within the last few years and more closures are expected to occur in the near future. As regional disposal facilities close, there is an increasing need for regional transfer facilities to efficiently transport solid waste generated to more distant processing or disposal facilities. These transfer facilities are essential for the cities in the County of Los Angeles and the unincorporated areas to be able to properly manage solid waste in accordance with the requirements of the California Integrated Waste Management Act of 1989, also known as AB 939, provided they are found to be environmentally and technically feasible.

   If you have any questions regarding environmental comments above, please contact Benjamin Cortez at (626) 458-2536.

If you have any questions or require additional information, please contact Toan Duong at (626) 458-4945.

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OVOV November 2008 Workshop Comment Cards

Element	Comment	Action	Timeline	Responsible Party	Resident Contact Info
OS	• Blue Streams should be noted. There are developments over the location of these streams. This should also be noted.				Katharine Squires 661-296-4305 kat_268@att.net
	• Glad to see that SEA's (Sig.Eco.Areas) have been included on maps. Strong language should be in place to protect these areas from development				
	• All fossils/specimens found during grading etc. should really be donated to the Los Angeles County Museum to be recorded.				
	• It is critical that development not be permitted in areas of extreme fire/earthquake danger, i.e. Lyons Cyn Ranch				
	• It is imperative that the best paleontologist etc., be consulted. The rate of uplift in the Towsley Cyn. Area is parallel to that of the Himalayas! A very good reason to limit development				
	• Limiting sprawl development is essential - continuing concern				
	• Having wildlife corridors on maps would be great to see				
ALL	• Conditions or New Zone Commercial Suburban for Smiser Property - 35 feet height limit - .375 x 1,611,720 sq. ft. = 604,375 sq. ft. - .50 x 1,511,720 sq. ft. = 805,860 sq. ft. - .75 x 1,611,720 sq. ft. = 1,208,790 sq. ft.				Calgrove Corridor Coalition Annette Lucas, Co Chair Glenda Bona, Co Chair
	• A beautiful entrance into the Santa Clarita Valley that feathers into the existing neighborhoods				
	• Wiley Canyon – No more than 4 lanes				
	• Green Belts throughout the development				
	• Calculation does not include CalTrans property taken away for freeway development				

Element	Comment	Action	Timeline	Responsible Party	Resident Contact Info
Land Use Housing Circulation Open Space EIR	• Connecting Dockweiler with Lyons will create a terrible unsafe condition for the Dockweiler residents. The Lyons crossing will create another unsafe train crossing at a time when more trains are being used for commuter transportation and movement of freight.				Sandra Cattell sumcatt@yahoo.com
	• All Blue Line Streams should be shown in transportation, housing, land use, safety, and circulation elements (not just floodway).				
	• Las Lomas area land purchase options by Palmer either have or are about to expire.				
	• Placerita creek, near South Fork, should be investigated as a SEA, definitely is an underground stream.				
	• Would like to see most of the property owned by Casden in Placerita become open space.				
	• Lyons Ranch project is unsafe. It is in an extreme high fire hazard area. It is also in an SEA.				
	• DO NOT ALLOW building in high fire hazard, flood hazard, and high earthquake hazard areas. We cannot afford this gambling with lives nor does the next of the community want to bear the expense.				
Land Use	• What is NET result of Down-Zone/Up-Zone density?				Tony Natoli 20842 Benz Rd. 661-296-7277 natolial@pacbell.net
Land Use	• 21563 Cleardale St. Newhall, CA 91321				Phil Rawlins 21565 Cleardale 661-259-3533 p_frawlins@sbcglobal.net
	• Lot 133. No Road, No Water				
	• Flood Plain goes through middle of property				
	• High risk fire zone				
	• New zoning not compatible with surrounding properties.				
	• Please find picture of property				
	• SEE ATTACHED PICTURE TO COMMENT CARD				
ALL	• Interactive mapping – City to create program similar to county re. current land use density and future land use density				Timben Boydston
OS	• Check final rule federal register shows boundary for Arroyo to				

Element	Comment	Action	Timeline	Responsible Party	Resident Contact Info
OS	• Property designation in Placerita Canyon				Phil Rawlins
	• Reconsider higher density residential designation along Los Canyon Road on east side of Sand Cyn Rd.				

PCPOA OVOV Concerns; dated December 23, 2008

PCPOA OVOV Concerns

Flood Concerns:

1. Maps must list all blue line streams.
2. Plan must protect both blue line streams and the recharge areas along them. The normal and usual flow of a blue line stream should never be channelized, built on or altered in any way.
3. Homes behind the blue line streams cannot be further isolated and threatened.
4. The newest FEMA studies and maps must be followed; building in Floodways must be assiduously avoided.
5. Water flow must be considered. In Placerita Canyon, the City did an engineering study in conjunction with the backbone sewer system that showed the system did not need lifts or pump stations; it could be gravity fed to what is now considered the "Cowboy Festival" parking lot. That clearly means that water drains to that field. If it is covered with buildings and concrete, water will back up in Placerita Canyon threatening residents and property.

Circulation Element:

1. A recent article in the Los Angeles Times indicated most commuter rail fatalities occur at at-grade crossings. The proposed Lyons to Dockweiler at-grade crossing will be very heavily traveled and the only viable way from Placerita Canyon into the City. Projected increased rail traffic over the next years and decades will only exacerbate circulation and safety problems.
2. Circulation studies on the Lyons to Dockweiler at-grade crossing must be done on "peak volume" basis.

Neighborhood Identity:

1. Poor planning can destroy a neighborhood. Placerita Canyon, from the railroad tracks to Sierra Highway, is designated a Special Standards District to protect our rural equestrian neighborhood. Any development within, or adjacent to, the Special Standards District should reflect the unique heritage of Placerita Canyon. There need to be adequate circulation and buffer zones to protect and preserve the rural equestrian nature.
2. The new MXN (Mixed Use Neighborhood) is not appropriate in a Special Standards District where up to four times the square footage of that in the Regional Mall would be allowed on the "Cowboy Festival" parking lot. The Mall is served by three major regional roads; Placerita Canyon is served by a single two-lane road. (Dockweiler, at build-out, is planned to be only a four-lane road.) Further, the area in Placerita Canyon is currently designated a Floodplain and is due to be upgraded to Floodway; it is totally unsuitable to the level of development discussed in the Land Use Portion of One Valley One Vision.

General Comments:

1. Placerita Canyon Property Owners' Association Board of Directors looks forward to presenting additional suggestions to strengthen the Special Standards District.
2. The Preliminary Land Use map (October 6, 2008) inexplicably shows a high density project (19 DU's per acre) in the middle of Placerita Canyon. We were told this was an error and would be corrected. Please do so.

Thomas M. Surak Comment on NOP; dated May 27, 2009

Thomas M. Surak

23712 Adamsboro Drive
Newhall, CA 91321

May 27, 2009

Mr. Jason Smisko, Senior Planner

City of Santa Clarita

Email: jsmisko@santa-clarita.com

Mr. Paul Novak, Planning Deputy

County of Los Angeles

Email: sosuna@lacbos.org

Re: Notice of Preparation - One Valley, One Vision

Dear Mr. Smisko and Mr. Novak:

I am pleased to be able to provide the following comments regarding the draft OVOV documents. In general, the documents appear to be deficient in many areas. They do not offer Santa Clarita residents the same protections and promises which currently exist in the General Plan. Also, as having participated in many aspects of the OVOV process, I can testify to the fact that it was overly cumbersome, often confusing and not at all conducive to inviting full participation by all interested parties. Several of my specific issues and concerns are discussed below. I expect similar comments will be submitted by other residents, which will require additional public participation before the OVOV process can move forward. I can only hope that this will lead to timely and successful resolution of all issues.

The City has not made a proper showing for why it is proposing significant revisions the existing General Plan. The City's flyer, "OVOV Facts and Benefits" which was widely circulated to the public, clearly states that the build-out population estimates adopted for the 1991 General Plan maxed at 521,977 people, and that the OVOV estimates a build-out population range of 444,000 to 485,000. The obvious yet unanswered question is then, "Why are increases in zoning densities, in many cases significant ones, being proposed for the OVOV?" The City cannot legitimately argue that the increased density is to accommodate non-residential development because most OVOV commercial zoning definitions allow for extremely high density (e.g., a minimum of 11 units per acre) residential use. These "commercial zone" residential densities overwhelm those of the surrounding neighborhoods, and such development can only be perceived as detrimental to nearby residents. As further discussed below, the City's concept of a "Valley of Villages" as laid out in the OVOV is not consistent with the principle of enhancing established neighborhoods, nor with development consistent with neighborhood community character, which are both key objectives stated in the OVOV.

Page L-39 of the current General Plan makes it clear that the land use designations adopted in 1991 "should not be construed as temporary holding categories awaiting higher density designations in the

future." It further states, "The Plan has looked at development suitability within the entire Santa Clarita Valley and applies designations for anticipated, long-term future development." The draft OVOV clearly makes a mockery of this promise. OVOV zoning densities are drastically increased throughout the valley.

Also, many new zoning categories are overly broad with respect to allowable types of applicable development. For example, the Regional Commercial, Community Commercial and Neighborhood Commercial zoning designations all allow for mixed use (i.e., residential) development, even though the OVOV also has separate "Mixed Use" zoning designations which more clearly convey the ability to allow such proposed developments. The General Plan is clear when it states "surrounding characteristics, preservation of neighborhood integrity and compatibility with existing uses shall also be taken into consideration in connection with new development proposals." The guiding theme of the OVOV, "A Valley of Villages", casts these neighborhood protections aside by requiring increasing density projects which are entirely inconsistent with the characteristics of surrounding neighborhoods.

The City's concept of a "Valley of Villages" conveniently avoids discussion on the subject of different housing types having different public service requirements. For example, persistent crime hotspots in the Santa Clarita Valley are highly correlated with housing density, e.g., the largest crime problems are associated with higher density housing near downtown Newhall and in Canyon Country. The OVOV does not consider or address additional financial and emotional costs which will be imposed upon existing residents as a consequence of increased crime associated with the OVOV's high density housing proposals.

The OVOV undermines existing neighborhood protections from such high density projects. These protections are inherent in the 1991 General Plan, which many who have since settled into Santa Clarita relied on when making their decision to move here. Without a showing of benefits to existing neighborhoods, one can readily conclude that the OVOV is primarily designed to provide developers an opportunity to further increase their profit opportunities through increased zoning densities. Such opportunities are properly restricted under the existing General Plan through its embedded protections provided to residents of Santa Clarita, and these protections must be maintained.

Some basic elements of the OVOV which must be understood to ensure full participation in the OVOV process were not (and may still not be) clearly communicated to the public. For example, the proposed zoning designation of the Smiser property located in my neighborhood near Calgrove & Wiley Canyon was recently (and unknowingly) revised. At the November public workshops which showcased the draft OVOV, the Smiser property zoning designation was clearly identified as Community Commercial. A completely new zoning designation for this property, Mixed Use – Neighborhood (MXN), has just recently been brought to my attention. However, one cannot readily determine that there has been a new zoning designation by reviewing the revised December 19 Preliminary Land Use map posted for public review, which is the key document for purposes of OVOV review and understanding. The blue and white striped color designation assigned to this MXN zoning designation on the map completely blends in with the blue and white stripe used to assumedly delineate the city boundary which is adjacent to the Smiser property. No reasonable person could have been expected to learn of this zoning change through periodic review of this map, yet that is what was expected from those attempting to participate in the OVOV process. I can only assume that this color scheme selection was just a coincidence and unintentional. However, it does illustrate one of the many unnecessary difficulties OVOV participants have had to overcome in order to properly become engaged in the OVOV process.

Another example of confusion derives directly from the exclusion of a critical clarification in the General Plan from the OVOV zoning definitions. The General Plan clarifies that appropriate project intensity "is generally expected to be between the low and mid-point of the allowable floor area ratio (FAR) range". Comparisons made by City Staff in documents and at public meetings which suggested that allowable city development under the General Plan and the OVOV were equivalent did not incorporate the lower FAR range clarification embedded in the General Plan, and thus overstated allowable development

under the General Plan. Stated another way, the OVOV will allow for much denser development even at similar FAR since it no longer requires project intensity to be at the lower end of the allowable FAR range. Unless the above clarification regarding a lower appropriate project intensity is incorporated into the OVOV, representations made regarding comparable allowable development under the General Plan and the OVOV were incorrect because they minimized impacts under the OVOV, and were likely to have diminished public participation in the OVOV process.

Also, there is language throughout the OVOV which lessens the certainty of limiting future development to the designated zoning. For example, page I-3 states "all subsequent planning and development decisions within the Santa Clarita Valley planning area shall be determined to be consistent with these documents, except as provided herein for any land use applications pending during the plan preparation and adoption process." This caveat completely undermines the ability of citizens to fully appreciate what is capable of being developed in their neighborhoods and other areas where they may have special concerns and interests, and effectively disengages many from actively participating in the OVOV process. In addition, this caveat is not consistent with public representations which have made. Please refer to an October 5, 2008 article in "The Signal" titled, "SCV ponders 'one vision' for growth" which quotes both of you as well as Paul Brotzman. This article includes the following statement: "Though general plans by definition are general, the state mandated documents must include a map that describes exactly what type of development can occur on every inch of land." I do not recall any clarification or rebuttal to this statement having been made by City or County staff. I also believe many more residents have read "the Signal" for information on the OVOV than have read through the several hundred pages of draft OVOV documents. The development flexibility being sought in the OVOV which I cited above does not comply with this statement. Therefore information provided to the majority of residents regarding the development flexibility sought within the OVOV is misleading at best. The City and County cannot assume that residents fully comprehend this development flexibility. Therefore the OVOV cannot be allowed move forward with this intended flexibility without further public disclosure and discussion.

The OVOV inadequately addresses how existing deficiencies in City parks and recreation facilities will be met. The OVOV states, "The Land Use Element is the City's and County's long-term blueprint for development of property to meet Santa Clarita Valley's future needs for … parks, open space…including location for future uses within the planning area." It furthermore states, "The provision of adequate park space and facilities to serve residents is not only required by State planning law, but is recognized as necessary to provide for public health and quality of life." The OVOV further recognizes that "another issue for park development is distribution of park facilities, as many local parks are concentrated within master planned communities, and outlying areas have access to fewer local parks." The OVOV confirms that the City has a "standard" (the term "requirement" is used in the 1991 General Plan, which I interpret as the true intent) of five acres of park facilities per 1000 residents, and yet the City currently has "only about 1.5-2 acres of developed parkland per 1000 population", which is essentially unchanged from when the General Plan was adopted in 1991. (In fact, as of October 2008 the true ratio is 1.4 acres of parkland per 1000 population as stated by the City of Santa Clarita Parks, Recreation, and Community Services Commission, which increases the magnitude of the existing parkland deficiency.) In essence, notwithstanding the claims that significant parkland has been added since 1991, due to corresponding population growth there has been no significant progress made towards meeting the parkland "target" in almost two decades. This is especially true in areas which were identified as being underserved throughout that timeframe, which will have to be met through land acquisition using "additional funding sources." This is because the State's Quimby Act which has been used to acquire the majority of parkland added since 1991 only provides parkland (and only at an below "target" three acres per 1000 population) for residents of new developments.

The OVOV ignores the critical additional parkland requirement (per Policy LU 3.4.1) by stating that the Conservation and Open Space element "will not serve as a park master plan but will instead focus on broad policy issues relating to park planning." The OVOV just defers on this issue by identifying as City Task 8.1, "Complete and adopt a revised Park and Recreation Master Plan for the City by 2009." This is unacceptable. The OVOV must fully coordinate with the park master plan on a detailed level; by not

doing so, the OVOV invites development of remaining open areas which must be preserved for future parkland to meet the adopted parkland "target." This need for coordination holds especially true in areas which have an identified parkland deficiency and minimal remaining acreage which can help meet that deficiency. In fact, the Final Draft of the Parks, Recreation and Open Space Master Plan Update states, "Priority should be given to meeting the current (park) acreage deficit of 612 acres." However, the OVOV not only lacks any priority with respect to additional parkland in the OVOV, there are inherent barriers to the creation of additional parkland created by the OVOV.

For example, the Calgrove/Wiley Canyon neighborhood was identified in the existing General Plan as being "severely underserved" with respect to parks (this neighborhood is similarly identified as having a "service area gap" in the Final Draft of the Parks, Recreation and Open Space Master Plan Update, which I take as a euphemism). The only remaining undeveloped land which can be used for a neighborhood park in the Calgrove/Wiley Canyon area is the Smiser property. However, not only does the latest OVOV zoning of the Smiser property not include any reference to parkland, it instead proposes to increase the density allowed for development of that property! By increasing the allowable build densities on remaining undeveloped property such as Smiser, the OVOV increases the residual value of properties which are most suitable for helping close the significant gap between target and actual park acreage. Thus the OVOV will create further barriers to meeting the park master plan objectives by unnecessarily increasing the future cost of acquiring acreage for parkland. This will undermine the ability of and likely preclude the City from meet existing, let alone future, parkland needs under the prescribed "target".

The environmental aspect of the OVOV addresses climate issues only from a macro perspective; the issue of microclimate changes which are common with increased "urbanized" development such as that contemplated by the OVOV is ignored. Microclimate issues must be incorporated into the EIR study process to provide a complete and proper assessment of potential impacts from the build out proposed by the OVOV. Also, there is a lack of focus on increased noise associated with increased urban development, both during and after construction, as proposed in the OVOV. The importance of this issue cannot be ignored since increased noise pollution has the ability to undermine the tranquility that residents of Santa Clarita currently appreciate and will continue to expect in the future.

Please feel free to contact me for further clarification on the above.

Sincerely,

Thomas M. Surak

Valley Industrial Association Letter to the City of Santa Clarita; dated February 6, 2009

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February 6, 2009

Paul Brotzman
Director of Community Development
City of Santa Clarita
23920 Valencia Blvd., #300
Santa Clarita, CA 91355

Subject: VIA input to the City draft Housing Element and Circulation Element

Dear Mr. Brotzman,

Thank you to you and your City Staff members for calling the meeting with me and VIA board member Andy Pattantyus on January 15, 2009, to review the City's plans for complying with SB-2 requirements in the revision of the Housing Element, which currently exists in draft versions. Please send us a copy of the next draft as soon as it becomes available. In this letter, we first summarize the meeting, then we will get into the specific things that the business community (represented by VIA) would like to see included in the Housing Element and Circulation Element.

Summary of Meeting on Jan 15, 2009.

Attendees from VIA: Kathy Norris and Andy Pattantyus
Attendees from the City: Paul Brotzman, Tina Haddad, Jason Killebrew, Lisa Webber

Purpose of the meeting: Review SB-2 Affect on Business Parks

Summary. SB-2 requires each City and County in California to designate at least one zoning code where Homeless Shelters and Transitional Living Centers can exist "by-right", which means that Use Permits are not required to set-up an operation. The city of Santa Clarita has decided to handle the requirement by creating an "overlay" onto the zoning code "Business Park". The boundaries of the overlay encompass most of the area of the Centre Point Business Park and the Valencia Business Park. The Centre Pointe overlay area encompasses the current location of the Winter Shelter on Golden Valley Road. The City can still contractually apply constraints to any homeless shelter operation, regulating such parameters as the number of beds, operating hours, parking, etc.

Other. While we had everybody in the room, VIA made its interests known to the City re: Housing and Transportation

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Housing. First we talked about the Housing Element. The City says that it will make available sufficient land to build 4,000 low and very low income housing by 2014 at a density of 30 units per acre. The City cautioned that the City is required only to make the land available, but not to assure that the units get built. That is a "free market" issue. The City said the main problem is the lack of rentals. While nationally, the ownership to rental ratio is 65 / 35, in Santa Clarita Valley it is 80 / 20. The community shows a strong bias against rentals, because of the public's perception that crime and trouble is associated with rental developments.

Transportation. Next we talked about the Circulation Element. VIA talked about the need for more trains and more buses that start earlier in the day and leave later at night. The City responded by saying the issue is money. Trains and buses are subsidized, meaning that the fare does not cover the cost of operation. Thus, funding is needed. Santa Clarita is a part of the North LA Transportation Corridor. Thus, on every transportation project, we compete with the City of LA. We need to more actively lobby and more actively measure the needs. The City mentioned that lobbyist Arthur Sohikian is actively lobbying on behalf of the North LA County Transportation Corridor.

VIA indicated to the City that VIA expects the City to take a leadership position in solving these problems, which means doing more than the minimum required by law.

Housing Element Compliance with SB-2

As stated in the summary of the meeting, the primary purpose of the meeting was for the City to review with VIA the method of compliance to the state law SB-2, which requires that the City designate at least one zoning code where homeless shelters and transitional living centers can locate "by-right", without any use permits. As we understand it, the City intends to comply with the requirements by designating an "overlay" onto the zoning code Business Park (BP) which encompasses most of the Centre Pointe business park and the Valencia Industrial Park on the Northwest part of town. Impact on the community will be mitigated by City processes for review and community comment, as with any other development. We also understand that transitional housing and permanent supportive housing will be allowed in the zoning code "Residential".

The Valley Industrial Association supports this proposal.

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Housing Element and Workforce Housing

The Valley Industrial Association is a business organization, and, as such, it is our mission to support business and industry in the Santa Clarita Valley. VIA believes that in order for a city to be vibrant and successful, we not only need a variety of workers at all levels, but we need varied housing availability to support those workers and their families. This must be incorporated as a part of the City's general plan and housing element.

The Valley Industrial Association has been researching and advocating the subject of Workforce Housing for several years. We have conducted several forums, including a symposium and a panel discussion. We have also surveyed many of our member companies to identify the issues. We believe the issue can be best summarized as follows: ***A large number of hourly and salaried workers, such as factory workers, teachers, EMT, firemen, policemen and other essential service workers, who work in Santa Clarita cannot afford to live in Santa Clarita.*** We are talking about workers who earn between $30K and $60K per year. This results in a reliance on a non-local workforce that creates a number of challenges for our employers, including: high worker turnover, loss of workdays during a disaster (when freeways are shut-down), long and costly commutes for the lower tier of wage earners, and an inadequate labor pool to draw from when trying to fill job openings.

In this context, VIA has reviewed the November 20, 2008 draft of the Housing element. VIA understands that there is a newer draft that will be available in January or February, but we worked with the version available to us.

VIA's assessment is that the November 20, 2008 draft of the City of Santa Clarita housing element is minimally compliant with the state requirements, and on many issues does not meet the needs of the businesses represented by VIA.

The biggest deficiency is in the area of Work Force housing, which encompasses Low Income and Very Low Income. The current draft of the Housing Element lumps Low Income and Very Low Income housing together into one category. These categories are very distinctly different, and should be kept in two separated categories. The draft Housing Element says that against a need of 1,256 units of Very Low Income housing, only 20 were constructed? Why? How will the City assure that this same pattern does not repeat in the next 7 years? VIA understands that sufficient zoning will be designated to meet the need. But what if the free market does not fill the need? What pro-active steps will the City take to assure that the much needed housing gets built?

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Circulation Element and Transportation

VIA commends the City of Santa Clarita for doing an excellent job with Santa Clarita Transit, with MetroLink, with the Cross Valley connector, with Traffic Flow upgrades, and with repaving of major arteries within the industrial parks (ex: Rye Canyon Rd. repaving.). In spite of this excellence, there are some transportation needs that are not being met, and VIA would like to call the City's attention to these matters.

Ultimately, the business community in Santa Clarita needs easy access to a large and stable labor pool. Ideally, the workers should be able to live in the same community where they work, without long and expensive commutes. The members of VIA understand that any solution based on development and construction of housing will be at least a decade away, considering the pace of development and community input. Thus, VIA sees improved transportation as the interim method of assuring a stable and readily available workforce.

More could be done in the Section "Travel Demand Management". This section is vague and lacking in specific measures that the City could initiate, with co-operation and support from manufacturing employers and members of VIA. For example, one of the VIA manufacturing employers offered an incentive for workers to take the train from Palmdale and Lancaster to Santa Clarita. Only 4 out of hundreds of eligible workers took advantage of the incentive? Why? The City should investigate and find out. VIA has conducted some informal inquiries to learn about the issue. The trains do not leave early enough and late enough between Palmdale/Lancaster and Santa Clarita to even support a single shift with overtime (a ten or 11 hour workday). Thus, workers would have to sacrifice available working hours in order to take the train (using the incentive). Thus, they do not take the train.

VIA has responded to gaps in available public transportation by educating its members about the availability of van pools, and has promoted the use of several available services. The van pools can be contracted either by the employers, or by the workers directly independently of the employers. Through discussions with its members, VIA has found out that van pools and transportation incentives are extremely price sensitive, with as little as $5 to $10 per week being the difference between participation and non-participation. How many van pools are in operation to support Santa Clarita businesses? The City should know this, and should see van pools as an indicator of gaps in public transportation.

Transit Corridors. Missing in the Circulation Element is any discussion about the establishment of high density transportation corridors in the master plan that are specifically located in proximity to the zones and parcels designated as "high density" to encourage the development of transit oriented housing that is specifically well suited to the needs of the Santa Clarita hourly workforce.

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Hours of Operation. Section O. Summary of Circulation Needs. This section does not address the needs of the membership of VIA to get hourly workers from Palmdale / Lancaster / Pacoima / Santa Paula to Santa Clarita in the morning, and back at night. Also, the element does not support the transportation needs of manufacturers that would like to expand the use of their capitally intensive facilities to a two shift operation. Two shift operations would require trains and buses that leave outlying areas between 4:00 and 5:30 in the morning, and between noon and two in the afternoon, and returning in the late afternoon (after first shift) and returning after mid-night (after second shift).

Compliance with SB-375 "Anti-Sprawl" Bill

The current drafts of the Housing Element and Circulation Element do not address the requirements of SB-375. VIA strongly advocates that the drafts of these elements be

upgraded to address the requirements of SB-375 in the current revisions. Otherwise, both elements will have to be reviewed and upgraded again within 2 years to comply with SB-375. The basic principle of "anti-sprawl" is that workers should live in the same community where they work, resulting in a short reasonable commute that is energy efficient and reduces greenhouse gas emissions.

Both the Housing Element and the Circulation Element do not address the following question: ***How many hourly workers in Santa Clarita do not live in Santa Clarita?*** Is it 10,000? 20,000? How do the people who work in Santa Clarita, but live far away (Palmdale, Lancaster, Santa Paula, Frazier Park, Pacoima), get to work? When fully built out, the Industrial Parks in Santa Clarita will employ about 80,000 people. Will half of these workers face a 40 mile each way commute every day?

The Housing Element is completely devoid of any study or survey that quantifies the number of people who work in Santa Clarita, but do not live in Santa Clarita. During the public review and community input session in August of 2008 at the Newhall Community Center, VIA requested that the City take steps to quantify the number of people who work in Santa Clarita, but cannot afford to live in Santa Clarita. So far, there is no evidence that the City has attempted to quantify this very important number. As one example, Princess Cruises employs 2,000 people in Santa Clarita. Of these workers, 1,200 live in Santa Clarita, and 800 do not.

The Circulation Element does not address the subject of making provision for low income workers to live close to their workplaces, along high density transportation corridors such as trains, trolleys, and major bus routes. How long does it take for an hourly worker to get to work by bus and/or train? How many bus transfers are required? How much does it cost per month? How does that cost compare to car pooling and van pooling?

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Leadership

VIA would like the City of Santa Clarita to join VIA in taking a leadership position in the Housing Element and Circulation Element, by planning for the community's real needs, rather than what is minimally required by state law. The Industrial Community in Santa Clarita, represented by VIA, has real needs that are currently not being met in the planning and development processes. These needs are approximately summarized in this letter.

VIA would like to challenge the City of Santa Clarita to do the following:

1. While VIA admires the City's plan to comply with SB 2, we feel merely complying with minimum requirements isn't enough for such a forward thinking city like ours. We're so much better than that! Let's improve on the basics.
2. Help draft Housing and Circulation Elements that meet the needs of the business community and the hourly workers that work in Santa Clarita.
3. We need a more granular approach to housing. We need to make sure diverse housing across many spectrums of need is included. Each level must be clearly defined (low income and very low income should not be combined into a single level). A more granular approach is needed. The plan must be very specific. Where are single starting teachers going to live? Where are other public service employees like EMT, firemen, policemen going to live? Where is a newly graduated engineer going to live? How will the City assure that 4,000 units of low income and very low income housing are built? Simply stating that "the free market will take care of it" is not an answer. As well, we (the City and the business community) have the social responsibility to educate people about purchasing, the lending processes, and how to succeed financially.
4. The planning (for assuring that workers are available) needs to go beyond housing and should incorporate transportation and mobility (circulation elements). Currently, the Housing and Circulation Elements try to answer the question: "Where do the residents of Santa Clarita work, and how do they get to work?" Now, in the new revisions, we must also answer the question: "***Where do the workers of Santa Clarita live, and how will they get to work***?"
5. Where will the high density housing be built? Special consideration should be given to locating the housing near transportation hubs, or locating transportation hubs near the housing. Residents will need effective and reasonable transportation choices to get to the workplace.
6. The plan should be very specific about how properties/projects will be acquired and how the housing will be offered. Who will build it? Who will interview the applicants? If the free market does not respond (perhaps because they view the environment as "hostile") then what action will the City take to assure that there are bidders for the desired projects?
7. Will the City of Santa Clarita commit funds and/or land to Work Force housing? If so, how much?

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VIA will be happy to work with the City to assure that the needs of the industrial business community are met.

Please note that the content of this letter is approved by the board of VIA, and thus represents the needs of the industrial business community represented by VIA.

Sincerely,

Kathy Norris

Kathy Norris
President and CEO

cc: Tina Haddad
Jason Killebrew
Lisa Webber
Andy Pattantyus
Randy Moberg

APPENDIX 3.2

One Valley One Vision Valley-wide Traffic Study, prepared by Austin-Foust Associates, Inc.; dated May 2009

ONE VALLEY ONE VISION

VALLEY-WIDE TRAFFIC STUDY

TECHNICAL REPORT FOR THE CIRCULATION ELEMENTS OF THE SANTA CLARITA VALLEY AREA PLAN UPDATE (LOS ANGELES COUNTY) AND THE CITY OF SANTA CLARITA GENERAL PLAN UPDATE

MAY 2009

AUSTIN-FOUST ASSOCIATES, INC.
TRAFFIC ENGINEERING AND TRANSPORTATION PLANNING

ONE VALLEY ONE VISION

VALLEY-WIDE TRAFFIC STUDY

Technical Report for the Circulation Elements of the Santa Clarita Valley Area Plan Update (Los Angeles County) and the City of Santa Clarita General Plan Update

Prepared for:

City of Santa Clarita
County of Los Angeles

Prepared by:

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(714) 667-0496

May 22, 2009

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1.0 INTRODUCTION

This report presents the results of a traffic study carried out for One Valley One Vision (OVOV). OVOV is a joint effort between the County of Los Angeles, the City of Santa Clarita, and Santa Clarita Valley residents and businesses to create a single vision and guidelines for the future growth of the Santa Clarita Valley and the preservation of natural resources. This traffic study presents information for the City of Santa Clarita General Plan Update and the Santa Clarita Valley Area Plan Update for the County of Los Angeles. More specifically, it contains existing and future traffic information that provides resource material that can assist the City and County in updating their Circulation Elements, and serves as a technical resource document for the Environmental Impact Reports being prepared by both the City and the County.

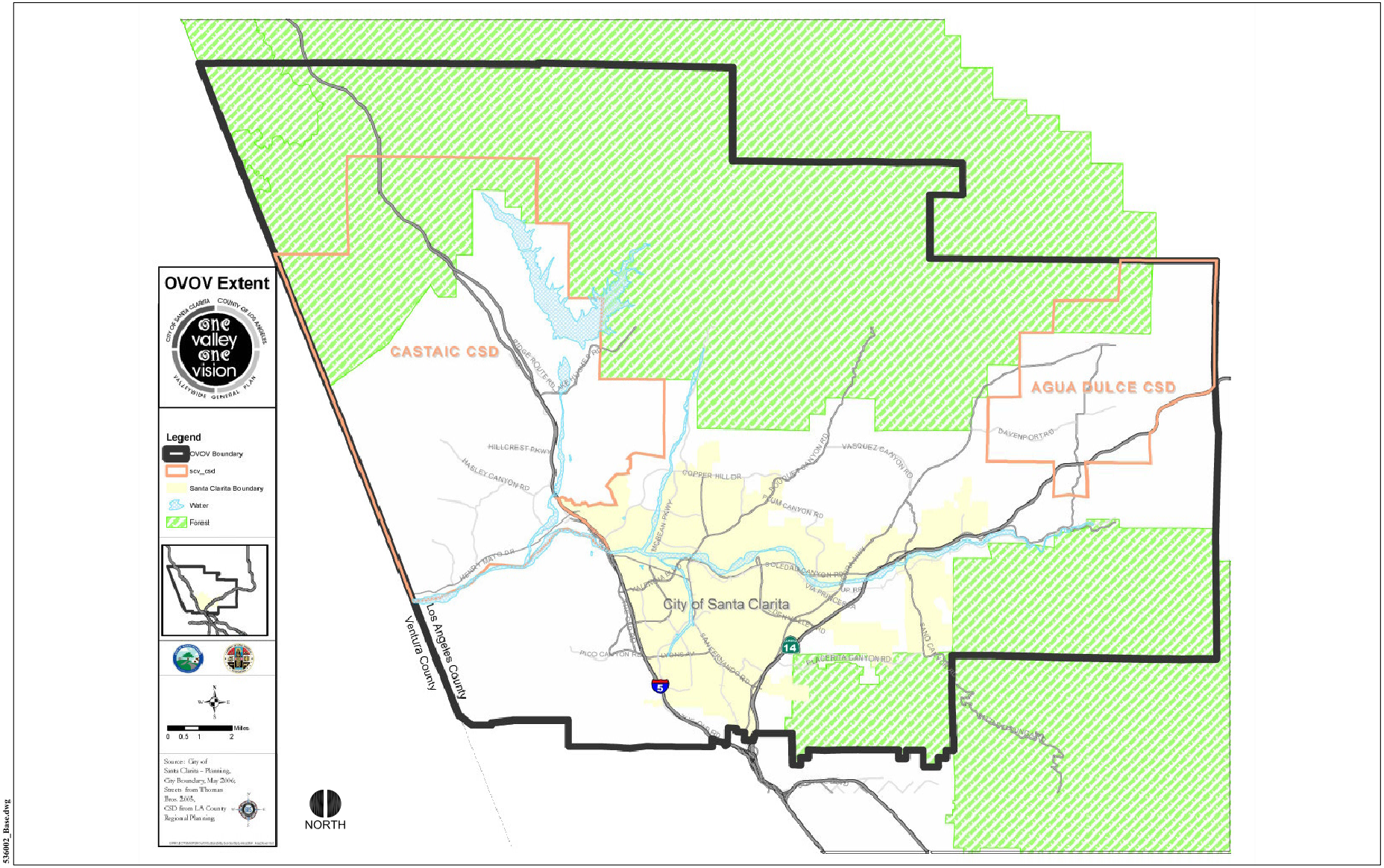
1.1 BACKGROUND

This traffic study was carried out to achieve three primary objectives:

1. Update the City's traffic forecasting model with current land use planning estimates
2. Prepare long-range traffic forecasts
3. Evaluate the proposed Land Use and Circulation Elements and propose potential changes to the arterial roadway component

The technical analysis results presented here pertain to the arterial roadway component of the City and County Circulation Elements. Existing conditions are compared with the anticipated growth in traffic on the City and County street system, and recommendations are made with respect to an updated arterial roadway component. A comparison is also made between long-range traffic forecasts based on the current City General Plan/County Area Plan and conditions based on the proposed OVOV Plan.

The area addressed in this traffic study includes the City, its sphere of influence, and unincorporated Los Angeles County areas. All three areas comprise what is referred to as the OVOV area, which is illustrated in Figure 1-1.



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To derive traffic forecasts, use is made of the Santa Clarita Valley Consolidated Traffic Model (SCVCTM). This traffic model produces peak hour and average daily traffic (ADT) forecasts for the OVOV area roadway system. Buildout land use data from the proposed City General Plan/County Area Plan Land Use Elements has been used as the basis for the traffic forecasts, thereby showing future circulation system needs in relation to future land use projections.

Part of this work effort involved updating the traffic model originally developed in 1994 (see discussion on SCVCTM in Chapter 2.0) with the land use data noted above. A major update was previously carried out in 2004 and periodic refinements were subsequently made up until this update.

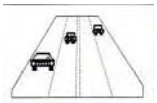
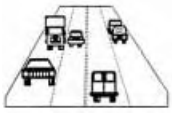
1.2 PERFORMANCE CRITERIA

To evaluate the roadway system in relation to future land use in the OVOV area, use is made of performance criteria. These criteria include "performance standards" and "thresholds of significance." The latter are used for identifying individual land development project impacts in an EIR context, and while not specifically applied in a planning study of this type, they are given here for informational purposes. The performance standards form part of City and County Policy (e.g., in the City's Circulation Element and in the County Congestion Management Program) and represent desired operating conditions for the OVOV roadway system. For a Circulation Element to be in "balance" with the Land Use Element of the General Plan, the circulation system must achieve the performance standard criteria.

The performance criteria used here are based on two primary measures. The first is "capacity", which establishes the vehicle carrying ability of a roadway, and the second is "volume." The volume measure is either a traffic count (in the case of existing volumes) or a forecast for a future point in time. The ratio between the volume and the capacity gives a volume/capacity (V/C) ratio and based on that V/C ratio, a corresponding level of service (LOS) is defined. Traffic LOS is designated A through F with LOS A representing free flow conditions and LOS F representing severe traffic congestion. Traffic flow quality for each LOS is provided in Table 1-1 based on descriptions for arterial roadways as contained in the 2000 Highway Capacity Manual (HCM 2000).

The performance criteria are separated according to two components of the circulation system; arterial roadways and freeway segments. ADT data as well as peak hour data is used in both cases to establish V/C and LOS measures and to define the performance criteria. The following sections outline the criteria for each of the two components.

Table 1-1: Level of Service Descriptions for Urban Streets

Level of Service	Example	Flow Conditions	Percent of free flow speeds (FFS)
A		LOS "A" describes primarily free-flow operations at average travel speeds, usually about 90 percent of the FFS for the given street class. Vehicles are completely unimpeded in their ability to maneuver within the traffic stream. Control delay at signalized intersections is normal..	90
B		LOS "B" describes reasonably unimpeded operations at average travel speeds, usually about 70 percent of the FFS for the street class. Vehicles are completely unimpeded in their ability to maneuver with the traffic stream. Control delay at signalized intersections is minimal.	70
C		LOS "C" describes stable operations; however, ability to maneuver and change lanes in midblock locations may be more restricted that at LOS "B," and longer queues, adverse signal coordination, or both may contribute to lower average travel speeds of about 50 percent of the FFS for the street class.	50
D		LOS "D" borders on a range in which small increases in flow may cause substantial increases in delay and decreases in travel speed. LOS "D" may be due to adverse signal progression, inappropriate signal timing, high volumes, or a combination of these factors. Average travel speeds are about 40 percent of FFS.	40
E		LOS "E" is characterized by significant delays and average travel speeds of 33 percent or less of the FFS. Such operations are caused by a combination of adverse progression, high signal density, high volumes, extensive delays at critical intersections, and inappropriate signal timing.	33
F		LOS "F" is characterized by urban street flow at extremely low speeds, typically one-third to one-fourth of the FFS. Intersection congestion is likely at critical signalized locations, with high delays, high volumes, and extensive queuing.	25

Source: Highway Capacity Manual 2000, Transportation Research Board, National Research Council

1.2.1 Arterial Streets and Intersections

Arterial roadway segments are evaluated using a generalized average daily traffic (ADT) capacity as summarized in Table 1-2. They are based on the type of roadway as classified in the City General Plan/County Area Plan Circulation Elements. It can be noted that these ADT capacity values are suitable for planning purposes, but they are not intended as precise measures of capacity. The ultimate capacity of a roadway is based upon a number of factors including the relationships between peak hour and daily traffic volumes, the roadway design features (allowing parking, driveway access and cross streets, the intersection geometrics, etc.), the amount of traffic crossing the roadway or turning onto or off of the roadway at intersecting roadways, and the actual turn movements at an intersection.

Table 1-2: Daily Roadway Capacity Values

General Plan Designation	Lanes	Ultimate Capacity (Level of Service "E")[1]
Major Arterial Highway	8	72,000
	6	54,000
Secondary Arterial Highway	4	36,000
Limited Secondary Arterial Highway	2	18,000
Collector[2]	2	15,000

[1]The ultimate capacity value is an estimate of the physical limit of daily traffic flows (level of service "E") based upon typical suburban peak hour characteristics. This value can vary significantly depending upon volume demand characteristics (amount of off-peak travel and duration of peak periods) as well as roadway design features (access, spacing, intersection geometrics, etc.).
[2]Collector roadways are not identified in the City/County Circulation Elements but are included in the traffic analysis on a limited basis.

Although level of service is an important factor in transportation planning, it is not the only or even the most important criterion used in all cases. Depending on the area being planned, other factors may be considered as having priority over expedited movement of vehicles. For example, in some commercial areas, high-speed vehicle movements could be detrimental to the desired character of development. In all portions of the OVOV planning area, traffic level of service must be weighed against other community priorities such as quality of life and environmental resource protection, in order to achieve a balanced approach to transportation and land use planning.

The County General Plan does not specify an acceptable LOS for the purpose of long-range planning, however in conformance with the Los Angeles County Congestion Management Program (LA CMP), the maximum acceptable level of service on arterial roads (i.e., major, secondary, and limited secondary highways) within the OVOV planning area is LOS E. The City strives to achieve LOS D or

better on arterial roads to the extent feasible given right-of-way and physical constraints, while recognizing that in higher density urban areas there is generally a tradeoff between vehicle LOS and other factors such as pedestrian mobility, and that LOS E is acceptable in those types of urban settings. In residential neighborhoods, vehicular LOS is less important than other factors, such as traffic volumes and speeds.

Table 1-3 summarizes the V/C ranges that correspond to LOS "A" through "F" for arterial roads and intersections as used by the City and the County.

Table 1-3: LOS Criteria for Arterials

LOS	Roadway V/C & Intersection ICU Ranges
A	0.00 – 0.60
B	0.61 – 0.70
C	0.71 – 0.80
D	0.81 – 0.90
E	0.91 – 1.00
F	Above 1.00
Source: Congestion Management Program of Los Angeles County	

Both the V/C ratio and the LOS are used in determining impact significance. As noted above, certain LOS values are deemed unacceptable, and increases in the V/C ratio which cause or contribute to the LOS being unacceptable are defined as a significant impact.

In establishing V/C based performance criteria, there are certain items that need to be addressed to obtain suitable V/C estimates and relate them to LOS. For instance, while average daily traffic (ADT) is a useful measure to show general levels of traffic on a facility and to provide data for other related aspects such as noise and air quality, highway congestion is largely a peak hour or peak period occurrence. Because of this, ADT is not used here as the sole basis for capacity evaluation, but instead this evaluation also evaluates those parts of the day when such congestion can occur, specifically the a.m. and p.m. peak hours.

Levels of service for arterial roadway intersections are determined based on operating conditions during the a.m. and p.m. peak hours. The intersection capacity utilization (ICU) methodology is applied, providing a planning level basis for determining V/C and LOS. This methodology sums the V/C ratios for the critical movements of an intersection and is the preferred intersection analysis procedure of the City of Santa Clarita and the County of Los Angeles. The ICU calculation methodology is summarized in Table 1-4.

Table 1-4: Arterial Intersection ICU Methodology

City of Santa Clarita ICU Calculation Methodology Level of service to be based on peak hour intersection capacity utilization (ICU) values calculated using the following assumptions: Saturation Flow Rates: 1,750 vehicles/hour/lane for all lanes Clearance Interval: .10
County of Los Angeles ICU Calculation Methodology Level of service to be based on peak hour intersection capacity utilization (ICU) values calculated using the following assumptions: Saturation Flow Rates: 1,600 vehicles/hour/lane for through lanes, right-turn lanes, and single left-turn lanes 2,880 vehicles/hour/lane for dual left-turn lanes (total of both lanes) Clearance Interval: .10

1.2.2 Freeway Segments

Table 1-5 summarizes the V/C ranges that correspond to LOS "A" through "F" for general freeway segments. The V/C ranges listed for freeway segments are based on the V/C and LOS relationships specified in the *2000 Highway Capacity Manual* (see Reference 1 in Section 1.5 and referred to as "*HCM 2000*" in this report) for basic freeway sections with free-flow speeds of 105 kilometers per hour (65 miles per hour), and are specified by the County's Congestion Management Program (CMP) for the evaluation of CMP freeway monitoring stations.

Table 1-5: LOS Criteria for Basic Freeway Segments

LOS	Freeway Segment Volume Density Ranges	Freeway Segment V/C Ranges
A	0.0 – 11.0	0.00 – 0.30
B	11.1 – 18.0	0.31 – 0.50
C	18.1 – 26.0	0.51 – 0.71
D	26.1 – 35.0	0.72 – 0.89
E	35.1 – 45.0	0.90 – 1.00
F	Above 45.0	Above 1.00
Sources: HCM 2000 Congestion Management Program of Los Angeles County		

1.3 INFORMATION IN THIS REPORT

The information presented in this report is arranged as follows:

Chapter 1.0 Introduction – background and scope plus a description of the performance criteria used in the traffic analysis.

Chapter 2.0 Transportation Setting – describes existing conditions with respect to circulation, and future growth forecasts.

Chapter 3.0 Arterial Roadways – presents the proposed roadway component of the City and County Circulation Elements.

Chapter 4.0 Traffic Analysis – discusses future traffic volumes and levels of service, and shows the improvements needed to implement the proposed roadway plan.

Technical appendices contain tabular data as appropriate, and traffic model data can be found in the previously referenced traffic model report and technical notebook.

1.4 DEFINITIONS

Certain terms used throughout this report are defined below to clarify their intended meaning:

ADT Average Daily Traffic. Generally used to measure the total two-directional traffic volumes passing a given point on a roadway.

DU Dwelling Unit. Used in quantifying residential land use.

ICU Intersection Capacity Utilization. A measure of the volume to capacity ratio for an intersection. Typically used to determine the peak hour level of service for a given set of intersection volumes.

LOS Level of Service. A scale used to evaluate circulation system performance based

on intersection ICU values or volume/capacity ratios of arterial segments.

Peak Hour — This refers to the hour during the a.m. peak period (typically 7 a.m. - 9 a.m.) or the p.m. peak period (typically 3 p.m. - 6 p.m.) in which the greatest number of vehicle trips are generated by a given land use or are traveling on a given roadway.

Tripend — A trip generation measure which represents the total trips entering and leaving a location.

TSF — Thousand Square Feet. Used in quantifying non-residential land uses, and refers to building floor area.

V/C — Volume to Capacity Ratio. This is typically used to describe the percentage of capacity utilized by existing or projected traffic on a segment of an arterial or intersection.

VPD — Vehicles Per Day. Similar to ADT, but more typically applied to trip generation (i.e., the amount of traffic generated by a given amount of land use).

VPH — Vehicles Per Hour. Used for roadway volumes (counts or forecasts) and trip generation estimates. Measures the number of vehicles in a one-hour period, typically the a.m. or p.m. peak hour.

CMP — Congestion Management Program. A state mandated program administered by the Los Angeles County Metropolitan Transportation Authority (MTA) that provides a mechanism for coordinating land use and development decisions.

1.5 REFERENCES

1. "Highway Capacity Manual 2000," Transportation Research Board, National Research Council, 2000.

2. "Santa Clarita Valley Consolidated Traffic Model Report," County of Los Angeles Department of Public Works, 1994.

3. "Draft Santa Clarita Valley Consolidated Traffic Model 2004 Update and Validation," City of Santa Clarita and County of Los Angeles Department of Public Works, June 2004.

4. "Transportation Concept Report, Interstate 5," California Department of Transportation District 7 Office of Advance Planning System Planning Unit, November 1998.

5. Draft Project Report – I-5 HOV and Truck Lane Project from SR-14 to Parker Road in Los Angeles County," California Department of Transportation District 7, March 2008.

6. "Interregional Transportation Strategic Plan," California Department of Transportation, June 1998.

7. "North County Combined Highway Corridors Study Final Report," Los Angeles County Metropolitan Transportation Authority, June 2004.

8. "2004 Congestion Management Program for Los Angeles County," Los Angeles County Metropolitan Transportation Authority, July 2004.

2.0 TRANSPORTATION SETTING

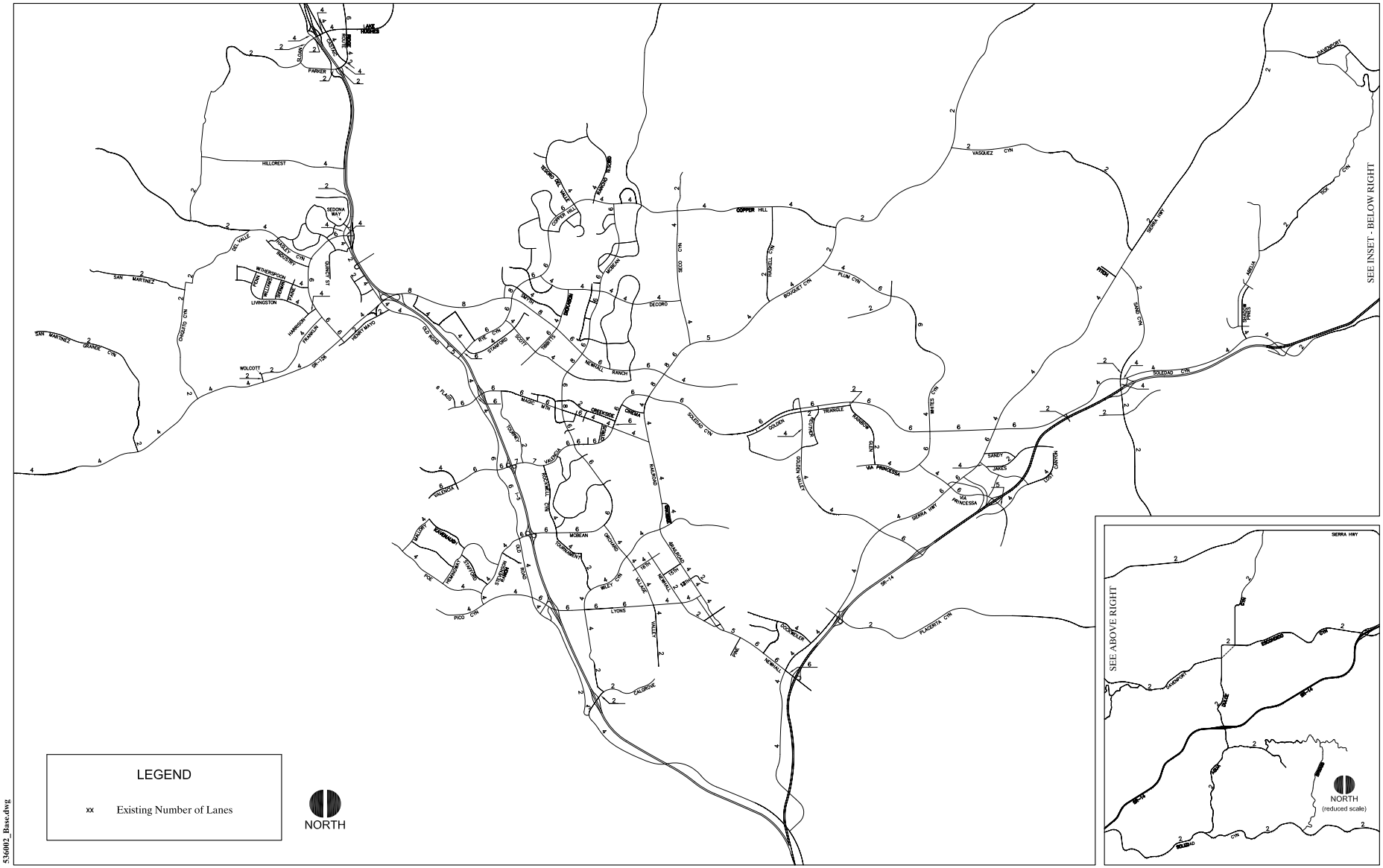
This chapter discusses the transportation setting for the Santa Clarita Valley roadway system. Existing conditions are described including traffic volumes on the City and County street system and levels of service (LOS) for those same street system segments and for key intersections. Information on future land use and the corresponding increase in study area trip generation is also given and discussed in relation to its growth implications.

2.1 EXISTING ROADWAYS

The existing roadway system within the OVOV planning area is illustrated in Figure 2-1. Shown here is the number of lanes (midblock) on individual segments of the valley-wide roadway system.

The primary regional roadway components serving the Santa Clarita Valley are the I-5 and SR-14 freeways, passing through the Valley from north to south, and the SR-126 highway, which connects the Santa Clarita Valley to Ventura County. The I-5 freeway is listed as a "high priority corridor" on the National Highway System (NHS). The I-5 and the SR-14 freeways are part of the Surface Transportation Assistance Act (STAA) national truck network, and the SR-126 highway is a designated terminal access route for the STAA national truck network. 18 interchanges, 10 on I-5 and eight on SR-14, serve the Valley. The 10 interchanges on the I-5 are located at Sloan Canyon Road/Lake Hughes Road, Parker Road/Ridge Route Road, Hasley Canyon Road, SR-126/Newhall Ranch Road, Rye Canyon (at The Old Road), Magic Mountain Parkway, Valencia Boulevard, Stevenson Ranch Parkway/McBean Parkway, Pico Canyon Road/Lyons Avenue, and Calgrove Boulevard. The eight interchanges on the SR-14 are located at Agua Dulce Canyon Road, Soledad Canyon Road, Sand Canyon Road, Sierra Highway, Via Princessa, Golden Valley Road, Placerita Canyon Road, and San Fernando Road.

Several major north-south arterials run through the Valley. Newhall Avenue/Railroad Avenue/Bouquet Canyon Road originates at the southern part of the SR-14 freeway, traverses the Valley, and terminates at Elizabeth Lake Road, just west of Palmdale, and well north of the OVOV boundaries. The roadway varies in width from two to eight lanes. Stevenson Ranch Road/McBean Parkway originates at Pico Canyon Road, traverses the City, and terminates at Copper Hill Drive. The roadway varies in width from four to eight lanes. Whites Canyon Road originates at Via Princessa and terminates at Bouquet Canyon Road. The roadway varies in width from four to six lanes. The Old Road originates



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near the SR-14/I-5 interchange and traverses the entire west side of the Valley, terminating north of Lake Hughes Road. The roadway varies in width from two to six lanes. Golden Valley Road originates just south of the SR-14 freeway, traverses the middle portion of the Valley, and terminates at a grade separated crossing of Soledad Canyon Road. Sierra Highway originates near the SR-14/I-5 interchange, traverses the Valley on the east side, and terminates at Angeles Forest Highway just north of the Angeles National Forest and well north-east of the OVOV boundaries. Sierra Highway varies between two to six lanes.

Several east-west arterials serve the Valley and provide access to the I-5 and SR-14 freeways. Many of these arterials are incomplete and provide access to only portions of the Valley. To the north is Rye Canyon Road/Copper Hill Drive with four to eight lanes throughout and a half interchange at the I-5 freeway. The next arterial to the south is SR-126/Newhall Ranch Road, which varies from four to eight lanes throughout and also provides an interchange to the I-5 freeway. Magic Mountain Parkway originates just west of the I-5 freeway and terminates at Railroad Avenue. The main east-west arterial is further to the south and exists as both Valencia Boulevard and Soledad Canyon Road, which varies from two to seven lanes throughout. Valencia Boulevard originates just west of the I-5 freeway, is renamed to Soledad Canyon Road at the Bouquet Canyon Road intersection, and terminates to the east of the SR-14 freeway near the Acton Canyon area and well east of the OVOV boundaries. This roadway features interchanges with the I-5 freeway as well as the SR-14 freeway. The final east-west arterial is Pico Canyon Road/Lyons Avenue, which varies from two to six lanes. This stretch of roadway is relatively short, starting west of Stevenson Ranch Parkway in the Santa Susana Mountains and terminating at Railroad Avenue. It also provides an interchange with the I-5 freeway.

The Cross Valley Connector is a primarily east-west roadway formed by the combination of Newhall Ranch Road and Golden Valley Road. As Newhall Ranch Road, the Cross Valley Connector originates at the SR-126/I-5 interchange and continues east to a terminus east of Bouquet Canyon Road near the Santa Clara River. A future extension of Golden Valley Road will cross the Santa Clara River and connect to Newhall Ranch Road, resulting in a continuous roadway between SR-126 and the SR-14 freeway.

Within the Santa Clarita Valley, connectivity of the street network is interrupted by topographic constraints, including rolling terrain, canyons, and the Santa Clara River. In addition, the prevalent subdivision pattern comprised of local cul-de-sac streets with limited connectivity, acts to funnel all traffic onto collector and arterial streets. As a result, regional traffic is concentrated on a limited number

of arterial streets. Projects such as completion of the Cross-Valley Connector, the Via Princessa gap closure, and plans to create a new north-south connection through the center of the Valley (Santa Clarita Parkway), are examples of projects intended to increase connectivity.

2.1.1 Existing Traffic Volumes

Figure 2-2 shows the study area roadway segments included in this evaluation, which includes all roadway segments identified in the Highway Plan (see discussion in Chapter 3.0) and select collector streets. This analysis also includes key intersections of Highway Plan roadways, which are considered the principal intersections within the Santa Clarita Valley. As such, these principal intersections are required to accommodate significant volumes of traffic and are critical to vehicle mobility within the Santa Clarita Valley. Figure 2-3 shows the principal intersections included in this evaluation.

Existing average daily traffic (ADT) volumes on the study area street system are illustrated in Figure 2-4. These counts were collected at various times between 2005 to 2008 by the Traffic and Transportation Planning Division of the Department of Public Works of the City of Santa Clarita, by the Traffic and Lighting division of the County of Los Angeles Department of Public works, and by various development projects as part of their entitlement process. These counts provide a representative sample of existing traffic conditions throughout the Valley.

Illustrations of peak hour turning movement volumes for each principal intersection can be found in Figure 2-5 for the a.m. peak hour and in Figure 2-6 for the p.m. peak hour. As with the ADT counts, the peak hour counts were collected at various times between 2005 and 2008 and provide a representative sample of existing traffic conditions throughout the Valley.

2.1.2 Existing Levels of Service

As discussed in the performance criteria section of Chapter 1.0, LOS is based on two primary measures. The first is “capacity” which establishes the vehicle carrying ability of a roadway and the second is “volume.” The volume measure is either a traffic count (in the case of existing volumes) or a forecast for a future point in time. The ratio between the volume and the capacity gives a volume/capacity (V/C) ratio and based on that V/C ratio, a corresponding LOS is defined.

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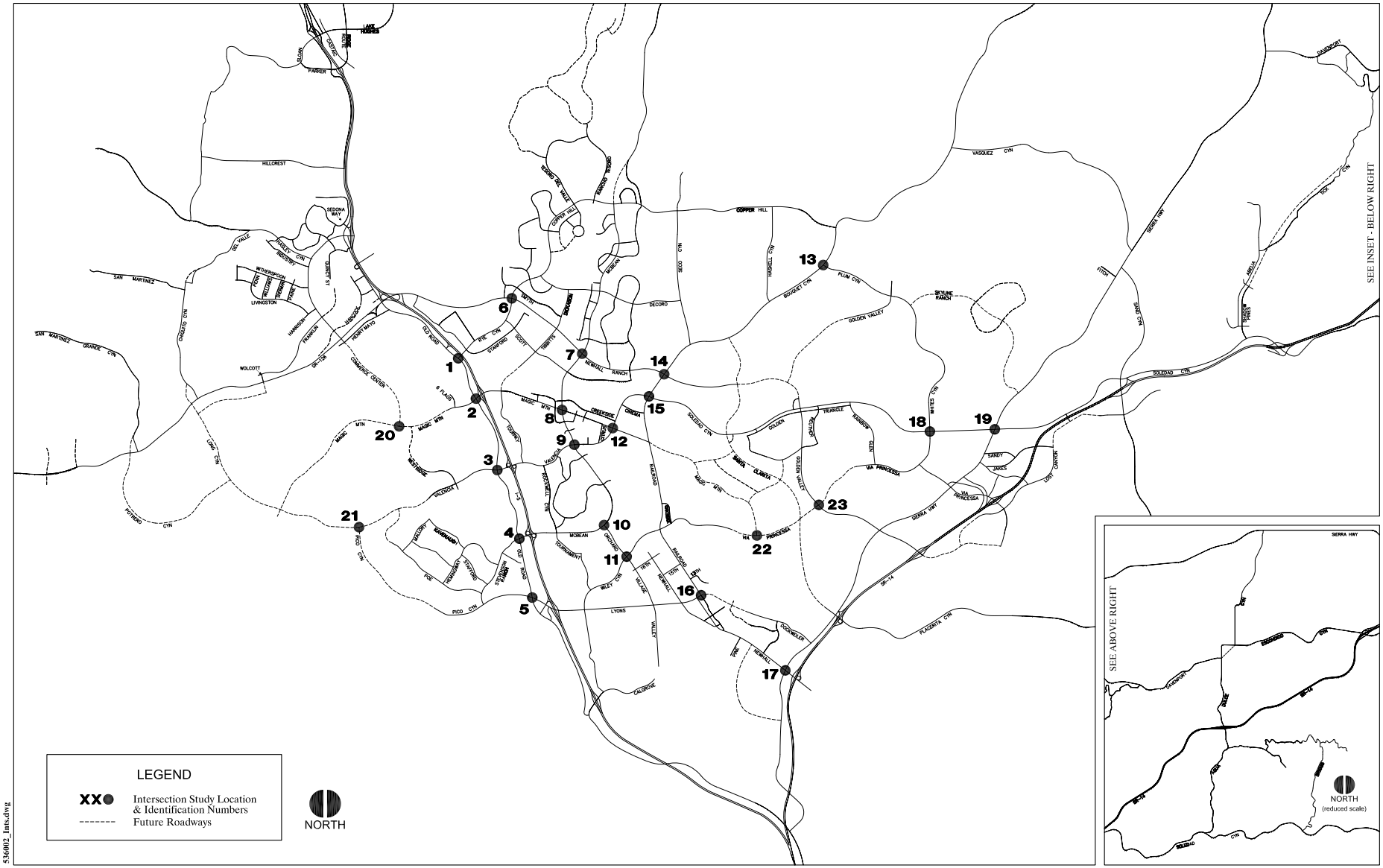

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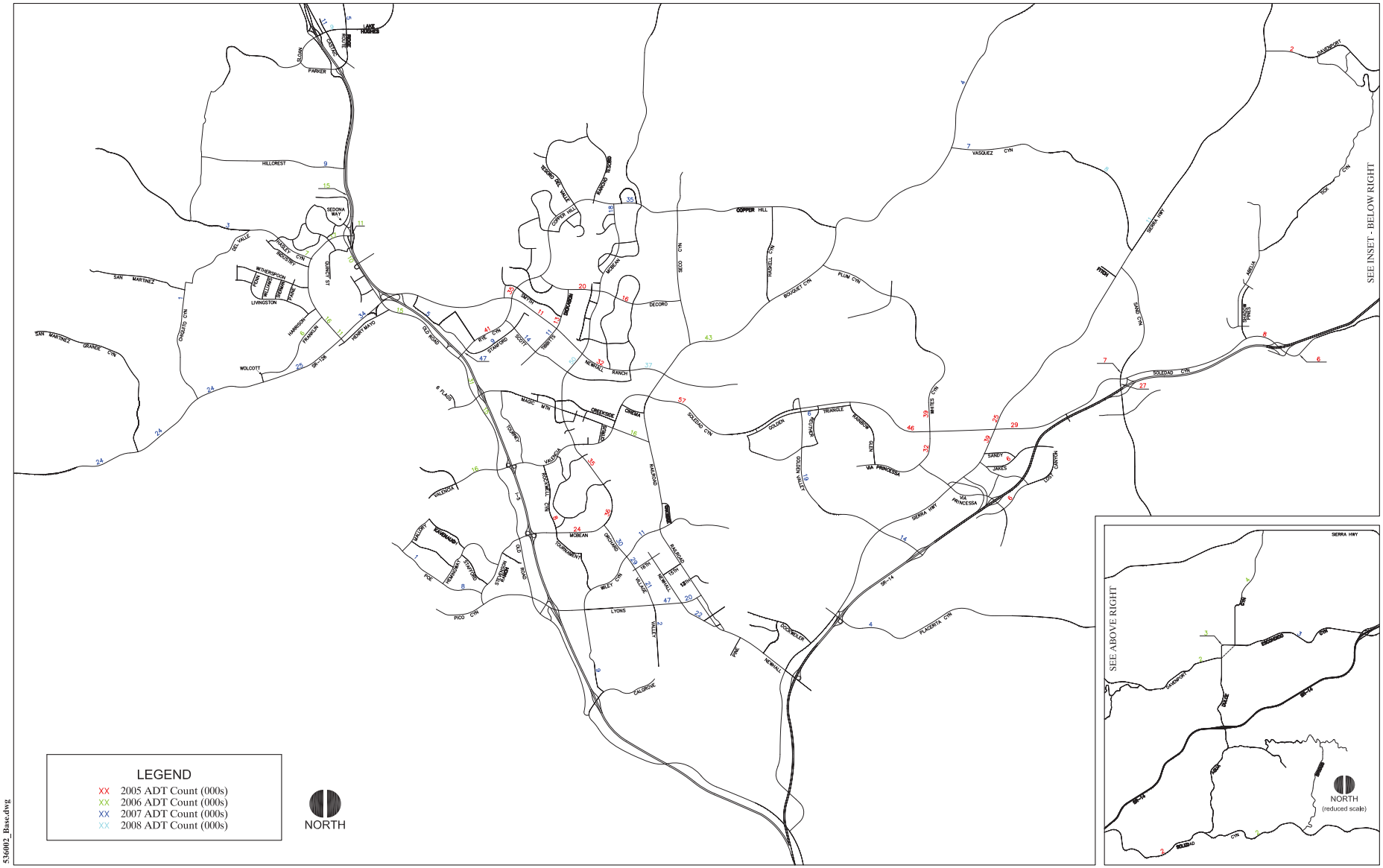

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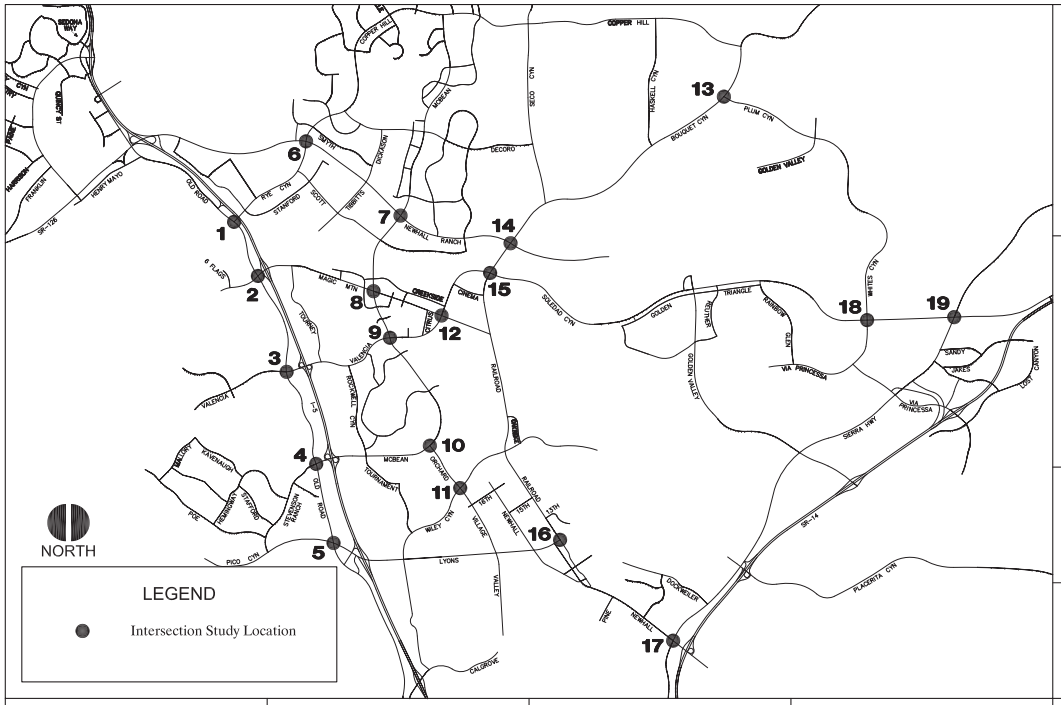

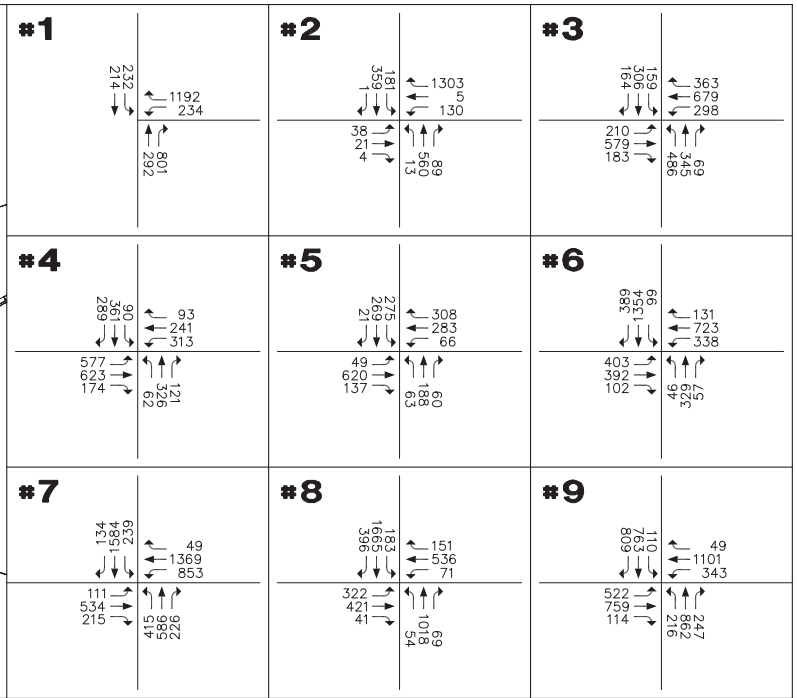

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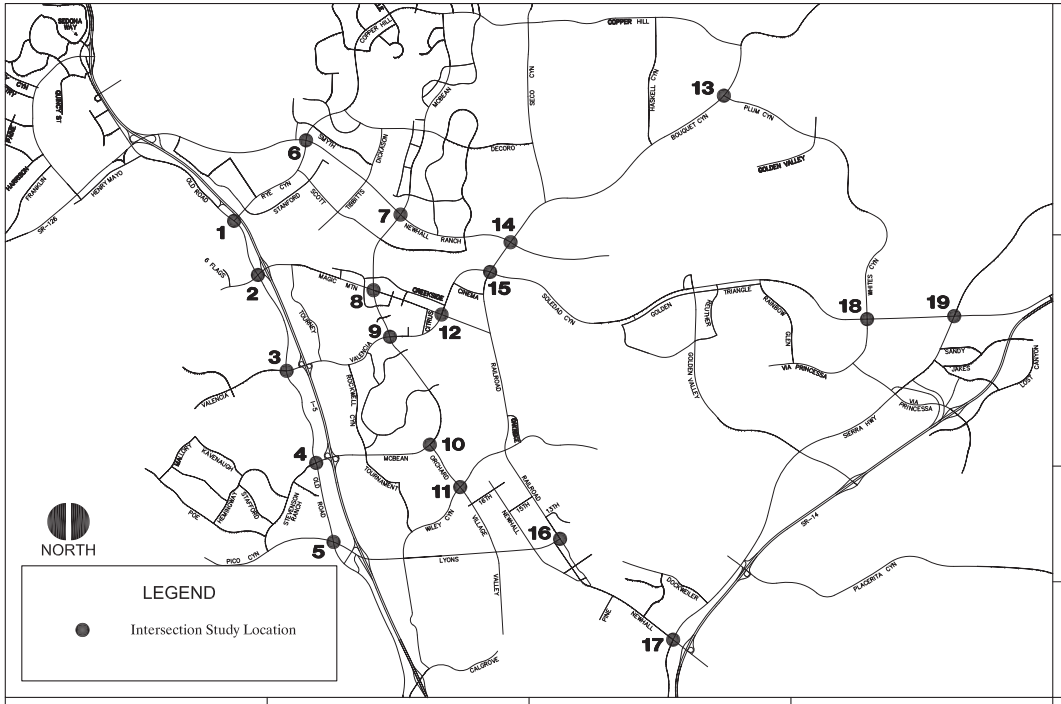

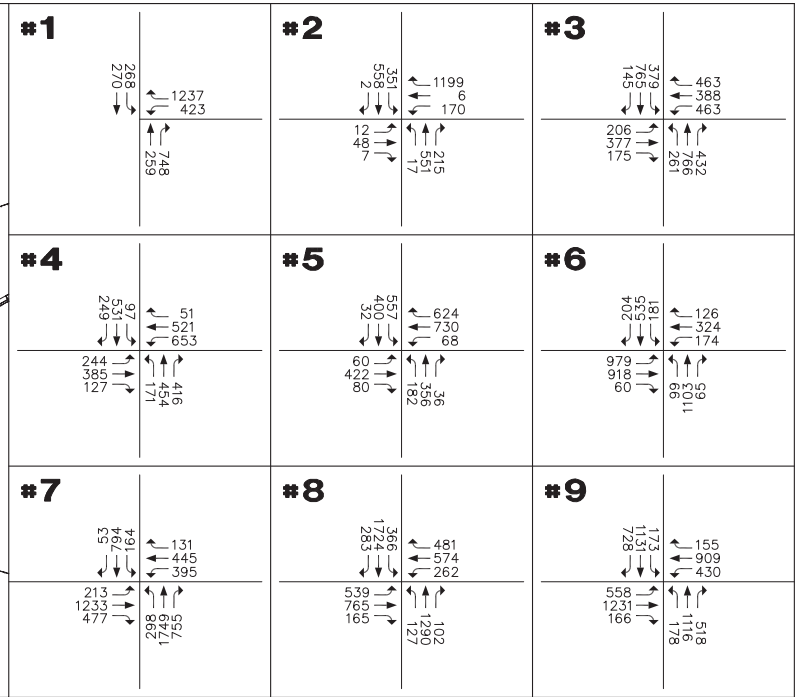

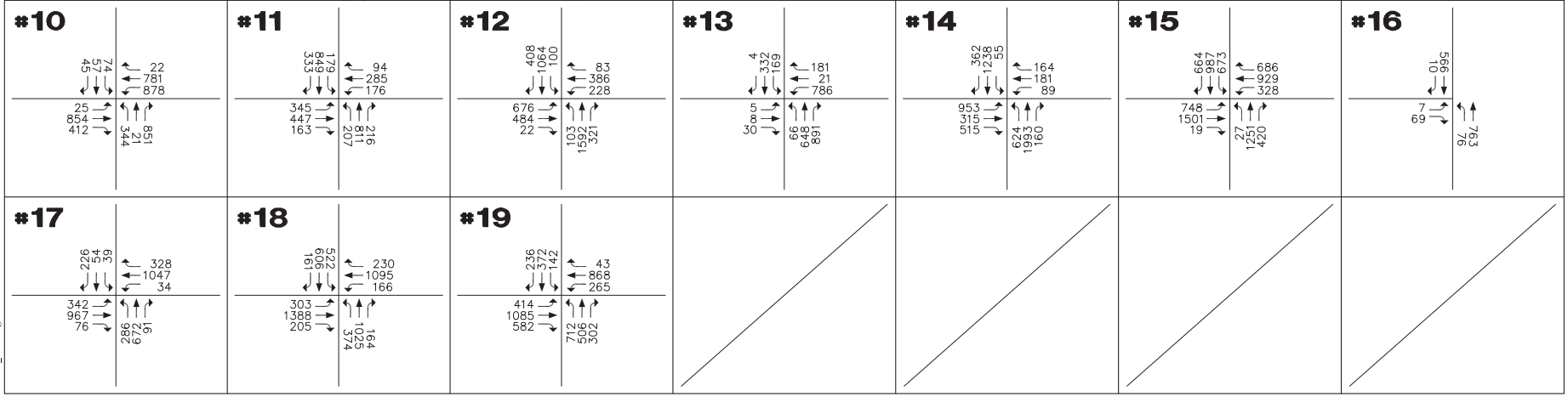

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Table 2-1 lists the existing ADT volumes and corresponding LOS and V/C values. As can be seen here, four roadway segments do not meet the performance standard of LOS "E" or better:

- Lyons Avenue between Orchard Village Road and Newhall Avenue (#92)
- Newhall Avenue between Lyons Avenue and Main Street (#131)
- Soledad Canyon Road between of Bouquet Canyon Road and Commuter Way (#211)
- Whites Canyon Road between Soledad Canyon Road and Pleasantdale Street (#288)

The results of the ICU LOS analyses for study area principal intersections are shown in Table 2-2 (detailed ICU worksheets are provided in Appendix A). The table shows that most intersections currently operate at LOS D or better, however the intersection of Bouquet Canyon Road at Soledad Canyon Road (in the City of Santa Clarita) currently operates with an ICU of .91, which is LOS E.

2.2 FUTURE TRAFFIC GROWTH

Existing and future land use data formed the basis for preparing the future traffic volumes used in this traffic study. Future land uses tabulated by traffic analysis zone (TAZ) were provided by City staff and were derived by quantifying the data outlined in the proposed OVOV Land Use Element. Existing land use tabulated by TAZ was prepared as part of a comprehensive update and recalibration of the Santa Clarita Valley Consolidated Traffic Model (SCVCTM) undertaken in 2004 (see Reference 3 in Section 1.5). Data was provided for the entire OVOV area, which includes the City of Santa Clarita, its sphere of influence, and portions of unincorporated Los Angeles County. A comparison of 2004 to the proposed OVOV Buildout land use by TAZ is provided in Appendix B, and a comparison of the current City General Plan/County Area Plan Buildout land use to the proposed OVOV Buildout land use by TAZ is also provided in Appendix B.

The amount of traffic generated by a certain type of land use is estimated by applying a representative trip generation rate to the amount of land use in the area under consideration. The SCVCTM uses a predefined set of trip generation rates calibrated specifically to local conditions to calculate both peak hour and ADT trips by land use. A detailed listing of trip rates and the corresponding trip generation by TAZ is provided in Appendix D.

Table 2-1: ADT V/C and LOS – Existing (2005-2008)

Roadway Segment	Volume	Year	Lanes	Capacity	V/C	LOS
1. Agua Dulce n/o Escondido Cyn	4,000	2006	2	18,000	.22	A
2. Agua Dulce n/o Davenport	3,000	2006	2	18,000	.17	A
4. Agua Dulce s/o SR-14	<500	2005	2	18,000	.00	A
6. Ave Scott s/o Stanford	14,000	2007	4	36,000	.39	A
8. Ave Stanford s/o Vanderbilt	5,000	2007	4	36,000	.14	A
10. Ave Stanford s/o Rye Cyn	9,000	2007	4	36,000	.25	A
11. Bouquet Cyn n/o Vasquez	4,000	2007	2	18,000	.22	A
16. Bouquet Cyn e/o Seco	43,000	2006	5	45,000	.96	E
25. Castaic n/o Lake Hughes	11,000	2007	4	36,000	.31	A
28. Chiquito Cyn s/o San Martinez Cyn	1,000	2007	2	18,000	.06	A
31. Commerce Center s/o Franklin	16,000	2006	6	54,000	.30	A
32. Commerce Center n/o SR-126	11,000	2006	6	54,000	.20	A
35. Copper Hill n/o Newhall Ranch	35,000	2005	8	72,000	.49	A
39. Copper Hill e/o McBean	35,000	2007	4	36,000	.97	E
43. Davenport e/o Sierra Hwy	2,000	2005	2	18,000	.11	A
44. Davenport w/o Agua Dulce	2,000	2006	2	18,000	.11	A
46. Decoro e/o Dickason	20,000	2005	4	36,000	.56	A
48. Decoro w/o Hillsborough	16,000	2005	4	36,000	.44	A
51. Dickason n/o Newhall Ranch	13,000	2005	4	36,000	.36	A
54. Escondido e/o Agua Dulce	3,000	2007	2	18,000	.17	A
55. Franklin e/o Wolcott Way	<500	2006	2	15,000	.00	A
56. Franklin w/o Commerce Center	6,000	2006	4	36,000	.17	A
62. Golden Valley s/o Centre Point	19,000	2007	4	36,000	.53	A
64. Golden Valley e/o Sierra Hwy	14,000	2007	6	54,000	.26	A
68. Hasley Cyn w/o Del Valle	3,000	2007	2	18,000	.17	A
69. Hasley Cyn w/o Commerce Center	7,000	2006	4	36,000	.19	A
70. Hasley Cyn w/o The Old Road	17,000	2006	6	54,000	.31	A

(Continued)

Table 2-1: ADT V/C and LOS – Existing (2005-2008) (Continued)

Roadway Segment	Volume	Year	Lanes	Capacity	V/C	LOS
71. Hasley Cyn w/o I-5	11,000	2006	4	36,000	.31	A
74. Hillcrest w/o The Old Road	9,000	2007	4	36,000	.25	A
75. Jakes Way e/o Canyon Park	6,000	2005	2	18,000	.33	A
77. Lake Hughes e/o Castaic	9,000	2008	4	36,000	.25	A
78. Lake Hughes e/o Ridge Route	2,000	2007	2	18,000	.11	A
86. Lost Cyn n/o Via Princessa	6,000	2005	4	36,000	.17	A
87. Lost Cyn s/o Via Princessa	2,000	2005	2	18,000	.11	A
92. Lyons e/o Orchard Village	47,000	2007	4	36,000	1.31	**F**
93. Lyons w/o Main Street	20,000	2007	4	36,000	.56	A
105. Magic Mtn e/o Valencia	16,000	2006	4	36,000	.44	A
109. McBean s/o Copper Hill	18,000	2007	6	54,000	.33	A
113. McBean s/o Newhall Ranch	50,000	2008	8	72,000	.69	B
117. McBean s/o Valencia	35,000	2005	6	54,000	.65	B
118. McBean n/o Orchard Village	36,000	2005	6	54,000	.67	B
119. McBean e/o Rockwell Cyn	24,000	2005	6	54,000	.44	A
124. Newhall Ranch e/o Rye Cyn	11,000	2005	8	72,000	.15	A
126. Newhall Ranch e/o McBean	32,000	2005	8	72,000	.44	A
127. Newhall Ranch w/o Bouquet Cyn	37,000	2008	8	72,000	.51	A
131. Newhall s/o Lyons	22,000	2007	2	18,000	1.22	**F**
136. Orchard Village s/o McBean	30,000	2007	4	36,000	.83	D
137. Orchard Village s/o Wiley Cyn	29,000	2007	4	36,000	.81	D
138. Orchard Village n/o Lyons	21,000	2007	4	36,000	.58	A
146. Placerita Cyn e/o SR-14	4,000	2007	2	18,000	.22	A
150. Poe s/o Mallory	1,000	2007	4	36,000	.03	A
151. Poe w/o Stevenson Ranch	8,000	2007	4	36,000	.22	A
161. Ridge Route n/o Lake Hughes	5,000	2007	6	54,000	.09	A
166. Rockwell Cyn n/o McBean	8,000	2005	4	36,000	.22	A

(Continued)

Table 2-1: ADT V/C and LOS – Existing (2005-2008) (Continued)

Roadway Segment	Volume	Year	Lanes	Capacity	V/C	LOS
168. Rye Cyn w/o Ave Scott	41,000	2005	6	54,000	.76	C
169. Rye Cyn e/o The Old Road	47,000	2007	6	54,000	.87	D
172. San Martinez Grande Cyn n/o SR-126	<500	2005	2	15,000	.00	A
174. Sand Cyn n/o Soledad Cyn	7,000	2005	2	18,000	.39	A
175. Sand Cyn s/o Soledad Cyn	27,000	2005	4	36,000	.75	C
192. Sierra Hwy n/o Vasquez Cyn	11,000	2008	2	18,000	.61	B
195. Sierra Hwy n/o Soledad Cyn	25,000	2005	4	36,000	.69	B
196. Sierra Hwy s/o Soledad Cyn	39,000	2005	6	54,000	.72	C
211. Soledad Cyn e/o Bouquet Cyn	57,000	2005	6	54,000	1.06	**F**
215. Soledad Cyn w/o Whites Cyn	46,000	2005	6	54,000	.85	D
217. Soledad Cyn e/o Sierra Hwy	29,000	2005	6	54,000	.54	A
222. Soledad Cyn e/o Shadow Pines	8,000	2005	4	36,000	.22	A
223. Soledad Cyn e/o SR-14	6,000	2005	2	18,000	.33	A
224. Soledad Cyn w/o Agua Dulce	2,000	2005	2	18,000	.11	A
225. Soledad Cyn e/o Agua Dulce	2,000	2006	2	18,000	.11	A
227. SR-126 w/o San Martinez Grande Cyn	24,000	2007	4	44,000	.55	A
228. SR-126 w/o Chiquito Cyn/Long Cyn	24,000	2007	4	44,000	.55	A
229. SR-126 w/o Wolcott	24,000	2007	4	44,000	.55	A
230. SR-126 w/o Commerce Center	25,000	2007	4	44,000	.57	A
231. SR-126 w/o I-5	34,000	2007	6	66,000	.52	A
239. The Old Road n/o Sedona Way	15,000	2006	2	18,000	.83	D
242. The Old Road n/o Biscailuiz	10,000	2006	2	18,000	.56	A
245. The Old Road s/o Henry Mayo	15,000	2006	4	36,000	.42	A
247. The Old Road n/o Magic Mtn	31,000	2006	4	36,000	.86	D
248. The Old Road s/o Magic Mtn	15,000	2006	4	36,000	.42	A

(Continued)

Table 2-1: ADT V/C and LOS – Existing (2005-2008) (Continued)

Roadway Segment	Volume	Year	Lanes	Capacity	V/C	LOS
254. Tibbitts s/o Newhall Ranch	11,000	2007	6	54,000	.20	A
262. Valencia w/o The Old Road	16,000	2006	6	54,000	.30	A
273. Valley s/o Lyons	2,000	2007	4	36,000	.06	A
274. Vasquez Cyn e/o Bouquet Cyn	7,000	2007	2	18,000	.39	A
275. Vasquez Cyn w/o Sierra Hwy	8,000	2008	2	18,000	.44	A
288. Whites Cyn n/o Soledad	39,000	2005	4	36,000	1.08	**F**
289. Whites Cyn s/o Soledad	32,000	2005	6	54,000	.59	A
290. Wiley Cyn e/o Orchard Village	11,000	2007	4	36,000	.31	A
294. Wiley Cyn n/o Calgrove	9,000	2007	2	18,000	.50	A

LOS in **Bold** exceeds performance criteria of LOS E.

Level of service ranges: .00 - .60 A .61 - .70 B .71 - .80 C
.81 - .90 D .91 – 1.00 E Above 1.00 F

Table 2-2: ICU and LOS Summary - Existing Conditions

Intersection	AM Peak Hour ICU	AM Peak Hour LOS	PM Peak Hour ICU	PM Peak Hour LOS	Count Year
1. The Old Road & Rye Canyon	.58	A	.69	B	2008
2. The Old Road & Magic Mountain	.48	A	.59	A	2007
3. The Old Road & Valencia	.54	A	.61	B	2006
4. The Old Road & McBean	.55	A	.69	B	2007
5. The Old Road & Pico Canyon	.54	A	.73	C	2007
6. Rye/Copper Hill & Newhall Ranch	.59	A	.69	B	2008
7. McBean & Newhall Ranch	.77	C	.77	C	2008
8. McBean & Magic Mountain	.60	A	.79	C	2007
9. McBean & Valencia	.67	B	.72	C	2007
10. Orchard Village & McBean	.57	A	.76	C	2005
11. Orchard Village & Wiley Canyon	.46	A	.76	C	2005
12. Valencia & Magic Mountain	.52	A	.82	D	2006
13. Bouquet Canyon & Plum Canyon	.68	B	.73	C	2007
14. Bouquet Canyon & Newhall Ranch	.76	C	.76	C	2006
15. Bouquet Canyon & Soledad Canyon	.76	C	.91	E	2006
16. Railroad & Lyons	.29	A	.32	A	2005
17. Sierra Highway & Newhall	.57	A	.64	B	2008
18. Whites Canyon & Soledad Canyon	.79	C	.89	D	2007
19. Sierra Highway & Soledad Canyon	.88	D	.80	C	2007

Level of service ranges: .00 - .60 A; .61 - .70 B; .71 - .80 C; .81 - .90 D; .91 – 1.00 E; Above 1.00 F

Table 2-3 lists existing (2004) and future (OVOV Buildout) land use for the Valley based on six generalized land use categories. As can be seen here, buildout of the planned OVOV land uses implies a growth in valley-wide tripends of around 121 percent. Figure 2-7 and Figure 2-8 graphically illustrate both existing (2004) and future (OVOV Buildout) ADT volumes listed in Table 2-3. Figure 2-9 graphically illustrates the increase in valley-wide tripends. As a basis of comparison, the current City General Plan/County Area Plan land use is also compared to the OVOV Buildout land use, and is reflected in Table 2-4. Important to note is that each tripend represents one end of a trip (or in other words, every trip has two tripends), and that the tripends tabulated in the previously referenced Table 2-3 and Table 2-4 are one of multiple factors that determine the actual volume of vehicles on the roadway system. Other factors, such as the relative proximity of complementary land use types, determine trip lengths. Vehicle trips in combination with trip lengths determine the number of vehicle miles traveled (VMT) on a daily basis.

Table 2-3: Valley-wide Land Use and Trip Generation – Existing (2004) vs. OVOV Buildout

Land Use Category	Units	Existing (2004)		OVOV Buildout		% Increase
		Amount	Tripends	Amount	Tripends	
SF Residential	DU	48,251	471,153	81,395	795,563	69%
MF Residential	DU	24,387	191,023	67,679	514,809	170%
Subtotal	*DU*	*72,638*	*662,176*	*149,074*	*1,310,372*	*98%*
Commercial Retail	TSF	9,157.63	515,716	23,585.06	1,230,042	139%
Commercial Office	TSF	2,072.12	25,996	17,311.53	205,851	692%
Industrial Park	TSF	18,332.42	107,565	40,735.96	240,697	124%
Subtotal	*TSF*	*29,562.17*	*649,277*	*81,632.55*	*1,676,590*	*158%*
Other (Schools, etc.)	--	--	176,541	--	301,424	71%
TOTAL		--	1,487,994	--	3,288,386	121%[1]

Where:
SF = Single Family
MF = Multi-Family
DU = dwelling units
TSF = thousand square feet of floor area
Tripends = Daily Tripends (one trip = 2 tripends)

[1]Represents an annual increase of approximately 2.6% (compounded) if buildout is presumed to occur over a 30 year period.

Figure 2-7: Existing (2004) Average Daily Traffic (ADT) Percentages

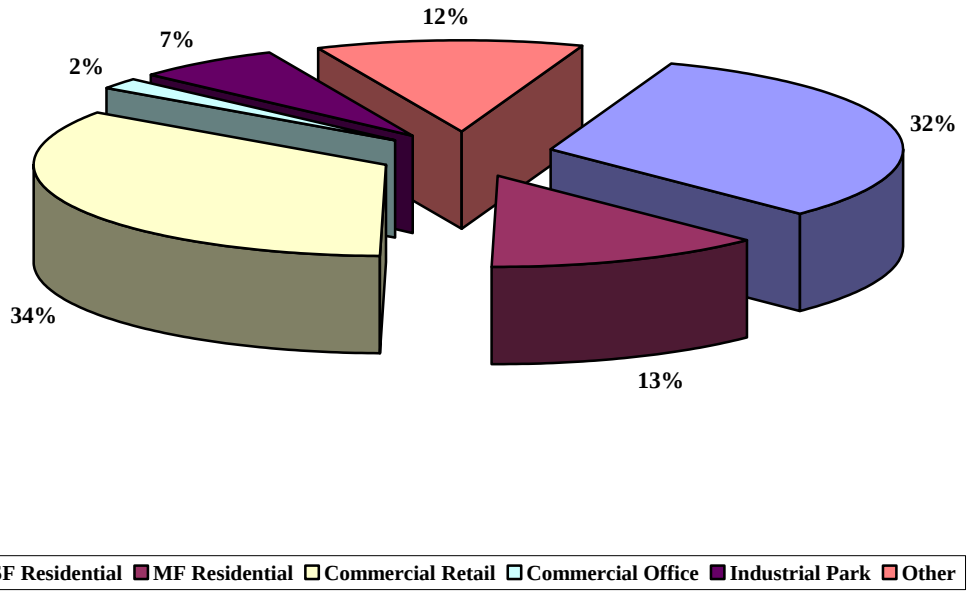


Figure 2-8: OVOV Buildout Average Daily Traffic (ADT) Percentages

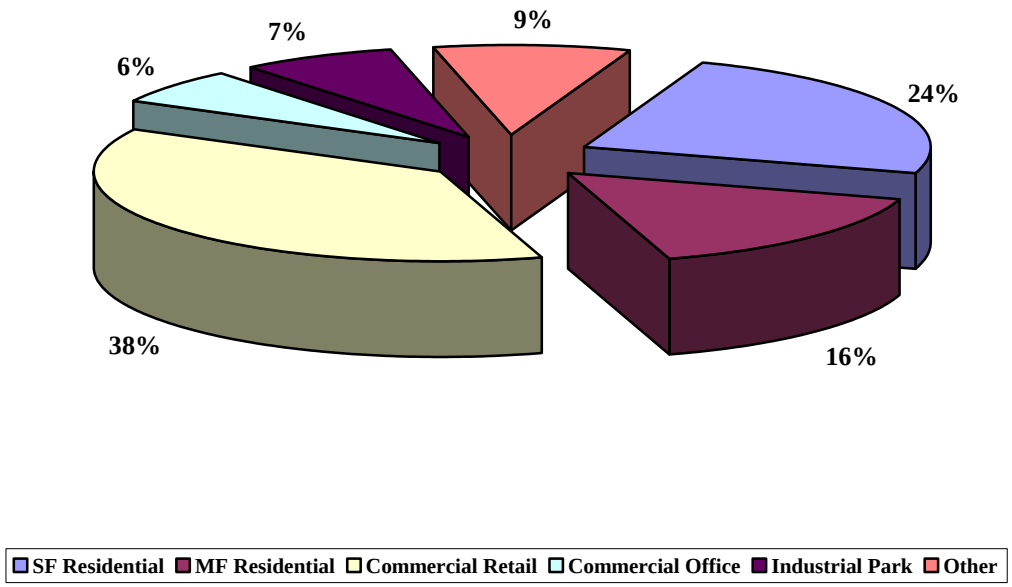


Figure 2-9: Total Average Daily Traffic (ADT) Volume Comparison

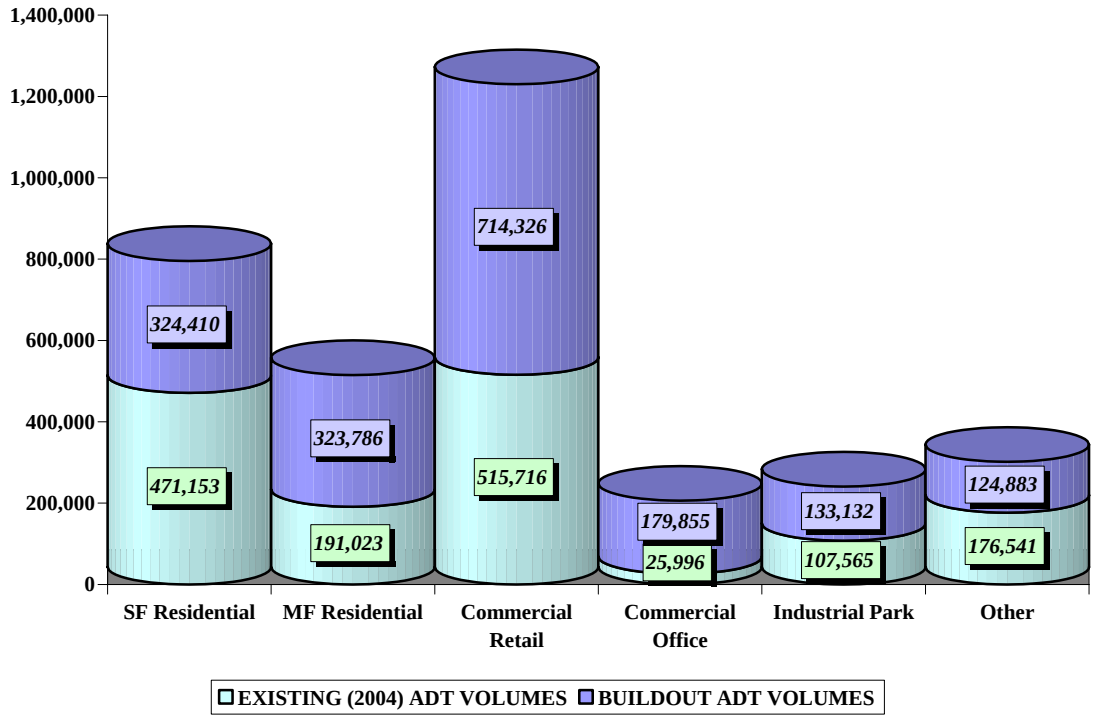


Table 2-4: Valley-wide Land Use and Trip Generation – Current Plan Buildout vs. OVOV Buildout

Land Use Category	Units	Current Plan Buildout		Proposed OVOV Buildout		% Increase
		Amount	Tripends	Amount	Tripends	
SF Residential	DU	89,373	877,112	81,395	795,563	-9%
MF Residential	DU	62,543	481,988	67,679	514,809	7%
Subtotal	*DU*	*151,916*	*1,359,100*	*149,074*	*1,310,372*	*-4%*
Commercial Retail	TSF	21,561.65	1,134,793	23,585.06	1,230,042	8%
Commercial Office	TSF	14,746.77	169,850	17,311.53	205,851	21%
Industrial Park	TSF	43,144.21	254,465	40,735.96	240,697	-5%
Subtotal	*TSF*	*79,452.63*	*1,559,108*	*81,632.55*	*1,676,590*	*8%*
Other (Schools, etc.)	--	--	288,885	--	301,424	4%
TOTAL		--	3,207,093	--	3,288,386	3%

Where:
SF = Single Family
MF = Multi-Family
DU = dwelling units
TSF = thousand square feet of floor area
Tripends = Daily Tripends (one trip = 2 tripends)

The proposed City of Santa Clarita Land Use Element describes how an emphasis has been placed on allowing mixed uses in order to allow residents to reach services in ways that are not exclusively automobile-dependent, such as by walking, biking and transit. Grouping mixed uses together also reduces the need for residents to take multiple vehicle trips to obtain services and reach employment centers, resulting in a net reduction in the number of vehicles on the roadway. The proposed OVOV land uses also represent a reduction in residential dwelling units of approximately 4 percent and an increase in office square footage of approximately 21 percent in comparison to the current City General Plan/County Area Plan. This change results in an improved jobs to housing balance for the Valley, which reduces the need for residents to commute outside of the Valley for employment.

The traffic forecasting process utilized by the SCVCTM derives vehicle trips based on trip distribution functions that take into account the geographical placement of land uses in relation to each other. As noted above, VMT is a function of both the number of trips and trip lengths and Table 2-5 provides a comparison between the current City General Plan/County Area Plan and the proposed OVOV land uses for these factors.

Table 2-5: Trip Length and VMT Comparison

Scenario	Total Vehicle Trips (ADT)	Total VMT (veh-miles)	Average Trip Length (miles)
Current General Plan/Area Plan at Buildout	1,874,000	25,373,000	13.5
Proposed OVOV Land Uses at Buildout	1,860,000	21,532,000	11.6
Difference	-14,000	-3,841,000	-1.9
	-1%	-15%	-14%

Where:
ADT = Average Daily Trips
VMT = Vehicle Miles Traveled (daily)
Source: Santa Clarita Valley Consolidated Traffic Model (SCVCTM)

The above table shows that with the proposed OVOV land uses, the total number of vehicle trips is approximately 1 percent less than with the current General Plan and that the average trip length is reduced by approximately 1.9 miles. Total VMT is reduced by approximately 15 percent. These reductions are primarily due to factors inherent to the land use plan such as density, mixed use, and an improved jobs to housing ratio that reduces the number of commuter trips outside of the Valley.

The impact analysis provided in Chapter 4.0 compares roadway traffic volumes and LOS resulting from the proposed OVOV plan to forecasts based on the current City General Plan/County Area Plan.

3.0 ARTERIAL ROADWAYS

This chapter discusses the arterial roadway component of the City and County Circulation Elements. Referred to as the "Arterial Highway Plan" or simply the "Highway Plan," it provides recommendations for the Santa Clarita Valley's arterial roadway system.

3.1 ROADWAY CLASSIFICATIONS

The Highway Plan is defined using a hierarchy of arterial roadway classifications. Each is described by size and function, and has specific physical dimensions. The proposed Highway Plan maintains the general structure of the existing City and County Circulation Elements by utilizing the established roadway classifications of the current Highway Plan.

The functional classifications range from multi-lane expressways to two-lane undivided roadways.

3.1.1 Major Arterial Highway

This classification applies to six- to eight-lane roadways with raised landscaped medians (Urban) or painted medians (Rural). Their function is to carry high volumes of local and regional traffic. Unsignalized minor street and driveway access may be allowed but signalized access is preferred, and left-turn restrictions should be placed at unsignalized access locations. Curbside parking is prohibited. Bike lanes or bike trails can be employed in addition to sidewalk space. Traffic carrying capacities of around 54,000± vehicles per day for a six-lane roadway and 72,000± vehicles per day for an eight-lane roadway can be achieved depending on the degree of access control, peak period traffic loadings, and lane configurations at the major intersections.

3.1.2 Secondary Arterial Highway

This classification applies to four-lane roadways with raised landscaped medians (Sub-urban) or painted medians (Urban and Rural). In some areas of Urban Secondary, the painted median may allow for two-way left turns. Left turn restrictions will generally be placed at minor unsignalized driveways (i.e., median breaks will typically only be provided at intersections). As a primary traffic carrier, curbside

parking is prohibited. Bike lanes or bike trails can be employed in addition to sidewalk space. Traffic carrying capacities of 36,000± vehicles per day can be achieved depending on the degree of access control and peak period traffic loadings.

3.1.3 Limited Secondary Arterial Highway

This classification applies to two-lane roadways generally without medians or bike lanes. This classification is generally less restrictive with respect to access to adjacent property. These routes are typically located in remote foothill, mountain and canyon areas. Their primary function is to provide access to low-density areas. Traffic carrying capacities of 18,000± vehicles per day can be achieved depending on the degree of access control and peak period traffic loadings.

3.1.4 Parkway

This classification applies to urban and non-urban routes having park-like features either within or adjacent to the roadway. The width of right-of-way varies as necessary to incorporate these features, but shall not be less than 80 feet. Traffic carrying capacities vary depending on the specific roadway improvements that are provided. Roadway improvements will vary based on the composition and volume of traffic to be carried.

3.1.5 Collector Streets

This classification applies to two-lane roadways in residential, commercial and industrial areas that serve some through traffic as well as the adjacent properties. Collectors connect local streets with arterial highways and balance mobility and access. Typically no median is provided and on street parking is allowed. While not as wide as an arterial highway, Collectors are typically wider than local streets in terms of right-of-way and lane widths. Traffic carrying capacities of 15,000± vehicles per day can be achieved depending on the degree of access control and peak period traffic loadings.

3.1.6 Local Streets

This classification applies to two-lane roadways in residential areas that serve the adjacent properties. Local streets are intended to provide access to adjacent land uses exclusively, and are not designed or intended to carry through-traffic or allow for high speeds. Traffic carrying capacities of

10,000 vehicles per day or more are physically possible, but a maximum capacity of approximately 2,500± vehicles per day is targeted in order to provide an environment consistent with the adjoining residential uses.

3.1.7 Expressway

This classification applies to multi-lane State Highways under the jurisdiction of the California Department of Transportation (Caltrans). Expressways have restrictive access control consisting of grade-separated interchanges or signalized at-grade intersections with a minimum spacing of one mile. Traffic carrying capacities of around 44,000± vehicles per day for a four-lane expressway up to around 88,000± vehicles per day for an eight-lane expressway can be achieved depending on the degree of access control, peak period traffic loadings, and lane configurations at the major intersections.

The above roadway classifications are listed in Table 3-1 and conceptual cross-sections are illustrated in Figure 3-1.

3.2 ROADWAY DIMENSIONS

The preceding discussion on roadway classifications included general ranges for right-of-way (ROW) and pavement width. While the maximum value represents a desirable standard, variations in right-of-way width and specific roadway improvements will occur in certain cases due to physical constraints and/or right-of-way limitations. Hence, the roadway classifications may deviate from the standards where physical constraints exist, where preservation of community character dictates special treatment. Bikeways and sidewalks also affect the specific standards applied to various roadways. However, the overriding circulation goal is that all roadways carry the designated design volume of traffic at the desired performance standard.

3.3 PROPOSED ROADWAY PLAN

A recommended arterial roadway component of the City and County Circulation Elements (the Highway Plan) has been developed based on the traffic analysis presented in Chapter 4.0. The preparation of the traffic analysis consisted of evaluating the proposed OVOV buildout land uses in conjunction with various alternatives of roadway configurations. From this analysis, a recommended Highway Plan evolved.

Table 3-1: Roadway Classifications

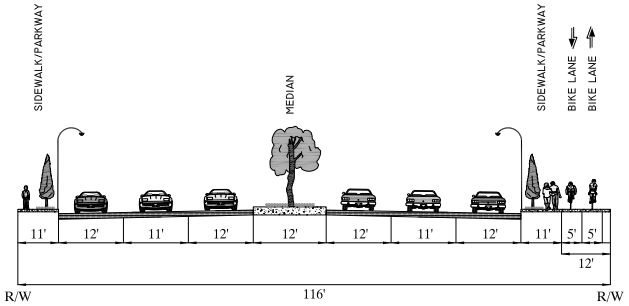
Highway Plan Classification	Functional Classification	Definition	Typical ROW Width (Curb-Curb Width)	Typical Configuration	Design Maximum Two-Way Daily Traffic Volume
MAJOR HIGHWAY	6 to 8 Lane Roadway	Arterials with at least 6 travel lanes for high mobility, designed with limited vehicular access to driveways and cross streets. The typical road section includes a raised landscaped median with left turn pockets at intersections. Street sections may include striped, on-street bikeways or separated bike paths.	108'-138' (84'-118')	6 – 8 lanes 14' Raised Median, or 12' Painted Median Bike Lanes or Trails No Parking Signalized side street access	54,000 (6L) 72,000 (8L)
SECONDARY HIGHWAY	4 Lane Roadway	Arterials with an ultimate design section of 4 travel lanes, designed for high mobility and with limited vehicular access from driveways and cross streets. The typical road section includes a median with left turn pockets provided at intersections. Secondary highways are designed to service both through traffic, and to collect traffic from collector and local streets.	86'-92' (58'-72')	4 Lanes 14' Raised Median, or 12' Painted Median Bike Lanes or Trails No Parking Signalized side street access	36,000
LIMITED SECONDARY HIGHWAY	2 Lane Roadway	Arterials with an ultimate roadway design section of 2 travel lanes and less restrictive access control. The typical road section does not include a median. These streets are designed to accommodate moderate volumes of traffic and are typically located in remote foothill, mountainous and canyon areas..	64' (28')	2 Lanes No Median No Bike Lanes No Parking	18,000
PARKWAY	2 or more Lane Roadway	Arterials having park-like features either within or adjacent to the roadway. Specific features vary depending on the composition and volume of traffic to be carried.	80' or more (varies)	2 or more Lanes	varies

(Continued)

Table 3-1: Roadway Classifications (Continued)

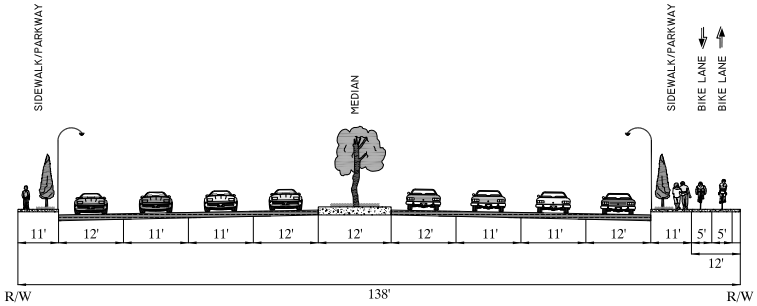
Highway Plan Classification	Functional Classification	Definition	Typical ROW Width (Curb-Curb Width)	Typical Configuration	Design Maximum Two-Way Daily Traffic Volume
COLLECTOR STREET	2 Lane Roadway	Streets which have an ultimate roadway design section of 2 travel lanes with limited vehicular access to the roadway from driveways and cross streets. The roadway is usually undivided and does not always accommodate left turn pockets at intersections. Collector streets are designed to provide both access and limited mobility, servicing local traffic from residential, commercial, and industrial uses and providing access to the arterial roadway system. Collector streets are not depicted on the adopted Highway Plan.	64' (40')	2 Lanes No Median No Bike Lanes Parking typically allowed.	15,000
LOCAL STREET	2 Lane Roadway	Streets which have an ultimate roadway design section of 2 travel lanes designed for full access and limited mobility. Local streets are not included on the adopted Highway Plan.	58'-60' (34'-36')	2 Lanes No Median No Bike Lanes Parking typically allowed.	2,500
EXPRESSWAY	4 to 8 Lane Roadway	Highways which have an ultimate roadway design section of 4 or more lanes that are part of the State Highway system. Expressways have restrictive access control consisting of grade-separated interchanges or at-grade signalized intersections with a minimum spacing of 1 mile.	200' (varies)	4 or More Lanes Median No Bike Lanes No Parking Grade Separation, or Signalized side-street access	44,000 (4L) 88,000 (8L)

MAJOR ARTERIAL HIGHWAY
(WITH BIKE TRAIL DETAIL)



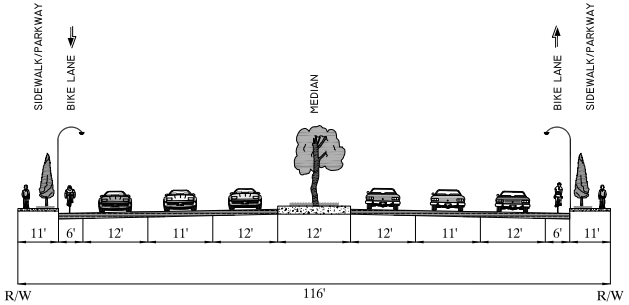
THREE LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

MAJOR ARTERIAL HIGHWAY
(EIGHT LANE ALTERNATIVE WITH BIKE TRAIL DETAIL)



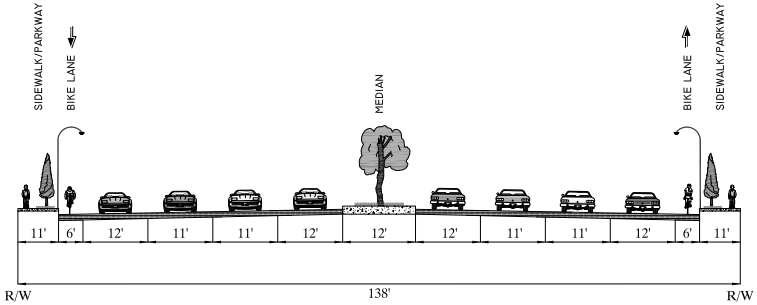
FOUR LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

MAJOR ARTERIAL HIGHWAY
(WITH BIKE LANE DETAIL)



THREE LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

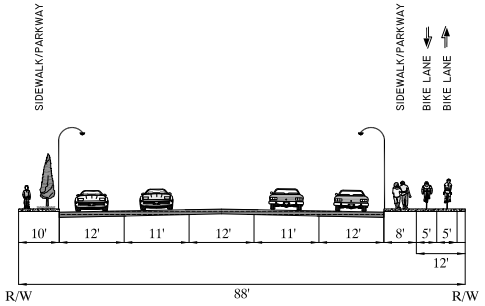
MAJOR ARTERIAL HIGHWAY
(EIGHT LANE ALTERNATIVE WITH BIKE LANE DETAIL)



FOUR LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

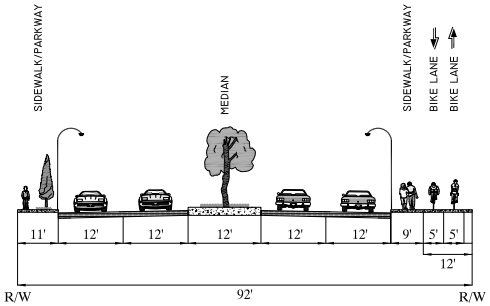
536002_Cross_Sections.dwg

URBAN SECONDARY ARTERIAL HIGHWAY
(WITH BIKE TRAIL DETAIL)



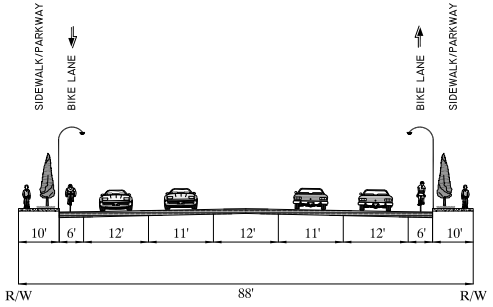
TWO LANES IN EACH DIRECTION WITH TWO WAY
LEFT TURN LANE, NO ON-STREET PARKING

SUB-URBAN SECONDARY ARTERIAL HIGHWAY
(WITH BIKE TRAIL DETAIL)



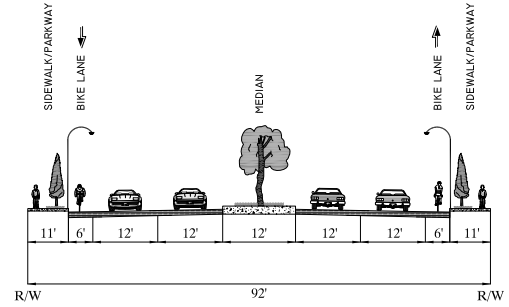
TWO LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

URBAN SECONDARY ARTERIAL HIGHWAY
(WITH BIKE LANE DETAIL)



TWO LANES IN EACH DIRECTION WITH TWO WAY
LEFT TURN LANE, NO ON-STREET PARKING

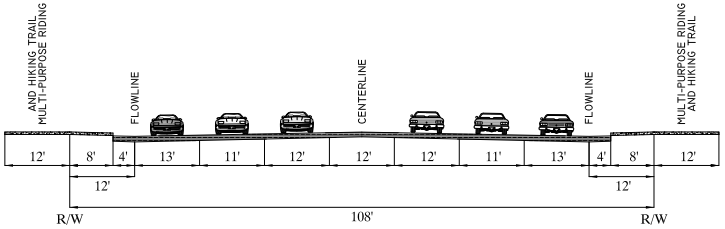
URBAN SECONDARY ARTERIAL HIGHWAY
(WITH BIKE LANE DETAIL)



TWO LANES IN EACH DIRECTION WITH RAISED
LANDSCAPE MEDIAN, NO ON-STREET PARKING

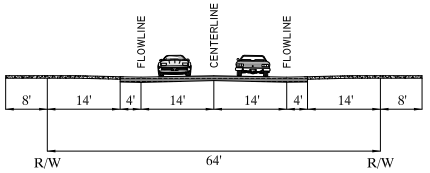
536002_Cross_Sections.dwg

RURAL MAJOR HIGHWAY



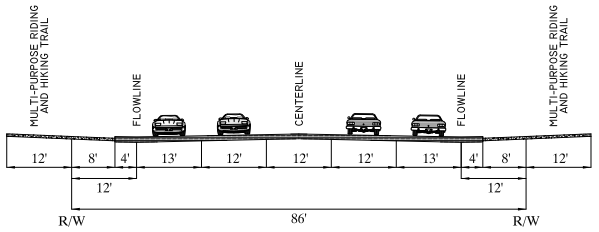
THREE LANES IN EACH DIRECTION WITH TWO WAY LEFT TURN LANE, NO ON-STREET PARKING

LIMITED SECONDARY ARTERIAL HIGHWAY



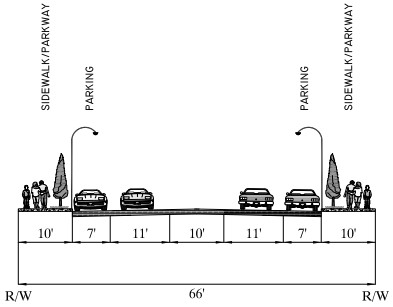
ONE LANE IN EACH DIRECTION WITH NO ON-STREET PARKING

RURAL SECONDARY HIGHWAY



TWO LANES IN EACH DIRECTION WITH TWO WAY LEFT TURN LANE, NO ON-STREET PARKING

INDUSTRIAL/COMMERCIAL CUL-DE-SAC



ONE LANE IN EACH DIRECTION WITH TWO WAY LEFT TURN LANE, WITH ON-STREET PARKING

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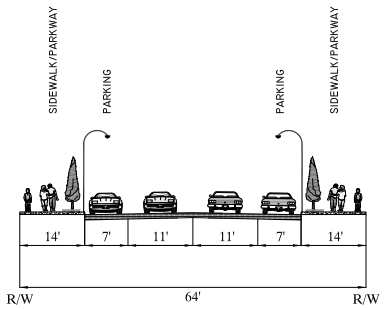
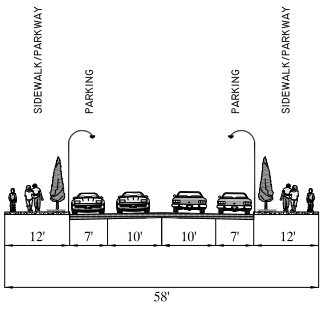
RESIDENTIAL COLLECTOR



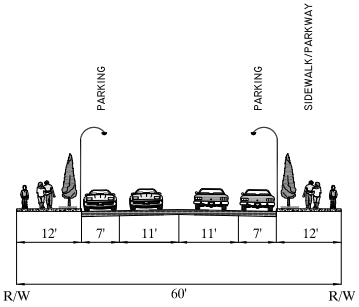
ONE LANE IN EACH DIRECTION WITH ON-STREET PARKING

RESIDENTIAL CUL-DE-SAC



ONE LANE IN EACH DIRECTION WITH ON-STREET PARKING

RESIDENTIAL THROUGH STREET



ONE LANE IN EACH DIRECTION WITH ON-STREET PARKING

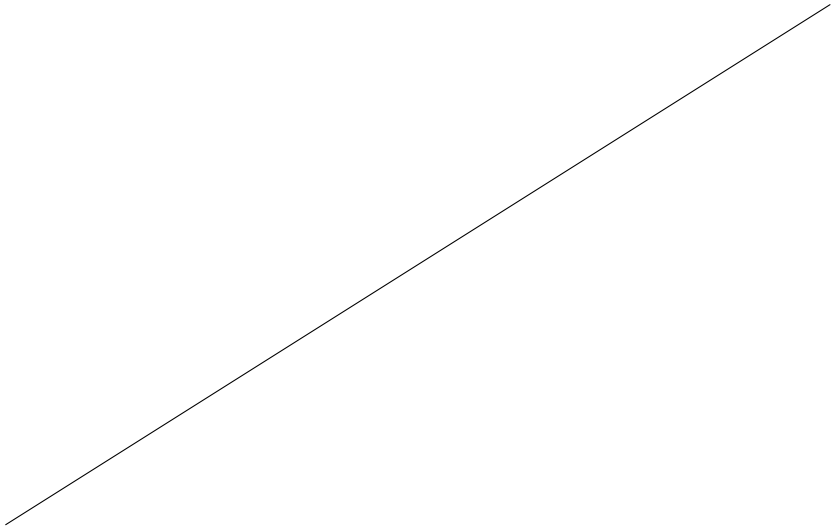


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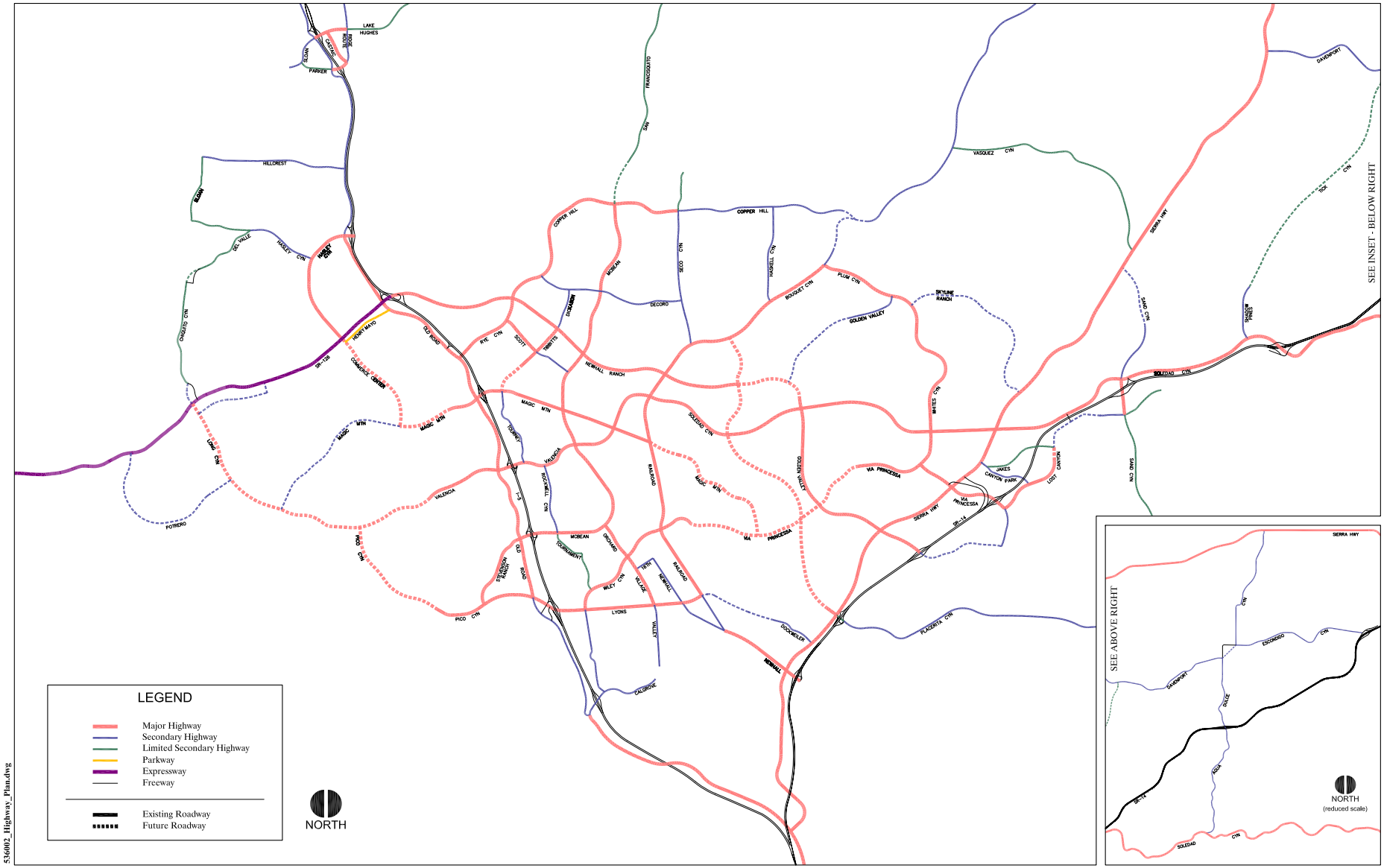
Figure 3-2 shows the proposed Highway Plan. Illustrated here by color and by line width are the recommended Highway Plan classifications as discussed earlier in this chapter. In the next chapter, future traffic volumes are estimated based on this Highway Plan to show its ability to serve the future traffic demands created by buildout of the OVOV land uses.

The recommended Highway Plan includes multiple changes from the current Highway Plan. Designations of the following roadway segments were recommended to be changed as a result of the traffic analysis:

1. **Lake Hughes Road from Ridge Route Road to Angeles National Forest Boundary** – Reclassify from a major highway to a limited secondary highway.
2. **Vasquez Canyon Road from Bouquet Canyon Road to Sierra Highway** – Reclassify from a secondary highway to a limited secondary highway.
3. **Sand Canyon Road from the Santa Clarita City boundary to Sierra Highway** – Reclassify from a major highway to a secondary highway along existing alignment.
4. **Shadow Pines Boulevard/Tick Canyon Road from Grandifloras Road to Davenport Road** – Reclassify from a secondary highway to a limited secondary highway.
5. **Bouquet Canyon Road from Plum Canyon Road to Vasquez Canyon Road** – Reclassify from a major highway to a secondary highway.
6. **Skyline Ranch Road from Plum Canyon Road to Sierra Highway** – Reclassify planned major highway to a secondary highway (or an alternative section as proposed by the pending development project through which this roadway passes.)
7. **Valencia Boulevard/Potrero Canyon Road from the Newhall Ranch/Stevenson Ranch boundary to the planned Long Canyon Road** – Reclassify planned secondary highway to a major highway.
8. **Long Canyon Road from the planned Santa Clara River Bridge to the planned Valencia Boulevard/Potrero Canyon Road** – Reclassify planned secondary highway to a major highway.
9. **Pico Canyon Road from the Newhall Ranch/Stevenson Ranch boundary to Valencia Boulevard** – Reclassify planned secondary highway to a major highway.
10. **Jakes Way from Canyon Park Boulevard to the planned Lost Canyon Road extension** – add classification for the existing roadway as a limited secondary highway.
11. **McBean Parkway from Copper Hill Drive to San Fransisquito Canyon Road** – Reclassify planned secondary highway to a limited secondary highway.



536002_Highway_Plan.dwg

12. **San Fransisquito Canyon Road from the planned extension of McBean Parkway to the Angeles National Forest** – Reclassify from a secondary highway to a limited secondary highway.
13. **Lost Canyon Road from Jakes Way to Sand Canyon Road** – Reclassify planned major highway to a secondary highway.

The following roadway segments were recommended to be removed from the Highway Plan as a result of the traffic analysis:

1. **16th Street from Newhall Avenue to Railroad Avenue** – Remove planned secondary highway.
2. **Sloan Canyon Road from Hillcrest Parkway to Quail Valley Road** – Remove planned limited secondary highway.
3. **Castaic Road from Parker Road to Newhall Ranch Road** – Remove planned secondary highway.
4. **Biscailuz Drive from The Old Road to the previously planned extension of Castaic Road** – Remove planned secondary highway.
5. **Landmark Village (VTTM 53108) Spine Road** – Remove planned secondary highway.
6. **"A" Street (Mallory Drive) from Poe Parkway to Valencia Boulevard** – Remove planned secondary highway.
7. **Poe Parkway from Stevenson Ranch Parkway to Valencia Boulevard** – Remove secondary (existing and planned) highway.
8. **Cruzan Mesa Road from Whites Canyon Road to Sierra Highway** – Remove planned limited secondary highway.

The following roadway alignments were recommended to be changed as a result of the traffic analysis:

1. **Sand Canyon Road from the Santa Clarita City boundary to Sierra Highway** – Realign planned secondary highway along the existing driven roadway.
2. **Long Canyon Road/Potrero Canyon Road/Valencia Boulevard at planned intersection** – Realign to make Long Canyon Road/Valencia Boulevard the continuous roadway.
3. **Chiquito Canyon Road/Long Canyon Road at State Route 126** – Revise alignments to create a continuous north/south roadway.

4. **Whites Canyon Road from Plum Canyon Road to Vasquez Canyon Road** – Revise alignment to connect from Plum Canyon Road to Sierra Highway (as the proposed Skyline Ranch Road).

Table 3-2 indicates the designation of all General Plan roadways as shown on the proposed Highway Plan.

Table 3-2: Highway Plan Roadways in the Planning Area

Roadway Classification	Roadway Segments in Planning Area
Expressways	SR-126
Major Highways	Avenue Scott (from Rye Canyon Road to Avenue Tibbitts) Avenue Tibbitts Bouquet Canyon Road (from Plum Canyon Road to Magic Mountain Parkway) Castaic Road (from Lake Hughes Road to Parker Road) Commerce Center Drive Copper Hill Drive (from Newhall Ranch Road to Seco Canyon Road) Golden Valley Road (from Newhall Ranch Road to SR-14 freeway) Hasley Canyon Road (from Commerce Center Drive to I-5 freeway) Lake Hughes Road (from The Old Road to Ridge Route Road) Long Canyon Road (from SR-126 to Valencia Boulevard) Lost Canyon Road (from Jakes Way to Via Princessa) Lyons Avenue Magic Mountain Parkway (from Commerce Center Drive to Via Princessa) McBean Parkway (from I-5 freeway to Copper Hill Drive) Newhall Avenue (from Railroad Avenue to SR-14 freeway) Newhall Ranch Road Orchard Village Road Parker Road (from The Old Road to Castaic Road) Pico Canyon Road Plum Canyon Road Railroad Avenue (from Magic Mountain Parkway to Lyons Avenue) Rye Canyon Road Sand Canyon Road (from Soledad Canyon Road to Lost Canyon Road) Santa Clarita Parkway Sierra Highway Soledad Canyon Road Stevenson Ranch Parkway The Old Road (from Hasley Canyon Road to Lyons Avenue) The Old Road (from Calgrove Boulevard to Sierra Highway) Valencia Boulevard Via Princessa (from Wiley Canyon Road to Lost Canyon Road) Whites Canyon Road Wiley Canyon Road (from Lyons Avenue to Via Princessa)

(Continued)

Table 3-2: Highway Plan Roadways in the Planning Area (Continued)

Roadway Classification	Roadway Segments in Planning Area
Secondary Highways	16th Street (from Orchard Village Road to Newhall Avenue) Agua Dulce Canyon Road Avenue Scott (from Avenue Tibbitts to McBean Parkway) Bouquet Canyon Road (from Plum Canyon Road to Angeles National Forest boundary) Calgrove Boulevard Canyon Park Boulevard Copper Hill Drive (from Seco Canyon Road to Bouquet Canyon Road) Davenport Road Decoro Drive Dickason Drive Dockweiler Drive Escondido Canyon Road Golden Valley Road (from Newhall Ranch Road to Plum Canyon Road) Golden Valley Road (from SR-14 freeway to Via Princessa) Haskell Canyon Road (from Copper Hill Drive to Bouquet Canyon Road) Hasley Canyon Road (from Del Valle Road to Commerce Center Drive) Hillcrest Parkway Long Canyon Road (from Chiquito Canyon Road to SR-126) Lost Canyon Road (from Jakes Way to Sand Canyon Road) Magic Mountain Parkway (from Long Canyon Road to Commerce Center Drive) Newhall Avenue (from 16th Street to Railroad Avenue) Placerita Canyon Road (from Sierra Highway to Sand Canyon Road) Potrero Canyon Road Railroad Avenue (from Lyons Avenue to Newhall Avenue) Ridge Route Road (from approximately ¾ mile north of Northlake Hills elementary school to Castaic Road) Rockwell Canyon Road Sand Canyon Road (from Sierra Highway to Soledad Canyon Road) Seco Canyon Road (from Copper Hill Drive to Bouquet Canyon Road) Shadow Pines Boulevard (from Tick Canyon Road to Soledad Canyon Road) Skyline Ranch Road Sloan Canyon Road (from The Old Road to Quail Valley Road) The Old Road (from Oak Valley Road to Hasley Canyon Road) The Old Road (from Pico Canyon Road to Calgrove Boulevard) Tourney Road Valley Street Via Princessa (from Lost Canyon Road to Golden Valley Road) Wiley Canyon Road (from Lyons Avenue to Calgrove Boulevard)

(Continued)

Table 3-2: Highway Plan Roadways in the Planning Area (Continued)

Roadway Classification	Roadway Segments in Planning Area
Limited Secondary Highways	Bouquet Canyon Road (from Angeles National Forest Boundary to Elizabeth Lake Road) Chiquito Canyon Road (from Del Valle Road to Long Canyon Road) Del Valle Road (from Chiquito Canyon Road to Hasley Canyon Road) Hasley Canyon Road (from Sloan Canyon Road to Del Valle Road) Jakes Way Lake Hughes Road (from Ridge Route Road to Pine Canyon Road) Lost Canyon Road (from Sand Canyon Road to Oak Springs Canyon Road) McBean Parkway (from San Francisquito Canyon Road to Copper Hill Drive) Ridge Route Road (from Templin Highway to approximately ¾ mile north of Northlake Hills elementary school) San Francisquito Canyon Road (from McBean Parkway to Elizabeth Lake Road) Sand Canyon Road (from Lost Canyon Road to Little Tujunga Canyon Road) Seco Canyon Road (from Discovery Ridge Drive to Copper Hill Drive) Sloan Canyon Road (from Hillcrest Parkway to Hasley Canyon Road) Tick Canyon Road Tournament Road Vasquez Canyon Road
Parkways	Henry Mayo Drive (from Commerce Center Drive to The Old Road)

4.0 TRAFFIC ANALYSIS

This chapter presents long-range traffic data based on the proposed OVOV land uses and the proposed Highway Plan. Future levels of service findings are discussed and potential improvements needed to implement the plan are summarized.

4.1 LONG-RANGE TRAFFIC VOLUMES

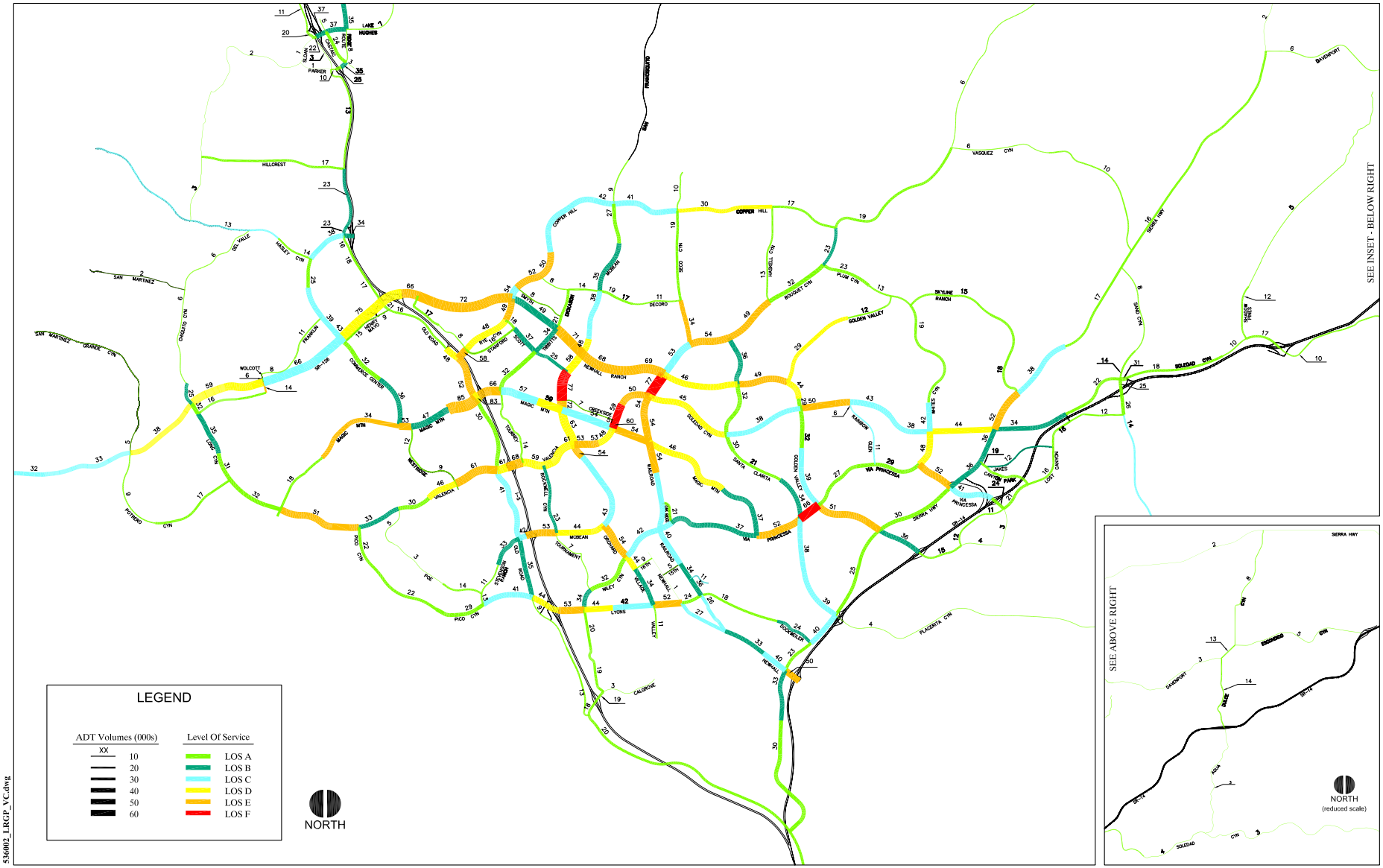
Future daily and peak hour traffic volumes on the analysis area circulation system were estimated for the proposed OVOV land uses and for the current City General Plan/County Area Plan land uses using traffic forecasts produced by the Santa Clarita Valley Consolidated Traffic Model (SCVCTM). They were derived for the roadway system described in the previous chapter, which represents buildout of the proposed Highway Plan.

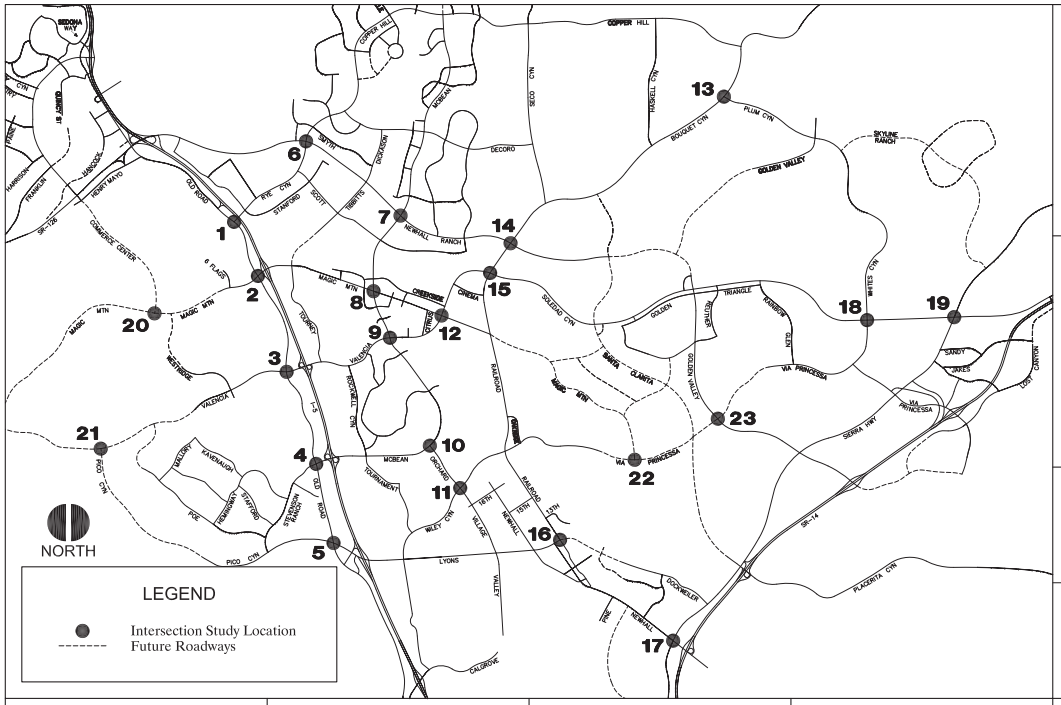
Long-range ADT volumes for this roadway plan are shown in Figure 4-1, and peak hour volumes for principal intersections are provided in Figure 4-2 and Figure 4-3 for the a.m. and p.m. peak hours, respectively. They are labeled here as OVOV Buildout Conditions and represent buildout of the proposed OVOV land use plan. While a specific date that corresponds to buildout of the land use is indeterminable due to variations in market conditions, these forecasts can generally be considered a year-2035 horizon for planning purposes.

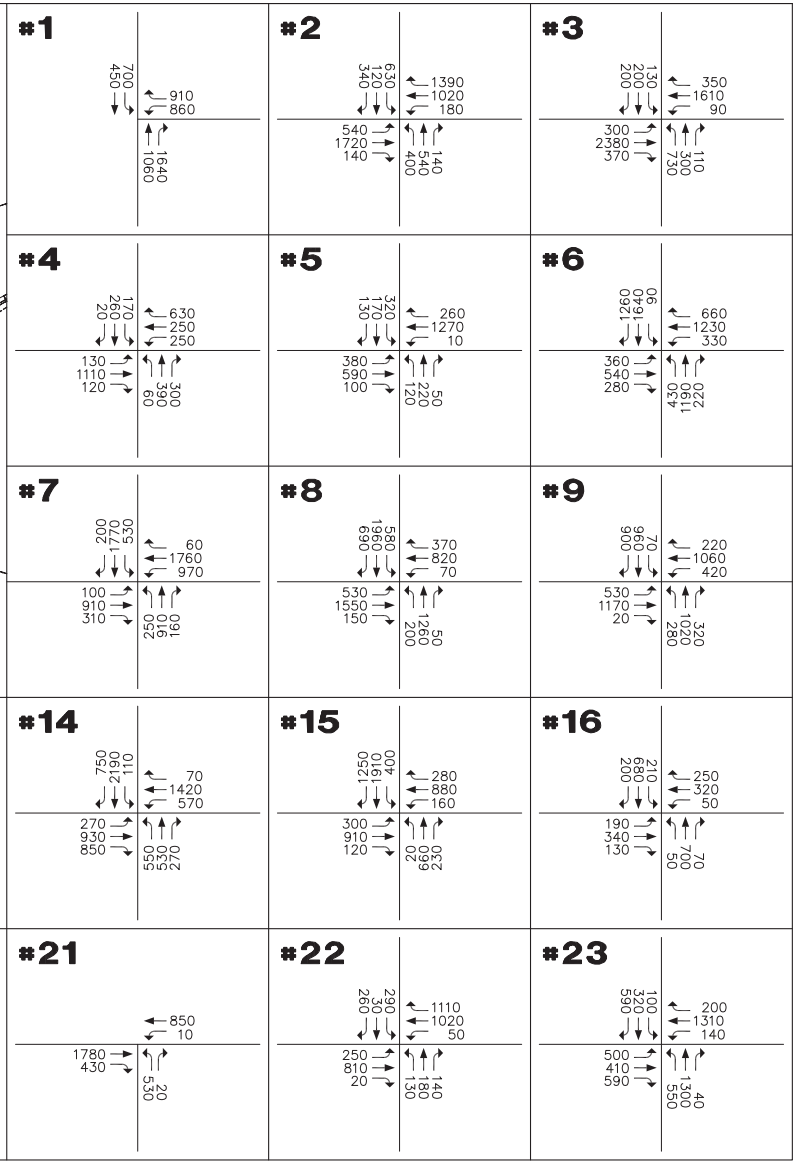
Traffic volumes based on the current City General Plan/County Area Plan traffic model are also presented for comparison purposes. ADT volumes are illustrated in Figure 4-4, and peak hour volumes for principal intersections are provided in Figure 4-5 and Figure 4-6 for the a.m. and p.m. peak hours, respectively.

4.2 LONG-RANGE LEVELS OF SERVICE

A comparison of OVOV Buildout Conditions to traffic forecasts based on the current City General Plan/County Area Plan is provided in Table 4-1. The table presents roadway segment V/C ratios and LOS values for each of the two scenarios. A comparable table for peak hour intersection conditions is provided in Table 4-2 and Table 4-3, which presents ICU and LOS values for each of the two scenarios based on existing intersection geometry as well as with buildout of the proposed Highway Plan.


LEGEND
ADT Volumes (000s)
XX
10
20
30
40
50
60
Level Of Service
LOS A
LOS B
LOS C
LOS D
LOS E
LOS F
NORTH
SEE INSET - BELOW RIGHT
SEE ABOVE RIGHT
NORTH
(reduced scale)
SOLEDAD CYN
SIERRA HWY
PLACERITA CYN
SAN MARTINEZ GRANDE CYN
HILLCREST
COPPER HILL
SKYLINE RANCH
GOLDEN VALLEY
DAVENPORT
VASQUEZ CYN
SAND CYN
WOLCOTT
COMMERCE CENTER
FRANKLIN
OAKGLEN CYN
LONG CYN
POTRERO CYN
MAGIC MTN
WESTRIDGE
VALENCIA
PICO CYN
FOX
ROAD
RYE CYN
STANFORD
SCOTT
NORTH
OLD ROAD
NEWHALL RANCH
DECORO
GOLDEN
MCBEAN
TOURNEY
TOURNAMENT
ORCHARD
RAILROAD
NEWHALL
WILEY CYN
VALLEY
LYONS
CALGROVE
ROCKWELL CYN
ROCKWELLER
VALENCIA BLVD
SANTA CLARITA
MA PRINCESSA
WA PRINCESSA
HASKELL CYN
BOUQUET CYN
PLUM CYN
WHITES CYN
RANGER
KEN
CANYON
LOST
JAKES
CANYON PARK
SR-14
SR-126
SR-118
SR-23
SR-27
SR-1
SR-2
SR-101
SR-170
SR-5
SR-99
SR-57
SR-60
SR-71
SR-91
SR-210
SR-405
SR-605
SR-710
I-5
I-10
I-15
I-105
I-110
I-210
I-405
I-605
I-710
US-101
US-395
US-6
US-50
US-66
US-95
US-99
ANTELOPE
ACTON
AGUA
BALCE
BROPHY
CAJON
CHILAO
CLEAR CREEK
DAVENPORT
DEVILS CANYON
ELIZABETH LAKE
FISH CANYON
GLENDORA
HEMET
HESPERIA
HOLCOMB
HOLLYWOOD
HUNTINGTON
INDIO
LA CANADA
LA HABRA
LA MIRADA
LA PUENTE
LAKE ELSINORE
LAKE HUGHES
LAKE MATHEWS
LAKE PERRIS
LAKEVIEW
LANCASTER
LEBEC
LEONA VALLEY
LOMA LINDA
LOMITA
LONG BEACH
LOS ANGELES
MALIBU
MANHATTAN BEACH
MARINA DEL REY
MIRA LOMA
MONROVIA
MONTEBELLO
MONTEREY PARK
MORENO VALLEY
MOUNT BALDY
NEEDLES
NEWPORT BEACH
NORCO
NORTH HOLLYWOOD
NORWALK
OCEANSIDE
ONTARIO
ORANGE
OXNARD
PACIFIC PALISADES
PALMDALE
PALOS VERDES
PARAMOUNT
PASADENA
PERRIS
PICO RIVERA
POMONA
RANCHO CUCAMONGA
RANCHO PALOS VERDES
REDLANDS
RIALTO
RIVERSIDE
ROLLING HILLS
ROSEMEAD
SAN BERNARDINO
SAN CLEMENTE
SAN DIMAS
SAN FERNANDO
SAN GABRIEL
SAN JACINTO
SAN JUAN CAPISTRANO
SAN MARINO
SANTA ANA
SANTA BARBARA
SANTA CLARITA
SANTA FE SPRINGS
SANTA MONICA
SANTA PAULA
SEAL BEACH
SEPULVEDA
SHERMAN OAKS
SIERRA MADRE
SIMI VALLEY
SOUTH EL MONTE
SOUTH GATE
STANTON
STUDIO CITY
SUN VALLEY
SUNLAND
SYLMAR
TARZANA
TEMECULA
TEMPLE CITY
THOUSAND OAKS
TORRANCE
TUJUNGA
TUSTIN
VAN NUYS
VENICE
VENTURA
VERDUGO CITY
VERNON
VILLA PARK
WALNUT
WEST COVINA
WEST HILLS
WESTLAKE VILLAGE
WESTMINSTER
WHITTIER
WILMINGTON
WOODLAND HILLS





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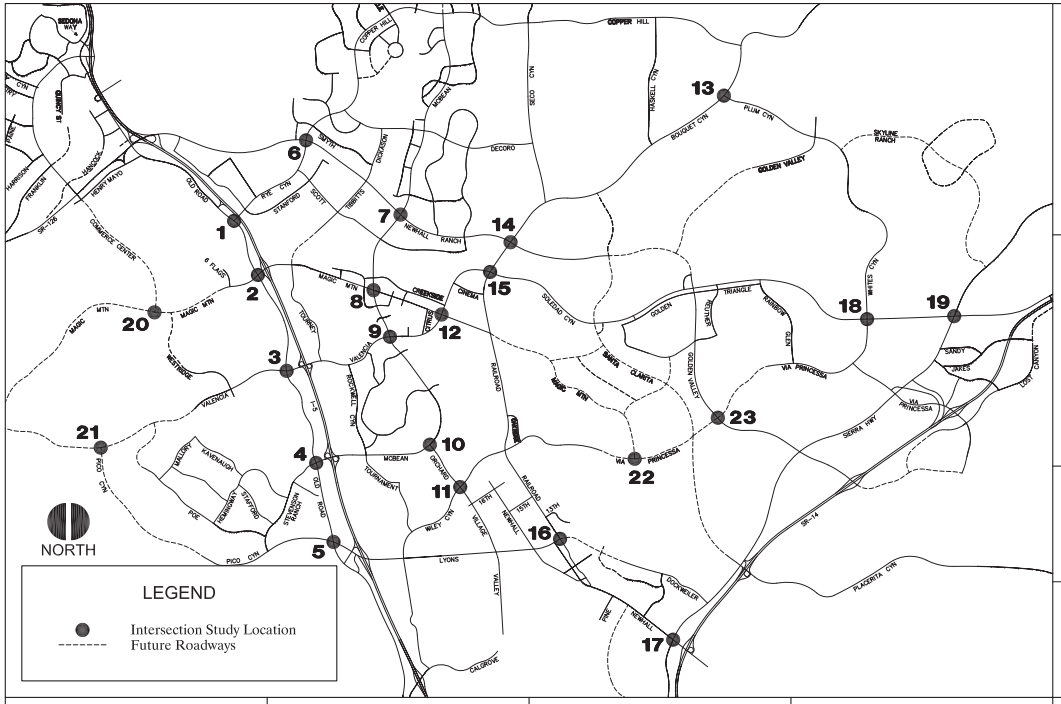

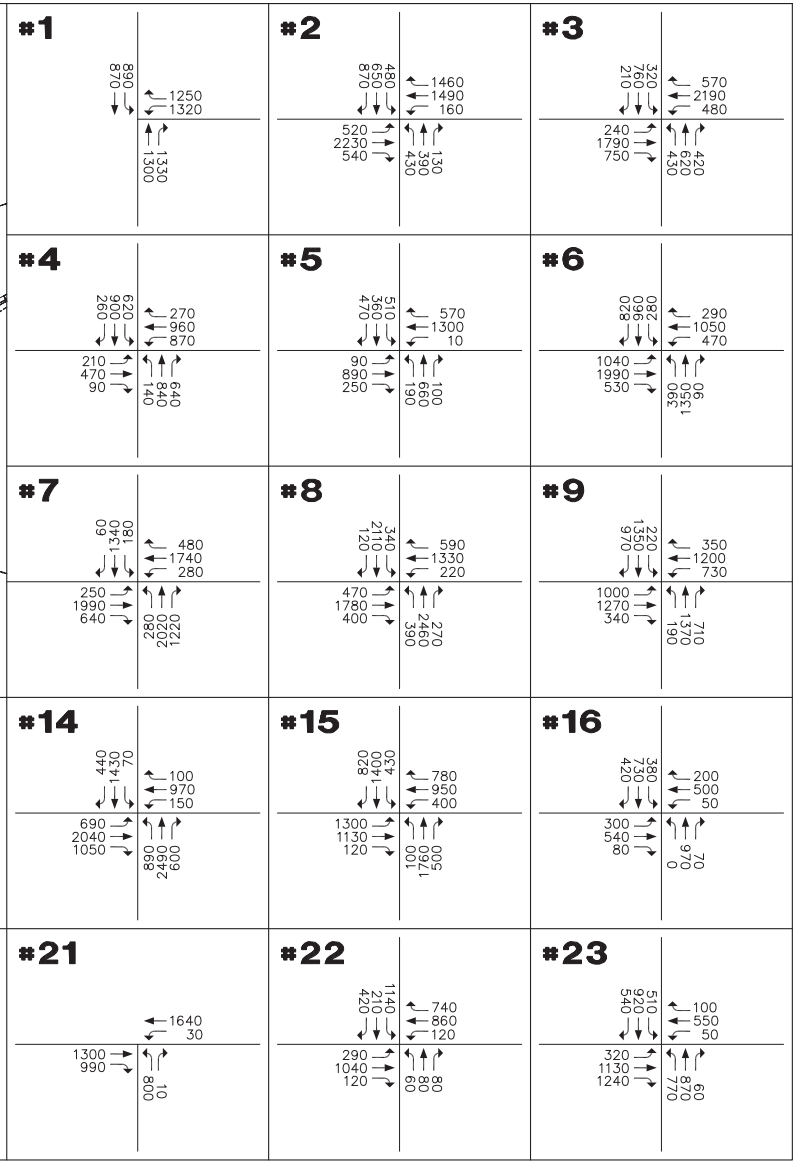

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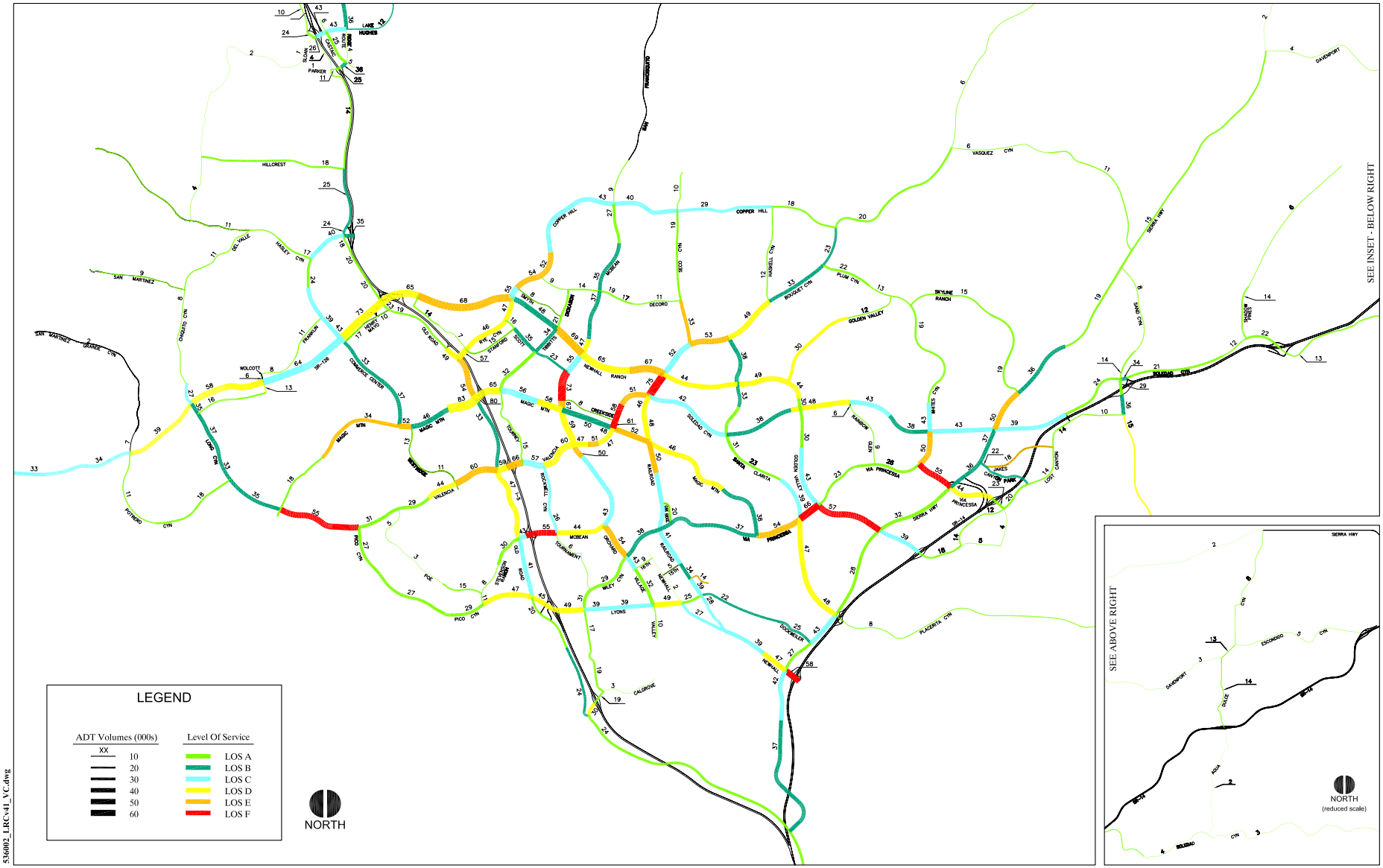

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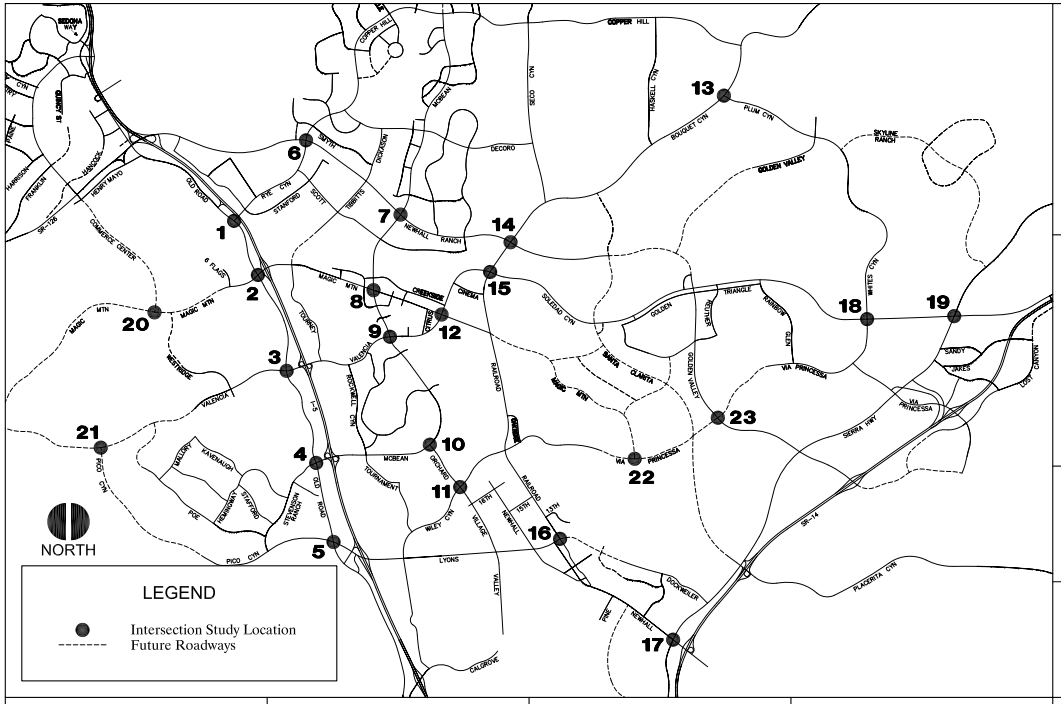

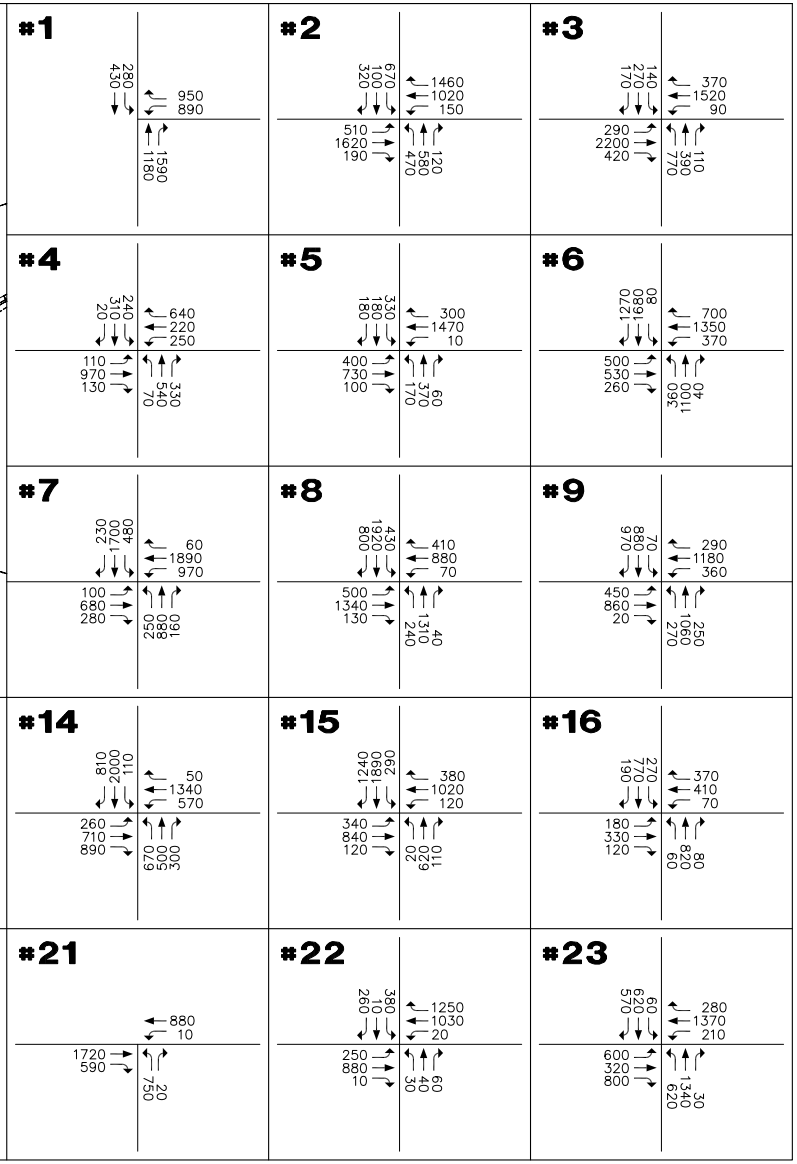

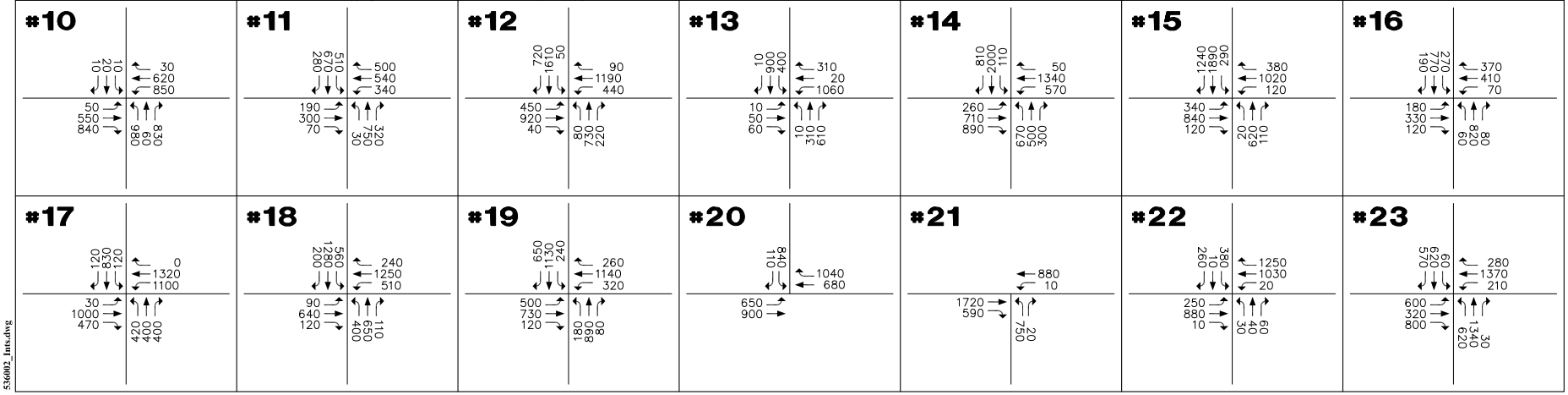

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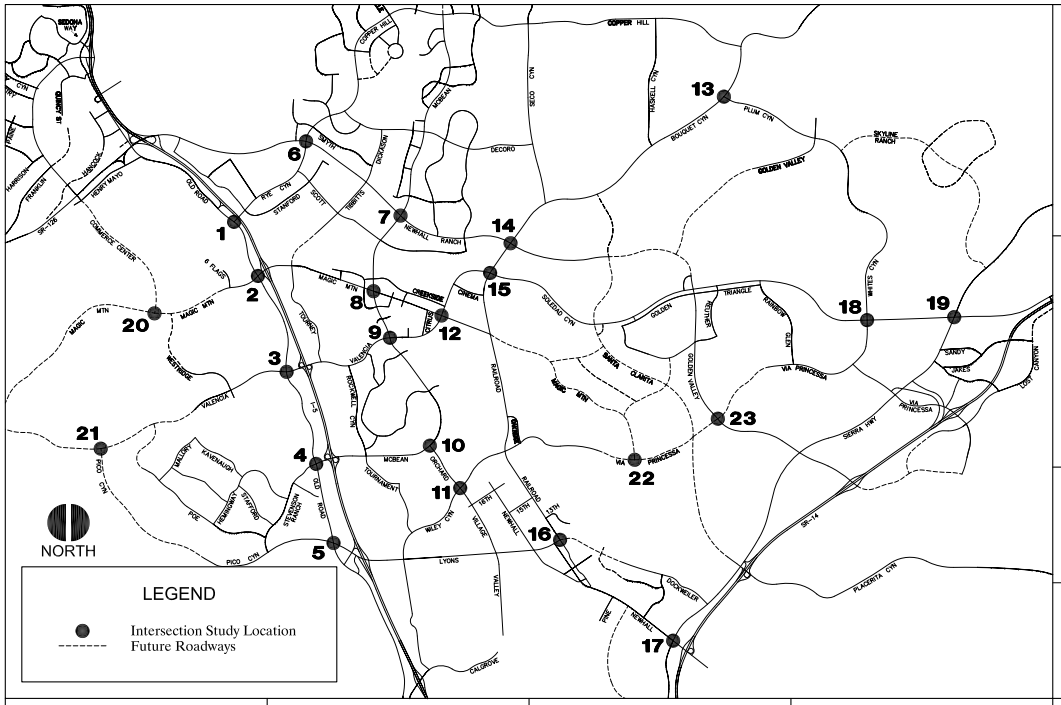

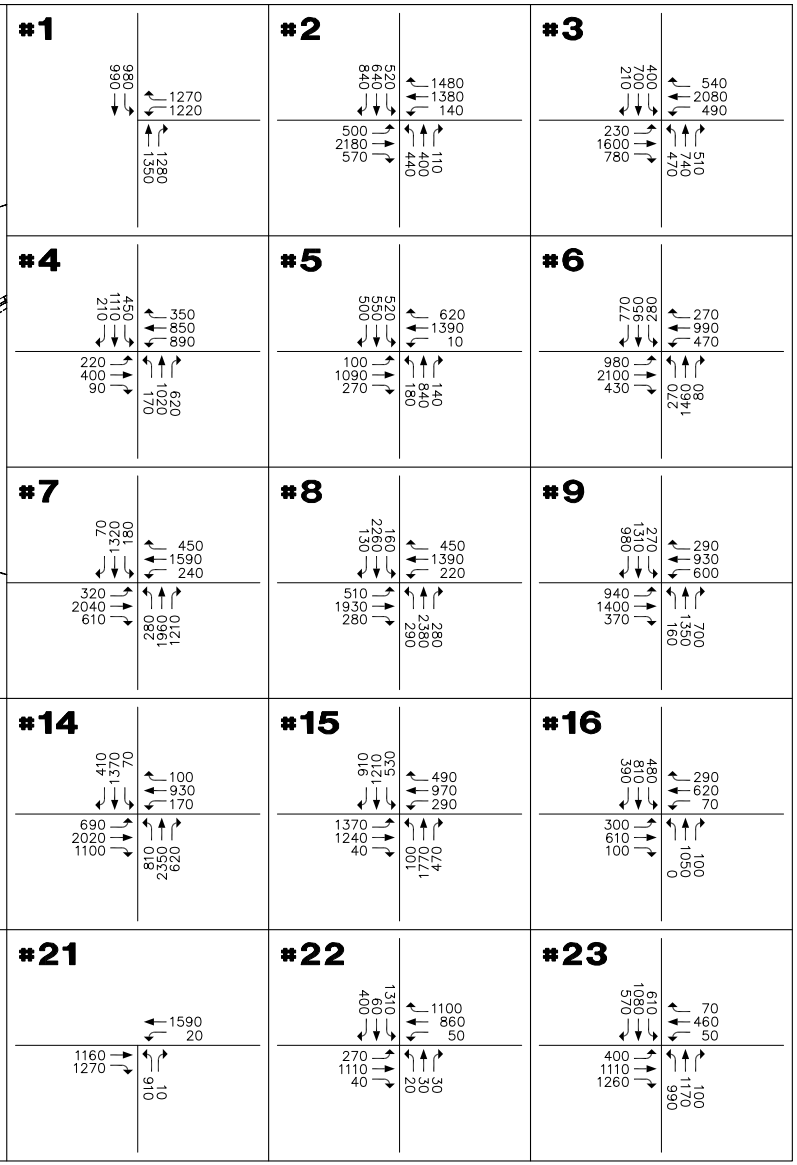

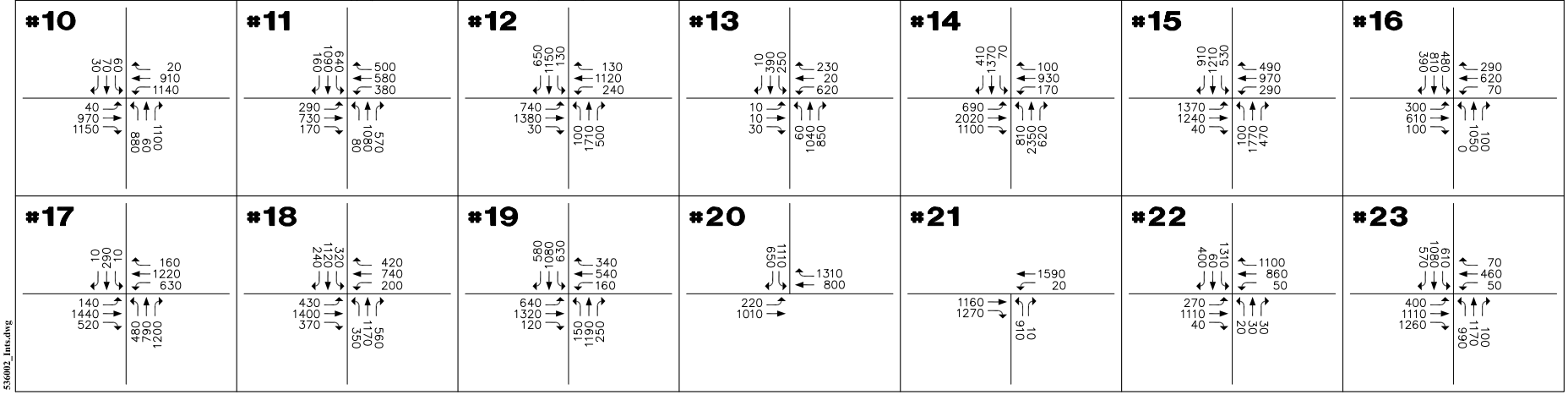

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Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
1. Agua Dulce n/o Escondido Cyn	4	36,000	8,000	.22	A	8,000	.22	A
2. Agua Dulce n/o Davenport	4	36,000	13,000	.36	A	13,000	.36	A
3. Agua Dulce n/o SR-14	4	36,000	14,000	.39	A	14,000	.39	A
4. Agua Dulce s/o SR-14	4	36,000	2,000	.06	A	3,000	.08	A
5. Ave Scott s/o Rye Canyon	6	54,000	16,000	.30	A	18,000	.33	A
6. Ave Scott s/o Stanford	6	54,000	35,000	.65	B	37,000	.69	B
7. Ave Scott n/o McBean	4	36,000	23,000	.64	B	25,000	.69	B
8. Ave Stanford s/o Vanderbilt	4	36,000	14,000	.39	A	17,000	.47	A
9. Ave Stanford n/o Rye Cyn	4	30,000	7,000	.23	A	8,000	.27	A
10. Ave Stanford s/o Rye Cyn	4	36,000	15,000	.42	A	16,000	.44	A
11. Bouquet Cyn n/o Vasquez	4	36,000	6,000	.17	A	6,000	.17	A
12. Bouquet Cyn n/o Copper Hill	4	36,000	20,000	.56	A	19,000	.53	A
13. Bouquet Cyn e/o Plum Cyn	4	36,000	23,000	.64	B	23,000	.64	B
14. Bouquet Cyn e/o Haskell	6	54,000	33,000	.61	B	32,000	.59	A
15. Bouquet Cyn w/o Haskell	6	54,000	49,000	.91	E	49,000	.91	E
16. Bouquet Cyn e/o Seco	6	54,000	53,000	.98	E	54,000	1.00	E
17. Bouquet Cyn w/o Seco	8	72,000	52,000	.72	C	53,000	.74	C
18. Bouquet Cyn s/o Newhall Ranch	8	72,000	75,000	1.04	**F**	77,000	1.07	**F**
19. Bouquet Cyn s/o Soledad	6	54,000	46,000	.85	D	54,000	1.00	E
20. Bouquet Cyn n/o Magic Mtn	6	54,000	48,000	.89	D	54,000	1.00	E
21. Calgrove e/o The Old Road	4	36,000	30,000	.83	D	18,000	.50	A
22. Calgrove w/o Wiley Cyn	4	36,000	19,000	.53	A	19,000	.53	A
23. Calgrove e/o Wiley Cyn	4	36,000	3,000	.08	A	3,000	.08	A
24. Canyon Park e/o Sierra Hwy	4	36,000	22,000	.61	B	19,000	.53	A
25. Castaic n/o Lake Hughes	4	36,000	6,000	.17	A	5,000	.14	A
26. Castaic s/o Lake Hughes	6	54,000	25,000	.46	A	24,000	.44	A
27. Castaic s/o Ridge Route	2	15,000	5,000	.33	A	3,000	.20	A
28. Chiquito Cyn s/o San Martinez Cyn	2	18,000	8,000	.44	A	6,000	.33	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
29. Chiquito Cyn (Long Cyn) n/o SR-126	4	36,000	27,000	.75	C	25,000	.69	B
30. Commerce Center s/o Industry	6	54,000	24,000	.44	A	25,000	.46	A
31. Commerce Center s/o Franklin	6	54,000	39,000	.72	C	39,000	.72	C
32. Commerce Center n/o SR-126	6	54,000	43,000	.80	C	43,000	.80	C
33. Commerce Center s/o Henry Mayo	6	54,000	33,000	.61	B	32,000	.59	A
34. Commerce Center n/o Magic Mtn	6	54,000	37,000	.69	B	36,000	.67	B
35. Copper Hill n/o Newhall Ranch	8	72,000	55,000	.76	C	54,000	.75	C
36. Copper Hill s/o Decoro	6	54,000	54,000	1.00	E	52,000	.96	E
37. Copper Hill n/o Decoro	6	54,000	52,000	.96	E	50,000	.93	E
38. Copper Hill w/o McBean	6	54,000	43,000	.80	C	42,000	.78	C
39. Copper Hill e/o McBean	6	54,000	40,000	.74	C	41,000	.76	C
40. Copper Hill e/o Seco Cyn	4	36,000	29,000	.81	D	30,000	.83	D
41. Copper Hill e/o Haskell	4	36,000	18,000	.50	A	17,000	.47	A
42. Creekside e/o McBean Pkwy	4	36,000	8,000	.22	A	7,000	.19	A
43. Davenport e/o Sierra Hwy	4	36,000	4,000	.11	A	6,000	.17	A
44. Davenport w/o Agua Dulce	4	36,000	3,000	.08	A	3,000	.08	A
45. Decoro e/o Copper Hill	4	36,000	9,000	.25	A	8,000	.22	A
46. Decoro e/o Dickason	4	36,000	14,000	.39	A	14,000	.39	A
47. Decoro e/o McBean	4	36,000	19,000	.53	A	19,000	.53	A
48. Decoro w/o Hillsborough	4	36,000	17,000	.47	A	17,000	.47	A
49. Decoro w/o Seco Cyn	4	36,000	11,000	.31	A	11,000	.31	A
50. Del Valle n/o San Martinez	2	18,000	11,000	.61	B	6,000	.33	A
51. Dickason n/o Newhall Ranch	6	54,000	21,000	.39	A	21,000	.39	A
52. Dockweiler e/o Railroad	4	36,000	22,000	.61	B	18,000	.50	A
53. Dockweiler w/o Sierra Hwy	4	36,000	25,000	.69	B	24,000	.67	B
54. Escondido e/o Agua Dulce	4	36,000	5,000	.14	A	5,000	.14	A
55. Franklin e/o Wolcott Way	2	15,000	8,000	.53	A	8,000	.53	A
56. Franklin w/o Commerce Center	4	36,000	11,000	.31	A	11,000	.31	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
57. Golden Valley s/o Plum Cyn	4	36,000	12,000	.33	A	12,000	.33	A
58. Golden Valley n/o Newhall Ranch	4	36,000	30,000	.83	D	29,000	.81	D
59. Golden Valley n/o Soledad	6	54,000	44,000	.81	D	44,000	.81	D
60. Golden Valley s/o Soledad	6	54,000	30,000	.56	A	29,000	.54	A
61. Golden Valley n/o Centre Point	6	54,000	30,000	.56	A	32,000	.59	A
62. Golden Valley s/o Centre Point	6	54,000	43,000	.80	C	39,000	.72	C
63. Golden Valley s/o Via Princessa	6	54,000	57,000	1.06	**F**	51,000	.94	E
64. Golden Valley e/o Sierra Hwy	6	54,000	39,000	.72	C	36,000	.67	B
65. Golden Valley e/o SR-14	4	36,000	18,000	.50	A	15,000	.42	A
66. Golden Valley e/o Lost Cyn	4	36,000	5,000	.14	A	4,000	.11	A
67. Haskell Cyn n/o Bouquet	4	36,000	12,000	.33	A	13,000	.36	A
68. Hasley Cyn w/o Del Valle	2	18,000	11,000	.61	B	13,000	.72	C
69. Hasley Cyn w/o Commerce Center	4	36,000	17,000	.47	A	14,000	.39	A
70. Hasley Cyn w/o The Old Road	6	54,000	40,000	.74	C	38,000	.70	B
71. Hasley Cyn w/o I-5	6	54,000	35,000	.65	B	34,000	.63	B
72. Henry Mayo e/o Commerce Center	4	36,000	17,000	.47	A	15,000	.42	A
73. Henry Mayo w/o The Old Road	4	36,000	10,000	.28	A	9,000	.25	A
74. Hillcrest w/o The Old Road	4	36,000	18,000	.50	A	17,000	.47	A
75. Jakes Way e/o Canyon Park	2	18,000	18,000	1.00	E	12,000	.67	B
76. Lake Hughes w/o Castaic	6	54,000	43,000	.80	C	37,000	.69	B
77. Lake Hughes e/o Castaic	6	54,000	43,000	.80	C	37,000	.69	B
78. Lake Hughes e/o Ridge Route	2	18,000	12,000	.67	B	7,000	.39	A
79. Long Cyn s/o SR-126	6	54,000	35,000	.65	B	32,000	.59	A
80. Long Cyn s/o River Village	6	54,000	37,000	.69	B	35,000	.65	B
81. Long Cyn n/o Potrero Cyn	6	54,000	33,000	.61	B	31,000	.57	A
82. Long Canyon s/o Potrero Cyn	6	54,000	35,000	.65	B	32,000	.59	A
83. Lost Cyn w/o Sand Cyn	4	36,000	10,000	.28	A	12,000	.33	A
84. Lost Cyn n/o Jakes Way	4	36,000	14,000	.39	A	16,000	.44	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
85. Lost Cyn n/o Canyon Park	6	54,000	14,000	.26	A	16,000	.30	A
86. Lost Cyn n/o Via Princessa	6	54,000	20,000	.37	A	21,000	.39	A
87. Lost Cyn s/o Via Princessa	4	36,000	12,000	.33	A	11,000	.31	A
88. Lost Cyn n/o Golden Valley	4	36,000	14,000	.39	A	12,000	.33	A
89. Lyons e/o I-5	6	54,000	49,000	.91	E	53,000	.98	E
90. Lyons e/o Wiley Cyn	6	54,000	39,000	.72	C	44,000	.81	D
91. Lyons w/o Orchard Village	6	54,000	39,000	.72	C	42,000	.78	C
92. Lyons e/o Orchard Village	6	54,000	49,000	.91	E	52,000	.96	E
93. Lyons w/o Main Street	6	54,000	25,000	.46	A	24,000	.44	A
94. Magic Mtn e/o Long Cyn	4	36,000	18,000	.50	A	18,000	.50	A
95. Magic Mtn w/o Commerce Center	4	36,000	34,000	.94	E	34,000	.94	E
96. Magic Mtn e/o Commerce Center	6	54,000	52,000	.96	E	53,000	.98	E
97. Magic Mtn e/o Westridge	8	72,000	46,000	.64	B	47,000	.65	B
98. Magic Mtn w/o The Old Road	10	90,000	83,000	.92	E	85,000	.94	E
99. Magic Mtn e/o The Old Road	10	90,000	80,000	.89	D	83,000	.92	E
100. Magic Mtn e/o I-5	8	72,000	65,000	.90	D	66,000	.92	E
101. Magic Mtn e/o Tourney	8	72,000	56,000	.78	C	57,000	.79	C
102. Magic Mtn w/o McBean	8	72,000	58,000	.81	D	59,000	.82	D
103. Magic Mtn e/o McBean	8	72,000	50,000	.69	B	54,000	.75	C
104. Magic Mtn w/o Valencia	8	72,000	48,000	.67	B	51,000	.71	C
105. Magic Mtn e/o Valencia	6	54,000	52,000	.96	E	54,000	1.00	E
106. Magic Mtn e/o Bouquet Cyn	6	54,000	46,000	.85	D	46,000	.85	D
107. Magic Mtn n/o Via Princessa	6	54,000	38,000	.70	B	37,000	.69	B
108. McBean n/o Copper Hill	2	18,000	9,000	.50	A	9,000	.50	A
109. McBean s/o Copper Hill	6	54,000	27,000	.50	A	27,000	.50	A
110. McBean n/o Decoro	6	54,000	35,000	.65	B	35,000	.65	B
111. McBean s/o Decoro	6	54,000	37,000	.69	B	38,000	.70	B
112. McBean n/o Newhall Ranch	6	54,000	47,000	.87	D	48,000	.89	D

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
113. McBean s/o Newhall Ranch	8	72,000	55,000	.76	C	58,000	.81	D
114. McBean s/o Ave Scott	8	72,000	73,000	1.01	**F**	77,000	1.07	**F**
115. McBean n/o Magic Mtn	8	72,000	67,000	.93	E	72,000	1.00	E
116. McBean n/o Valencia	8	72,000	59,000	.82	D	63,000	.88	D
117. McBean s/o Valencia	6	54,000	50,000	.93	E	54,000	1.00	E
118. McBean n/o Orchard Village	6	54,000	43,000	.80	C	43,000	.80	C
119. McBean e/o Rockwell Cyn	6	54,000	44,000	.81	D	44,000	.81	D
120. McBean w/o Rockwell Cyn	6	54,000	55,000	1.02	**F**	53,000	.98	E
121. McBean w/o I-5	6	54,000	43,000	.80	C	42,000	.78	C
122. Newhall Ranch e/o I-5	8	72,000	65,000	.90	D	66,000	.92	E
123. Newhall Ranch w/o Rye Cyn	8	72,000	68,000	.94	E	72,000	1.00	E
124. Newhall Ranch e/o Rye Cyn	8	72,000	48,000	.67	B	49,000	.68	B
125. Newhall Ranch w/o McBean	8	72,000	69,000	.96	E	71,000	.99	E
126. Newhall Ranch e/o McBean	8	72,000	65,000	.90	D	68,000	.94	E
127. Newhall Ranch w/o Bouquet Cyn	8	72,000	67,000	.93	E	69,000	.96	E
128. Newhall Ranch e/o Bouquet Cyn	6	54,000	44,000	.81	D	46,000	.85	D
129. Newhall Ranch e/o Santa Clarita	6	54,000	49,000	.91	E	49,000	.91	E
130. Newhall n/o Lyons	4	36,000	2,000	.06	A	1,000	.03	A
131. Newhall s/o Lyons	4	36,000	27,000	.75	C	27,000	.75	C
132. Newhall n/o Valle Oro	6	54,000	39,000	.72	C	33,000	.61	B
133. Newhall n/o Sierra Hwy	6	54,000	47,000	.87	D	40,000	.74	C
134. Newhall s/o Sierra Hwy	6	54,000	58,000	1.07	**F**	50,000	.93	E
135. Oak Ridge e/o Railroad	4	36,000	20,000	.56	A	21,000	.58	A
136. Orchard Village s/o McBean	6	54,000	54,000	1.00	E	54,000	1.00	E
137. Orchard Village s/o Wiley Cyn	6	54,000	43,000	.80	C	44,000	.81	D
138. Orchard Village n/o Lyons	6	54,000	32,000	.59	A	34,000	.63	B
139. Parker e/o Sloan	2	18,000	1,000	.06	A	1,000	.06	A
140. Parker w/o I-5	6	54,000	11,000	.20	A	10,000	.19	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
141. Pico Cyn s/o Valencia	6	54,000	27,000	.50	A	22,000	.41	A
142. Pico Cyn w/o Whispering Oaks	6	54,000	27,000	.50	A	22,000	.41	A
143. Pico Cyn w/o Stevenson Ranch	6	54,000	29,000	.54	A	29,000	.54	A
144. Pico Cyn w/o The Old Road	6	54,000	47,000	.87	D	41,000	.76	C
145. Pico Cyn w/o I-5	6	54,000	45,000	.83	D	44,000	.81	D
146. Placerita Cyn e/o SR-14	4	36,000	8,000	.22	A	4,000	.11	A
147. Plum Cyn s/o Bouquet Cyn	6	54,000	22,000	.41	A	23,000	.43	A
148. Plum Cyn w/o Golden Valley	6	54,000	13,000	.24	A	13,000	.24	A
149. Poe s/o Valencia	4	36,000	5,000	.14	A	5,000	.14	A
150. Poe s/o Mallory	4	36,000	3,000	.08	A	3,000	.08	A
151. Poe w/o Stevenson Ranch	4	36,000	15,000	.42	A	14,000	.39	A
152. Potrero s/o SR-126	4	36,000	11,000	.31	A	9,000	.25	A
153. Potrero w/o Long Cyn	4	36,000	18,000	.50	A	17,000	.47	A
154. Railroad s/o Magic Mtn	6	54,000	50,000	.93	E	54,000	1.00	E
155. Railroad s/o Oak Ridge	6	54,000	41,000	.76	C	40,000	.74	C
156. Railroad n/o 13th St	6	54,000	34,000	.63	B	34,000	.63	B
157. Railroad n/o Lyons	6	54,000	39,000	.72	C	36,000	.67	B
158. Railroad s/o Lyons	4	36,000	28,000	.78	C	26,000	.72	C
159. Rainbow Glen s/o Soledad Cyn	2	15,000	6,000	.40	A	6,000	.40	A
160. Rainbow Glen n/o Via Princessa	2	15,000	9,000	.60	A	11,000	.73	C
161. Ridge Route n/o Lake Hughes	6	54,000	36,000	.67	B	35,000	.65	B
162. Ridge Route n/o Castaic	4	36,000	4,000	.11	A	8,000	.22	A
163. Ridge Route e/o I-5	6	54,000	36,000	.67	B	35,000	.65	B
164. Ridge Route btwn I-5 Ramps	6	54,000	25,000	.46	A	25,000	.46	A
165. Landmark e/o Long Cyn	4	36,000	16,000	.44	A	16,000	.44	A
166. Rockwell Cyn n/o McBean	4	36,000	26,000	.72	C	23,000	.64	B
167. Rye Cyn e/o Ave Scott	6	54,000	47,000	.87	D	49,000	.91	E
168. Rye Cyn w/o Ave Scott	6	54,000	46,000	.85	D	48,000	.89	D

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
169. Rye Cyn e/o The Old Road	7	63,000	57,000	.90	D	58,000	.92	E
170. San Martinez w/o Del Valle	2	15,000	9,000	.60	A	2,000	.13	A
171. San Martinez Grande Cyn n/o VTTM 60678	2	15,000	2,000	.13	A	<500	.00	A
172. San Martinez Grande Cyn n/o SR-126	4	36,000	7,000	.19	A	5,000	.14	A
173. Sand Cyn s/o Sierra Hwy	4	36,000	8,000	.22	A	8,000	.22	A
174. Sand Cyn n/o Soledad Cyn	4	36,000	14,000	.39	A	14,000	.39	A
175. Sand Cyn s/o Soledad Cyn	6	54,000	29,000	.54	A	25,000	.46	A
176. Sand Cyn s/o SR-14	6	54,000	36,000	.67	B	26,000	.48	A
177. Sand Cyn s/o Lost Cyn	2	18,000	15,000	.83	D	14,000	.78	C
178. Santa Clarita s/o Bouquet Cyn	6	54,000	38,000	.70	B	36,000	.67	B
179. Santa Clarita s/o Newhall Ranch	6	54,000	33,000	.61	B	32,000	.59	A
180. Santa Clarita s/o Soledad	6	54,000	31,000	.57	A	30,000	.56	A
181. Santa Clarita s/o Porta Bella	6	54,000	23,000	.43	A	21,000	.39	A
182. Santa Clarita n/o Via Princessa	6	54,000	39,000	.72	C	34,000	.63	B
183. Santa Clarita s/o Via Princessa	6	54,000	47,000	.87	D	38,000	.70	B
184. Santa Clarita w/o Sierra Hwy	6	54,000	48,000	.89	D	39,000	.72	C
185. Seco Cyn n/o Copper Hill	2	18,000	10,000	.56	A	10,000	.56	A
186. Seco Cyn s/o Copper Hill	4	36,000	19,000	.53	A	19,000	.53	A
187. Seco Cyn n/o Bouquet Cyn	4	36,000	33,000	.92	E	34,000	.94	E
188. Shadow Pines n/o Soledad Cyn	4	36,000	14,000	.39	A	12,000	.33	A
189. Shadow Pines n/o Grandifloras	2	18,000	6,000	.33	A	5,000	.28	A
190. Sierra Hwy w/o Agua Dulce	6	54,000	2,000	.04	A	2,000	.04	A
191. Sierra Hwy n/o Davenport	6	54,000	2,000	.04	A	2,000	.04	A
192. Sierra Hwy n/o Vasquez Cyn	6	54,000	15,000	.28	A	16,000	.30	A
193. Sierra Hwy s/o Sand Cyn	6	54,000	19,000	.35	A	17,000	.31	A
194. Sierra Hwy n/o Skyline Ranch	6	54,000	36,000	.67	B	38,000	.70	B
195. Sierra Hwy n/o Soledad Cyn	6	54,000	50,000	.93	E	52,000	.96	E
196. Sierra Hwy s/o Soledad Cyn	6	54,000	37,000	.69	B	36,000	.67	B

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
197. Sierra Hwy s/o Canyon Park	6	54,000	36,000	.67	B	36,000	.67	B
198. Sierra Hwy s/o Via Princessa	6	54,000	32,000	.59	A	30,000	.56	A
199. Sierra Hwy s/o Golden Valley	6	54,000	28,000	.52	A	25,000	.46	A
200. Sierra Hwy n/o Dockweiler	6	54,000	43,000	.80	C	40,000	.74	C
201. Sierra Hwy n/o Newhall	6	54,000	27,000	.50	A	23,000	.43	A
202. Sierra Hwy s/o Newhall	6	54,000	42,000	.78	C	33,000	.61	B
203. Sierra Hwy n/o SR-14	6	54,000	37,000	.69	B	30,000	.56	A
204. Skyline Ranch e/o Plum Cyn	4	36,000	15,000	.42	A	15,000	.42	A
205. Skyline Ranch w/o Sierra Hwy	4	36,000	19,000	.53	A	18,000	.50	A
206. Sloan Cyn e/o The Old Road	6	54,000	26,000	.48	A	22,000	.41	A
207. Sloan Cyn e/o Parker	4	36,000	1,000	.03	A	1,000	.03	A
208. Sloan Cyn w/o Parker	4	36,000	2,000	.06	A	2,000	.06	A
209. Sloan Cyn s/o Hillcrest	2	18,000	4,000	.22	A	3,000	.17	A
210. Smyth s/o Copper Hill	4	30,000	8,000	.27	A	8,000	.27	A
211. Soledad Cyn e/o Bouquet Cyn	6	54,000	42,000	.78	C	45,000	.83	D
212. Soledad Cyn w/o Golden Valley	6	54,000	38,000	.70	B	38,000	.70	B
213. Soledad Cyn e/o Golden Valley	6	54,000	48,000	.89	D	50,000	.93	E
214. Soledad Cyn e/o Rainbow Glen	6	54,000	43,000	.80	C	43,000	.80	C
215. Soledad Cyn w/o Whites Cyn	6	54,000	38,000	.70	B	38,000	.70	B
216. Soledad Cyn e/o Whites Cyn	6	54,000	43,000	.80	C	44,000	.81	D
217. Soledad Cyn e/o Sierra Hwy	6	54,000	39,000	.72	C	34,000	.63	B
218. Soledad Cyn w/o Sand Cyn	6	54,000	24,000	.44	A	22,000	.41	A
219. Soledad Cyn e/o Sand Cyn	6	54,000	34,000	.63	B	31,000	.57	A
220. Soledad Cyn e/o SR-14 (at Sand Cyn)	6	54,000	21,000	.39	A	18,000	.33	A
221. Soledad Cyn w/o Shadow Pines	6	54,000	12,000	.22	A	10,000	.19	A
222. Soledad Cyn e/o Shadow Pines	6	54,000	22,000	.41	A	17,000	.31	A
223. Soledad Cyn e/o SR-14	4	36,000	13,000	.36	A	10,000	.28	A
224. Soledad Cyn w/o Agua Dulce	4	36,000	4,000	.11	A	4,000	.11	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
225. Soledad Cyn e/o Agua Dulce	4	36,000	3,000	.08	A	3,000	.08	A
226. SR-126 at County Line	4	44,000	33,000	.75	C	32,000	.73	C
227. SR-126 w/o San Martinez Grande Cyn	4	44,000	34,000	.77	C	33,000	.75	C
228. SR-126 w/o Chiquito Cyn/Long Cyn	4	44,000	39,000	.89	D	38,000	.86	D
229. SR-126 w/o Wolcott	6	66,000	58,000	.88	D	59,000	.89	D
230. SR-126 w/o Commerce Center	8	88,000	64,000	.73	C	66,000	.75	C
231. SR-126 w/o I-5	8	88,000	73,000	.83	D	75,000	.85	D
232. Stevenson Ranch w/o Old Road	6	54,000	30,000	.56	A	33,000	.61	B
233. Stevenson Ranch n/o Poe	6	54,000	8,000	.15	A	11,000	.20	A
234. Stevenson Ranch n/o Pico Cyn	6	54,000	11,000	.20	A	13,000	.24	A
235. The Old Road n/o I-5 (at Lake Hughes)	4	36,000	10,000	.28	A	11,000	.31	A
236. The Old Road n/o Sloan Cyn	6	54,000	24,000	.44	A	20,000	.37	A
237. The Old Road n/o Parker	4	36,000	4,000	.11	A	3,000	.08	A
238. The Old Road n/o Hillcrest	4	36,000	14,000	.39	A	13,000	.36	A
239. The Old Road n/o Sedona Way	4	36,000	25,000	.69	B	23,000	.64	B
240. The Old Road n/o Hasley Cyn	4	36,000	24,000	.67	B	23,000	.64	B
241. The Old Road s/o Hasley Cyn	6	54,000	18,000	.33	A	16,000	.30	A
242. The Old Road n/o Biscailuiz	6	54,000	20,000	.37	A	18,000	.33	A
243. The Old Road n/o Turnberry	6	54,000	20,000	.37	A	17,000	.31	A
244. The Old Road n/o Henry Mayo	6	54,000	23,000	.43	A	21,000	.39	A
245. The Old Road s/o Henry Mayo	6	54,000	19,000	.35	A	16,000	.30	A
246. The Old Road n/o Rye Cyn	6	54,000	49,000	.91	E	48,000	.89	D
247. The Old Road n/o Magic Mtn	6	54,000	54,000	1.00	E	52,000	.96	E
248. The Old Road s/o Magic Mtn	6	54,000	33,000	.61	B	30,000	.56	A
249. The Old Road s/o Valencia	6	54,000	47,000	.87	D	41,000	.76	C
250. The Old Road s/o McBean	6	54,000	41,000	.76	C	35,000	.65	B
251. The Old Road s/o Pico	4	36,000	20,000	.56	A	9,000	.25	A
252. The Old Road n/o Calgrove	4	36,000	24,000	.67	B	13,000	.36	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
253. The Old Road s/o Calgrove	6	54,000	24,000	.44	A	20,000	.37	A
254. Tibbitts s/o Newhall Ranch	6	54,000	34,000	.63	B	34,000	.63	B
255. Tibbitts n/o Magic Mtn	6	54,000	32,000	.59	A	32,000	.59	A
256. Tournament s/o McBean	2	18,000	6,000	.33	A	7,000	.39	A
257. Tourney n/o Valencia	4	36,000	15,000	.42	A	14,000	.39	A
258. Valencia e/o Magic Mtn	6	54,000	55,000	1.02	**F**	51,000	.94	E
259. Valencia e/o Pico Cyn	6	54,000	31,000	.57	A	33,000	.61	B
260. Valencia e/o Poe	6	54,000	29,000	.54	A	30,000	.56	A
261. Valencia w/o Westridge	6	54,000	44,000	.81	D	46,000	.85	D
262. Valencia w/o The Old Road	7	63,000	60,000	.95	E	61,000	.97	E
263. Valencia e/o Old Road	8	72,000	59,000	.82	D	61,000	.85	D
264. Valencia e/o I-5	8	72,000	66,000	.92	E	68,000	.94	E
265. Valencia e/o Tourney	8	72,000	57,000	.79	C	59,000	.82	D
266. Valencia w/o McBean	8	72,000	60,000	.83	D	61,000	.85	D
267. Valencia e/o McBean	6	54,000	47,000	.87	D	53,000	.98	E
268. Valencia w/o Citrus	6	54,000	51,000	.94	E	53,000	.98	E
269. Valencia s/o Magic Mtn	6	54,000	47,000	.87	D	48,000	.89	D
270. Valencia n/o Magic Mtn	6	54,000	61,000	1.13	**F**	60,000	1.11	**F**
271. Valencia s/o Cinema	6	54,000	58,000	1.07	**F**	59,000	1.09	**F**
272. Valencia w/o Bouquet Cyn	6	54,000	51,000	.94	E	50,000	.93	E
273. Valley s/o Lyons	4	36,000	10,000	.28	A	11,000	.31	A
274. Vasquez Cyn e/o Bouquet Cyn	2	18,000	6,000	.33	A	6,000	.33	A
275. Vasquez Cyn w/o Sierra Hwy	2	18,000	11,000	.61	B	10,000	.56	A
276. Via Princessa e/o Oak Ridge	6	54,000	37,000	.69	B	37,000	.69	B
277. Via Princessa e/o Magic Mtn	6	54,000	54,000	1.00	E	52,000	.96	E
278. Via Princessa e/o Santa Clarita	6	54,000	66,000	1.22	**F**	66,000	1.22	**F**
279. Via Princessa w/o Rainbow Glen	6	54,000	23,000	.43	A	27,000	.50	A
280. Via Princessa e/o Rainbow Glen	6	54,000	26,000	.48	A	29,000	.54	A

(Continued)

Table 4-1: ADT V/C and LOS – Current General Plan Buildout Conditions vs OVOV Buildout Conditions (Continued)

Roadway Segment	Lanes	Capacity	Current GP			OVOV GP		
			Volume	V/C	LOS	Volume	V/C	LOS
281. Via Princessa s/o Whites Cyn	6	54,000	55,000	1.02	**F**	52,000	.96	E
282. Via Princessa s/o Sierra Hwy	6	54,000	44,000	.81	D	41,000	.76	C
283. Via Princessa n/o Lost Cyn	6	54,000	23,000	.43	A	24,000	.44	A
284. Via Princessa s/o Lost Cyn	6	54,000	4,000	.07	A	3,000	.06	A
285. Westridge s/o Magic Mtn	4	36,000	13,000	.36	A	12,000	.33	A
286. Westridge n/o Valencia	4	36,000	11,000	.31	A	9,000	.25	A
287. Whites Cyn s/o Skyline Ranch	6	54,000	19,000	.35	A	19,000	.35	A
288. Whites Cyn n/o Soledad	6	54,000	43,000	.80	C	42,000	.78	C
289. Whites Cyn s/o Soledad	6	54,000	50,000	.93	E	48,000	.89	D
290. Wiley Cyn e/o Orchard Village	6	54,000	38,000	.70	B	42,000	.78	C
291. Wiley Cyn e/o Tournament	6	54,000	29,000	.54	A	32,000	.59	A
292. Wiley Cyn n/o Lyons	6	54,000	31,000	.57	A	34,000	.63	B
293. Wiley Cyn s/o Lyons	4	36,000	17,000	.47	A	20,000	.56	A
294. Wiley Cyn n/o Calgrove	4	36,000	19,000	.53	A	19,000	.53	A
295. Wolcott n/o SR-126	2	15,000	6,000	.40	A	6,000	.40	A
296. Wolcott s/o SR-126	4	36,000	13,000	.36	A	14,000	.39	A
297. 13th St e/o Railroad	2	15,000	14,000	.93	E	11,000	.73	C
298. 16th St e/o Orchard Village	4	36,000	9,000	.25	A	9,000	.25	A

LOS in **Bold** exceeds performance criteria.

Number of Occurrences

LOS	Current GP	OVOV GP
A-C	222	226
D	36	26
E	30	41
F	10	5

Level of service ranges: .00 - .60 A .61 - .70 B .71 - .80 C
.81 - .90 D .91 – 1.00 E Above 1.00 F

Table 4-2: Buildout ICU Summary for Principal Intersections – Existing Lanes

Existing Intersection Lanes								
	Current GP				OVOV GP			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
Intersection	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
1. The Old Road & Rye Canyon	1.58	**F**	2.31	**F**	1.74	**F**	2.30	**F**
2. The Old Road & Magic Mountain	1.15	**F**	1.45	**F**	1.18	**F**	1.48	**F**
3. The Old Road & Valencia	.85	D	.95	E	.84	D	.95	E
4. The Old Road & McBean	.72	C	1.05	**F**	.69	B	1.12	**F**
5. The Old Road & Pico Canyon	1.05	**F**	1.08	**F**	.93	E	.99	E
6. Rye/Copper Hill & Newhall Ranch	.85	D	.89	D	.81	D	.89	D
7. McBean & Newhall Ranch	.80	C	.91	E	.83	D	.93	E
8. McBean & Magic Mountain	.87	D	1.21	**F**	.97	E	1.24	**F**
9. McBean & Valencia	.70	B	.89	D	.71	C	.94	E
10. Orchard Village & McBean	.91	E	1.23	**F**	.94	E	1.26	**F**
11. Orchard Village & Wiley Canyon	1.00	E	1.42	**F**	1.04	**F**	1.42	**F**
12. Valencia & Magic Mountain	.98	E	1.13	**F**	1.10	**F**	1.25	**F**
13. Bouquet Canyon & Plum Canyon	.80	C	.76	C	.80	C	.77	C
14. Bouquet Canyon & Newhall Ranch	1.02	**F**	1.16	**F**	1.00	E	1.17	**F**
15. Bouquet Canyon & Soledad Canyon	.72	C	1.03	**F**	.72	C	1.03	**F**
16. Railroad & Lyons	.62	B	.81	D	.54	A	.72	C
17. Sierra Highway & Newhall	1.31	**F**	1.29	**F**	1.16	**F**	1.15	**F**
18. Whites Canyon & Soledad Canyon	.89	D	.92	E	.86	D	.91	E
19. Sierra Highway & Soledad Canyon	.90	D	1.23	**F**	.86	D	1.10	**F**
20. Commerce Center & Magic Mountain	.76	C	.74	C	.76	C	.77	C
21. Pico Canyon & Valencia Boulevard	.85	D	.98	E	.75	C	.81	D
22. Magic Mountain & Via Princessa	.57	A	.80	C	.61	A	.79	C
23. Golden Valley & Via Princessa	.91	E	.83	D	.88	D	.76	C

LOS in **Bold** exceeds performance criteria of LOS E.

Number of Occurrences

LOS	Current GP	OVOV GP
A-C	11	13
D	10	8
E	8	9
F	17	16

Level of service ranges: .00 - .60 A .61 - .70 B .71 - .80 C
.81 - .90 D .91 – 1.00 E Above 1.00 F

Table 4-3: Buildout ICU Summary for Principal Intersections – Buildout Lanes

Buildout Intersection Lanes								
Intersection	Current GP				OVOV GP			
	AM Peak Hour		PM Peak Hour		AM Peak Hour		PM Peak Hour	
	ICU	LOS	ICU	LOS	ICU	LOS	ICU	LOS
1. The Old Road & Rye Canyon	.70	B	1.00	E	.85	D	.99	E
2. The Old Road & Magic Mountain	.79	C	.84	D	.78	C	.86	D
3. The Old Road & Valencia	.85	D	.92	E	.84	D	.95	E
4. The Old Road & McBean	.68	B	.95	E	.65	B	.90	D
5. The Old Road & Pico Canyon	.96	E	1.07	**F**	.85	D	.97	E
6. Rye/Copper Hill & Newhall Ranch	.85	D	.89	D	.81	D	.89	D
7. McBean & Newhall Ranch	.80	C	.88	D	.83	D	.89	D
8. McBean & Magic Mountain	.75	C	.93	E	.77	C	.95	E
9. McBean & Valencia	.66	B	.85	D	.70	B	.87	D
10. Orchard Village & McBean	.79	C	.97	E	.78	C	.98	E
11. Orchard Village & Wiley Canyon	.74	C	.98	E	.78	C	.98	E
12. Valencia & Magic Mountain	.83	D	.95	E	.82	D	.86	D
13. Bouquet Canyon & Plum Canyon	.80	C	.76	C	.80	C	.77	C
14. Bouquet Canyon & Newhall Ranch	.94	E	.87	D	.89	D	.89	D
15. Bouquet Canyon & Soledad Canyon	.72	C	.94	E	.72	C	.94	E
16. Railroad & Lyons	.62	B	.81	D	.54	A	.72	C
17. Sierra Highway & Newhall	1.11	**F**	.98	E	.89	D	.84	D
18. Whites Canyon & Soledad Canyon	.80	C	.92	E	.80	C	.90	D
19. Sierra Highway & Soledad Canyon	.88	D	.88	D	.86	D	.89	D
20. Commerce Center & Magic Mountain	.76	C	.74	C	.76	C	.77	C
21. Pico Canyon & Valencia Boulevard	.85	D	.98	E	.75	C	.81	D
22. Magic Mountain & Via Princessa	.57	A	.80	C	.61	B	.81	D
23. Golden Valley & Via Princessa	.91	E	.83	D	.88	D	.76	C

LOS in **Bold** exceeds performance criteria of LOS E.

Number of Occurrences

LOS	Current GP	OVOV GP
A-C	17	17
D	13	22
E	14	7
F	2	0

Level of service ranges: .00 - .60 A .61 - .70 B .71 - .80 C
.81 - .90 D .91 – 1.00 E Above 1.00 F

Descriptions of the roadway and intersection improvements needed to build out the proposed Highway Plan are provided in the following Section.

4.2.1 Arterial Roadway Segments

Section 1.2.1 discusses the Performance Criteria for Arterial Streets and Intersections used for this analysis, and that the maximum acceptable LOS on arterial roads within the OVOV planning area is LOS E. The traffic model forecasts indicate that the OVOV land use buildout conditions exceed LOS E (i.e., LOS F conditions) for the following five roadway segments:

- Bouquet Canyon Road between Newhall Ranch Road and Soledad Canyon Road (#18)
- McBean Parkway between Avenue Scott and Creekside Road (#114)
- Valencia Boulevard between Creekside Road and Magic Mountain Parkway (#270)
- Valencia Boulevard between Cinema Drive and Creekside Road (#271)
- Via Princessa between Santa Clarita Parkway and Golden Valley Road (#278)

In comparison, traffic model forecasts for the current City General Plan/County Area Plan buildout conditions indicate that LOS E is exceeded at the following 10 roadway segments:

- Bouquet Canyon Road between Newhall Ranch Road and Soledad Canyon Road (#18)
- Golden Valley Road between Via Princessa and Sierra Highway (#63)
- McBean Parkway between Avenue Scott and Creekside Road (#114)
- McBean Parkway between the I-5 freeway and Rockwell Canyon Road (#120)
- Newhall Avenue between Sierra Highway and SR-14 freeway (#134)
- Valencia Boulevard between Pico Canyon Road and Magic Mountain Parkway (West) (#258)
- Valencia Boulevard between Creekside Road and Magic Mountain Parkway (#270)
- Valencia Boulevard between Cinema Drive and Creekside Road (#271)
- Via Princessa between Santa Clarita Parkway and Golden Valley Road (#278)
- Via Princessa between Whites Canyon Road and Sierra Highway (#281)

In total, the proposed OVOV land uses result in five fewer LOS F roadway segments in comparison to the current City General Plan/County Area Plan traffic forecasts. In each case, the deficient locations with the proposed OVOV land uses are shown to be otherwise forecast as LOS F based

on the current City General Plan/County Area Plan.

4.2.2 Arterial Intersections

Intersection LOS estimates for the proposed OVOV land uses and for the current City General Plan/County Area Plan, for both existing and future intersection geometry, was presented in the previously referenced Table 4-2 and Table 4-3. The forecasts indicate multiple deficiencies based on the existing intersection geometry. Intersection improvements that are consistent with the proposed Highway Plan, details of which are provided in the following Section, result in conditions of LOS E or better for the proposed OVOV land uses at all principal intersections. In comparison, the current City General Plan/County Area Plan results in LOS F conditions at two principal intersections. An illustration of intersection LOS conditions based on both the proposed OVOV land uses and the current City General Plan/County Area Plan is provided in Figure 4-7.

Overall, intersection operations are shown to improve with the proposed OVOV land uses in comparison to forecast conditions based on the current City General Plan/County Area Plan. As shown in the previously referenced table, the average ICU at principal intersections decreases by .02 with the proposed OVOV land uses. In the a.m. peak hour, the average ICU decreases from .80 to .78, and in the p.m. peak hour, the average ICU decreases from .90 to .88.

Both the City and the County have specific requirements regarding the LOS of intersections outlined in their traffic impact study guidelines. Each say that a change in ICU value of .01 or more for LOS E and F conditions, or a change of .02 or more for LOS D conditions, represents a significant impact at the individual project level. Furthermore, the County also says that a change of .04 or more for LOS C conditions represents a significant impact at the individual project level, as stated in the current Traffic Impact Analysis Guidelines of the County Department of Public Works. While not applied for long-range planning studies such as this, these guidelines provide an indication of the significant impacts to be expected as the OVOV area builds out over time. This analysis indicates that each of the principal intersections, with the exception of Bouquet Canyon Road at Plum Canyon Road, will be significantly impacted at some point as the Valley builds out in accordance with the proposed OVOV land uses. Mitigation measures in addition to the future lane configurations identified in this study are likely not feasible due to right-of-way constraints. However, with the proposed OVOV land uses no intersection is forecast to exceed LOS E, while two intersections are forecast to exceed LOS E based on traffic model forecasts for the current City General Plan/County Area Plan.

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INTERSECTION LEVEL OF SERVICE COMPARISON - PRINCIPAL INTERSECTIONS

Figure 4-7

4.3 FUTURE IMPROVEMENTS

Roadway improvements in the form of roadway widening and intersection improvements will be needed to build out the proposed Highway Plan. Table 4-4 lists the improvements needed to implement the recommended Highway Plan as illustrated in the previously referenced Figure 3-2. Table 4-5 summarizes the corresponding intersection lane improvements needed to achieve conditions of LOS E or better.

4.4 FREEWAY ANALYSIS

A planning level analysis has been prepared for select freeway segments within the OVOV area. The purpose of the analysis is to compare conditions based on the proposed OVOV land uses to traffic forecasts based on the current City General Plan/County Area Plan.

4.4.1 I-5 Freeway

The I-5 freeway is listed as a "high priority corridor" on the National Highway System (NHS). The corridor serves inter-regional travel in the north-south direction from California's most southern border with Mexico to Washington's most northern border with Canada. Within the OVOV area, the I-5 freeway is classified as an urban interstate (see Reference 4 in Section 1.5).

The I-5 freeway generally consists of four mix-flow lanes in each direction through the OVOV area. Through the SR-14 interchange area, the I-5 freeway consists of three mix-flow lanes in each direction along with two dedicated truck bypass lanes which are separated from the mainline lanes. Several interchanges provide access to the freeway as described in Section 2.1. A truck weigh station facility operated by the California Highway Patrol is located on the northbound side of the I-5 freeway just south of the SR-126 interchange. High Occupancy Vehicle (HOV) lanes have recently been constructed just south of the Santa Clarita Valley.

Caltrans planning documents have identified the I-5 freeway through this area as needing additional lanes to accommodate existing and anticipated increases in traffic volumes. Caltrans District 7 currently proposes to add additional lanes to the I-5 freeway between the SR-14 interchange and the Parker Road interchange, a distance of approximately 13.6 miles (see Reference 5 in Section 1.5). The project proposes to extend the existing HOV lanes from the SR-14 interchange to just south of the Parker Road interchange, incorporate truck climbing lanes from the SR-14 interchange to the Pico Canyon

Table 4-4: Roadway Improvements to Build-Out the Highway Plan

Roadway/Segment	Improvement	Comments
Agua Dulce Canyon Road		
Between Sierra Highway and Escondido Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between Escondido Canyon Road and Davenport Road	Construct new 4 lane Secondary Highway	Gap closure segment
Between Davenport Road and Soledad Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Avenue Scott		
Between Rye Canyon Road and Avenue Tibbitts	Re-stripe roadway from 4 lanes to 6 lanes	
Avenue Tibbitts		
Between Avenue Scott and Avenue Hopkins	Re-stripe roadway from 4 lanes to 6 lanes	
Between Avenue Hopkins and Magic Mountain Parkway	Construct new 6 lane Major Highway	Includes new bridge over the Santa Clara River
Bouquet Canyon Road		
Between Angeles National Forest and Plum Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	Includes realignment in the Copper Hill Drive area
Between Plum Canyon and future Santa Clarita Parkway	Re-stripe roadway from 4 lanes to 6 lanes	Will lose the existing Class II bike lane due to re-striping
Between future Santa Clarita Parkway and Seco Canyon Road	Re-stripe roadway from 5 lanes to 6 lanes	Will lose the existing Class II bike lane due to re-striping
Between Seco Canyon Road and Espuella Drive	Widen roadway from 6 lanes to an 8 lane Major Highway	Includes bride widening
Between Soledad Canyon Road and Magic Mountain Parkway	Re-stripe roadway from 4 lanes to 6 lanes	
Castaic Road		
Between Lake Hughes Road and Ridge Route Road	Re-stripe roadway from 4 lanes to 6 lanes	
Commerce Center Drive		
Between Henry Mayo Drive and Magic Mountain Parkway	Construct new 6 lane Major Highway	Includes new bridge over the Santa Clara River
Copper Hill Drive		
Between Avenida Rancho Tesoro and San Francisquito Creek Bridge	Re-stripe roadway from 4 lanes to 6 lanes	
Between San Francisquito Creek Bridge and McBean Parkway	Widen roadway from 4 lanes to a 6 lane Major Highway	Includes widening bridge over the San Francisquito Creek
Davenport Road		
Between Sierra Highway and Agua Dulce Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Dockweiler Drive		
Between Railroad Avenue and Leonard Tree Lane	Construct new 4 lane Secondary Highway	
Between Leonard Tree Lane and Sierra Highway	Re-stripe roadway from 2 lanes to 4 lanes	Will lose the existing on-street parking due to re-striping

(Continued)

Table 4-4: Roadway Improvements to Build-Out the Highway Plan (Continued)

Roadway/Segment	Improvement	Comments
Escondido Canyon Road		
east of Agua Dulce Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Golden Valley Road		
Between Plum Canyon Road and Dorothy Street	Re-stripe roadway from 2 lanes to 4 lanes	
Between Dorothy Street and Newhall Ranch Road	Construct new 4 lane Secondary Highway	
Between Newhall Ranch Road and Valley Center Drive	Construct new 6 lane Major Highway	Includes new bridge over the Santa Clara River
Between Valley Center Drive and Center Pointe Parkway	Re-stripe roadway from 4 lanes to 6 lanes	
Between Center Pointe Parkway and Sierra Highway	Widen roadway from 4 lanes to a 6 lane Major Highway	
Between SR-14 freeway and Via Princessa	Construct new 4 lane Secondary Highway	
Haskell Canyon Road		
Between Copper Hill Drive and Grovepark Drive/Ridgegrove Drive	Re-stripe roadway from 2 lanes to 4 lanes	
Henry Mayo Drive		
Between Commerce Center Drive and The Old Road	Widen roadway from 2 lanes to a 4 lane Parkway	
Lake Hughes Road		
Between I-5 freeway and Castaic Road	Re-stripe roadway from 4 lanes to 6 lanes	
Long Canyon Road (future)		
Between Chiquito Canyon Road and SR-126	Construct new 4 lane Secondary Highway	
Between SR-126 and Valencia Boulevard	Construct new 6 lane Major Highway	Includes new bridge over the Santa Clara River
Lost Canyon Road		
Between Sand Canyon Road and La Veda Avenue	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between La Veda Avenue and Jakes Way	Construct new 4 lane Secondary Highway	
Between Jakes Way and railroad bridge	Construct new 6 lane Major Highway	
Between railroad bridge and Via Princessa	Re-stripe roadway from 4 lanes to 6 lanes	
Lyons Avenue		
Between Orchard Village Road and Railroad Avenue	Re-stripe roadway from 4 lanes to 6 lanes	Will lose the existing on-street parking due to re-striping

(Continued)

Table 4-4: Roadway Improvements to Build-Out the Highway Plan (Continued)

Roadway/Segment	Improvement	Comments
Magic Mountain Parkway		
Between Long Canyon Road and Commerce Center Drive	Construct new 4 lane Secondary Highway	
Between Commerce Center Drive and Westridge Parkway	Construct new 6 lane Major Highway	
Between Westridge Parkway and Six Flags Magic Mountain	Construct new 8 lane Major Highway	
Between Six Flags Magic Mountain and I-5 freeway	Widen roadway from 4 lanes to an 8 lane Major Highway	
Between I-5 freeway and Auto Center Drive	Re-stripe roadway from 6 lanes to 8 lanes	
Between Auto Center Drive and Valencia Boulevard	Widen roadway from 4 lanes to an 8 lane Major Highway	
Between Valencia Boulevard and Railroad Avenue	Re-stripe roadway from 4 lanes to 6 lanes	
Between Railroad Avenue and Via Princessa	Construct new 6 lane Major Highway	
McBean Parkway		
Between San Francisquito Canyon Road and Copper Hill Drive	Construct new 2 lane Limited Secondary Highway	
Between Avenue Scott and Creekside Road	Widen roadway from 6 lanes to an 8 lane Major Highway	Includes widening bridge over the Santa Clara River
Between Magic Mountain Parkway and Valencia	Re-stripe roadway from 6 lanes to 8 lanes	
Newhall Ranch Road		
Between Rye Canyon Road and Avenue Tibbitts	Widen roadway from 4 lanes to an 8 lane Major Highway	
Between Avenue Tibbitts and McBean Parkway	Widen roadway from 6 lanes to an 8 lane Major Highway	Includes widening bridge over the San Francisquito Creek
Between McBean Parkway and Bouquet Canyon Road	Re-stripe roadway from 7 lanes to 8 lanes	
Between Bouquet Canyon Road and Santa Clarita Parkway	Re-stripe roadway from 4 lanes to 6 lanes	
Between Santa Clarita Parkway and Golden Valley Road	Construct new 6 lane Major Highway	
Newhall Avenue		
Between 16th Street and Railroad Avenue	Re-stripe roadway from 2 lanes to 4 lanes	Will lose the existing on-street parking due to re-striping

(Continued)

Table 4-4: Roadway Improvements to Build-Out the Highway Plan (Continued)

Roadway/Segment	Improvement	Comments
The Old Road		
north of Lake Hughes Road	Re-stripe roadway from 2 lanes to 4 lanes	
Between Lake Hughes Road and Sedona Way	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between Hasley Canyon Road and I-5 SB Ramps at Rye Canyon Road	Widen roadway from 4 lanes to a 6 lane Major Highway	
Between I-5 SB Ramps at Rye Canyon Road and Rye Canyon Road	Re-stripe roadway from 4 lanes to 6 lanes	
Between Rye Canyon Road and Magic Mountain Parkway	Widen roadway from 4 lanes to a 6 lane Major Highway	Includes widening bridge over the Santa Clara River
Between McBean Parkway and Lyons Avenue	Re-stripe roadway from 4 lanes to 6 lanes	
Between Sagecrest Circle (South) and Calgrove Boulevard	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between Calgrove Boulevard and Sierra Highway	Widen roadway from 4 lanes to a 6 lane Major Highway	
Orchard Village Road		
Between McBean Parkway and Lyons Avenue	Widen roadway from 4 lanes to a 6 lane Major Highway	
Parker Road		
Between The Old Road and I-5 freeway	Widen roadway from 2 lanes to a 6 lane Major Highway	
Pico Canyon Road		
Between Valencia Boulevard and Whispering Oaks Road	Construct new 6 lane Major Highway	
Between Whispering Oaks Road and I-5 freeway	Re-stripe roadway from 4 lanes to 6 lanes	
Placerita Canyon Road		
Between SR-14 freeway and Sand Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Plum Canyon Road		
Between Bouquet Canyon Road and Golden Valley Road	Re-stripe roadway from 4 lanes to 6 lanes	
Potrero Canyon Road (future)		
Between SR-126 and Long Canyon Road	Construct new 4 lane Secondary Highway	Includes new bridge over the Santa Clara River
Railroad Avenue		
Between Magic Mountain Parkway and Lyons Avenue	Re-stripe roadway from 4 lanes to 6 lanes	
Ridge Route Road		
Between I-5 freeway and Castaic Road	Widen roadway from 2 lanes to a 6 lane Major Highway	

(Continued)

Table 4-4: Roadway Improvements to Build-Out the Highway Plan (Continued)

Roadway/Segment	Improvement	Comments
Sand Canyon Road		
Between Sierra Highway and Soledad Canyon Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between SR-14 freeway and Lost Canyon Road	Widen roadway from 2 lanes to a 6 lane Major Highway	Includes widening bridge over the Santa Clara River
Santa Clarita Parkway (future)		
Between Bouquet Canyon Road and Sierra Highway	Construct new 6 lane Major Highway	Includes new bridge over the Santa Clara River
Shadow Pines Boulevard/Tick Canyon Road		
Between Grandifloras Road and Davenport Road	Construct new 2 lane Limited Secondary Highway	
Sierra Highway		
east of Agua Dulce Canyon Road	Widen roadway from 2 lanes to a 6 lane Major Highway	
Between Agua Dulce Canyon Road and Vasquez Canyon Road	Widen roadway from 2 lanes to a 6 lane Major Highway	
Between Vasquez Canyon and Soledad Canyon	Widen roadway from 4 lanes to a 6 lane Major Highway	
Between Via Princessa and Newhall Avenue	Re-stripe roadway from 4 lanes to 6 lanes	
Between Newhall Avenue and The Old Road	Widen roadway from 4 lanes to a 6 lane Major Highway	
Skyline Ranch Road (future)		
Between Whites Canyon Road and Sierra Highway	Construct new 4 lane Secondary Highway	
Sloan Canyon Road		
Between The Old Road and Parker Road	Widen roadway from 2 lanes to a 4 lane Secondary Highway	
Between Parker Road and Quail Valley Road	Re-stripe roadway from 2 lanes to 4 lanes	
Between Hillcrest Parkway and Hasley Canyon Road	Construct new 2 lane Limited Secondary Highway	
Soledad Canyon Road		
Between River Circle and SR-14 freeway	Re-stripe roadway from 4 lanes to 6 lanes	Will lose the existing Class II bike lane due to re-striping
east of SR-14 freeway	Widen roadway from 2 lanes to a 6 lane Major Highway	
Stevenson Ranch Parkway		
Between The Old Road and Pico Canyon Road	Re-stripe roadway from 4 lanes to 6 lanes	Will lose the existing Class II bike lane due to re-striping

(Continued)

Table 4-4: Roadway Improvements to Build-Out the Highway Plan (Continued)

Roadway/Segment	Improvement	Comments
Valencia Boulevard		
Between Long Canyon Road and existing Valencia Boulevard terminus just west of Boulder Crest Drive	Construct new 6 lane Major Highway	
Between I-5 freeway and McBean Parkway	Reconstruct roadway from 7 lanes to an 8 lane Major Highway	
Via Princessa		
Between existing Via Princessa terminus just east of Claibourne Court and existing Via Princessa terminus just west of Sheldon Avenue	Construct new 6 lane Major Highway	Gap closure segment
Between Sheldon Avenue and Rainbow Glen Drive	Widen roadway from 2 lanes to a 6 lane Major Highway	
Between Rainbow Glen Drive and Whites Canyon Road	Re-stripe roadway from 4 lanes to 6 lanes	
Between SR-14 freeway and Lost Canyon Road	Re-stripe roadway from 4 lanes to 6 lanes	
Between Golden Valley Road and the existing Via Princessa terminus just south of Swan Lane and	Construct new 4 lane Secondary Highway	
Whites Canyon Road		
Between Ashboro Drive and Soledad Canyon Road	Re-stripe roadway from 4 lanes to 6 lanes	
Wiley Canyon Road		
Bridge over Railroad Avenue	Widen roadway from 4 lanes to a 6 lane Major Highway	Includes bridge widening
Between bridge over Railroad Avenue and Lyons Avenue	Re-stripe roadway from 4 lanes to 6 lanes	Will lose the existing Class II bike lane due to re-striping
Between Lyons Avenue and Wabuska Street	Widen roadway from 4 lanes to a 6 lane Major Highway	
Between Wabuska Street and Calgrove Boulevard	Widen roadway from 2 lanes to a 6 lane Major Highway	

Table 4-5: Intersection Improvements to Build-Out the Highway Plan

Intersection	Improvement	Comments
1. The Old Road & Rye Canyon Road	Add 2nd & 3rd northbound through lanes Add 2nd southbound left-turn lane Add 3rd southbound through lane Add 2nd & 3rd westbound left-turn lanes	County intersection
2. The Old Road & Magic Mountain Parkway	Add 2nd northbound left-turn lane Add 3rd northbound through lane Add 2nd southbound left-turn lane Add 3rd southbound through lane Add 1st southbound right-turn lane Add 2nd eastbound left-turn lane Add 3rd, 4th & 5th eastbound through lanes Add 2nd westbound left-turn lane Add 4th westbound through lane	County intersection; Under construction
3. The Old Road & Valencia Boulevard	Modify traffic signal to provide eastbound right-turn overlap phasing	County intersection
4. The Old Road & McBean Parkway	Add 2nd southbound left-turn lane Add 1st westbound right-turn lane	County intersection
5. The Old Road & Pico Canyon Road	Add 2nd northbound left-turn lane Convert southbound right-turn lane to 2nd southbound through lane Convert westbound right-turn lane to 3rd westbound through lane	County intersection
6. Rye Canyon Road/Copper Hill Road & Newhall Ranch Road	None	City intersection; Existing geometry sufficient for build-out conditions
7. McBean Parkway & Newhall Ranch Road	Add 4th westbound through lane	City intersection
8. McBean Parkway & Magic Mountain Parkway	Add 4th northbound through lane Add 3rd eastbound through lane Add 3rd westbound through lane	City intersection
9. McBean Parkway & Valencia Boulevard	Convert 1st northbound right-turn lane to 4th northbound through lane Add 4th westbound through lane	City intersection Will require ROW on north side of Valencia, east of McBean, to relocate the existing westbound right-turn lane.
10. Orchard Village Road & McBean Parkway	Add 1st eastbound right-turn lane	City intersection; North leg (hospital driveway) to be improved by site development Will require ROW from HMNMH site to realign McBean.

(Continued)

Table 4-5: Intersection Improvements to Build-Out the Highway Plan (Continued)

Intersection	Improvement	Comments
11. Orchard Village Road & Wiley Canyon Road	Add 3rd northbound through lane Convert 1st southbound through lane to 2nd southbound left-turn lane Convert southbound right-turn lane to 2nd southbound through lane (shared through/right) Convert 2nd eastbound left-turn lane to 3rd eastbound through lane Convert westbound right-turn lane to 3rd westbound through lane (shared through/right)	City intersection No ROW required but placing new through lanes on Orchard Village adjacent to the curb (e.g., north of Wiley Cyn Road) requires removing the trees adjacent to the curb lane. Also requires removal of Bike Lane from westbound Wiley Cyn Road.
12. Valencia Boulevard & Magic Mountain Parkway	Add 1st northbound right-turn lane Add 3rd eastbound through lane Add 2nd westbound left-turn lane Convert westbound right-turn lane to 3rd westbound through lane (shared through/right)	City intersection Will require ROW on south side of Magic Mtn., east and west of Valencia, and on east side of Valencia, south of Magic Mtn.
13. Bouquet Canyon Road & Plum Canyon Road	None	City intersection; Existing geometry sufficient for build-out conditions
14. Bouquet Canyon Road & Newhall Ranch Road	Add 2nd southbound left-turn lane Add 3rd & 4th eastbound through lanes Add 4th westbound through lane	City intersection
15. Bouquet Canyon Road & Soledad Canyon Road	Add 4th northbound through lane	City intersection Will require ROW on east side of Bouquet, south of Soledad, to relocate the existing northbound right-turn lane.

(Continued)

Table 4-5: Intersection Improvements to Build-Out the Highway Plan (Continued)

Intersection	Improvement	Comments
16. Railroad Avenue & Lyons Avenue	Add 2nd northbound left-turn lane Add 1st & 2nd southbound left-turn lanes Add 2nd southbound right-turn lane Add 3rd eastbound left-turn lane Add 1st eastbound through lane Convert eastbound right-turn lane to 2nd eastbound through lane (shared through/right) Add 1st westbound left-turn lane Add 1st, 2nd & 3rd westbound through lanes Add 1st westbound right-turn lane	City intersection; Lanes per Downtown Newhall Specific Plan Will require ROW on north and south sides of Lyons, and on west side of Railroad, north of Lyons.
17. Sierra Highway & Newhall Avenue	Add 1st & 2nd northbound right-turn lanes Add 2nd westbound left-turn lane	City intersection; Can remove the existing 2nd northbound left-turn lane and the westbound right-turn lane. Will require ROW on east side of Sierra, south of Newhall. May require ROW on east side of Sierra, just north of Newhall.
18. Whites Canyon Road & Soledad Canyon Road	Convert northbound right-turn lane to 3rd northbound through lane (shared through/right) Convert southbound right-turn lane to 3rd southbound through lane (shared through/right)	City intersection Will require ROW on west side of Whites Cyn, south of Soledad Cyn.
19. Sierra Highway & Soledad Canyon Road	Convert northbound right-turn lane to 3rd northbound through lane (shared through/right) Add 2nd southbound left-turn lane Convert southbound right-turn lane to 3rd southbound through lane (shared through/right) Convert eastbound right-turn lane to 3rd eastbound through lane (shared through/right)	City intersection Will require ROW on east side of Sierra, north of Soledad Cyn.
20. Commerce Center Drive & Magic Mountain Parkway	Add 1st & 2nd southbound left-turn lanes Add 1st southbound right-turn lane Add 1st & 2nd eastbound left-turn lanes Add 1st, 2nd & 3rd eastbound through lanes Add 1st, 2nd & 3rd westbound through lanes Add 1st westbound free-flow right-turn lane	Future County intersection
21. Pico Canyon Road & Valencia Boulevard	Add 1st & 2nd northbound left-turn lanes Add 1st northbound right-turn lane Add 1st, 2nd & 3rd eastbound through lanes (3rd through is shared through/right) Add 1st westbound left-turn lane Add 1st, 2nd & 3rd westbound through lanes	Future County intersection

(Continued)

Table 4-5: Intersection Improvements to Build-Out the Highway Plan (Continued)

22. Magic Mountain Parkway & Via Princessa	Add 1st northbound left-turn lane Add 1st northbound through lane Add 1st northbound right-turn lane Add 1st & 2nd southbound left-turn lanes Add 1st southbound through lane Add 1st southbound right-turn lane Add 1st eastbound left-turn lane Add 1st, 2nd & 3rd eastbound through lanes (3rd through is shared through/right) Add 1st westbound left-turn lane Add 1st, 2nd & 3rd westbound through lanes Add 1st westbound free-flow right-turn lane	Future City intersection
23. Golden Valley Road & Via Princessa	Add 1st & 2nd northbound left-turn lane Add 1st, 2nd & 3rd northbound through lanes Add 1st northbound right-turn lane Add 1st & 2nd southbound left-turn lane Add 1st, 2nd & 3rd southbound through lanes Add 1st southbound right-turn lane Add 1st & 2nd eastbound left-turn lane Add 1st, 2nd & 3rd eastbound through lanes Add 1st & 2nd eastbound right-turn lanes Add 1st & 2nd westbound left-turn lanes Add 1st, 2nd & 3rd westbound through lanes Add 1st westbound right-turn lane	Future City intersection

Road/Lyons Avenue interchange, and construct and/or extend auxiliary lanes between interchanges at six locations. A Project Approval and Environmental Document (PA&ED) has recently been completed for this project, but funding for construction has not been secured.

4.4.2 SR-14 Freeway

The SR-14 freeway, in conjunction with US 395, is one of the four major north-south corridors serving California. The corridor connects the Eastern Sierra and Western Nevada regions to the Southern California region. The Caltrans "Interregional Transportation Strategic Plan" identifies the SR-14/US-395 corridor as a "High Emphasis - Focus Route" (see Reference 6 in Section 1.5). The SR-14 freeway is designated as a Super Truck Route (STR), and is also part of the Surface Transportation Assistance Act (STAA) truck network, which provides freeway access for oversized trucks. Within Caltrans District 7, the SR-14 freeway serves as a major commuter route between Antelope Valley communities such as the Cities of Palmdale and Lancaster and the Los Angeles area.

Within the OVOV area, the SR-14 freeway generally consists of three to six lanes in each direction, including one HOV lane in each direction. From the I-5 freeway to the Newhall Avenue interchange, there are five mix-flow lanes and one HOV lane in each direction; from the Newhall Avenue interchange to the Golden Valley Road interchange, there are three mix-flow lanes and one HOV lane in each direction; from the Golden Valley Road interchange to the Sierra Highway interchange, there are four mix-flow lanes and one HOV lane in each direction; from the Sierra Highway interchange to the Sand Canyon Road interchange, there are three mix-flow lanes and one HOV lane in each direction; from the Sand Canyon Road interchange to the Soledad Canyon Road interchange, there are two mix-flow lanes and one HOV lane in each direction; and from the Soledad Canyon Road interchange to the Escondido Canyon Road interchange, there are three mix-flow lanes and one HOV lane in each direction.

The North County Combined Highway Corridors Study (see Reference 7 in Section 1.5), a joint study sponsored in part by the Los Angeles County Metropolitan Transportation Agency (Metro), Caltrans, the County of Los Angeles, and the City of Santa Clarita, identified the SR-14 freeway through the OVOV area as needing additional lanes to accommodate existing and anticipated increases in traffic volumes. The study identified a short-range plan to complete the mainline to a minimum of three lanes in each direction, and a long-range plan to complete the mainline to four lanes in each direction between the Newhall Avenue interchange and the Sand Canyon interchange, and to add a dedicated truck lane between the I-5 freeway and the Placerita Canyon Road interchange. The study also identified a short-

range plan to convert the existing HOV lanes to a reversible HOV lane configuration that would provide three HOV lanes in the peak travel direction. However, subsequent planning efforts by Caltrans and Metro have focused on utilizing two conventional (i.e., non-reversible) HOV lanes in each direction in-lieu of reversible HOV lanes.

Caltrans is currently constructing HOV lane direct connectors between the existing SR-14 HOV lanes and the existing I-5 HOV lanes. This project is estimated to be completed by 2013.

4.4.3 Freeway Traffic Volumes and LOS

A summary of traffic volumes for ADT, a.m. peak hour, and p.m. peak hour conditions is provided in Table 4-6 for six key freeway segments within the OVOV area. Calculations of demand to capacity (D/C) ratios are provided in Appendix E, and the corresponding LOS is summarized in Table 4-7. The freeway LOS estimates are calculated based on both the existing number of freeway lanes and the planned future lanes. In the case of the I-5 freeway, the planned future lanes are based on the I-5 HOV and Truck Lane project discussed in Section 4.4.1. In the case of the SR-14 freeway, the planned future lanes are based on the short-range plan outlined in the Metro study discussed in Section 4.4.2.

The freeway LOS summarized in the previously referenced Table 4-7 indicates that with the proposed OVOV land uses, freeway conditions are the same or one level of service better than with the current City General Plan/County Area Plan. When the future freeway lanes are taken into account, deficiencies occur with the current City General Plan/County Area Plan on the SR-14 freeway in the peak direction (i.e., southbound in the a.m. peak hour and northbound in the p.m. peak hour). With the proposed OVOV land uses, deficiencies are still expected to occur, although to a lesser extent and at fewer segments due to lower freeway traffic volumes.

4.5 CONGESTION MANAGEMENT PROGRAM ANALYSIS

The Los Angeles County Congestion Management Program (CMP) (See Reference 8 in Section 1.5) states that only development projects are subject to the CMP Land Use Analysis Program and the CMP Transportation Impact Analysis. As such, a literal CMP analysis is not required for the General Plan/Area Plan update.

Table 4-6: Freeway Volume Summary

Segment	ADT	AM Peak Hour		PM Peak Hour	
		NB	SB	NB	SB
I-5 south of Parker Interchange					
Existing Conditions	110,000	1,860	2,190	3,570	3,070
Current GP	240,000	5,140	6,950	8,760	7,980
Proposed OVOV GP	239,000	4,090	6,770	8,770	7,640
I-5 south of Valencia Interchange					
Existing Conditions	179,000	5,430	5,310	6,050	6,420
Current GP	269,000	8,540	9,970	9,730	10,320
Proposed OVOV GP	259,000	7,860	8,200	9,190	10,300
I-5 north of SR-14 Interchange					
Existing Conditions	202,000	5,600	6,610	6,970	6,410
Current GP	308,000	8,710	10,430	10,530	10,800
Proposed OVOV GP	269,000	7,540	7,380	8,700	10,480
SR-14 south of Aqua Dulce Interchange					
Existing Conditions	110,000	1,970	5,580	5,130	2,810
Current GP	200,000	4,260	11,970	11,300	5,190
Proposed OVOV GP	158,000	2,700	11,780	10,590	3,350
SR-14 south of Sierra Highway Interchange					
Existing Conditions	152,000	2,510	7,090	7,500	3,380
Current GP	279,000	5,020	15,330	15,430	7,100
Proposed OVOV GP	217,000	3,900	14,350	13,580	5,150
SR-14 north of I-5 Interchange					
Existing Conditions	176,000	2,950	8,350	8,430	4,100
Current GP	316,000	6,320	16,170	16,250	8,490
Proposed OVOV GP	230,000	5,100	13,920	13,390	6,820

Table 4-7: Freeway Level of Service Summary

Segment	AM Peak Hour		PM Peak Hour	
	NB	SB	NB	SB
Existing Freeway Lanes				
I-5 south of Parker Interchange				
Existing Conditions	A	A	B	B
Current GP	C	D	**F**	E
Proposed OVOV GP	C	D	**F**	E
I-5 south of Valencia Interchange				
Existing Conditions	C	C	D	D
Current GP	**F**	**F**	**F**	**F**
Proposed OVOV GP	E	**F**	**F**	**F**
I-5 north of SR-14 Interchange				
Existing Conditions	A	**F**	D	E
Current GP	**F**	**F**	**F**	**F**
Proposed OVOV GP	E	**F**	**F**	**F**
SR-14 south of Aqua Dulce Interchange				
Existing Conditions	A	C	C	B
Current GP	C	**F**	**F**	C
Proposed OVOV GP	B	**F**	**F**	B
SR-14 south of Sierra Highway Interchange				
Existing Conditions	A	C	D	B
Current GP	B	**F**	**F**	C
Proposed OVOV GP	B	**F**	**F**	C
SR-14 north of I-5 Interchange				
Existing Conditions	A	C	C	B
Current GP	C	**F**	**F**	C
Proposed OVOV GP	B	**F**	**F**	C
Future Freeway Lanes				
I-5 south of Parker Interchange				
Current GP	C	C	D	D
Proposed OVOV GP	B	C	D	D
I-5 south of Valencia Interchange				
Current GP	D	E	E	E
Proposed OVOV GP	D	D	E	E
I-5 north of SR-14 Interchange				
Current GP	D	D	E	D
Proposed OVOV GP	C	C	D	D
SR-14 south of Aqua Dulce Interchange				
Current GP	B	**F**	**F**	C
Proposed OVOV GP	A	**F**	**F**	B
SR-14 south of Sierra Highway Interchange				
Current GP	B	**F**	**F**	C
Proposed OVOV GP	B	**F**	**F**	B
SR-14 north of I-5 Interchange				
Current GP	B	**F**	**F**	C
Proposed OVOV GP	B	E	E	B

LOS in **Bold** exceeds performance criteria of LOS E.

CMP roadways within the OVOV area consist of the following:

- I-5 Freeway
- SR-14 Freeway
- SR-126 Expressway
- Sierra Highway from Newhall Avenue to the SR-14 freeway at Red Rover Mine Road
- Magic Mountain Parkway from the I-5 freeway to Railroad Avenue
- Railroad Avenue/Newhall Avenue from Magic Mountain Parkway to the SR-14 freeway

Section 4.2 shows that each of the CMP arterial roadways achieves the CMP LOS target of LOS E or better with the proposed OVOV land uses. Section 4.4.3 shows that the I-5 freeway achieves the CMP LOS target of LOS E or better with the proposed OVOV land uses. The SR-14 freeway is anticipated to operate at LOS F conditions in the peak direction with either the current City General Plan/County Area Plan or with the proposed OVOV land uses. However, with the proposed OVOV land uses, traffic volumes on the SR-14 freeway are lower and there are fewer segments at LOS F than with the current City General Plan/County Area Plan.

4.6 ALTERNATIVES ANALYSIS

Multiple alternative scenarios have been evaluated. The first consists of downgrading vacant land by one land use category (i.e., reducing the allowable density) for areas designated as Urban Residential. The second is referred to as the Preservation Corridor Alternative and consists of designating approximately 5,968 acres as RL10 (single-family homes at a density not to exceed 1 du/10 acres) instead of RL2 and RL5 (single-family homes at a density not to exceed 1 du/2 acres and 1 du/5 acres, respectively). The third is referred to as the Transit Corridor/Increased Employment Opportunity Alternative and consists of designating approximately 809 acres as H30 (multi-family housing at a minimum density of 18 and maximum density of 30 du/acre) and IO (office, research and development, light assembly and fabrication, warehousing and distribution, and supportive commercial uses) instead of H2 (single-family homes and other residential uses at a density not to exceed 2 du/acre) and RL10.

Table 4-8, Table 4-9, and Table 4-10 show that these alternatives change the total amount of trip generation within the OVOV planning area by -1.9 percent, -0.7 percent, and 4.9 percent, respectively.

Table 4-8: Alternative 1 Trip Generation Summary

Downgrading Vacant by One Land Use Category for Urban Residential							
Proposed OVOV Land Uses [1]				Alternative OVOV Land Uses [1]			
Land Use	Units		ADT	Land Use	Units		ADT
UR1	1,458	DU	14,434	NU5	729	DU	7,217
UR2	3,180	DU	31,482	UR1	1,272	DU	12,593
UR3	4,025	DU	32,200	UR2	1,830	DU	18,117
UR4	785	DU	6,280	UR3	480	DU	3,840
UR5	6,150	DU	49,200	UR4	3,690	DU	29,520
Total	15,598	DU	133,596	Total	8,001	DU	71,287
				Difference			-62,309

Total OVOV Buildout ADT Tripend Generation:	3,288,386
Change due to Alternative (from above)	-62,309
Total OVOV Alternative ADT Tripend Generation:	3,226,077
Percent change in ADT Tripend Generation:	-1.9%

[1] Vacant Urban Residential only

Table 4-9: Alternative 2 Trip Generation Summary

Preservation Corridor Alternative							
Proposed OVOV Land Uses				Alternative OVOV Land Uses			
Land Use	Units		ADT	Land Use	Units		ADT
RL2	2,613	DU	25,866	RL10	597	DU	5,908
RL5	148	DU	1,469				
Total	2,761	DU	27,335	Total			5,908
				Difference			-21,427

Total OVOV Buildout ADT Tripend Generation:	3,288,386
Change due to Alternative (from above)	-21,427
Total OVOV Alternative ADT Tripend Generation:	3,266,959
Percent change in ADT Tripend Generation:	-0.7%

Table 4-10: Alternative 3 Trip Generation Summary

Transit Corridor/Increased Employment Opportunity Alternative							
Proposed OVOV Land Uses				Alternative OVOV Land Uses			
Land Use	Units		ADT	Land Use	Units		ADT
H2	215	DU	2,129	H30(1)	16,251	DU	121,070
RL10	70	DU	693	IO(2)	267.098	acres	41,536
Total	285	DU	2,822	Total			162,606
				Difference			159,784

Total OVOV Buildout ADT Tripend Generation:	3,288,386
Change due to Alternative (from above)	159,784
Total OVOV Alternative ADT Tripend Generation:	3,448,170
Percent change in ADT Tripend Generation:	4.9%

(1) assumed 50% apartments, 50% condominiums
(2) assumed .35 FAR

Appendix A

INTERSECTION CAPACITY UTILIZATION WORKSHEETS – OFF SITE

Peak hour intersection volume/capacity ratios are calculated by means of intersection capacity utilization (ICU) values. ICU calculations were performed for the intersections shown in Figure A-1.

The procedure is based on the critical movement methodology, and shows the amount of capacity utilized by each critical move. A "de-facto" right-turn lane is used in the ICU calculation for cases where a curb lane is wide enough to separately serve both through and right-turn traffic (typically with a width of 19 feet from curb to outside of through-lane with parking prohibited during peak periods). Such lanes are treated the same as striped right-turn lanes during the ICU calculations, but they are denoted on the ICU calculation worksheets using the letter "d" in place of a numerical entry for right-turn lanes.

The methodology also incorporates a check for right-turn capacity utilization. Both right-turn-on-green (RTOG) and right-turn-on-red (RTOR) capacity availability are calculated and checked against the total right-turn capacity need. If insufficient capacity is available, then an adjustment is made to the total capacity utilization value. The following example shows how this adjustment is made.

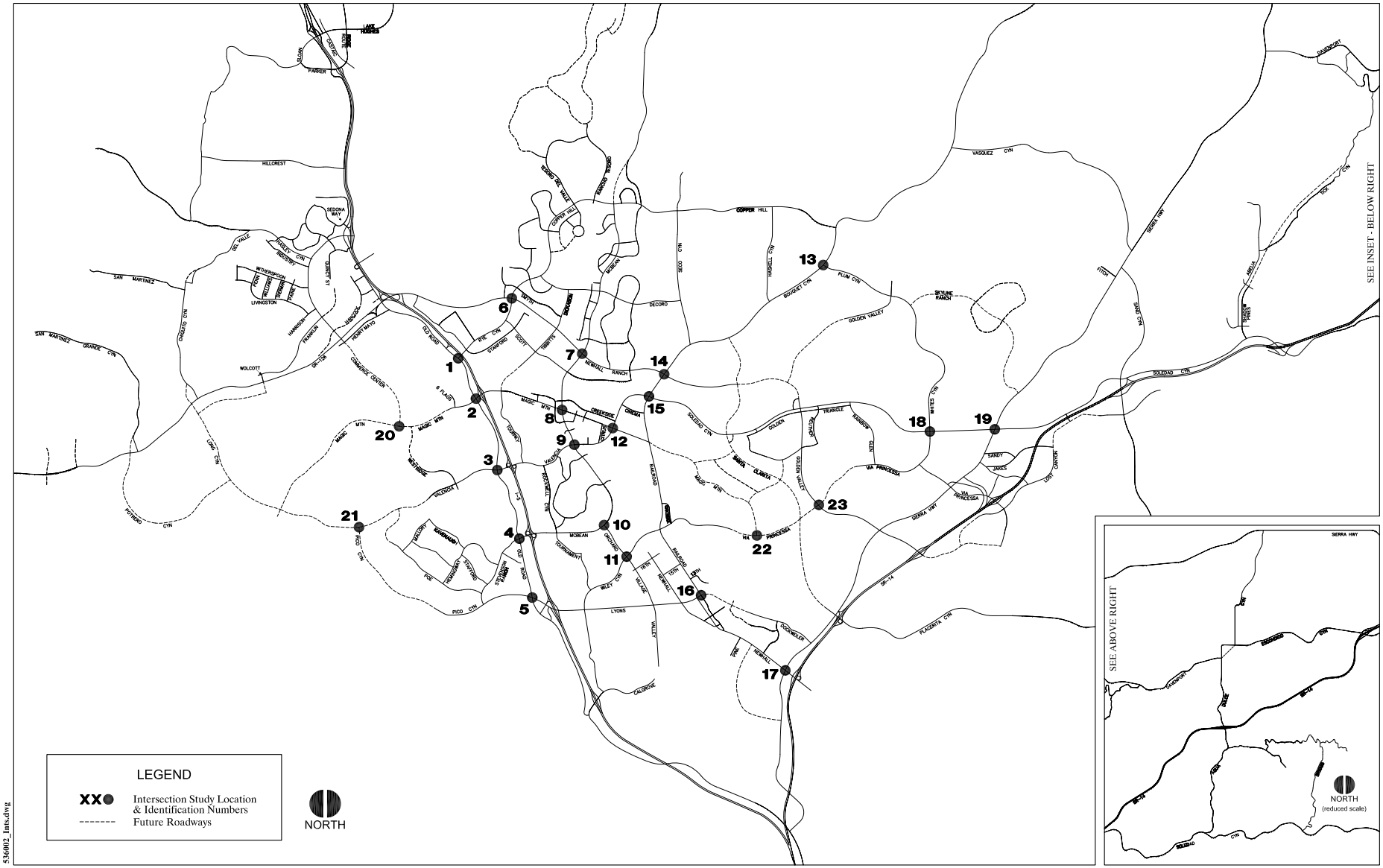
Example of Right-turn Capacity Utilization For Northbound Right

1. Right-Turn-On-Green (RTOG)

If NBT is critical move, then:
RTOG = V/C (NBT)
Otherwise,
RTOG = V/C (NBL) + V/C (SBT) - V/C (SBL)

2. Right-Turn-On-Red (RTOR)

If WBL is critical move, then:
RTOR = V/C (WBL)
Otherwise,
RTOR = V/C (EBL) + V/C (WBT) - V/C (EBT)



536002_Ints.dwg

STUDY AREA INTERSECTION IDENTIFICATION NUMBERS

Figure A-1

3. Right-Turn Overlap Adjustment

If the northbound right is assumed to overlap with the adjacent westbound left, adjustments to the RTOG and RTOR values are made as follows:

RTOG = RTOG + V/C (WBL)
RTOR = RTOR - V/C (WBL)

4. Total Right-Turn Capacity (RTC) Availability For NBR

RTC = RTOG + factor x RTOR
Where factor = RTOR saturation flow factor (typically 75%)

5. Right-turn Adjustment for ICU Calculation

Right-turn adjustment is then as follows: Additional ICU = V/C (NBR) - RTC

A zero or negative value indicates that adequate capacity is available and no adjustment is necessary. A positive value indicates that the available RTOR and RTOG capacity does not adequately accommodate the right-turn V/C, therefore the right-turn is essentially considered to be a critical movement. In such cases, the right-turn adjustment is noted on the ICU worksheet and it is included in the total capacity utilization value. When it is determined that a right-turn adjustment is required for more than one right-turn movement, the word "multi" is printed on the worksheet instead of an actual right-turn movement reference, and the right-turn adjustments are cumulatively added to the total capacity utilization value. In such cases, further operational evaluation is typically carried out to determine if under actual operational conditions, the critical right-turns would operate simultaneously, and therefore a right-turn adjustment credit should be applied.

Shared Lane V/C Methodology

For intersection approaches where shared usage of a lane is permitted by more than one turn movement (e.g., left/through, through/right, left/through/right), the individual turn volumes are evaluated to determine whether dedication of the shared lane is warranted to any one given turn movement. The following example demonstrates how this evaluation is carried out:

Example of Shared Lane Utilization for Shared Left/Through Lane

1. Average Lane Volume (ALV)

$$ALV = \frac{\text{Left-Turn Volume + Through Volume}}{\text{Total Left + Through Approach Lanes (including shared lane)}}.$$

2. ALV for Each Approach

$$ALV\ (Left) = \frac{\text{Left-Turn Volume}}{\text{Left Approach Lanes (including shared lane)}}.$$

$$ALV\ (Through) = \frac{\text{Through Volume}}{\text{Through Approach Lanes (including shared lane)}}.$$

3. Lane Dedication is Warranted

If ALV (Left) is greater than ALV then full dedication of the shared lane to the left-turn approach is warranted. Left-turn and through V/C ratios for this case are calculated as follows:

$$V/C\ (Left) = \frac{\text{Left-Turn Volume}}{\text{Left Approach Capacity (including shared lane)}}.$$

$$V/C\ (Through) = \frac{\text{Through Volume}}{\text{Through Approach Capacity (excluding shared lane)}}.$$

Similarly, if ALV (Through) is greater than ALV then full dedication to the through approach is warranted, and left-turn and through V/C ratios are calculated as follows:

$$V/C\ (Left) = \frac{\text{Left-Turn Volume}}{\text{Left Approach Capacity (excluding shared lane)}}.$$

$$V/C\ (Through) = \frac{\text{Through Volume}}{\text{Through Approach Capacity (including shared lane)}}.$$

4. Lane Dedication is not Warranted

If ALV (Left) and ALV (Through) are both less than ALV, the left/through lane is assumed to be truly shared and each left, left/through or through approach lane carries an evenly distributed volume of traffic equal to ALV. A combined left/through V/C ratio is calculated as follows:

$$\text{V/C (Left/Through)} = \frac{\text{Left-Turn Volume + Through Volume}}{\text{Total Left + Through Approach Capacity (including shared lane)}}.$$

This V/C (Left/Through) ratio is assigned as the V/C (Through) ratio for the critical movement analysis and ICU summary listing.

If split phasing has not been designated for this approach, the relative proportion of V/C (Through) that is attributed to the left-turn volume is estimated as follows:

If approach has more than one left-turn (including shared lane), then:

$$\text{V/C (Left)} = \text{V/C (Through)}$$

If approach has only one left-turn lane (shared lane), then:

$$\text{V/C (Left)} = \frac{\text{Left-Turn Volume}}{\text{Single Approach Lane Capacity}}.$$

If this left-turn movement is determined to be a critical movement, the V/C (Left) value is posted in brackets on the ICU summary printout.

These same steps are carried out for shared through/right lanes. If full dedication of a shared through/right lane to the right-turn movement is warranted, the right-turn V/C value calculated in step three is checked against the RTOR and RTOG capacity availability if the option to include right-turns in the V/C ratio calculations is selected. If the V/C value that is determined using the shared lane methodology described here is reduced due to RTOR and RTOG capacity availability, the V/C value for the through/right lanes is posted in brackets.

When an approach contains more than one shared lane (e.g., left/through and through/right), steps one and two listed above are carried out for the three turn movements combined. Step four is carried out if dedication is not warranted for either of the shared lanes. If dedication of one of the shared lanes is warranted to one movement or another, step three is carried out for the two movements involved, and then steps one through four are repeated for the two movements involved in the other shared lane.

1. The Old Road & Rye Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	1	1600	292	.18*	259	.16*
NBR	f		801		748	
SBL	1	1600	232	.15*	268	.17*
SBT	2	3200	214	.07	270	.08
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	234	.15*	423	.26*
WBT	0	0	0		0	
WBR	f		1192		1237	
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.58** **.69**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	1	1600	1180	.74*	1350	.84*
NBR	f		1590		1280	
SBL	1	1600	280	.18*	980	.61*
SBT	2	3200	430	.13	990	.31
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	890	.56*	1220	.76*
WBT	0	0	0		0	
WBR	f		950		1270	
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **1.58** **2.31**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	1	1600	1060	.66*	1300	.81*
NBR	f		1640		1330	
SBL	1	1600	700	.44*	890	.56*
SBT	2	3200	450	.14	870	.27
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	1	1600	860	.54*	1320	.83*
WBT	0	0	0		0	
WBR	f		910		1250	
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **1.74** **2.30**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	3	4800	1180	.25*	1350	.28*
NBR	2	3200	1590	.50	1280	.40
SBL	2	2880	280	.10*	980	.34*
SBT	3	4800	430	.09	990	.21
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	3	4320	890	.21*	1220	.28*
WBT	0	0	0		0	
WBR	2	3200	950	.30	1270	.40
Right Turn Adjustment			NBR	.04*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for WBR NBR

TOTAL CAPACITY UTILIZATION **.70** **1.00**

1. The Old Road & Rye Canyon

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	3	4800	1060	.22*	1300	.27*
NBR	2	3200	1640	.51	1330	.42
SBL	2	2880	700	.24*	890	.31*
SBT	3	4800	450	.09	870	.18
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	0	0	0		0	
EBR	0	0	0		0	
WBL	3	4320	860	.20*	1320	.31*
WBT	0	0	0		0	
WBR	2	3200	910	.28	1250	.39
Right Turn Adjustment			NBR	.09*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for WBR NBR

TOTAL CAPACITY UTILIZATION	**.85**	**.99**

2. The Old Road & Magic Mountain

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		13	.01	17	.01
NBT	1.5	4800	560	.18*	551	.17*
NBR	1	1600	89	.06	215	.13
SBL	1.5		181		351	
SBT	1.5	4800	359	.11*	558	.19*
SBR	0		1		2	
EBL	1	1600	38	.02	12	.01
EBT	2	3200	21	.01*	48	.02*
EBR	1	1600	4	.00	7	.00
WBL	1	1600	130	.08*	170	.11*
WBT	3	4800	5	.00	6	.00
WBR	f		1303		1199	
Clearance Interval				.10*		.10*
Note: Assumes N/S Split Phasing						
TOTAL CAPACITY UTILIZATION				**.48**		**.59**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		470		440	
NBT	1.5	4800	580	.22*	400	.18*
NBR	1	1600	120	.08	110	.07
SBL	1.5		670		520	.33
SBT	1.5	4800	100	.23*	640	.40*
SBR	0		320		840	.52
EBL	1	1600	510	.32	500	.31
EBT	2	3200	1620	.51*	2180	.68*
EBR	1	1600	190	.12	570	.36
WBL	1	1600	150	.09*	140	.09*
WBT	3	4800	1020	.21	1380	.29
WBR	f		1460		1480	
Clearance Interval				.10*		.10*
Note: Assumes N/S Split Phasing						
TOTAL CAPACITY UTILIZATION				**1.15**		**1.45**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		400		430	
NBT	1.5	4800	540	.20*	390	.17*
NBR	1	1600	140	.09	130	.08
SBL	1.5		630		480	.30
SBT	1.5	4800	120	.23*	650	.41*
SBR	0		340		870	.54
EBL	1	1600	540	.34	520	.33
EBT	2	3200	1720	.54*	2230	.70*
EBR	1	1600	140	.09	540	.34
WBL	1	1600	180	.11*	160	.10*
WBT	3	4800	1020	.21	1490	.31
WBR	f		1390		1460	
Clearance Interval				.10*		.10*
Note: Assumes N/S Split Phasing						
TOTAL CAPACITY UTILIZATION				**1.18**		**1.48**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	470	.16	440	.15*
NBT	3	4800	580	.12*	400	.08
NBR	1	1600	120	.08	110	.07
SBL	2	2880	670	.23*	520	.18
SBT	2.5	6400	100	.03	640	.20*
SBR	1.5		320	.10	840	
EBL	2	2880	510	.18*	500	.17*
EBT	5	8000	1620	.20	2180	.27
EBR	1	1600	190	.12	570	.36
WBL	2	2880	150	.05	140	.05
WBT	4	6400	1020	.16*	1380	.22*
WBR	f		1460		1480	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.79**		**.84**

2. The Old Road & Magic Mountain

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	400	.14	430	.15*
NBT	3	4800	540	.11*	390	.08
NBR	1	1600	140	.09	130	.08
SBL	2	2880	630	.22*	480	.17
SBT	2.5	6400	120	.04	650	.20*
SBR	1.5		340		870	.27
EBL	2	2880	540	.19*	520	.18*
EBT	5	8000	1720	.22	2230	.28
EBR	1	1600	140	.09	540	.34
WBL	2	2880	180	.06	160	.06
WBT	4	6400	1020	.16*	1490	.23*
WBR	f		1390		1460	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.78**		**.86**

3. The Old Road & Valencia

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	486	.17*	261	.09
NBT	3	4800	345	.07	766	.16*
NBR	1	1600	69	.04	432	.27
SBL	2	2880	159	.06	379	.13*
SBT	3	4800	306	.06*	765	.16
SBR	1	1600	164	.10	145	.09
EBL	2	2880	210	.07*	206	.07
EBT	4	6400	579	.09	377	.06*
EBR	1	1600	183	.11	175	.11
WBL	2	2880	298	.10	463	.16*
WBT	3	4800	679	.14*	388	.08
WBR	f		363		463	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.54**		**.61**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	770	.27*	470	.16*
NBT	3	4800	390	.08	740	.15
NBR	1	1600	110	.07	510	.32
SBL	2	2880	140	.05	400	.14
SBT	3	4800	270	.06*	700	.15*
SBR	1	1600	170	.11	210	.13
EBL	2	2880	290	.10*	230	.08*
EBT	4	6400	2200	.34	1600	.25
EBR	1	1600	420	.26	780	.49
WBL	2	2880	90	.03	490	.17
WBT	3	4800	1520	.32*	2080	.43*
WBR	f		370		540	
Right Turn Adjustment					EBR	.03*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.85**		**.95**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	730	.25*	430	.15*
NBT	3	4800	300	.06	620	.13
NBR	1	1600	110	.07	420	.26
SBL	2	2880	130	.05	320	.11
SBT	3	4800	200	.04*	760	.16*
SBR	1	1600	200	.13	210	.13
EBL	2	2880	300	.10*	240	.08*
EBT	4	6400	2380	.37	1790	.28
EBR	1	1600	370	.23	750	.47
WBL	2	2880	90	.03	480	.17
WBT	3	4800	1610	.34*	2190	.46*
WBR	f		350		570	
Right Turn Adjustment			SBR	.01*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.84**		**.95**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	770	.27*	470	.16*
NBT	3	4800	390	.08	740	.15
NBR	1	1600	110	.07	510	.32
SBL	2	2880	140	.05	400	.14
SBT	3	4800	270	.06*	700	.15*
SBR	1	1600	170	.11	210	.13
EBL	2	2880	290	.10*	230	.08*
EBT	4	6400	2200	.34	1600	.25
EBR	1	1600	420	.26	780	.49
WBL	2	2880	90	.03	490	.17
WBT	3	4800	1520	.32*	2080	.43*
WBR	f		370		540	
Clearance Interval				.10*		.10*
Note: Assumes Right-Turn Overlap for EBR						
TOTAL CAPACITY UTILIZATION				**.85**		**.92**

3. The Old Road & Valencia

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	730	.25*	430	.15*
NBT	3	4800	300	.06	620	.13
NBR	1	1600	110	.07	420	.26
SBL	2	2880	130	.05	320	.11
SBT	3	4800	200	.04*	760	.16*
SBR	1	1600	200	.13	210	.13
EBL	2	2880	300	.10*	240	.08*
EBT	4	6400	2380	.37	1790	.28
EBR	1	1600	370	.23	750	.47
WBL	2	2880	90	.03	480	.17
WBT	3	4800	1610	.34*	2190	.46*
WBR	f		350		570	
Right Turn Adjustment			SBR	.01*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for EBR

TOTAL CAPACITY UTILIZATION	**.84**	**.95**

4. The Old Road & McBean

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	62	.04*	171	.11*
NBT	3	4800	326	.07	454	.09
NBR	1	1600	121	.08	416	.26
SBL	1	1600	90	.06	97	.06
SBT	2	3200	361	.11*	531	.17*
SBR	1	1600	289	.18	249	.16
EBL	2	2880	577	.20*	244	.08
EBT	3	4800	623	.13	385	.08*
EBR	1	1600	174	.11	127	.08
WBL	2	2880	313	.11	653	.23*
WBT	2	3200	241	.10*	521	.18
WBR	0	0	93		51	
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.55** **.69**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	70	.04	170	.11
NBT	3	4800	540	.11*	1020	.21*
NBR	1	1600	330	.21	620	.39
SBL	1	1600	240	.15*	450	.28*
SBT	2	3200	310	.10	1110	.35
SBR	1	1600	20	.01	210	.13
EBL	2	2880	110	.04	220	.08*
EBT	3	4800	970	.20*	400	.08
EBR	1	1600	130	.08	90	.06
WBL	2	2880	250	.09*	890	.31
WBT	2	3200	220	.14	850	.38*
WBR	0	0	640	.40	350	
Right Turn Adjustment		Multi		.07*		
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.72** **1.05**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	60	.04	140	.09
NBT	3	4800	390	.08*	840	.18*
NBR	1	1600	300	.19	640	.40
SBL	1	1600	170	.11*	620	.39*
SBT	2	3200	260	.08	900	.28
SBR	1	1600	20	.01	260	.16
EBL	2	2880	130	.05	210	.07*
EBT	3	4800	1110	.23*	470	.10
EBR	1	1600	120	.08	90	.06
WBL	2	2880	250	.09*	870	.30
WBT	2	3200	250	.16	960	.38*
WBR	0	0	630	.39	270	
Right Turn Adjustment		Multi		.08*		
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.69** **1.12**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	70	.04	170	.11*
NBT	3	4800	540	.11*	1020	.21
NBR	1	1600	330	.21	620	.39
SBL	2	2880	240	.08*	450	.16
SBT	2	3200	310	.10	1110	.35*
SBR	1	1600	20	.01	210	.13
EBL	2	2880	110	.04	220	.08
EBT	3	4800	970	.20*	400	.08*
EBR	1	1600	130	.08	90	.06
WBL	2	2880	250	.09*	890	.31*
WBT	2	3200	220	.07	850	.27
WBR	1	1600	640	.40	350	.22
Right Turn Adjustment		Multi		.10*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.68** **.95**

4. The Old Road & McBean

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	60	.04	140	.09
NBT	3	4800	390	.08*	840	.18*
NBR	1	1600	300	.19	640	.40
SBL	2	2880	170	.06*	620	.22*
SBT	2	3200	260	.08	900	.28
SBR	1	1600	20	.01	260	.16
EBL	2	2880	130	.05	210	.07
EBT	3	4800	1110	.23*	470	.10*
EBR	1	1600	120	.08	90	.06
WBL	2	2880	250	.09*	870	.30*
WBT	2	3200	250	.08	960	.30
WBR	1	1600	630	.39	270	.17
Right Turn Adjustment		Multi	.09*			
Clearance Interval			.10*			.10*
Note: Assumes Right-Turn Overlap for NBR						
TOTAL CAPACITY UTILIZATION			**.65**			**.90**

5. The Old Road & Pico Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	63	.04*	182	.11*
NBT	2	3200	188	.08	356	.12
NBR	0	0	60		36	
SBL	2	2880	275	.10	557	.19
SBT	1	1600	269	.17*	400	.25*
SBR	1	1600	21	.01	32	.02
EBL	1	1600	49	.03	60	.04*
EBT	2	3200	620	.19*	422	.13
EBR	1	1600	137	.09	80	.05
WBL	1	1600	66	.04*	68	.04
WBT	2	3200	283	.09	730	.23*
WBR	f		308		624	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.54**		**.73**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	170	.11	180	.11
NBT	2	3200	370	.13*	840	.31*
NBR	0	0	60		140	
SBL	2	2880	330	.11*	520	.18*
SBT	1	1600	180	.11	550	.34
SBR	1	1600	180	.11	500	.31
EBL	1	1600	400	.25*	100	.06*
EBT	2	3200	730	.23	1090	.34
EBR	1	1600	100	.06	270	.17
WBL	1	1600	10	.01	10	.01
WBT	2	3200	1470	.46*	1390	.43*
WBR	f		300		620	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.05**		**1.08**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1600	120	.08*	190	.12
NBT	2	3200	220	.08	660	.24*
NBR	0	0	50		100	
SBL	2	2880	320	.11	510	.18*
SBT	1	1600	170	.11*	360	.23
SBR	1	1600	130	.08	470	.29
EBL	1	1600	380	.24*	90	.06*
EBT	2	3200	590	.18	890	.28
EBR	1	1600	100	.06	250	.16
WBL	1	1600	10	.01	10	.01
WBT	2	3200	1270	.40*	1300	.41*
WBR	f		260		570	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.93**		**.99**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	170	.06	180	.06
NBT	2	3200	370	.13*	840	.31*
NBR	0	0	60		140	
SBL	2	2880	330	.11*	520	.18*
SBT	2	3200	180	.11	550	.33
SBR	0	0	180		500	
EBL	1	1600	400	.25*	100	.06*
EBT	2	3200	730	.23	1090	.34
EBR	1	1600	100	.06	270	.17
WBL	1	1600	10	.01	10	.01
WBT	3	4800	1470	.37*	1390	.42*
WBR	0	0	300		620	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.96**		**1.07**

5. The Old Road & Pico Canyon

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	120	.04	190	.07
NBT	2	3200	220	.08*	660	.24*
NBR	0	0	50		100	
SBL	2	2880	320	.11*	510	.18*
SBT	2	3200	170	.09	360	.23
SBR	0	0	130		470	.29
EBL	1	1600	380	.24*	90	.06*
EBT	2	3200	590	.18	890	.28
EBR	1	1600	100	.06	250	.16
WBL	1	1600	10	.01	10	.01
WBT	3	4800	1270	.32*	1300	.39*
WBR	0	0	260		570	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.85**		**.97**

6. Rye/Copper Hill & Newhall Ranch

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	46	.01*	99	.03
NBT	3	5250	329	.06	1103	.21*
NBR	f		57		65	
SBL	2	3500	99	.03	181	.05*
SBT	3	5250	1354	.26*	535	.10
SBR	f		389		204	
EBL	2	3500	403	.12*	979	.28*
EBT	4	7000	392	.06	918	.13
EBR	1	1750	102	.06	60	.03
WBL	2	3500	338	.10	174	.05
WBT	4	7000	723	.10*	324	.05*
WBR	f		131		126	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.59**		**.69**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	360	.10*	270	.08
NBT	3	5250	1100	.21	1460	.28*
NBR	f		40		80	
SBL	2	3500	80	.02	280	.08*
SBT	3	5250	1680	.32*	950	.18
SBR	f		1270		770	
EBL	2	3500	500	.14*	980	.28
EBT	4	7000	530	.08	2100	.30*
EBR	1	1750	260	.15	430	.25
WBL	2	3500	370	.11	470	.13*
WBT	4	7000	1350	.19*	990	.14
WBR	f		700		270	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.85**		**.89**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	430	.12*	390	.11
NBT	3	5250	1190	.23	1350	.26*
NBR	f		220		90	
SBL	2	3500	90	.03	280	.08*
SBT	3	5250	1640	.31*	960	.18
SBR	f		1260		820	
EBL	2	3500	360	.10*	1040	.30*
EBT	4	7000	540	.08	1990	.28
EBR	1	1750	280	.16	530	.30
WBL	2	3500	330	.09	470	.13
WBT	4	7000	1230	.18*	1050	.15*
WBR	f		660		290	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.81**		**.89**

7. McBean & Newhall Ranch

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	415	.12*	298	.09
NBT	3	5250	586	.11	1749	.33*
NBR	2	3500	226	.06	755	.22
SBL	2	3500	239	.07	164	.05*
SBT	4	7000	1584	.23*	794	.11
SBR	f		134		53	
EBL	2	3500	111	.03	213	.06
EBT	4	7000	534	.08*	1233	.18*
EBR	1	1750	215	.12	477	.27
WBL	2	3500	853	.24*	395	.11*
WBT	3	5250	1369	.26	445	.08
WBR	1	1750	49	.03	131	.07
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.77**		**.77**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	250	.07	280	.08
NBT	3	5250	880	.17*	1960	.37*
NBR	2	3500	160	.05	1210	.35
SBL	2	3500	480	.14*	180	.05*
SBT	4	7000	1700	.24	1320	.19
SBR	f		230		70	
EBL	2	3500	100	.03*	320	.09*
EBT	4	7000	680	.10	2040	.29
EBR	1	1750	280	.16	610	.35
WBL	2	3500	970	.28	240	.07
WBT	3	5250	1890	.36*	1590	.30*
WBR	1	1750	60	.03	450	.26
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.80**		**.91**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	250	.07	280	.08
NBT	3	5250	910	.17*	2020	.38*
NBR	2	3500	160	.05	1220	.35
SBL	2	3500	530	.15*	180	.05*
SBT	4	7000	1770	.25	1340	.19
SBR	f		200		60	
EBL	2	3500	100	.03	250	.07*
EBT	4	7000	910	.13*	1990	.28
EBR	1	1750	310	.18	640	.37
WBL	2	3500	970	.28*	280	.08
WBT	3	5250	1760	.34	1740	.33*
WBR	1	1750	60	.03	480	.27
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.83**		**.93**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	250	.07	280	.08
NBT	3	5250	880	.17*	1960	.37*
NBR	2	3500	160	.05	1210	.35
SBL	2	3500	480	.14*	180	.05*
SBT	4	7000	1700	.24	1320	.19
SBR	f		230		70	
EBL	2	3500	100	.03	320	.09
EBT	4	7000	680	.10*	2040	.29*
EBR	1	1750	280	.16	610	.35
WBL	2	3500	970	.28*	240	.07*
WBT	4	7000	1890	.27	1590	.23
WBR	1	1750	60	.03	450	.26
Right Turn Adjustment			EBR	.01*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.80**		**.88**

7. McBean & Newhall Ranch

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	250	.07	280	.08
NBT	3	5250	910	.17*	2020	.38*
NBR	2	3500	160	.05	1220	.35
SBL	2	3500	530	.15*	180	.05*
SBT	4	7000	1770	.25	1340	.19
SBR	f		200		60	
EBL	2	3500	100	.03	250	.07
EBT	4	7000	910	.13*	1990	.28*
EBR	1	1750	310	.18	640	.37
WBL	2	3500	970	.28*	280	.08*
WBT	4	7000	1760	.25	1740	.25
WBR	1	1750	60	.03	480	.27
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.83**		**.89**

8. McBean & Magic Mountain

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	54	.02*	127	.04
NBT	3	5250	1018	.19	1290	.25*
NBR	f		69		102	
SBL	2	3500	183	.05	366	.10*
SBT	4	7000	1665	.24*	1724	.25
SBR	f		396		283	
EBL	2	3500	322	.09*	539	.15*
EBT	2	3500	421	.12	765	.22
EBR	1	1750	41	.02	165	.09
WBL	2	3500	71	.02	262	.07
WBT	2	3500	536	.15*	574	.16*
WBR	1	1750	151	.09	481	.27
Right Turn Adjustment					WBR	.03*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.60**		**.79**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	240	.07	290	.08
NBT	3	5250	1310	.25*	2380	.45*
NBR	f		40		280	
SBL	2	3500	430	.12*	160	.05*
SBT	4	7000	1920	.27	2260	.32
SBR	f		800		130	
EBL	2	3500	500	.14	510	.15
EBT	2	3500	1340	.38*	1930	.55*
EBR	1	1750	130	.07	280	.16
WBL	2	3500	70	.02*	220	.06*
WBT	2	3500	880	.25	1390	.40
WBR	1	1750	410	.23	450	.26
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.87**		**1.21**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	200	.06	390	.11
NBT	3	5250	1260	.24*	2460	.47*
NBR	f		50		270	
SBL	2	3500	580	.17*	340	.10*
SBT	4	7000	1960	.28	2110	.30
SBR	f		690		120	
EBL	2	3500	530	.15	470	.13
EBT	2	3500	1550	.44*	1780	.51*
EBR	1	1750	150	.09	400	.23
WBL	2	3500	70	.02*	220	.06*
WBT	2	3500	820	.23	1330	.38
WBR	1	1750	370	.21	590	.34
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.97**		**1.24**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	240	.07*	290	.08*
NBT	4	7000	1310	.19	2380	.34
NBR	f		40		280	
SBL	2	3500	430	.12	160	.05
SBT	4	7000	1920	.27*	2260	.32*
SBR	f		800		130	
EBL	2	3500	500	.14*	510	.15
EBT	3	5250	1340	.26	1930	.37*
EBR	1	1750	130	.07	280	.16
WBL	2	3500	70	.02	220	.06*
WBT	3	5250	880	.17*	1390	.26
WBR	1	1750	410	.23	450	.26
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for WBR

TOTAL CAPACITY UTILIZATION **.75** **.93**

8. McBean & Magic Mountain

OVOV GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	200	.06	390	.11
NBT	4	7000	1260	.18*	2460	.35*
NBR	1	1750	50	.03	270	.15
SBL	2	3500	580	.17*	340	.10*
SBT	4	7000	1960	.28	2110	.30
SBR	f		690		120	
EBL	2	3500	530	.15	470	.13
EBT	3	5250	1550	.30*	1780	.34*
EBR	1	1750	150	.09	400	.23
WBL	2	3500	70	.02*	220	.06*
WBT	3	5250	820	.16	1330	.25
WBR	1	1750	370	.21	590	.34
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for WBR

TOTAL CAPACITY UTILIZATION	**.77**	**.95**

9. McBean & Valencia

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	216	.06*	178	.05*
NBT	3	5250	862	.16	1116	.21
NBR	2	3500	247	.07	518	.15
SBL	2	3500	110	.03	173	.05
SBT	3	5250	763	.15*	1131	.22*
SBR	2	3500	809	.23	728	.21
EBL	2	3500	522	.15*	558	.16
EBT	3	5250	759	.14	1231	.23*
EBR	1	1750	114	.07	166	.09
WBL	2	3500	343	.10	430	.12*
WBT	3	5250	1101	.21*	909	.17
WBR	1	1750	49	.03	155	.09
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.67** **.72**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	270	.08*	160	.05
NBT	3	5250	1060	.20	1350	.26*
NBR	2	3500	250	.07	700	.20
SBL	2	3500	70	.02	270	.08*
SBT	3	5250	880	.17*	1310	.25
SBR	2	3500	970	.28	980	.28
EBL	2	3500	450	.13*	940	.27*
EBT	3	5250	860	.16	1400	.27
EBR	1	1750	20	.01	370	.21
WBL	2	3500	360	.10	600	.17
WBT	3	5250	1180	.22*	930	.18*
WBR	1	1750	290	.17	290	.17
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.70** **.89**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	280	.08*	190	.05
NBT	3	5250	1020	.19	1370	.26*
NBR	2	3500	320	.09	710	.20
SBL	2	3500	70	.02	220	.06*
SBT	3	5250	960	.18*	1350	.26
SBR	2	3500	900	.26	970	.28
EBL	2	3500	530	.15*	1000	.29*
EBT	3	5250	1170	.22	1270	.24
EBR	1	1750	20	.01	340	.19
WBL	2	3500	420	.12	730	.21
WBT	3	5250	1060	.20*	1200	.23*
WBR	1	1750	220	.13	350	.20
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.71** **.94**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	270	.08*	160	.05*
NBT	4	7000	1060	.15	1350	.19
NBR	1	1750	250	.14	700	.40
SBL	2	3500	70	.02	270	.08
SBT	3	5250	880	.17*	1310	.25*
SBR	2	3500	970	.28	980	.28
EBL	2	3500	450	.13*	940	.27
EBT	3	5250	860	.16	1400	.27*
EBR	1	1750	20	.01	370	.21
WBL	2	3500	360	.10	600	.17*
WBT	4	7000	1180	.17*	930	.13
WBR	1	1750	290	.17	290	.17
Right Turn Adjustment			SBR	.01*	NBR	.01*
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.66** **.85**

9. McBean & Valencia

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	280	.08*	190	.05*
NBT	4	7000	1020	.15	1370	.20
NBR	1	1750	320	.18	710	.41
SBL	2	3500	70	.02	220	.06
SBT	3	5250	960	.18*	1350	.26*
SBR	2	3500	900	.26	970	.28
EBL	2	3500	530	.15	1000	.29*
EBT	3	5250	1170	.22*	1270	.24
EBR	1	1750	20	.01	340	.19
WBL	2	3500	420	.12*	730	.21
WBT	4	7000	1060	.15	1200	.17*
WBR	1	1750	220	.13	350	.20
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION	**.70**	**.87**

10. Orchard Village & McBean

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		413		344	
NBT	0.5	3500	55	.13*	21	.10*
NBR	2	3500	591	.17	851	.24
SBL	0	0	19		74	
SBT	1	1750	20	.02*	57	.07*
SBR	d	1750	14	.01	45	.03
EBL	1	1750	14	.01	25	.01
EBT	3	5250	445	.13*	854	.24*
EBR	0	0	317	.18	412	
WBL	2	3500	656	.19*	878	.25*
WBT	3	5250	651	.14	781	.15
WBR	0	0	58		22	
Clearance Interval				.10*		.10*

Note: Assumes N/S Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.57** **.76**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		980		880	
NBT	0.5	3500	60	.30*	60	.27*
NBR	2	3500	830	.24	1100	.31
SBL	0	0	10		60	
SBT	1	1750	20	.02*	70	.07*
SBR	d	1750	10	.01	30	.02
EBL	1	1750	50	.03	40	.02
EBT	3	5250	550	.16*	970	.28*
EBR	0	0	840	.48	1150	.66
WBL	2	3500	850	.24*	1140	.33*
WBT	3	5250	620	.12	910	.18
WBR	0	0	30		20	
Right Turn Adjustment		EBR	.09*	EBR	.18*	
Clearance Interval				.10*		.10*

Note: Assumes N/S Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.91** **1.23**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		960		910	
NBT	0.5	3500	60	.29*	60	.28*
NBR	2	3500	850	.24	1110	.32
SBL	0	0	10		60	
SBT	1	1750	20	.02*	70	.07*
SBR	d	1750	10	.01	30	.02
EBL	1	1750	50	.03	40	.02
EBT	3	5250	440	.13*	900	.26*
EBR	0	0	880	.50	1200	.69
WBL	2	3500	860	.25*	1140	.33*
WBT	3	5250	650	.13	950	.18
WBR	0	0	30		20	
Right Turn Adjustment		EBR	.15*	EBR	.22*	
Clearance Interval				.10*		.10*

Note: Assumes N/S Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.94** **1.26**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		980		880	
NBT	0.5	3500	60	.30*	60	.27*
NBR	2	3500	830	.24	1100	.31
SBL	1.5		10	.01	60	
SBT	1.5	5250	20	.01*	70	.02*
SBR	1	1750	10	.01	30	.02
EBL	1	1750	50	.03	40	.02
EBT	2.5	7000	550	{.14}*	970	{.25}*
EBR	1.5		840		1150	
WBL	2	3500	850	.24*	1140	.33*
WBT	3	5250	620	.12	910	.18
WBR	0	0	30		20	
Clearance Interval				.10*		.10*

Note: Assumes N/S Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.79** **.97**

10. Orchard Village & McBean

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1.5		960		910	
NBT	0.5	3500	60	.29*	60	.28*
NBR	2	3500	850	.24	1110	.32
SBL	1.5		10	.01	60	
SBT	1.5	5250	20	.01*	70	.02*
SBR	1	1750	10	.01	30	.02
EBL	1	1750	50	.03	40	.02
EBT	2.5	7000	440	.13*	900	{.25}*
EBR	1.5		880	.25	1200	
WBL	2	3500	860	.25*	1140	.33*
WBT	3	5250	650	.13	950	.18
WBR	0	0	30		20	
Clearance Interval				.10*		.10*

Note: Assumes N/S Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.78** **.98**

11. Orchard Village & Wiley Cyn

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	131	.07	207	.12
NBT	2	3500	567	.19*	811	.29*
NBR	0	0	82		216	
SBL	1	1750	82	.05*	179	.10*
SBT	2	3500	405	.12	849	.24
SBR	1	1750	252	.14	333	.19
EBL	2	3500	144	.04*	345	.10
EBT	2	3500	97	.05	447	.17*
EBR	0	0	84		163	
WBL	1	1750	76	.04	176	.10*
WBT	2	3500	275	.08*	285	.08
WBR	1	1750	75	.04	94	.05
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.46**		**.76**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	30	.02	80	.05
NBT	2	3500	750	.31*	1080	.47*
NBR	0	0	320		570	
SBL	1	1750	510	.29*	640	.37*
SBT	2	3500	670	.19	1090	.31
SBR	1	1750	280	.16	160	.09
EBL	2	3500	190	.05	290	.08
EBT	2	3500	300	.11*	730	.26*
EBR	0	0	70		170	
WBL	1	1750	340	.19*	380	.22*
WBT	2	3500	540	.15	580	.17
WBR	1	1750	500	.29	500	.29
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.00**		**1.42**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	50	.03	80	.05
NBT	2	3500	710	.30*	1050	.47*
NBR	0	0	330		610	
SBL	1	1750	530	.30*	650	.37*
SBT	2	3500	610	.17	1140	.33
SBR	1	1750	340	.19	150	.09
EBL	2	3500	230	.07	320	.09
EBT	2	3500	370	.13*	760	.26*
EBR	0	0	90		140	
WBL	1	1750	370	.21*	390	.22*
WBT	2	3500	690	.20	710	.20
WBR	1	1750	460	.26	540	.31
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.04**		**1.42**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	30	.02	80	.05
NBT	3	5250	750	.20*	1080	.31*
NBR	0	0	320		570	.33
SBL	2	3500	510	.15*	640	.18*
SBT	3	5250	670	.18	1090	.24
SBR	0	0	280		160	
EBL	1	1750	190	.11*	290	.17
EBT	3	5250	300	.07	730	.17*
EBR	0	0	70		170	
WBL	1	1750	340	.19	380	.22*
WBT	3	5250	540	.15*	580	.17
WBR	0	0	500	.29	500	.29
Right Turn Adjustment			WBR	.03*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.74**		**.98**

11. Orchard Village & Wiley Cyn

OVOV GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	50	.03	80	.05
NBT	3	5250	710	.20*	1050	.30*
NBR	0	0	330		610	.35
SBL	2	3500	530	.15*	650	.19*
SBT	2	3500	610	.27	1140	.37
SBR	0	0	340		150	
EBL	1	1750	230	.13*	320	.18
EBT	3	5250	370	.09	760	.17*
EBR	0	0	90		140	
WBL	1	1750	370	.21	390	.22*
WBT	3	5250	690	.20*	710	.20
WBR	0	0	460	.26	540	.31
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.78**		**.98**

12. Valencia & Magic Mountain

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	43	.02*	103	.06
NBT	3	5250	709	.15	1592	.36*
NBR	0	0	92		321	
SBL	1	1750	28	.02	100	.06*
SBT	3	5250	1294	.25*	1064	.20
SBR	2	3500	516	.15	408	.12
EBL	2	3500	227	.06*	676	.19*
EBT	2	3500	186	.07	484	.14
EBR	0	0	45		22	
WBL	1	1750	127	.07	228	.13
WBT	2	3500	326	.09*	386	.11*
WBR	1	1750	33	.02	83	.05
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.52** **.82**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	80	.05*	100	.06
NBT	3	5250	730	.18	1710	.42*
NBR	0	0	220		500	
SBL	1	1750	50	.03	130	.07*
SBT	3	5250	1610	.31*	1150	.22
SBR	2	3500	720	.21	650	.19
EBL	2	3500	450	.13	740	.21
EBT	2	3500	920	.27*	1380	.40*
EBR	0	0	40		30	
WBL	1	1750	440	.25*	240	.14*
WBT	2	3500	1190	.34	1120	.32
WBR	1	1750	90	.05	130	.07
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **.98** **1.13**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	80	.05*	130	.07
NBT	3	5250	830	.21	1760	.47*
NBR	0	0	270		690	
SBL	1	1750	20	.01	50	.03*
SBT	3	5250	1640	.31*	1250	.24
SBR	2	3500	750	.21	580	.17
EBL	2	3500	530	.15	700	.20
EBT	2	3500	910	.29*	1300	.38*
EBR	0	0	100		40	
WBL	1	1750	610	.35*	470	.27*
WBT	2	3500	1040	.30	970	.28
WBR	1	1750	70	.04	40	.02
Clearance Interval				.10*		.10*

TOTAL CAPACITY UTILIZATION **1.10** **1.25**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	80	.05*	100	.06
NBT	3	5250	730	.14	1710	.33*
NBR	1	1750	220	.13	500	.29
SBL	1	1750	50	.03	130	.07*
SBT	3	5250	1610	.31*	1150	.22
SBR	2	3500	720	.21	650	.19
EBL	2	3500	450	.13*	740	.21*
EBT	3	5250	920	.18	1380	.27
EBR	0	0	40		30	
WBL	2	3500	440	.13	240	.07
WBT	3	5250	1190	.24*	1120	.24*
WBR	0	0	90		130	
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.83** **.95**

12. Valencia & Magic Mountain

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	80	.05*	130	.07
NBT	3	5250	830	.16	1760	.34*
NBR	1	1750	270	.15	690	.39
SBL	1	1750	20	.01	50	.03*
SBT	3	5250	1640	.31*	1250	.24
SBR	2	3500	750	.21	580	.17
EBL	2	3500	530	.15*	700	.20*
EBT	3	5250	910	.19	1300	.26
EBR	0	0	100		40	
WBL	2	3500	610	.17	470	.13
WBT	3	5250	1040	.21*	970	.19*
WBR	0	0	70		40	
Clearance Interval				.10*		.10*
Note: Assumes Right-Turn Overlap for NBR						
TOTAL CAPACITY UTILIZATION				**.82**		**.86**

13. Bouquet Canyon & Plum Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	14	.01	66	.04
NBT	2	3500	209	.06*	648	.19*
NBR	1	1750	633	.36	891	.51
SBL	1	1750	182	.10*	169	.10*
SBT	2	3500	476	.14	332	.10
SBR	0	0	2		4	
EBL	0	0	6		5	
EBT	1	1750	10	.03*	8	.02*
EBR	0	0	43		30	
WBL	1.5		1364		786	
WBT	0.5	3500	5	.39*	21	.23*
WBR	1	1750	133	.08	181	.10
Right Turn Adjustment					NBR	.09*
Clearance Interval				.10*		.10*

Note: Assumes E/W Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.68** **.73**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	10	.01	60	.03
NBT	2	3500	310	.09*	1040	.30*
NBR	1	1750	610	.35	850	.49
SBL	1	1750	400	.23*	250	.14*
SBT	2	3500	900	.26	390	.11
SBR	0	0	10		10	
EBL	0	0	10		10	
EBT	1	1750	50	.07*	10	.03*
EBR	0	0	60		30	
WBL	1.5		1060		620	
WBT	0.5	3500	20	.31*	20	.18*
WBR	1	1750	310	.18	230	.13
Right Turn Adjustment					NBR	.01*
Clearance Interval				.10*		.10*

Note: Assumes E/W Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.80** **.76**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	10	.01	60	.03
NBT	2	3500	330	.09*	1050	.30*
NBR	1	1750	600	.34	810	.46
SBL	1	1750	400	.23*	260	.15*
SBT	2	3500	940	.27	350	.10
SBR	0	0	10		10	
EBL	0	0	10		10	
EBT	1	1750	50	.07*	10	.03*
EBR	0	0	60		30	
WBL	1.5		1050		630	
WBT	0.5	3500	20	.31*	20	.19*
WBR	1	1750	310	.18	250	.14
Clearance Interval				.10*		.10*

Note: Assumes E/W Split Phasing
Note: Assumes Right-Turn Overlap for NBR

TOTAL CAPACITY UTILIZATION **.80** **.77**

14. Bouquet Canyon & Newhall Ranch

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	612	.17*	624	.18*
NBT	4	7000	655	.09	1993	.28
NBR	1	1750	46	.03	160	.09
SBL	1	1750	10	.01	55	.03
SBT	4	7000	2237	.32*	1238	.18*
SBR	1	1750	818	.47	362	.21
EBL	2	3500	249	.07*	953	.27*
EBT	2	3500	63	.02	315	.09
EBR	2	3500	505	.14	515	.15
WBL	2	3500	26	.01	89	.03
WBT	3	5250	94	.02*	181	.03*
WBR	1	1750	4	.00	164	.09
Right Turn Adjustment			SBR	.08*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR EBR

TOTAL CAPACITY UTILIZATION **.76** **.76**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	670	.19*	810	.23*
NBT	4	7000	500	.07	2350	.34
NBR	1	1750	300	.17	620	.35
SBL	1	1750	110	.06	70	.04
SBT	4	7000	2000	.29*	1370	.20*
SBR	1	1750	810	.46	410	.23
EBL	2	3500	260	.07	690	.20
EBT	2	3500	710	.20*	2020	.58*
EBR	2	3500	890	.25	1100	.31
WBL	2	3500	570	.16*	170	.05*
WBT	3	5250	1340	.26	930	.18
WBR	1	1750	50	.03	100	.06
Right Turn Adjustment			SBR	.08*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR EBR

TOTAL CAPACITY UTILIZATION **1.02** **1.16**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	550	.16*	890	.25*
NBT	4	7000	530	.08	2490	.36
NBR	1	1750	270	.15	600	.34
SBL	1	1750	110	.06	70	.04
SBT	4	7000	2190	.31*	1430	.20*
SBR	1	1750	750	.43	440	.25
EBL	2	3500	270	.08	690	.20
EBT	2	3500	930	.27*	2040	.58*
EBR	2	3500	850	.24	1050	.30
WBL	2	3500	570	.16*	150	.04*
WBT	3	5250	1420	.27	970	.18
WBR	1	1750	70	.04	100	.06
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR EBR

TOTAL CAPACITY UTILIZATION **1.00** **1.17**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	670	.19*	810	.23*
NBT	4	7000	500	.07	2350	.34
NBR	1	1750	300	.17	620	.35
SBL	2	3500	110	.03	70	.02
SBT	4	7000	2000	.29*	1370	.20*
SBR	1	1750	810	.46	410	.23
EBL	2	3500	260	.07*	690	.20
EBT	4	7000	710	.10	2020	.29*
EBR	2	3500	890	.25	1100	.31
WBL	2	3500	570	.16	170	.05*
WBT	4	7000	1340	.19*	930	.13
WBR	1	1750	50	.03	100	.06
Right Turn Adjustment			SBR	.10*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR WBR EBR

TOTAL CAPACITY UTILIZATION **.94** **.87**

14. Bouquet Canyon & Newhall Ranch

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	550	.16*	890	.25*
NBT	4	7000	530	.08	2490	.36
NBR	1	1750	270	.15	600	.34
SBL	2	3500	110	.03	70	.02
SBT	4	7000	2190	.31*	1430	.20*
SBR	1	1750	750	.43	440	.25
EBL	2	3500	270	.08	690	.20*
EBT	4	7000	930	.13*	2040	.29
EBR	2	3500	850	.24	1050	.30
WBL	2	3500	570	.16*	150	.04
WBT	4	7000	1420	.20	970	.14*
WBR	1	1750	70	.04	100	.06
Right Turn Adjustment			SBR	.03*		
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR WBR EBR

TOTAL CAPACITY UTILIZATION **.89** **.89**

15. Bouquet Canyon & Soledad Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	27	.02	27	.02
NBT	3	5250	512	.10*	1251	.24*
NBR	1	1750	260	.15	420	.24
SBL	2	3500	718	.21*	673	.19*
SBT	3	5250	1266	.24	987	.19
SBR	2	3500	752	.21	664	.19
EBL	3	5250	225	.04*	748	.14
EBT	3	5250	633	.12	1501	.29*
EBR	0	0	5		19	
WBL	2	3500	372	.11	328	.09*
WBT	2.5	7000	1608	{.31}*	929	{.20}
WBR	1.5		688	{.24}	686	
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.76** **.91**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	20	.01*	100	.06
NBT	3	5250	620	.12	1770	.34*
NBR	1	1750	110	.06	470	.27
SBL	2	3500	290	.08	530	.15*
SBT	3	5250	1890	.36*	1210	.23
SBR	2	3500	1240	.35	910	.26
EBL	3	5250	340	.06*	1370	.26*
EBT	3	5250	840	.18	1240	.24
EBR	0	0	120		40	
WBL	2	3500	120	.03	290	.08
WBT	2.5	7000	1020	{.19}*	970	{.18}*
WBR	1.5		380	{.03}	490	{.17}
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.72** **1.03**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	20	.01*	100	.06
NBT	3	5250	660	.13	1760	.34*
NBR	1	1750	230	.13	500	.29
SBL	2	3500	400	.11	430	.12*
SBT	3	5250	1910	.36*	1400	.27
SBR	2	3500	1250	.36	820	.23
EBL	3	5250	300	.06	1300	.25*
EBT	3	5250	910	.20*	1130	.24
EBR	0	0	120		120	
WBL	2	3500	160	.05*	400	.11
WBT	2.5	7000	880	.17	950	{.22}*
WBR	1.5		280		780	
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.72** **1.03**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	20	.01*	100	.06
NBT	4	7000	620	.09	1770	.25*
NBR	1	1750	110	.06	470	.27
SBL	2	3500	290	.08	530	.15*
SBT	3	5250	1890	.36*	1210	.23
SBR	2	3500	1240	.35	910	.26
EBL	3	5250	340	.06*	1370	.26*
EBT	3	5250	840	.18	1240	.24
EBR	0	0	120		40	
WBL	2	3500	120	.03	290	.08
WBT	2.5	7000	1020	{.19}*	970	{.18}*
WBR	1.5		380	{.01}	490	{.17}
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.72** **.94**

15. Bouquet Canyon & Soledad Canyon

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	20	.01*	100	.06
NBT	4	7000	660	.09	1760	.25*
NBR	1	1750	230	.13	500	.29
SBL	2	3500	400	.11	430	.12*
SBT	3	5250	1910	.36*	1400	.27
SBR	2	3500	1250	.36	820	.23
EBL	3	5250	300	.06	1300	.25*
EBT	3	5250	910	.20*	1130	.24
EBR	0	0	120		120	
WBL	2	3500	160	.05*	400	.11
WBT	2.5	7000	880	.17	950	{.22}*
WBR	1.5		280		780	
Clearance Interval				.10*		.10*

Note: Assumes Right-Turn Overlap for SBR

TOTAL CAPACITY UTILIZATION **.72** **.94**

16. Railroad & Lyons

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	54	.03*	76	.04
NBT	2	3500	601	.17	763	.22*
NBR	0	0	0		0	
SBL	0	0	0		0	
SBT	2	3500	512	.15*	566	.16
SBR	1	1750	10	.01	10	.01
EBL	2	3500	3	.00	7	.00
EBT	0	0	0		0	
EBR	1	1750	52	.03	69	.04
WBL	0	0	0		0	
WBT	0	0	0		0	
WBR	0	0	0		0	
Right Turn Adjustment			EBR	.01*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.29**		**.32**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	60	.02	0	.00
NBT	2	3500	820	.26*	1050	.33*
NBR	0	0	80		100	
SBL	2	3500	270	.08*	480	.14*
SBT	2	3500	770	.22	810	.23
SBR	2	3500	190	.05	390	.11
EBL	3	5250	180	.03	300	.06
EBT	2	3500	330	.13*	610	.20*
EBR	0	0	120		100	
WBL	1	1750	70	.04*	70	.04*
WBT	3	5250	410	.08	620	.12
WBR	1	1750	370	.21	290	.17
Right Turn Adjustment			WBR	.01*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.62**		**.81**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	50	.01	0	.00
NBT	2	3500	700	.22*	970	.30*
NBR	0	0	70		70	
SBL	2	3500	210	.06*	380	.11*
SBT	2	3500	680	.19	730	.21
SBR	2	3500	200	.06	420	.12
EBL	3	5250	190	.04	300	.06
EBT	2	3500	340	.13*	540	.18*
EBR	0	0	130		80	
WBL	1	1750	50	.03*	50	.03*
WBT	3	5250	320	.06	500	.10
WBR	1	1750	250	.14	200	.11
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.54**		**.72**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	60	.02	0	.00
NBT	2	3500	820	.26*	1050	.33*
NBR	0	0	80		100	
SBL	2	3500	270	.08*	480	.14*
SBT	2	3500	770	.22	810	.23
SBR	2	3500	190	.05	390	.11
EBL	3	5250	180	.03	300	.06
EBT	2	3500	330	.13*	610	.20*
EBR	0	0	120		100	
WBL	1	1750	70	.04*	70	.04*
WBT	3	5250	410	.08	620	.12
WBR	1	1750	370	.21	290	.17
Right Turn Adjustment			WBR	.01*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.62**		**.81**

16. Railroad & Lyons

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	50	.01	0	.00
NBT	2	3500	700	.22*	970	.30*
NBR	0	0	70		70	
SBL	2	3500	210	.06*	380	.11*
SBT	2	3500	680	.19	730	.21
SBR	2	3500	200	.06	420	.12
EBL	3	5250	190	.04	300	.06
EBT	2	3500	340	.13*	540	.18*
EBR	0	0	130		80	
WBL	1	1750	50	.03*	50	.03*
WBT	3	5250	320	.06	500	.10
WBR	1	1750	250	.14	200	.11
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.54**		**.72**

17. Sierra Highway & Newhall

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	70	.02*	286	.08
NBT	2	3500	47	.02	672	.22*
NBR	0	0	21		91	
SBL	1	1750	125	.07	39	.02*
SBT	3	5250	467	.13*	54	.02
SBR	0	0	270	.15	226	.13
EBL	2	3500	130	.04	342	.10*
EBT	3	5250	1144	.26*	967	.20
EBR	0	0	235		76	
WBL	1	1750	105	.06*	34	.02
WBT	3	5250	693	.13	1047	.20*
WBR	1	1750	16	.01	328	.19
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.57**		**.64**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	420	.12*	480	.14
NBT	2	3500	400	.23	790	.45*
NBR	0	0	400		1200	.69
SBL	1	1750	120	.07	10	.01*
SBT	3	5250	830	.18*	290	.06
SBR	0	0	120		10	
EBL	2	3500	30	.01	140	.04
EBT	3	5250	1000	.28*	1440	.37*
EBR	0	0	470		520	
WBL	1	1750	1100	.63*	630	.36*
WBT	3	5250	1320	.25	1220	.23
WBR	1	1750	0	.00	160	.09
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.31**		**1.29**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	200	.06*	460	.13
NBT	2	3500	180	.10	760	.43*
NBR	0	0	270	.15	1160	.66
SBL	1	1750	30	.02	20	.01*
SBT	3	5250	640	.14*	130	.03
SBR	0	0	80		20	
EBL	2	3500	40	.01	120	.03
EBT	3	5250	760	.22*	1310	.31*
EBR	0	0	480	.27	320	
WBL	1	1750	1110	.63*	490	.28*
WBT	3	5250	1260	.24	950	.18
WBR	1	1750	10	.01	30	.02
Right Turn Adjustment			EBR	.01*	NBR	.02*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.16**		**1.15**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	420	.24*	480	.27*
NBT	2	3500	400	.11	790	.23
NBR	2	3500	400	.11	1200	.34
SBL	1	1750	120	.07	10	.01
SBT	3	5250	830	.18*	290	.06*
SBR	0	0	120		10	
EBL	2	3500	30	.01	140	.04
EBT	3	5250	1000	.28*	1440	.37*
EBR	0	0	470		520	
WBL	2	3500	1100	.31*	630	.18*
WBT	3	5250	1320	.25	1220	.26
WBR	0	0	0		160	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**1.11**		**.98**

17. Sierra Highway & Newhall

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	200	.11*	460	.26*
NBT	2	3500	180	.05	760	.22
NBR	2	3500	270	.08	1160	.33
SBL	1	1750	30	.02	20	.01
SBT	3	5250	640	.14*	130	.03*
SBR	0	0	80		20	
EBL	2	3500	40	.01	120	.03
EBT	3	5250	760	.22*	1310	.31*
EBR	0	0	480	.27	320	
WBL	2	3500	1110	.32*	490	.14*
WBT	3	5250	1260	.24	950	.19
WBR	0	0	10		30	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.89**		**.84**

18. Whites Canyon & Soledad Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	291	.08*	374	.11
NBT	2	3500	572	.16	1025	.29*
NBR	1	1750	99	.06	164	.09
SBL	2	3500	474	.14	522	.15*
SBT	2	3500	842	.24*	606	.17
SBR	1	1750	376	.21	161	.09
EBL	2	3500	148	.04*	303	.09
EBT	3	5250	620	.15	1388	.30*
EBR	0	0	184		205	
WBL	2	3500	89	.03	166	.05*
WBT	3	5250	1315	.33*	1095	.25
WBR	0	0	423		230	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.79**		**.89**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	400	.11*	350	.10
NBT	2	3500	650	.19	1170	.33*
NBR	1	1750	110	.06	560	.32
SBL	2	3500	560	.16	320	.09*
SBT	2	3500	1280	.37*	1120	.32
SBR	1	1750	200	.11	240	.14
EBL	2	3500	90	.03*	430	.12
EBT	3	5250	640	.14	1400	.34*
EBR	0	0	120		370	
WBL	2	3500	510	.15	200	.06*
WBT	3	5250	1250	.28*	740	.21
WBR	0	0	240		420	.24
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.89**		**.92**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	430	.12*	400	.11
NBT	2	3500	560	.16	1160	.33*
NBR	1	1750	140	.08	500	.29
SBL	2	3500	590	.17	310	.09*
SBT	2	3500	1110	.32*	1070	.31
SBR	1	1750	230	.13	260	.15
EBL	2	3500	100	.03	460	.13
EBT	3	5250	730	.16*	1300	.33*
EBR	0	0	130		430	
WBL	2	3500	570	.16*	210	.06*
WBT	3	5250	1140	.26	820	.23
WBR	0	0	220		460	.26
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.86**		**.91**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	400	.11*	350	.10
NBT	3	5250	650	.14	1170	.33*
NBR	0	0	110		560	
SBL	2	3500	560	.16	320	.09*
SBT	3	5250	1280	.28*	1120	.26
SBR	0	0	200		240	
EBL	2	3500	90	.03*	430	.12
EBT	3	5250	640	.14	1400	.34*
EBR	0	0	120		370	
WBL	2	3500	510	.15	200	.06*
WBT	3	5250	1250	.28*	740	.21
WBR	0	0	240		420	.24
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.80**		**.92**

18. Whites Canyon & Soledad Canyon

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	430	.12*	400	.11
NBT	3	5250	560	.13	1160	.32*
NBR	0	0	140		500	
SBL	2	3500	590	.17	310	.09*
SBT	3	5250	1110	.26*	1070	.25
SBR	0	0	230		260	
EBL	2	3500	100	.03	460	.13
EBT	3	5250	730	.16*	1300	.33*
EBR	0	0	130		430	
WBL	2	3500	570	.16*	210	.06*
WBT	3	5250	1140	.26	820	.23
WBR	0	0	220		460	.26
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.80**		**.90**

19. Sierra Highway & Soledad Canyon

Existing Counts

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	461	.13*	712	.20*
NBT	2	3500	317	.09	506	.14
NBR	1	1750	167	.10	302	.17
SBL	1	1750	152	.09	142	.08
SBT	2	3500	986	.28*	372	.11*
SBR	1	1750	482	.28	236	.13
EBL	2	3500	409	.12*	414	.12
EBT	2	3500	995	.28	1085	.31*
EBR	1	1750	521	.30	582	.33
WBL	2	3500	294	.08	265	.08*
WBT	3	5250	1247	.25*	868	.17
WBR	0	0	44		43	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.88**		**.80**

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	180	.05	150	.04
NBT	2	3500	890	.25*	1190	.34*
NBR	1	1750	80	.05	250	.14
SBL	1	1750	240	.14*	630	.36*
SBT	2	3500	1130	.32	1080	.31
SBR	1	1750	650	.37	580	.33
EBL	2	3500	500	.14*	640	.18
EBT	2	3500	730	.21	1320	.38*
EBR	1	1750	120	.07	120	.07
WBL	2	3500	320	.09	160	.05*
WBT	3	5250	1140	.27*	540	.15
WBR	0	0	260		340	.19
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.90**		**1.23**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	160	.05	190	.05
NBT	2	3500	810	.23*	960	.27*
NBR	1	1750	100	.06	240	.14
SBL	1	1750	300	.17*	620	.35*
SBT	2	3500	930	.27	1010	.29
SBR	1	1750	850	.49	630	.36
EBL	2	3500	550	.16*	740	.21*
EBT	2	3500	780	.22	990	.28
EBR	1	1750	110	.06	120	.07
WBL	2	3500	280	.08	220	.06
WBT	3	5250	790	.18*	610	.17*
WBR	0	0	180		390	.22
Right Turn Adjustment			SBR	.02*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.86**		**1.10**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	180	.05*	150	.04
NBT	3	5250	890	.18	1190	.27*
NBR	0	0	80		250	
SBL	2	3500	240	.07	630	.18*
SBT	3	5250	1130	.32*	1080	.31
SBR	0	0	650	.37	580	.33
EBL	2	3500	500	.14*	640	.18*
EBT	3	5250	730	.16	1320	.27
EBR	0	0	120		120	
WBL	2	3500	320	.09	160	.05
WBT	3	5250	1140	.27*	540	.15*
WBR	0	0	260		340	.19
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.88**		**.88**

19. Sierra Highway & Soledad Canyon

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	160	.05*	190	.05
NBT	3	5250	810	.17	960	.23*
NBR	0	0	100		240	
SBL	2	3500	300	.09	620	.18*
SBT	3	5250	930	.27*	1010	.29
SBR	0	0	850	.49	630	.36
EBL	2	3500	550	.16*	740	.21*
EBT	3	5250	780	.17	990	.21
EBR	0	0	110		120	
WBL	2	3500	280	.08	220	.06
WBT	3	5250	790	.18*	610	.17*
WBR	0	0	180		390	.22
Right Turn Adjustment			SBR	.10*		
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.86**		**.89**

20. Commerce Center & Magic Mountain

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	2	2880	840	.29*	1110	.39*
SBT	0	0	0		0	
SBR	1	1600	110	.07	650	.41
EBL	2	2880	650	.23*	220	.08*
EBT	3	4800	900	.19	1010	.21
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	680	.14*	800	.17*
WBR	f		1040		1310	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.76**		**.74**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	2	2880	860	.30*	1190	.41*
SBT	0	0	0		0	
SBR	1	1600	110	.07	600	.38
EBL	2	2880	620	.22*	220	.08*
EBT	3	4800	960	.20	960	.20
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	670	.14*	840	.18*
WBR	f		980		1350	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.76**		**.77**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	2	2880	840	.29*	1110	.39*
SBT	0	0	0		0	
SBR	1	1600	110	.07	650	.41
EBL	2	2880	650	.23*	220	.08*
EBT	3	4800	900	.19	1010	.21
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	680	.14*	800	.17*
WBR	f		1040		1310	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.76**		**.74**

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	0	0	0		0	
NBT	0	0	0		0	
NBR	0	0	0		0	
SBL	2	2880	860	.30*	1190	.41*
SBT	0	0	0		0	
SBR	1	1600	110	.07	600	.38
EBL	2	2880	620	.22*	220	.08*
EBT	3	4800	960	.20	960	.20
EBR	0	0	0		0	
WBL	0	0	0		0	
WBT	3	4800	670	.14*	840	.18*
WBR	f		980		1350	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.76**		**.77**

21. Pico Canyon & Valencia

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	750	.26*	910	.32*
NBT	0	0	0		0	
NBR	1	1600	20	.01	10	.01
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1720	.48*	1160	.36*
EBR	0	0	590		1270	.79
WBL	1	1600	10	.01*	20	.01*
WBT	3	4800	880	.18	1590	.33
WBR	0	0	0		0	
Right Turn Adjustment					EBR	.19*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.85**		**.98**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	530	.18*	800	.28*
NBT	0	0	0		0	
NBR	1	1600	20	.01	10	.01
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1780	.46*	1300	.41*
EBR	0	0	430		990	.62
WBL	1	1600	10	.01*	30	.02*
WBT	3	4800	850	.18	1640	.34
WBR	0	0	0		0	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.75**		**.81**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	750	.26*	910	.32*
NBT	0	0	0		0	
NBR	1	1600	20	.01	10	.01
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1720	.48*	1160	.36*
EBR	0	0	590		1270	.79
WBL	1	1600	10	.01*	20	.01*
WBT	3	4800	880	.18	1590	.33
WBR	0	0	0		0	
Right Turn Adjustment					EBR	.19*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.85**		**.98**

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	2880	530	.18*	800	.28*
NBT	0	0	0		0	
NBR	1	1600	20	.01	10	.01
SBL	0	0	0		0	
SBT	0	0	0		0	
SBR	0	0	0		0	
EBL	0	0	0		0	
EBT	3	4800	1780	.46*	1300	.41*
EBR	0	0	430		990	.62
WBL	1	1600	10	.01*	30	.02*
WBT	3	4800	850	.18	1640	.34
WBR	0	0	0		0	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.75**		**.81**

22. Magic Mountain & Via Princessa

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	30	.02	20	.01
NBT	1	1750	40	.02*	30	.02*
NBR	1	1750	60	.03	30	.02
SBL	2	3500	380	.11*	1310	.37*
SBT	1	1750	10	.01	60	.03
SBR	1	1750	260	.15	400	.23
EBL	1	1750	250	.14*	270	.15*
EBT	3	5250	880	.17	1110	.22
EBR	0	0	10		40	
WBL	1	1750	20	.01	50	.03
WBT	3	5250	1030	.20*	860	.16*
WBR	f		1250		1100	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.57**		**.80**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	130	.07	60	.03
NBT	1	1750	180	.10*	80	.05*
NBR	1	1750	140	.08	80	.05
SBL	2	3500	290	.08*	1140	.33*
SBT	1	1750	30	.02	210	.12
SBR	1	1750	260	.15	420	.24
EBL	1	1750	250	.14*	290	.17*
EBT	3	5250	810	.16	1040	.22
EBR	0	0	20		120	
WBL	1	1750	50	.03	120	.07
WBT	3	5250	1020	.19*	860	.16*
WBR	f		1110		740	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.61**		**.81**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	30	.02	20	.01
NBT	1	1750	40	.02*	30	.02*
NBR	1	1750	60	.03	30	.02
SBL	2	3500	380	.11*	1310	.37*
SBT	1	1750	10	.01	60	.03
SBR	1	1750	260	.15	400	.23
EBL	1	1750	250	.14*	270	.15*
EBT	3	5250	880	.17	1110	.22
EBR	0	0	10		40	
WBL	1	1750	20	.01	50	.03
WBT	3	5250	1030	.20*	860	.16*
WBR	f		1250		1100	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.57**		**.80**

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	1	1750	130	.07	60	.03
NBT	1	1750	180	.10*	80	.05*
NBR	1	1750	140	.08	80	.05
SBL	2	3500	290	.08*	1140	.33*
SBT	1	1750	30	.02	210	.12
SBR	1	1750	260	.15	420	.24
EBL	1	1750	250	.14*	290	.17*
EBT	3	5250	810	.16	1040	.22
EBR	0	0	20		120	
WBL	1	1750	50	.03	120	.07
WBT	3	5250	1020	.19*	860	.16*
WBR	f		1110		740	
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.61**		**.81**

23. Golden Valley & Via Princessa

Current GP - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	620	.18*	990	.28*
NBT	3	5250	1340	.26	1170	.22
NBR	1	1750	30	.02	100	.06
SBL	2	3500	60	.02	610	.17
SBT	3	5250	620	.12*	1080	.21*
SBR	1	1750	570	.33	570	.33
EBL	2	3500	600	.17*	400	.11
EBT	3	5250	320	.06	1110	.21*
EBR	2	3500	800	.23	1260	.36
WBL	2	3500	210	.06	50	.01*
WBT	3	5250	1370	.26*	460	.09
WBR	1	1750	280	.16	70	.04
Right Turn Adjustment			SBR	.08*	SBR	.02*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.91**		**.83**

OVOV - Existing Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	550	.16	770	.22*
NBT	3	5250	1300	.25*	870	.17
NBR	1	1750	40	.02	60	.03
SBL	2	3500	100	.03*	510	.15
SBT	3	5250	320	.06	920	.18*
SBR	1	1750	590	.34	540	.31
EBL	2	3500	500	.14*	320	.09
EBT	3	5250	410	.08	1130	.22*
EBR	2	3500	590	.17	1240	.35
WBL	2	3500	140	.04	50	.01*
WBT	3	5250	1310	.25*	550	.10
WBR	1	1750	200	.11	100	.06
Right Turn Adjustment			SBR	.11*	SBR	.03*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.88**		**.76**

Current GP - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	620	.18*	990	.28*
NBT	3	5250	1340	.26	1170	.22
NBR	1	1750	30	.02	100	.06
SBL	2	3500	60	.02	610	.17
SBT	3	5250	620	.12*	1080	.21*
SBR	1	1750	570	.33	570	.33
EBL	2	3500	600	.17*	400	.11
EBT	3	5250	320	.06	1110	.21*
EBR	2	3500	800	.23	1260	.36
WBL	2	3500	210	.06	50	.01*
WBT	3	5250	1370	.26*	460	.09
WBR	1	1750	280	.16	70	.04
Right Turn Adjustment			SBR	.08*	SBR	.02*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.91**		**.83**

OVOV - Buildout Lanes

	LANES	CAPACITY	AM PK HOUR VOL	AM PK HOUR V/C	PM PK HOUR VOL	PM PK HOUR V/C
NBL	2	3500	550	.16	770	.22*
NBT	3	5250	1300	.25*	870	.17
NBR	1	1750	40	.02	60	.03
SBL	2	3500	100	.03*	510	.15
SBT	3	5250	320	.06	920	.18*
SBR	1	1750	590	.34	540	.31
EBL	2	3500	500	.14*	320	.09
EBT	3	5250	410	.08	1130	.22*
EBR	2	3500	590	.17	1240	.35
WBL	2	3500	140	.04	50	.01*
WBT	3	5250	1310	.25*	550	.10
WBR	1	1750	200	.11	100	.06
Right Turn Adjustment			SBR	.11*	SBR	.03*
Clearance Interval				.10*		.10*
TOTAL CAPACITY UTILIZATION				**.88**		**.76**

Appendix B

LAND USE AND TRIP GENERATION COMPARISON

1. 2004 and OVOV Buildout Plan
2. Current City General Plan/County Area Plan and OVOV Buildout Plan

See Appendix D for Traffic Analysis Zone (TAZ) map and trip generation rates.

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
1	1 SF Residential	DU	345.00	3,416	567.00	5,613	222.00	2,197
	5 Industrial Park	TSF	--	--	275.00	1,650	275.00	1,650
	SUB-TOTAL			3,416		7,263		3,847
2	1 SF Residential	DU	336.00	3,326	535.00	5,297	199.00	1,971
	SUB-TOTAL			3,326		5,297		1,971
3	1 SF Residential	DU	641.00	6,346	3,313.00	32,799	2,672.00	26,453
	2 MF Residential	DU	--	--	1,288.00	9,600	1,288.00	9,600
	3 Commercial Retail	TSF	150.00	8,109	320.00	17,299	170.00	9,190
	5 Industrial Park	TSF	77.49	395	334.29	1,936	256.80	1,541
	6 Other	--	--	885	--	1,088	--	203
	SUB-TOTAL			15,735		62,722		46,987
5	1 SF Residential	DU	1.00	10	229.00	2,267	228.00	2,257
	3 Commercial Retail	TSF	2.01	74	27.01	2,201	25.00	2,127
	SUB-TOTAL			84		4,468		4,384
6	1 SF Residential	DU	10.00	99	409.00	4,049	399.00	3,950
	SUB-TOTAL			99		4,049		3,950
7	1 SF Residential	DU	--	--	722.00	7,148	722.00	7,148
	SUB-TOTAL			--		7,148		7,148
8	1 SF Residential	DU	10.00	99	97.00	960	87.00	861
	SUB-TOTAL			99		960		861
9	1 SF Residential	DU	1.00	10	320.00	3,168	319.00	3,158
	SUB-TOTAL			10		3,168		3,158
10	1 SF Residential	DU	12.00	119	12.00	119	0.00	0
	2 MF Residential	DU	184.00	1,472	184.00	1,472	0.00	0
	3 Commercial Retail	TSF	33.64	1,348	300.00	12,018	266.36	10,670
	SUB-TOTAL			2,939		13,609		10,670
11	1 SF Residential	DU	23.00	228	108.00	1,070	85.00	842
	2 MF Residential	DU	138.00	1,104	237.00	1,817	99.00	713
	3 Commercial Retail	TSF	29.67	2,756	62.97	5,589	33.30	2,833
	4 Commercial Office	TSF	1.23	14	1.23	14	0.00	0
	5 Industrial Park	TSF	--	--	41.82	251	41.82	251
	6 Other	--		--	--	5	--	5
	SUB-TOTAL			4,102		8,746		4,644
12	1 SF Residential	DU	213.00	2,109	252.00	2,495	39.00	386
	6 Other	--		--	--	996	--	996
	SUB-TOTAL			2,109		3,491		1,382
13	1 SF Residential	DU	464.00	4,594	641.00	6,346	177.00	1,752
	2 MF Residential	DU	54.00	432	54.00	432	0.00	0
	3 Commercial Retail	TSF	--	--	25.00	2,127	25.00	2,127
	SUB-TOTAL			5,026		8,905		3,879

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
14	1 SF Residential	DU	19.00	188	117.00	1,158	98.00	970
	SUB-TOTAL			188		1,158		970
15	1 SF Residential	DU	78.00	772	370.00	3,663	292.00	2,891
	SUB-TOTAL			772		3,663		2,891
16	1 SF Residential	DU	--	--	291.00	2,881	291.00	2,881
	SUB-TOTAL			--		2,881		2,881
17	1 SF Residential	DU	146.00	1,445	380.00	3,762	234.00	2,317
	SUB-TOTAL			1,445		3,762		2,317
18	1 SF Residential	DU	188.00	1,523	568.00	5,285	380.00	3,762
	2 MF Residential	DU	--	--	109.00	872	109.00	872
	3 Commercial Retail	TSF	--	--	21.00	1,786	21.00	1,786
	6 Other	--		--	--	18	--	18
	SUB-TOTAL			1,523		7,961		6,438
19	1 SF Residential	DU	1,306.00	12,929	1,577.00	15,612	271.00	2,683
	6 Other	--	--	2,828	--	4,022	--	1,194
	SUB-TOTAL			15,757		19,634		3,877
20	1 SF Residential	DU	245.00	2,426	245.00	2,426	0.00	0
	2 MF Residential	DU	136.00	1,088	136.00	1,088	0.00	0
	5 Industrial Park	TSF	50.00	300	174.00	1,044	124.00	744
	SUB-TOTAL			3,814		4,558		744
21	1 SF Residential	DU	620.00	6,138	655.00	6,485	35.00	347
	3 Commercial Retail	TSF	--	--	70.00	5,954	70.00	5,954
	SUB-TOTAL			6,138		12,439		6,301
22	1 SF Residential	DU	350.00	3,465	350.00	3,465	0.00	0
	SUB-TOTAL			3,465		3,465		0
23	1 SF Residential	DU	--	--	373.00	3,693	373.00	3,693
	SUB-TOTAL			--		3,693		3,693
24	1 SF Residential	DU	--	--	422.00	4,178	422.00	4,178
	SUB-TOTAL			--		4,178		4,178
25	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			--		1,088		1,088
26	3 Commercial Retail	TSF	--	--	72.90	2,702	72.90	2,702
	SUB-TOTAL			--		2,702		2,702
27	2 MF Residential	DU	--	--	256.00	1,766	256.00	1,766
	SUB-TOTAL			--		1,766		1,766

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
28	1 SF Residential	DU	91.00	901	1,077.00	10,662	986.00	9,761
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			901		11,750		10,849
29	6 Other	--		--	--	52	--	52
	SUB-TOTAL			--		52		52
30	2 MF Residential	DU	--	--	275.00	2,200	275.00	2,200
	SUB-TOTAL			--		2,200		2,200
31	1 SF Residential	DU	--	--	65.00	644	65.00	644
	2 MF Residential	DU	--	--	200.00	1,600	200.00	1,600
	6 Other	--	--	1,160	--	1,740	--	580
	SUB-TOTAL			1,160		3,984		2,824
32	2 MF Residential	DU	--	--	94.00	752	94.00	752
	SUB-TOTAL			--		752		752
33	3 Commercial Retail	TSF	--	--	61.00	5,189	61.00	5,189
	SUB-TOTAL			--		5,189		5,189
34	3 Commercial Retail	TSF	--	--	107.10	5,790	107.10	5,790
	SUB-TOTAL			--		5,790		5,790
35	1 SF Residential	DU	--	--	616.00	6,098	616.00	6,098
	2 MF Residential	DU	--	--	260.00	1,860	260.00	1,860
	SUB-TOTAL			--		7,958		7,958
36	1 SF Residential	DU	190.00	1,881	190.00	1,881	0.00	0
	2 MF Residential	DU	268.00	2,144	268.00	2,144	0.00	0
	SUB-TOTAL			4,025		4,025		0
37	1 SF Residential	DU	212.00	2,099	212.00	2,099	0.00	0
	2 MF Residential	DU	128.00	1,024	128.00	1,024	0.00	0
	6 Other	--	--	186	--	186	--	0
	SUB-TOTAL			3,309		3,309		0
38	2 MF Residential	DU	--	--	331.00	2,399	331.00	2,399
	3 Commercial Retail	TSF	--	--	50.00	4,253	50.00	4,253
	SUB-TOTAL			--		6,652		6,652
39	3 Commercial Retail	TSF	--	--	150.40	8,131	150.40	8,131
	5 Industrial Park	TSF	35.40	212	4,000.00	24,000	3,964.60	23,788
	SUB-TOTAL			212		32,131		31,919
40	3 Commercial Retail	TSF	--	--	200.00	10,812	200.00	10,812
	4 Commercial Office	TSF	--	--	116.70	1,190	116.70	1,190
	6 Other	--	--	24	--	24	--	0
	SUB-TOTAL			24		12,026		12,002

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
41	4 Commercial Office	TSF	--	--	177.60	2,053	177.60	2,053
	5 Industrial Park	TSF	91.90	551	685.94	4,116	594.04	3,565
	SUB-TOTAL			551		6,169		5,618
42	4 Commercial Office	TSF	--	--	696.85	8,056	696.85	8,056
	SUB-TOTAL			--		8,056		8,056
43	3 Commercial Retail	TSF	--	--	27.00	1,001	27.00	1,001
	4 Commercial Office	TSF	--	--	100.75	1,165	100.75	1,165
	SUB-TOTAL			--		2,166		2,166
44	1 SF Residential	DU	445.00	4,406	445.00	4,406	0.00	0
	3 Commercial Retail	TSF	10.00	371	35.00	2,498	25.00	2,127
	6 Other	--	--	725	--	1,450	--	725
	SUB-TOTAL			5,502		8,354		2,852
45	4 Commercial Office	TSF	--	--	464.94	5,375	464.94	5,375
	5 Industrial Park	TSF	--	--	1,215.00	7,290	1,215.00	7,290
	SUB-TOTAL			--		12,665		12,665
46	3 Commercial Retail	TSF	77.00	2,854	77.00	2,854	0.00	0
	5 Industrial Park	TSF	161.65	970	445.80	2,675	284.15	1,705
	SUB-TOTAL			3,824		5,529		1,705
47	5 Industrial Park	TSF	2,403.65	14,422	4,254.10	25,525	1,850.45	11,103
	SUB-TOTAL			14,422		25,525		11,103
48	5 Industrial Park	TSF	--	--	720.00	4,320	720.00	4,320
	SUB-TOTAL			--		4,320		4,320
49	5 Industrial Park	TSF	600.20	3,601	764.30	4,586	164.10	985
	SUB-TOTAL			3,601		4,586		985
50	1 SF Residential	DU	100.00	990	350.00	3,465	250.00	2,475
	6 Other	--	--	1,000	--	2,000	--	1,000
	SUB-TOTAL			1,990		5,465		3,475
51	5 Industrial Park	TSF	--	--	1,221.36	7,328	1,221.36	7,328
	SUB-TOTAL			--		7,328		7,328
52	1 SF Residential	DU	10.00	99	100.00	990	90.00	891
	SUB-TOTAL			99		990		891
53	1 SF Residential	DU	--	--	35.00	347	35.00	347
	SUB-TOTAL			--		347		347

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
54	1 SF Residential	DU	--	--	62.00	614	62.00	614
	2 MF Residential	DU	--	--	589.00	4,712	589.00	4,712
	SUB-TOTAL			--		5,326		5,326
55	1 SF Residential	DU	--	--	164.00	1,624	164.00	1,624
	2 MF Residential	DU	--	--	922.00	7,376	922.00	7,376
	6 Other	--		--	--	15	--	15
	SUB-TOTAL			--		9,015		9,015
56	1 SF Residential	DU	--	--	19.00	188	19.00	188
	2 MF Residential	DU	--	--	23.00	184	23.00	184
	SUB-TOTAL			--		372		372
57	3 Commercial Retail	TSF	--	--	55.40	4,712	55.40	4,712
	4 Commercial Office	TSF	--	--	1,274.60	13,144	1,274.60	13,144
	SUB-TOTAL			--		17,856		17,856
58	5 Industrial Park	TSF	850.20	5,101	1,123.00	6,738	272.80	1,637
	SUB-TOTAL			5,101		6,738		1,637
59	5 Industrial Park	TSF	764.00	3,820	764.00	3,820	0.00	0
	SUB-TOTAL			3,820		3,820		0
60	3 Commercial Retail	TSF	--	--	34.80	1,290	34.80	1,290
	4 Commercial Office	TSF	--	--	27.20	314	27.20	314
	5 Industrial Park	TSF	--	--	160.50	963	160.50	963
	SUB-TOTAL			--		2,567		2,567
61	4 Commercial Office	TSF	--	--	48.80	564	48.80	564
	5 Industrial Park	TSF	--	--	825.65	4,954	825.65	4,954
	SUB-TOTAL			--		5,518		5,518
62	3 Commercial Retail	TSF	--	--	19.50	723	19.50	723
	5 Industrial Park	TSF	--	--	430.64	2,584	430.64	2,584
	SUB-TOTAL			--		3,307		3,307
63	5 Industrial Park	TSF	250.02	1,500	575.00	3,450	324.98	1,950
	6 Other	--		--	--	2,444	--	2,444
	SUB-TOTAL			1,500		5,894		4,394
64	5 Industrial Park	TSF	2,742.00	16,452	3,161.48	18,969	419.48	2,517
	SUB-TOTAL			16,452		18,969		2,517
65	3 Commercial Retail	TSF	--	--	155.00	8,379	155.00	8,379
	5 Industrial Park	TSF	329.00	1,974	329.00	1,974	0.00	0
	SUB-TOTAL			1,974		10,353		8,379

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
66	3 Commercial Retail	TSF	102.60	5,547	170.45	9,215	67.85	3,668
	5 Industrial Park	TSF	329.00	1,974	329.00	1,974	0.00	0
	SUB-TOTAL			7,521		11,189		3,668
67	1 SF Residential	DU	--	--	163.00	1,614	163.00	1,614
	2 MF Residential	DU	--	--	90.00	720	90.00	720
	SUB-TOTAL			--		2,334		2,334
68	2 MF Residential	DU	156.00	1,076	208.00	1,435	52.00	359
	SUB-TOTAL			1,076		1,435		359
69	1 SF Residential	DU	--	--	76.00	752	76.00	752
	SUB-TOTAL			--		752		752
70	3 Commercial Retail	TSF	67.00	3,622	147.00	7,947	80.00	4,325
	5 Industrial Park	TSF	472.00	2,765	604.00	3,557	132.00	792
	6 Other	--	--	3,518	--	3,518	--	0
	SUB-TOTAL			9,905		15,022		5,117
71	6 Other	--	--	4,475	--	4,475	--	0
	SUB-TOTAL			4,475		4,475		0
72	3 Commercial Retail	TSF	--	--	60.00	2,224	60.00	2,224
	6 Other	--	--	508	--	508	--	0
	SUB-TOTAL			508		2,732		2,224
74	1 SF Residential	DU	--	--	153.00	1,515	153.00	1,515
	2 MF Residential	DU	--	--	147.00	1,176	147.00	1,176
	SUB-TOTAL			--		2,691		2,691
75	2 MF Residential	DU	--	--	149.00	1,192	149.00	1,192
	6 Other	--		--	--	46	--	46
	SUB-TOTAL			--		1,238		1,238
76	2 MF Residential	DU	--	--	188.00	1,297	188.00	1,297
	3 Commercial Retail	TSF	--	--	11.00	936	11.00	936
	SUB-TOTAL			--		2,233		2,233
78	5 Industrial Park	TSF	1,615.00	9,690	1,776.00	10,656	161.00	966
	SUB-TOTAL			9,690		10,656		966
79	5 Industrial Park	TSF	685.00	4,110	685.00	4,110	0.00	0
	SUB-TOTAL			4,110		4,110		0
80	5 Industrial Park	TSF	828.00	4,968	880.00	5,280	52.00	312
	SUB-TOTAL			4,968		5,280		312
81	5 Industrial Park	TSF	711.00	4,266	711.00	4,266	0.00	0
	SUB-TOTAL			4,266		4,266		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
82	5 Industrial Park	TSF	714.00	4,284	1,007.55	6,045	293.55	1,761
	SUB-TOTAL			4,284		6,045		1,761
83	5 Industrial Park	TSF	876.00	5,256	876.00	5,256	0.00	0
	SUB-TOTAL			5,256		5,256		0
84	5 Industrial Park	TSF	333.00	1,998	333.00	1,998	0.00	0
	SUB-TOTAL			1,998		1,998		0
86	3 Commercial Retail	TSF	62.26	7,436	82.76	8,196	20.50	760
	6 Other	--	--	296	--	296	--	0
	SUB-TOTAL			7,732		8,492		760
89	6 Other	--	--	2,000	--	3,000	--	1,000
	SUB-TOTAL			2,000		3,000		1,000
90	2 MF Residential	DU	--	--	360.00	2,880	360.00	2,880
	3 Commercial Retail	TSF	--	--	1,305.35	57,648	1,305.35	57,648
	5 Industrial Park	TSF	63.88	383	163.88	983	100.00	600
	SUB-TOTAL			383		61,511		61,128
91	3 Commercial Retail	TSF	43.38	2,345	247.38	13,373	204.00	11,028
	SUB-TOTAL			2,345		13,373		11,028
92	2 MF Residential	DU	--	--	1,333.00	10,664	1,333.00	10,664
	3 Commercial Retail	TSF	--	--	618.00	24,757	618.00	24,757
	4 Commercial Office	TSF	--	--	629.00	7,271	629.00	7,271
	6 Other	--		--	--	2,469	--	2,469
	SUB-TOTAL			--		45,161		45,161
93	3 Commercial Retail	TSF	11.00	408	20.00	741	9.00	333
	6 Other	--	--	1,391	--	1,391	--	0
	SUB-TOTAL			1,799		2,132		333
94	6 Other	--	--	16,000	--	24,000	--	8,000
	SUB-TOTAL			16,000		24,000		8,000
96	1 SF Residential	DU	--	--	123.00	1,218	123.00	1,218
	2 MF Residential	DU	--	--	881.00	7,048	881.00	7,048
	SUB-TOTAL			--		8,266		8,266
97	6 Other	--	--	2,620	--	2,620	--	0
	SUB-TOTAL			2,620		2,620		0
98	3 Commercial Retail	TSF	--	--	6.20	527	6.20	527
	4 Commercial Office	TSF	--	--	691.50	7,053	691.50	7,053
	SUB-TOTAL			--		7,580		7,580

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
99	2 MF Residential	DU	--	--	470.00	3,760	470.00	3,760
	6 Other	--		--	--	53	--	53
	SUB-TOTAL			--		3,813		3,813
100	3 Commercial Retail	TSF	--	--	23.00	1,956	23.00	1,956
	4 Commercial Office	TSF	--	--	220.00	2,543	220.00	2,543
	SUB-TOTAL			--		4,499		4,499
101	3 Commercial Retail	TSF	--	--	491.60	19,693	491.60	19,693
	SUB-TOTAL			--		19,693		19,693
102	1 SF Residential	DU	--	--	38.00	376	38.00	376
	2 MF Residential	DU	--	--	460.00	3,510	460.00	3,510
	3 Commercial Retail	TSF	--	--	10.50	893	10.50	893
	4 Commercial Office	TSF	--	--	9.50	110	9.50	110
	SUB-TOTAL			--		4,889		4,889
103	1 SF Residential	DU	--	--	95.00	940	95.00	940
	2 MF Residential	DU	--	--	169.00	1,352	169.00	1,352
	3 Commercial Retail	TSF	--	--	48.00	3,627	48.00	3,627
	6 Other	--		--	--	1,130	--	1,130
	SUB-TOTAL			--		7,049		7,049
104	1 SF Residential	DU	--	--	175.00	1,732	175.00	1,732
	2 MF Residential	DU	--	--	363.00	2,737	363.00	2,737
	3 Commercial Retail	TSF	--	--	252.00	13,623	252.00	13,623
	4 Commercial Office	TSF	--	--	370.00	4,277	370.00	4,277
	SUB-TOTAL			--		22,369		22,369
105	2 MF Residential	DU	--	--	144.00	994	144.00	994
	3 Commercial Retail	TSF	--	--	27.10	2,305	27.10	2,305
	4 Commercial Office	TSF	--	--	315.90	3,652	315.90	3,652
	SUB-TOTAL			--		6,951		6,951
106	2 MF Residential	DU	--	--	520.00	3,588	520.00	3,588
	SUB-TOTAL			--		3,588		3,588
107	1 SF Residential	DU	--	--	461.00	4,564	461.00	4,564
	2 MF Residential	DU	--	--	326.00	2,608	326.00	2,608
	6 Other	--		--	--	6,268	--	6,268
	SUB-TOTAL			--		13,440		13,440
108	2 MF Residential	DU	--	--	2,189.00	17,512	2,189.00	17,512
	6 Other	--		--	--	1,111	--	1,111
	SUB-TOTAL			--		18,623		18,623
109	1 SF Residential	DU	--	--	38.00	376	38.00	376
	SUB-TOTAL			--		376		376

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
110	1 SF Residential	DU	--	--	184.00	1,822	184.00	1,822
	2 MF Residential	DU	--	--	548.00	4,384	548.00	4,384
	6 Other	--		--	--	1,112	--	1,112
	SUB-TOTAL			--		7,318		7,318
111	6 Other	--		--	--	238	--	238
	SUB-TOTAL			--		238		238
112	1 SF Residential	DU	--	--	246.00	2,435	246.00	2,435
	6 Other	--		--	--	1,433	--	1,433
	SUB-TOTAL			--		3,868		3,868
113	2 MF Residential	DU	--	--	354.00	2,832	354.00	2,832
	SUB-TOTAL			--		2,832		2,832
114	2 MF Residential	DU	--	--	560.00	4,480	560.00	4,480
	SUB-TOTAL			--		4,480		4,480
115	1 SF Residential	DU	--	--	603.00	5,970	603.00	5,970
	SUB-TOTAL			--		5,970		5,970
116	2 MF Residential	DU	--	--	1,262.00	10,096	1,262.00	10,096
	3 Commercial Retail	TSF	--	--	628.50	25,178	628.50	25,178
	SUB-TOTAL			--		35,274		35,274
117	2 MF Residential	DU	--	--	1,261.00	10,088	1,261.00	10,088
	3 Commercial Retail	TSF	--	--	628.50	25,178	628.50	25,178
	SUB-TOTAL			--		35,266		35,266
118	2 MF Residential	DU	--	--	161.00	1,288	161.00	1,288
	SUB-TOTAL			--		1,288		1,288
119	2 MF Residential	DU	--	--	1,679.00	11,585	1,679.00	11,585
	SUB-TOTAL			--		11,585		11,585
120	2 MF Residential	DU	--	--	2,425.00	19,400	2,425.00	19,400
	3 Commercial Retail	TSF	--	--	283.30	15,043	283.30	15,043
	4 Commercial Office	TSF	--	--	75.00	867	75.00	867
	6 Other	--		--	--	1,110	--	1,110
	SUB-TOTAL			--		36,420		36,420
121	1 SF Residential	DU	--	--	168.00	1,663	168.00	1,663
	2 MF Residential	DU	--	--	418.00	3,344	418.00	3,344
	SUB-TOTAL			--		5,007		5,007
122	2 MF Residential	DU	--	--	176.00	1,408	176.00	1,408
	SUB-TOTAL			--		1,408		1,408

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
123	1 SF Residential	DU	--	--	452.00	4,475	452.00	4,475
	2 MF Residential	DU	--	--	272.00	2,176	272.00	2,176
	3 Commercial Retail	TSF	--	--	17.20	637	17.20	637
	SUB-TOTAL			--		7,288		7,288
124	2 MF Residential	DU	--	--	1,343.00	4,983	1,343.00	4,983
	SUB-TOTAL			--		4,983		4,983
125	6 Other	--		--	--	6,215	--	6,215
	SUB-TOTAL			--		6,215		6,215
126	3 Commercial Retail	TSF	--	--	150.00	8,109	150.00	8,109
	4 Commercial Office	TSF	--	--	336.00	3,884	336.00	3,884
	SUB-TOTAL			--		11,993		11,993
127	2 MF Residential	DU	--	--	888.00	7,104	888.00	7,104
	SUB-TOTAL			--		7,104		7,104
128	1 SF Residential	DU	--	--	450.00	4,455	450.00	4,455
	SUB-TOTAL			--		4,455		4,455
129	1 SF Residential	DU	--	--	177.00	1,752	177.00	1,752
	SUB-TOTAL			--		1,752		1,752
130	1 SF Residential	DU	708.00	7,009	708.00	7,009	0.00	0
	SUB-TOTAL			7,009		7,009		0
131	1 SF Residential	DU	--	--	14.00	139	14.00	139
	2 MF Residential	DU	--	--	1,273.00	10,184	1,273.00	10,184
	6 Other	--		--	--	249	--	249
	SUB-TOTAL			--		10,572		10,572
132	1 SF Residential	DU	436.00	4,316	436.00	4,316	0.00	0
	6 Other	--	--	1,130	--	1,130	--	0
	SUB-TOTAL			5,446		5,446		0
133	3 Commercial Retail	TSF	27.00	1,460	27.00	1,460	0.00	0
	SUB-TOTAL			1,460		1,460		0
134	1 SF Residential	DU	482.00	4,772	482.00	4,772	0.00	0
	SUB-TOTAL			4,772		4,772		0
135	1 SF Residential	DU	20.00	198	174.00	1,723	154.00	1,525
	2 MF Residential	DU	172.00	1,376	172.00	1,376	0.00	0
	6 Other	--	--	1,656	--	1,656	--	0
	SUB-TOTAL			3,230		4,755		1,525
137	4 Commercial Office	TSF	--	--	72.00	832	72.00	832
	SUB-TOTAL			--		832		832

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
138	3 Commercial Retail	TSF	100.00	5,406	120.00	6,487	20.00	1,081
	SUB-TOTAL			5,406		6,487		1,081
139	2 MF Residential	DU	96.00	662	474.00	3,271	378.00	2,609
	SUB-TOTAL			662		3,271		2,609
140	1 SF Residential	DU	--	--	428.00	4,237	428.00	4,237
	2 MF Residential	DU	--	--	1,266.00	10,128	1,266.00	10,128
	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	4 Commercial Office	TSF	--	--	31.00	358	31.00	358
	6 Other	--		--	--	593	--	593
	SUB-TOTAL			--		17,017		17,017
141	3 Commercial Retail	TSF	30.40	7,657	30.40	7,657	0.00	0
	4 Commercial Office	TSF	--	--	50.00	578	50.00	578
	SUB-TOTAL			7,657		8,235		578
142	2 MF Residential	DU	--	--	670.00	5,360	670.00	5,360
	SUB-TOTAL			--		5,360		5,360
143	1 SF Residential	DU	484.00	4,791	578.00	5,722	94.00	931
	2 MF Residential	DU	80.00	640	160.00	1,280	80.00	640
	6 Other	--		--	--	2,846	--	2,846
	SUB-TOTAL			5,431		9,848		4,417
144	1 SF Residential	DU	--	--	6.00	59	6.00	59
	SUB-TOTAL			--		59		59
145	3 Commercial Retail	TSF	874.22	40,255	874.22	40,255	0.00	0
	5 Industrial Park	TSF	74.50	380	74.50	380	0.00	0
	SUB-TOTAL			40,635		40,635		0
146	1 SF Residential	DU	314.00	3,109	314.00	3,109	0.00	0
	2 MF Residential	DU	296.00	2,368	296.00	2,368	0.00	0
	SUB-TOTAL			5,477		5,477		0
147	1 SF Residential	DU	46.00	455	140.00	1,386	94.00	931
	2 MF Residential	DU	--	--	667.00	4,712	667.00	4,712
	6 Other	--	--	1,088	--	1,101	--	13
	SUB-TOTAL			1,543		7,199		5,656
148	3 Commercial Retail	TSF	196.58	13,426	196.58	13,426	0.00	0
	SUB-TOTAL			13,426		13,426		0
149	1 SF Residential	DU	535.00	5,297	535.00	5,297	0.00	0
	2 MF Residential	DU	500.00	4,000	500.00	4,000	0.00	0
	3 Commercial Retail	TSF	34.85	2,964	34.85	2,964	0.00	0
	SUB-TOTAL			12,261		12,261		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
150	1 SF Residential	DU	114.00	1,129	114.00	1,129	0.00	0
	SUB-TOTAL			1,129		1,129		0
151	1 SF Residential	DU	--	--	71.00	703	71.00	703
	SUB-TOTAL			--		703		703
152	1 SF Residential	DU	279.00	2,762	892.00	8,831	613.00	6,069
	6 Other	--		--	--	47	--	47
	SUB-TOTAL			2,762		8,878		6,116
153	1 SF Residential	DU	--	--	424.00	4,198	424.00	4,198
	SUB-TOTAL			--		4,198		4,198
159	1 SF Residential	DU	4.00	40	4.00	40	0.00	0
	5 Industrial Park	TSF	--	--	16.00	80	16.00	80
	6 Other	--		--	--	233	--	233
	SUB-TOTAL			40		353		313
160	1 SF Residential	DU	--	--	95.00	940	95.00	940
	2 MF Residential	DU	--	--	95.00	352	95.00	352
	SUB-TOTAL			--		1,292		1,292
161	1 SF Residential	DU	533.00	5,277	640.00	6,336	107.00	1,059
	2 MF Residential	DU	531.00	4,248	650.00	5,200	119.00	952
	3 Commercial Retail	TSF	54.86	11,598	151.82	18,358	96.96	6,760
	4 Commercial Office	TSF	61.66	713	282.41	3,265	220.75	2,552
	6 Other	--	--	2,329	--	2,329	--	0
	SUB-TOTAL			24,165		35,488		11,323
162	1 SF Residential	DU	83.00	822	335.00	3,055	252.00	2,233
	3 Commercial Retail	TSF	--	--	102.42	5,537	102.42	5,537
	5 Industrial Park	TSF	--	--	240.00	1,440	240.00	1,440
	SUB-TOTAL			822		10,032		9,210
163	5 Industrial Park	TSF	--	--	1,000.00	6,000	1,000.00	6,000
	SUB-TOTAL			--		6,000		6,000
164	1 SF Residential	DU	100.00	990	204.00	2,020	104.00	1,030
	2 MF Residential	DU	--	--	86.00	319	86.00	319
	5 Industrial Park	TSF	--	--	30.00	180	30.00	180
	6 Other	--	--	73	--	73	--	0
	SUB-TOTAL			1,063		2,592		1,529

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
165	1 SF Residential	DU	36.00	356	86.00	851	50.00	495
	2 MF Residential	DU	80.00	640	287.00	2,296	207.00	1,656
	3 Commercial Retail	TSF	61.78	3,740	127.83	6,188	66.05	2,448
	4 Commercial Office	TSF	13.81	160	13.81	160	0.00	0
	5 Industrial Park	TSF	14.71	86	3,402.47	20,413	3,387.76	20,327
	6 Other	--	--	414	--	414	--	0
	SUB-TOTAL			5,396		30,322		24,926
166	1 SF Residential	DU	431.00	4,267	431.00	4,267	0.00	0
	2 MF Residential	DU	217.00	1,736	462.00	3,696	245.00	1,960
	3 Commercial Retail	TSF	54.36	4,349	74.36	7,082	20.00	2,733
	4 Commercial Office	TSF	30.10	348	30.10	348	0.00	0
	5 Industrial Park	TSF	11.00	56	11.00	56	0.00	0
	6 Other	--		--	--	242	--	242
	SUB-TOTAL			10,756		15,691		4,935
167	1 SF Residential	DU	180.00	1,782	196.00	1,940	16.00	158
	SUB-TOTAL			1,782		1,940		158
168	1 SF Residential	DU	247.00	2,445	247.00	2,445	0.00	0
	SUB-TOTAL			2,445		2,445		0
169	1 SF Residential	DU	127.00	1,257	127.00	1,257	0.00	0
	2 MF Residential	DU	94.00	752	94.00	752	0.00	0
	3 Commercial Retail	TSF	200.00	8,012	300.00	12,018	100.00	4,006
	4 Commercial Office	TSF	--	--	20.00	684	20.00	684
	6 Other	--		--	--	152	--	152
	SUB-TOTAL			10,021		14,863		4,842
170	1 SF Residential	DU	60.00	594	60.00	594	0.00	0
	SUB-TOTAL			594		594		0
171	1 SF Residential	DU	32.00	317	60.00	594	28.00	277
	6 Other	--	--	979	--	1,088	--	109
	SUB-TOTAL			1,296		1,682		386
172	1 SF Residential	DU	185.00	1,831	185.00	1,831	0.00	0
	SUB-TOTAL			1,831		1,831		0
173	1 SF Residential	DU	336.00	3,326	386.00	3,821	50.00	495
	SUB-TOTAL			3,326		3,821		495
174	2 MF Residential	DU	--	--	400.00	2,342	400.00	2,342
	3 Commercial Retail	TSF	35.00	1,892	350.00	18,535	315.00	16,643
	4 Commercial Office	TSF	--	--	350.00	4,046	350.00	4,046
	6 Other	--		--	--	2,469	--	2,469
	SUB-TOTAL			1,892		27,392		25,500

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
175	1 SF Residential	DU	162.00	1,604	380.00	3,108	218.00	1,504
	2 MF Residential	DU	160.00	1,280	210.00	1,625	50.00	345
	3 Commercial Retail	TSF	98.01	5,298	98.01	5,298	0.00	0
	6 Other	--	--	1,295	--	1,295	--	0
	SUB-TOTAL			9,477		11,326		1,849
176	1 SF Residential	DU	686.00	6,791	762.00	7,544	76.00	753
	2 MF Residential	DU	135.00	1,080	270.00	2,012	135.00	932
	3 Commercial Retail	TSF	337.59	13,100	337.59	13,100	0.00	0
	6 Other	--		--	--	326	--	326
	SUB-TOTAL			20,971		22,982		2,011
177	1 SF Residential	DU	477.00	4,722	477.00	4,722	0.00	0
	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	3 Commercial Retail	TSF	97.57	5,275	97.57	5,275	0.00	0
	6 Other	--	--	776	--	1,264	--	488
	SUB-TOTAL			12,885		13,373		488
178	1 SF Residential	DU	333.00	3,297	333.00	3,297	0.00	0
	3 Commercial Retail	TSF	28.31	1,419	28.31	1,419	0.00	0
	4 Commercial Office	TSF	14.81	171	50.81	587	36.00	416
	6 Other	--		--	--	102	--	102
	SUB-TOTAL			4,887		5,405		518
179	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	2 MF Residential	DU	--	--	209.00	775	209.00	775
	3 Commercial Retail	TSF	21.78	807	28.78	4,280	7.00	3,473
	4 Commercial Office	TSF	24.83	849	52.00	1,778	27.17	929
	6 Other	--	--	207	--	207	--	0
	SUB-TOTAL			3,516		8,693		5,177
180	1 SF Residential	DU	428.00	4,237	428.00	4,237	0.00	0
	6 Other	--		--	--	653	--	653
	SUB-TOTAL			4,237		4,890		653
181	1 SF Residential	DU	282.00	2,792	282.00	2,792	0.00	0
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			3,880		3,880		0
182	1 SF Residential	DU	276.00	2,732	276.00	2,732	0.00	0
	2 MF Residential	DU	229.00	1,832	238.00	1,904	9.00	72
	3 Commercial Retail	TSF	76.23	4,121	96.23	5,202	20.00	1,081
	6 Other	--	--	280	--	280	--	0
	SUB-TOTAL			8,965		10,118		1,153
183	2 MF Residential	DU	634.00	5,072	634.00	5,072	0.00	0
	3 Commercial Retail	TSF	--	--	3.50	298	3.50	298
	6 Other	--	--	5,838	--	6,956	--	1,118
	SUB-TOTAL			10,910		12,326		1,416

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
184	4 Commercial Office	TSF	--	--	100.00	1,156	100.00	1,156
	6 Other	--		--	--	528	--	528
	SUB-TOTAL			--		1,684		1,684
185	1 SF Residential	DU	344.00	3,406	344.00	3,406	0.00	0
	SUB-TOTAL			3,406		3,406		0
186	1 SF Residential	DU	150.00	1,485	150.00	1,485	0.00	0
	4 Commercial Office	TSF	108.90	3,724	402.00	13,748	293.10	10,024
	6 Other	--	--	2,104	--	5,720	--	3,616
	SUB-TOTAL			7,313		20,953		13,640
187	1 SF Residential	DU	111.00	1,099	111.00	1,099	0.00	0
	2 MF Residential	DU	307.00	2,456	426.00	2,897	119.00	441
	6 Other	--	--	36	--	36	--	0
	SUB-TOTAL			3,591		4,032		441
188	1 SF Residential	DU	72.00	713	72.00	713	0.00	0
	2 MF Residential	DU	216.00	1,728	216.00	1,728	0.00	0
	SUB-TOTAL			2,441		2,441		0
189	3 Commercial Retail	TSF	--	--	3.00	255	3.00	255
	6 Other	--	--	20,856	--	30,800	--	9,944
	SUB-TOTAL			20,856		31,055		10,199
190	1 SF Residential	DU	171.00	1,693	171.00	1,693	0.00	0
	SUB-TOTAL			1,693		1,693		0
191	4 Commercial Office	TSF	--	--	78.56	2,687	78.56	2,687
	SUB-TOTAL			--		2,687		2,687
192	1 SF Residential	DU	164.00	1,624	164.00	1,624	0.00	0
	2 MF Residential	DU	660.00	5,280	660.00	5,280	0.00	0
	6 Other	--		--	--	520	--	520
	SUB-TOTAL			6,904		7,424		520
193	4 Commercial Office	TSF	250.00	2,550	250.00	2,550	0.00	0
	SUB-TOTAL			2,550		2,550		0
194	6 Other	--	--	796	--	796	--	0
	SUB-TOTAL			796		796		0
195	2 MF Residential	DU	76.00	608	76.00	608	0.00	0
	SUB-TOTAL			608		608		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
196	2 MF Residential	DU	--	--	10.00	80	10.00	80
	3 Commercial Retail	TSF	--	--	2.50	93	2.50	93
	4 Commercial Office	TSF	--	--	34.55	399	34.55	399
	6 Other	--		--	--	1,646	--	1,646
	SUB-TOTAL			--		2,218		2,218
197	3 Commercial Retail	TSF	--	--	13.00	1,106	13.00	1,106
	4 Commercial Office	TSF	--	--	400.00	4,080	400.00	4,080
	SUB-TOTAL			--		5,186		5,186
198	1 SF Residential	DU	331.00	3,277	331.00	3,277	0.00	0
	SUB-TOTAL			3,277		3,277		0
199	3 Commercial Retail	TSF	5.00	652	5.00	652	0.00	0
	6 Other	--	--	1,951	--	1,951	--	0
	SUB-TOTAL			2,603		2,603		0
200	4 Commercial Office	TSF	385.10	3,928	578.00	5,896	192.90	1,968
	SUB-TOTAL			3,928		5,896		1,968
201	4 Commercial Office	TSF	--	--	160.00	1,632	160.00	1,632
	SUB-TOTAL			--		1,632		1,632
202	2 MF Residential	DU	50.00	345	560.00	3,864	510.00	3,519
	3 Commercial Retail	TSF	13.00	482	22.00	815	9.00	333
	4 Commercial Office	TSF	13.00	150	13.00	150	0.00	0
	6 Other	--	--	4,218	--	4,218	--	0
	SUB-TOTAL			5,195		9,047		3,852
203	2 MF Residential	DU	--	--	450.00	3,105	450.00	3,105
	3 Commercial Retail	TSF	742.00	29,725	2,000.00	80,120	1,258.00	50,395
	4 Commercial Office	TSF	--	--	125.00	1,445	125.00	1,445
	SUB-TOTAL			29,725		84,670		54,945
204	3 Commercial Retail	TSF	62.00	2,298	62.00	2,298	0.00	0
	4 Commercial Office	TSF	400.00	4,624	400.00	4,624	0.00	0
	6 Other	--	--	5,808	--	5,808	--	0
	SUB-TOTAL			12,730		12,730		0
205	3 Commercial Retail	TSF	47.30	2,557	100.00	5,406	52.70	2,849
	4 Commercial Office	TSF	198.89	2,299	850.00	9,826	651.11	7,527
	6 Other	--	--	1,700	--	3,399	--	1,699
	SUB-TOTAL			6,556		18,631		12,075
206	3 Commercial Retail	TSF	141.99	8,876	187.61	11,782	45.62	2,906
	SUB-TOTAL			8,876		11,782		2,906

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
207	3 Commercial Retail	TSF	--	--	6.00	782	6.00	782
	4 Commercial Office	TSF	230.00	2,659	350.00	4,046	120.00	1,387
	SUB-TOTAL			2,659		4,828		2,169
208	2 MF Residential	DU	234.00	1,872	234.00	1,872	0.00	0
	SUB-TOTAL			1,872		1,872		0
209	1 SF Residential	DU	414.00	4,099	414.00	4,099	0.00	0
	2 MF Residential	DU	352.00	2,816	352.00	2,816	0.00	0
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			8,003		8,003		0
210	1 SF Residential	DU	205.00	2,029	205.00	2,029	0.00	0
	2 MF Residential	DU	208.00	1,664	208.00	1,664	0.00	0
	3 Commercial Retail	TSF	148.10	8,006	148.10	8,006	0.00	0
	SUB-TOTAL			11,699		11,699		0
211	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	SUB-TOTAL			1,653		1,653		0
212	1 SF Residential	DU	252.00	2,495	252.00	2,495	0.00	0
	2 MF Residential	DU	272.00	2,176	272.00	2,176	0.00	0
	6 Other	--	--	179	--	179	--	0
	SUB-TOTAL			4,850		4,850		0
213	1 SF Residential	DU	275.00	2,723	275.00	2,723	0.00	0
	6 Other	--	--	233	--	233	--	0
	SUB-TOTAL			2,956		2,956		0
214	1 SF Residential	DU	--	--	49.00	485	49.00	485
	2 MF Residential	DU	107.00	738	181.00	1,330	74.00	592
	6 Other	--		--	--	74	--	74
	SUB-TOTAL			738		1,889		1,151
215	1 SF Residential	DU	80.00	792	80.00	792	0.00	0
	2 MF Residential	DU	52.00	416	52.00	416	0.00	0
	3 Commercial Retail	TSF	143.56	7,020	143.56	7,020	0.00	0
	6 Other	--	--	5,056	--	6,027	--	971
	SUB-TOTAL			13,284		14,255		971
216	1 SF Residential	DU	22.00	218	22.00	218	0.00	0
	2 MF Residential	DU	128.00	1,024	448.00	3,507	320.00	2,483
	3 Commercial Retail	TSF	149.96	8,107	204.96	11,080	55.00	2,973
	4 Commercial Office	TSF	10.45	121	65.45	757	55.00	636
	SUB-TOTAL			9,470		15,562		6,092

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
217	1 SF Residential	DU	202.00	2,000	202.00	2,000	0.00	0
	2 MF Residential	DU	16.00	128	386.00	3,011	370.00	2,883
	3 Commercial Retail	TSF	65.75	3,554	110.75	5,222	45.00	1,668
	4 Commercial Office	TSF	22.44	259	22.44	259	0.00	0
	5 Industrial Park	TSF	22.44	135	22.44	135	0.00	0
	SUB-TOTAL			6,076		10,627		4,551
218	1 SF Residential	DU	458.00	4,081	511.00	4,606	53.00	525
	2 MF Residential	DU	641.00	5,128	810.00	6,414	169.00	1,286
	3 Commercial Retail	TSF	64.25	2,381	557.87	24,488	493.62	22,107
	6 Other	--	--	88	--	1,176	--	1,088
	SUB-TOTAL			11,678		36,684		25,006
219	1 SF Residential	DU	--	--	20.00	198	20.00	198
	2 MF Residential	DU	--	--	250.00	2,000	250.00	2,000
	4 Commercial Office	TSF	--	--	100.00	1,020	100.00	1,020
	SUB-TOTAL			--		3,218		3,218
220	1 SF Residential	DU	2.00	20	8.00	79	6.00	59
	4 Commercial Office	TSF	--	--	100.00	1,020	100.00	1,020
	6 Other	--	--	1,348	--	1,348	--	0
	SUB-TOTAL			1,368		2,447		1,079
221	1 SF Residential	DU	309.00	2,969	380.00	3,672	71.00	703
	2 MF Residential	DU	6.00	48	6.00	48	0.00	0
	4 Commercial Office	TSF	--	--	50.00	510	50.00	510
	5 Industrial Park	TSF	144.40	866	144.40	866	0.00	0
	6 Other	--	--	1,417	--	1,417	--	0
	SUB-TOTAL			5,300		6,513		1,213
222	1 SF Residential	DU	33.00	327	55.00	545	22.00	218
	6 Other	--	--	3,091	--	3,861	--	770
	SUB-TOTAL			3,418		4,406		988
223	3 Commercial Retail	TSF	43.38	2,345	110.00	5,947	66.62	3,602
	4 Commercial Office	TSF	0.36	4	248.00	2,867	247.64	2,863
	5 Industrial Park	TSF	70.36	422	242.00	1,452	171.64	1,030
	6 Other	--		--	--	823	--	823
	SUB-TOTAL			2,771		11,089		8,318
224	1 SF Residential	DU	260.00	2,484	280.00	2,682	20.00	198
	2 MF Residential	DU	500.00	4,000	550.00	4,400	50.00	400
	3 Commercial Retail	TSF	81.68	3,027	116.68	4,324	35.00	1,297
	6 Other	--	--	2,469	--	4,011	--	1,542
	SUB-TOTAL			11,980		15,417		3,437
225	1 SF Residential	DU	156.00	1,544	156.00	1,544	0.00	0
	6 Other	--	--	1,776	--	1,776	--	0
	SUB-TOTAL			3,320		3,320		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
226	1 SF Residential	DU	300.00	2,970	300.00	2,970	0.00	0
	2 MF Residential	DU	292.00	2,336	292.00	2,336	0.00	0
	3 Commercial Retail	TSF	69.70	2,583	85.38	3,917	15.68	1,334
	6 Other	--		--	--	354	--	354
	SUB-TOTAL			7,889		9,577		1,688
227	1 SF Residential	DU	100.00	990	118.00	1,168	18.00	178
	2 MF Residential	DU	184.00	1,472	786.00	6,288	602.00	4,816
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			2,462		8,544		6,082
228	1 SF Residential	DU	358.00	3,544	385.00	3,811	27.00	267
	SUB-TOTAL			3,544		3,811		267
229	1 SF Residential	DU	74.00	733	178.00	1,763	104.00	1,030
	SUB-TOTAL			733		1,763		1,030
230	1 SF Residential	DU	1.00	10	10.00	99	9.00	89
	SUB-TOTAL			10		99		89
231	1 SF Residential	DU	--	--	5.00	50	5.00	50
	2 MF Residential	DU	--	--	51.00	408	51.00	408
	6 Other	--		--	--	69	--	69
	SUB-TOTAL			--		527		527
232	1 SF Residential	DU	--	--	10.00	99	10.00	99
	2 MF Residential	DU	--	--	850.00	5,865	850.00	5,865
	SUB-TOTAL			--		5,964		5,964
234	3 Commercial Retail	TSF	--	--	100.00	5,406	100.00	5,406
	4 Commercial Office	TSF	--	--	470.24	4,796	470.24	4,796
	SUB-TOTAL			--		10,202		10,202
235	3 Commercial Retail	TSF	60.20	3,254	240.00	12,974	179.80	9,720
	4 Commercial Office	TSF	24.00	245	80.00	816	56.00	571
	SUB-TOTAL			3,499		13,790		10,291
236	1 SF Residential	DU	--	--	808.00	8,000	808.00	8,000
	6 Other	--		--	--	1,101	--	1,101
	SUB-TOTAL			--		9,101		9,101
237	1 SF Residential	DU	--	--	225.00	2,228	225.00	2,228
	2 MF Residential	DU	--	--	570.00	3,933	570.00	3,933
	4 Commercial Office	TSF	--	--	99.00	1,144	99.00	1,144
	6 Other	--		--	--	63	--	63
	SUB-TOTAL			--		7,368		7,368

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
238	1 SF Residential	DU	--	--	399.00	3,950	399.00	3,950
	2 MF Residential	DU	--	--	123.00	984	123.00	984
	3 Commercial Retail	TSF	--	--	184.00	12,479	184.00	12,479
	4 Commercial Office	TSF	--	--	340.00	3,621	340.00	3,621
	5 Industrial Park	TSF	--	--	944.00	5,664	944.00	5,664
	6 Other	--		--	--	67	--	67
	SUB-TOTAL			--		26,765		26,765
239	3 Commercial Retail	TSF	87.12	3,229	337.29	12,500	250.17	9,271
	4 Commercial Office	TSF	170.26	1,968	262.87	3,039	92.61	1,071
	5 Industrial Park	TSF	310.00	1,860	387.07	2,322	77.07	462
	6 Other	--	--	895	--	895	--	0
	SUB-TOTAL			7,952		18,756		10,804
240	3 Commercial Retail	TSF	--	--	181.00	14,181	181.00	14,181
	SUB-TOTAL			--		14,181		14,181
241	4 Commercial Office	TSF	--	--	1,228.00	13,198	1,228.00	13,198
	6 Other	--		--	--	1,128	--	1,128
	SUB-TOTAL			--		14,326		14,326
242	4 Commercial Office	TSF	--	--	368.00	3,910	368.00	3,910
	SUB-TOTAL			--		3,910		3,910
243	1 SF Residential	DU	--	--	211.00	2,089	211.00	2,089
	2 MF Residential	DU	--	--	816.00	6,099	816.00	6,099
	3 Commercial Retail	TSF	--	--	129.00	10,188	129.00	10,188
	4 Commercial Office	TSF	--	--	164.00	1,896	164.00	1,896
	SUB-TOTAL			--		20,272		20,272
244	1 SF Residential	DU	322.00	3,188	322.00	3,188	0.00	0
	SUB-TOTAL			3,188		3,188		0
245	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	6 Other	--	--	34	--	34	--	0
	SUB-TOTAL			232		232		0
246	5 Industrial Park	TSF	58.81	300	120.00	612	61.19	312
	SUB-TOTAL			300		612		312
247	3 Commercial Retail	TSF	71.37	3,858	500.00	20,030	428.63	16,172
	SUB-TOTAL			3,858		20,030		16,172
248	1 SF Residential	DU	2.00	20	2.00	20	0.00	0
	2 MF Residential	DU	4.00	32	4.00	32	0.00	0
	5 Industrial Park	TSF	882.09	5,293	1,200.00	7,200	317.91	1,907
	SUB-TOTAL			5,345		7,252		1,907

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
249	4 Commercial Office	TSF	--	--	250.00	2,890	250.00	2,890
	5 Industrial Park	TSF	291.68	1,488	291.68	1,488	0.00	0
	SUB-TOTAL			1,488		4,378		2,890
250	2 MF Residential	DU	--	--	450.00	3,435	450.00	3,435
	3 Commercial Retail	TSF	58.00	2,149	448.66	17,799	390.66	15,650
	4 Commercial Office	TSF	--	--	300.00	3,264	300.00	3,264
	SUB-TOTAL			2,149		24,498		22,349
251	5 Industrial Park	TSF	--	--	400.00	2,400	400.00	2,400
	SUB-TOTAL			--		2,400		2,400
252	4 Commercial Office	TSF	--	--	858.00	8,752	858.00	8,752
	SUB-TOTAL			--		8,752		8,752
253	1 SF Residential	DU	--	--	32.00	317	32.00	317
	SUB-TOTAL			--		317		317
254	3 Commercial Retail	TSF	8.71	323	116.21	6,134	107.50	5,811
	SUB-TOTAL			323		6,134		5,811
255	1 SF Residential	DU	2.00	20	20.00	198	18.00	178
	SUB-TOTAL			20		198		178
256	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	SUB-TOTAL			198		198		0
257	1 SF Residential	DU	103.00	1,020	170.00	1,683	67.00	663
	SUB-TOTAL			1,020		1,683		663
258	1 SF Residential	DU	54.00	535	130.00	1,287	76.00	752
	5 Industrial Park	TSF	--	--	125.00	638	125.00	638
	6 Other	--		--	--	3,324	--	3,324
	SUB-TOTAL			535		5,249		4,714
259	1 SF Residential	DU	--	--	10.00	99	10.00	99
	SUB-TOTAL			--		99		99
260	1 SF Residential	DU	27.00	267	402.00	3,980	375.00	3,713
	SUB-TOTAL			267		3,980		3,713
261	1 SF Residential	DU	10.00	99	25.00	247	15.00	148
	SUB-TOTAL			99		247		148
262	1 SF Residential	DU	346.00	3,425	790.00	7,821	444.00	4,396
	2 MF Residential	DU	--	--	100.00	800	100.00	800
	6 Other	--	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			4,513		9,709		5,196

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
263	2 MF Residential	DU	--	--	200.00	1,600	200.00	1,600
	SUB-TOTAL			--		1,600		1,600
264	1 SF Residential	DU	63.00	624	63.00	624	0.00	0
	2 MF Residential	DU	264.00	2,026	264.00	2,026	0.00	0
	SUB-TOTAL			2,650		2,650		0
265	2 MF Residential	DU	670.00	4,975	670.00	4,975	0.00	0
	SUB-TOTAL			4,975		4,975		0
266	2 MF Residential	DU	200.00	742	200.00	742	0.00	0
	3 Commercial Retail	TSF	101.04	5,462	120.00	6,487	18.96	1,025
	5 Industrial Park	TSF	--	--	75.00	383	75.00	383
	SUB-TOTAL			6,204		7,612		1,408
267	3 Commercial Retail	TSF	100.00	5,406	200.00	10,812	100.00	5,406
	SUB-TOTAL			5,406		10,812		5,406
268	2 MF Residential	DU	180.00	1,440	180.00	1,440	0.00	0
	3 Commercial Retail	TSF	182.33	9,857	182.33	9,857	0.00	0
	5 Industrial Park	TSF	75.00	383	112.00	571	37.00	188
	SUB-TOTAL			11,680		11,868		188
269	1 SF Residential	DU	173.00	1,713	266.00	2,633	93.00	920
	2 MF Residential	DU	--	--	25.00	93	25.00	93
	6 Other	--	--	8	--	737	--	729
	SUB-TOTAL			1,721		3,463		1,742
270	1 SF Residential	DU	8.00	79	308.00	3,049	300.00	2,970
	2 MF Residential	DU	--	--	75.00	278	75.00	278
	SUB-TOTAL			79		3,327		3,248
271	2 MF Residential	DU	--	--	171.00	1,180	171.00	1,180
	3 Commercial Retail	TSF	--	--	630.00	25,238	630.00	25,238
	SUB-TOTAL			--		26,418		26,418
272	1 SF Residential	DU	819.00	8,108	967.00	9,573	148.00	1,465
	2 MF Residential	DU	180.00	1,440	180.00	1,440	0.00	0
	3 Commercial Retail	TSF	8.12	691	8.12	691	0.00	0
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			11,327		12,792		1,465
273	1 SF Residential	DU	6.00	59	101.00	1,000	95.00	941
	SUB-TOTAL			59		1,000		941
274	1 SF Residential	DU	--	--	80.00	792	80.00	792
	4 Commercial Office	TSF	--	--	110.06	1,123	110.06	1,123
	SUB-TOTAL			--		1,915		1,915

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
275	1 SF Residential	DU	225.00	2,228	225.00	2,228	0.00	0
	SUB-TOTAL			2,228		2,228		0
276	1 SF Residential	DU	75.00	743	75.00	743	0.00	0
	2 MF Residential	DU	539.00	4,312	539.00	4,312	0.00	0
	3 Commercial Retail	TSF	98.01	8,337	98.01	8,337	0.00	0
	6 Other	--	--	73	--	73	--	0
	SUB-TOTAL			13,465		13,465		0
277	3 Commercial Retail	TSF	7.91	656	73.00	4,175	65.09	3,519
	4 Commercial Office	TSF	--	--	110.00	3,536	110.00	3,536
	5 Industrial Park	TSF	--	--	150.00	765	150.00	765
	SUB-TOTAL			656		8,476		7,820
278	2 MF Residential	DU	757.00	6,056	757.00	6,056	0.00	0
	3 Commercial Retail	TSF	81.89	6,966	81.89	6,966	0.00	0
	6 Other	--	--	398	--	398	--	0
	SUB-TOTAL			13,420		13,420		0
279	1 SF Residential	DU	313.00	2,160	313.00	2,160	0.00	0
	3 Commercial Retail	TSF	19.33	1,644	26.33	2,240	7.00	596
	4 Commercial Office	TSF	0.20	2	0.20	2	0.00	0
	5 Industrial Park	TSF	--	--	58.00	348	58.00	348
	SUB-TOTAL			3,806		4,750		944
280	4 Commercial Office	TSF	--	--	38.18	389	38.18	389
	SUB-TOTAL			--		389		389
281	2 MF Residential	DU	--	--	150.00	1,200	150.00	1,200
	SUB-TOTAL			--		1,200		1,200
282	2 MF Residential	DU	486.00	3,888	700.00	5,600	214.00	1,712
	3 Commercial Retail	TSF	17.90	968	17.90	968	0.00	0
	SUB-TOTAL			4,856		6,568		1,712
283	1 SF Residential	DU	161.00	1,594	175.00	1,732	14.00	138
	2 MF Residential	DU	400.00	3,200	667.00	5,336	267.00	2,136
	6 Other	--	--	1,618	--	1,740	--	122
	SUB-TOTAL			6,412		8,808		2,396
284	1 SF Residential	DU	2.00	20	2.00	20	0.00	0
	2 MF Residential	DU	254.00	2,032	254.00	2,032	0.00	0
	SUB-TOTAL			2,052		2,052		0
285	1 SF Residential	DU	--	--	80.00	792	80.00	792
	3 Commercial Retail	TSF	--	--	246.99	9,894	246.99	9,894
	4 Commercial Office	TSF	--	--	150.00	1,530	150.00	1,530
	SUB-TOTAL			--		12,216		12,216

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
286	1 SF Residential	DU	--	--	182.00	1,802	182.00	1,802
	SUB-TOTAL			--		1,802		1,802
287	1 SF Residential	DU	--	--	35.00	347	35.00	347
	2 MF Residential	DU	--	--	120.00	960	120.00	960
	SUB-TOTAL			--		1,307		1,307
288	1 SF Residential	DU	--	--	167.00	1,653	167.00	1,653
	6 Other	--		--	--	4,475	--	4,475
	SUB-TOTAL			--		6,128		6,128
289	1 SF Residential	DU	--	--	166.00	1,643	166.00	1,643
	2 MF Residential	DU	--	--	350.00	2,415	350.00	2,415
	4 Commercial Office	TSF	--	--	57.17	583	57.17	583
	SUB-TOTAL			--		4,641		4,641
290	1 SF Residential	DU	64.00	634	104.00	1,030	40.00	396
	2 MF Residential	DU	93.00	744	93.00	744	0.00	0
	SUB-TOTAL			1,378		1,774		396
291	1 SF Residential	DU	--	--	74.00	733	74.00	733
	2 MF Residential	DU	--	--	350.00	2,415	350.00	2,415
	4 Commercial Office	TSF	8.60	88	181.63	1,853	173.03	1,765
	SUB-TOTAL			88		5,001		4,913
292	1 SF Residential	DU	140.00	1,386	140.00	1,386	0.00	0
	SUB-TOTAL			1,386		1,386		0
293	1 SF Residential	DU	133.00	1,317	180.00	1,782	47.00	465
	2 MF Residential	DU	368.00	2,944	684.00	5,217	316.00	2,273
	SUB-TOTAL			4,261		6,999		2,738
294	2 MF Residential	DU	--	--	276.00	1,904	276.00	1,904
	3 Commercial Retail	TSF	124.35	6,722	155.00	8,379	30.65	1,657
	5 Industrial Park	TSF	210.00	1,260	300.00	1,800	90.00	540
	SUB-TOTAL			7,982		12,083		4,101
295	4 Commercial Office	TSF	--	--	56.00	647	56.00	647
	5 Industrial Park	TSF	666.67	3,400	1,020.58	5,205	353.91	1,805
	6 Other	--	--	56	--	156	--	100
	SUB-TOTAL			3,456		6,008		2,552
296	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			--		1,701		1,701
297	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			--		1,701		1,701

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
298	2 MF Residential	DU	830.00	5,727	830.00	5,727	0.00	0
	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			5,727		7,428		1,701
299	3 Commercial Retail	TSF	184.00	9,947	184.00	9,947	0.00	0
	SUB-TOTAL			9,947		9,947		0
300	3 Commercial Retail	TSF	272.00	10,896	300.00	12,018	28.00	1,122
	SUB-TOTAL			10,896		12,018		1,122
301	3 Commercial Retail	TSF	49.24	1,825	49.24	1,825	0.00	0
	6 Other	--	--	7,904	--	8,635	--	731
	SUB-TOTAL			9,729		10,460		731
302	3 Commercial Retail	TSF	30.00	2,552	30.00	2,552	0.00	0
	6 Other	--	--	3,750	--	3,750	--	0
	SUB-TOTAL			6,302		6,302		0
303	6 Other	--	--	5,625	--	5,625	--	0
	SUB-TOTAL			5,625		5,625		0
304	3 Commercial Retail	TSF	48.00	3,739	48.00	3,739	0.00	0
	6 Other	--	--	3,113	--	3,113	--	0
	SUB-TOTAL			6,852		6,852		0
305	2 MF Residential	DU	--	--	76.00	524	76.00	524
	3 Commercial Retail	TSF	202.65	11,364	202.65	11,364	0.00	0
	5 Industrial Park	TSF	--	--	100.00	510	100.00	510
	SUB-TOTAL			11,364		12,398		1,034
306	2 MF Residential	DU	--	--	250.00	1,863	250.00	1,863
	3 Commercial Retail	TSF	80.50	4,352	143.90	7,779	63.40	3,427
	4 Commercial Office	TSF	--	--	50.00	1,710	50.00	1,710
	6 Other	--	--	336	--	336	--	0
	SUB-TOTAL			4,688		11,688		7,000
307	3 Commercial Retail	TSF	132.80	9,301	132.80	9,301	0.00	0
	SUB-TOTAL			9,301		9,301		0
308	2 MF Residential	DU	200.00	1,380	200.00	1,380	0.00	0
	3 Commercial Retail	TSF	175.11	14,895	175.11	14,895	0.00	0
	5 Industrial Park	TSF	29.40	150	45.00	230	15.60	80
	SUB-TOTAL			16,425		16,505		80
309	3 Commercial Retail	TSF	3.00	111	3.00	111	0.00	0
	SUB-TOTAL			111		111		0
310	6 Other	--	--	45	--	4,208	--	4,163
	SUB-TOTAL			45		4,208		4,163

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
311	1 SF Residential	DU	132.00	1,307	132.00	1,307	0.00	0
	2 MF Residential	DU	63.00	504	63.00	504	0.00	0
	SUB-TOTAL			1,811		1,811		0
312	3 Commercial Retail	TSF	164.40	8,887	180.00	9,731	15.60	844
	6 Other	--	--	200	--	200	--	0
	SUB-TOTAL			9,087		9,931		844
313	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	SUB-TOTAL			2,112		2,112		0
314	3 Commercial Retail	TSF	178.00	9,623	178.00	9,623	0.00	0
	SUB-TOTAL			9,623		9,623		0
315	1 SF Residential	DU	56.00	554	56.00	554	0.00	0
	2 MF Residential	DU	168.00	1,344	168.00	1,344	0.00	0
	SUB-TOTAL			1,898		1,898		0
316	1 SF Residential	DU	121.00	1,198	121.00	1,198	0.00	0
	SUB-TOTAL			1,198		1,198		0
317	6 Other	--	--	1,135	--	1,135	--	0
	SUB-TOTAL			1,135		1,135		0
318	1 SF Residential	DU	21.00	208	21.00	208	0.00	0
	2 MF Residential	DU	252.00	2,016	252.00	2,016	0.00	0
	SUB-TOTAL			2,224		2,224		0
319	3 Commercial Retail	TSF	--	--	130.00	7,028	130.00	7,028
	6 Other	--		--	--	292	--	292
	SUB-TOTAL			--		7,320		7,320
320	1 SF Residential	DU	125.00	1,238	125.00	1,238	0.00	0
	SUB-TOTAL			1,238		1,238		0
321	1 SF Residential	DU	155.00	1,535	155.00	1,535	0.00	0
	2 MF Residential	DU	66.00	528	66.00	528	0.00	0
	SUB-TOTAL			2,063		2,063		0
322	1 SF Residential	DU	87.00	861	87.00	861	0.00	0
	SUB-TOTAL			861		861		0
323	1 SF Residential	DU	161.00	1,594	161.00	1,594	0.00	0
	2 MF Residential	DU	132.00	1,056	132.00	1,056	0.00	0
	SUB-TOTAL			2,650		2,650		0
325	1 SF Residential	DU	--	--	205.00	2,029	205.00	2,029
	SUB-TOTAL			--		2,029		2,029

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
326	1 SF Residential	DU	101.00	1,000	101.00	1,000	0.00	0
	SUB-TOTAL			1,000		1,000		0
327	1 SF Residential	DU	105.00	1,040	105.00	1,040	0.00	0
	SUB-TOTAL			1,040		1,040		0
328	1 SF Residential	DU	110.00	1,089	110.00	1,089	0.00	0
	SUB-TOTAL			1,089		1,089		0
329	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			1,088		1,088		0
330	1 SF Residential	DU	143.00	1,416	143.00	1,416	0.00	0
	SUB-TOTAL			1,416		1,416		0
331	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	SUB-TOTAL			1,653		1,653		0
332	1 SF Residential	DU	114.00	1,129	114.00	1,129	0.00	0
	2 MF Residential	DU	102.00	816	102.00	816	0.00	0
	SUB-TOTAL			1,945		1,945		0
333	1 SF Residential	DU	803.00	7,950	803.00	7,950	0.00	0
	2 MF Residential	DU	360.00	2,880	360.00	2,880	0.00	0
	3 Commercial Retail	TSF	25.05	928	25.05	928	0.00	0
	6 Other	--	--	1,340	--	1,740	--	400
	SUB-TOTAL			13,098		13,498		400
334	1 SF Residential	DU	164.00	1,624	164.00	1,624	0.00	0
	SUB-TOTAL			1,624		1,624		0
335	1 SF Residential	DU	194.00	1,921	194.00	1,921	0.00	0
	SUB-TOTAL			1,921		1,921		0
336	1 SF Residential	DU	589.00	5,831	589.00	5,831	0.00	0
	6 Other	--	--	1,107	--	1,107	--	0
	SUB-TOTAL			6,938		6,938		0
337	1 SF Residential	DU	390.00	3,861	390.00	3,861	0.00	0
	SUB-TOTAL			3,861		3,861		0
338	3 Commercial Retail	TSF	92.00	4,974	92.00	4,974	0.00	0
	SUB-TOTAL			4,974		4,974		0
339	1 SF Residential	DU	289.00	2,861	289.00	2,861	0.00	0
	6 Other	--	--	1,106	--	1,106	--	0
	SUB-TOTAL			3,967		3,967		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
340	1 SF Residential	DU	394.00	3,901	394.00	3,901	0.00	0
	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	SUB-TOTAL			6,013		6,013		0
341	2 MF Residential	DU	325.00	2,243	325.00	2,243	0.00	0
	6 Other	--	--	1,175	--	1,175	--	0
	SUB-TOTAL			3,418		3,418		0
342	2 MF Residential	DU	168.00	1,344	168.00	1,344	0.00	0
	SUB-TOTAL			1,344		1,344		0
343	1 SF Residential	DU	179.00	1,772	179.00	1,772	0.00	0
	2 MF Residential	DU	132.00	1,056	132.00	1,056	0.00	0
	SUB-TOTAL			2,828		2,828		0
344	1 SF Residential	DU	415.00	4,109	415.00	4,109	0.00	0
	3 Commercial Retail	TSF	--	--	40.00	2,162	40.00	2,162
	SUB-TOTAL			4,109		6,271		2,162
345	1 SF Residential	DU	23.00	228	81.00	802	58.00	574
	SUB-TOTAL			228		802		574
346	1 SF Residential	DU	--	--	10.00	99	10.00	99
	SUB-TOTAL			--		99		99
347	1 SF Residential	DU	313.00	3,099	313.00	3,099	0.00	0
	SUB-TOTAL			3,099		3,099		0
348	1 SF Residential	DU	517.00	5,118	517.00	5,118	0.00	0
	SUB-TOTAL			5,118		5,118		0
349	2 MF Residential	DU	83.00	664	388.00	3,104	305.00	2,440
	3 Commercial Retail	TSF	8.00	680	8.00	680	0.00	0
	6 Other	--	--	226	--	226	--	0
	SUB-TOTAL			1,570		4,010		2,440
350	6 Other	--	--	1,010	--	1,860	--	850
	SUB-TOTAL			1,010		1,860		850
352	1 SF Residential	DU	440.00	4,356	592.00	5,861	152.00	1,505
	6 Other	--		--	--	1,363	--	1,363
	SUB-TOTAL			4,356		7,224		2,868
353	1 SF Residential	DU	259.00	2,564	259.00	2,564	0.00	0
	6 Other	--		--	--	26	--	26
	SUB-TOTAL			2,564		2,590		26

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
355	1 SF Residential	DU	--	--	500.00	4,950	500.00	4,950
	6 Other	--		--	--	1,101	--	1,101
	SUB-TOTAL			--		6,051		6,051
356	1 SF Residential	DU	385.00	3,811	385.00	3,811	0.00	0
	3 Commercial Retail	TSF	--	--	60.00	5,104	60.00	5,104
	SUB-TOTAL			3,811		8,915		5,104
357	1 SF Residential	DU	--	--	90.00	891	90.00	891
	SUB-TOTAL			--		891		891
358	1 SF Residential	DU	105.00	1,040	275.00	2,723	170.00	1,683
	2 MF Residential	DU	121.00	968	121.00	968	0.00	0
	6 Other	--	--	970	--	1,138	--	168
	SUB-TOTAL			2,978		4,829		1,851
359	1 SF Residential	DU	570.00	5,643	570.00	5,643	0.00	0
	2 MF Residential	DU	192.00	1,536	192.00	1,536	0.00	0
	SUB-TOTAL			7,179		7,179		0
360	1 SF Residential	DU	538.00	5,326	538.00	5,326	0.00	0
	2 MF Residential	DU	248.00	1,984	248.00	1,984	0.00	0
	3 Commercial Retail	TSF	119.00	10,122	135.00	11,483	16.00	1,361
	6 Other	--	--	938	--	1,088	--	150
	SUB-TOTAL			18,370		19,881		1,511
361	1 SF Residential	DU	188.00	1,861	601.00	5,407	413.00	3,546
	6 Other	--		--	--	28	--	28
	SUB-TOTAL			1,861		5,435		3,574
362	1 SF Residential	DU	173.00	1,713	173.00	1,713	0.00	0
	SUB-TOTAL			1,713		1,713		0
363	1 SF Residential	DU	6.00	59	44.00	436	38.00	377
	SUB-TOTAL			59		436		377
364	1 SF Residential	DU	199.00	1,970	199.00	1,970	0.00	0
	SUB-TOTAL			1,970		1,970		0
365	1 SF Residential	DU	201.00	1,990	201.00	1,990	0.00	0
	2 MF Residential	DU	102.00	816	102.00	816	0.00	0
	3 Commercial Retail	TSF	11.00	936	11.00	936	0.00	0
	SUB-TOTAL			3,742		3,742		0
366	1 SF Residential	DU	600.00	5,940	600.00	5,940	0.00	0
	SUB-TOTAL			5,940		5,940		0
367	1 SF Residential	DU	437.00	4,326	437.00	4,326	0.00	0
	SUB-TOTAL			4,326		4,326		0

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
368	1 SF Residential	DU	1,070.00	10,593	1,070.00	10,593	0.00	0
	3 Commercial Retail	TSF	--	--	35.00	2,977	35.00	2,977
	6 Other	--	--	1,174	--	1,629	--	455
	SUB-TOTAL			11,767		15,199		3,432
369	1 SF Residential	DU	202.00	2,000	202.00	2,000	0.00	0
	SUB-TOTAL			2,000		2,000		0
370	1 SF Residential	DU	1,080.00	10,692	1,080.00	10,692	0.00	0
	6 Other	--	--	4,475	--	4,475	--	0
	SUB-TOTAL			15,167		15,167		0
371	1 SF Residential	DU	673.00	6,663	673.00	6,663	0.00	0
	6 Other	--	--	996	--	1,088	--	92
	SUB-TOTAL			7,659		7,751		92
372	1 SF Residential	DU	287.00	2,841	287.00	2,841	0.00	0
	2 MF Residential	DU	230.00	1,840	230.00	1,840	0.00	0
	3 Commercial Retail	TSF	80.00	4,325	80.00	4,325	0.00	0
	SUB-TOTAL			9,006		9,006		0
373	1 SF Residential	DU	236.00	2,336	236.00	2,336	0.00	0
	6 Other	--	--	889	--	1,307	--	418
	SUB-TOTAL			3,225		3,643		418
374	1 SF Residential	DU	--	--	300.00	2,970	300.00	2,970
	2 MF Residential	DU	--	--	304.00	2,098	304.00	2,098
	3 Commercial Retail	TSF	150.00	8,109	150.00	8,109	0.00	0
	6 Other	--		--	--	78	--	78
	SUB-TOTAL			8,109		13,255		5,146
375	3 Commercial Retail	TSF	5.00	2,481	45.00	5,883	40.00	3,402
	SUB-TOTAL			2,481		5,883		3,402
377	3 Commercial Retail	TSF	57.50	2,131	57.50	2,131	0.00	0
	SUB-TOTAL			2,131		2,131		0
378	1 SF Residential	DU	332.00	2,291	332.00	2,291	0.00	0
	2 MF Residential	DU	--	--	407.00	3,256	407.00	3,256
	3 Commercial Retail	TSF	41.00	1,519	51.00	1,890	10.00	371
	4 Commercial Office	TSF	56.00	571	56.00	571	0.00	0
	5 Industrial Park	TSF	--	--	110.00	660	110.00	660
	SUB-TOTAL			4,381		8,668		4,287
380	1 SF Residential	DU	--	--	125.00	1,238	125.00	1,238
	2 MF Residential	DU	--	--	400.00	2,760	400.00	2,760
	SUB-TOTAL			--		3,998		3,998

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
381	6 Other	--	--	130	--	223	--	93
	SUB-TOTAL			130		223		93
382	6 Other	--	--	180	--	180	--	0
	SUB-TOTAL			180		180		0
383	1 SF Residential	DU	231.00	2,287	266.00	2,633	35.00	346
	3 Commercial Retail	TSF	8.71	323	8.71	323	0.00	0
	SUB-TOTAL			2,610		2,956		346
384	1 SF Residential	DU	354.00	3,505	354.00	3,505	0.00	0
	SUB-TOTAL			3,505		3,505		0
385	1 SF Residential	DU	--	--	75.00	743	75.00	743
	SUB-TOTAL			--		743		743
387	1 SF Residential	DU	304.00	3,010	800.00	7,920	496.00	4,910
	2 MF Residential	DU	180.00	1,440	700.00	5,600	520.00	4,160
	SUB-TOTAL			4,450		13,520		9,070
388	1 SF Residential	DU	--	--	99.00	980	99.00	980
	2 MF Residential	DU	--	--	400.00	3,200	400.00	3,200
	6 Other	--		--	--	2,320	--	2,320
	SUB-TOTAL			--		6,500		6,500
389	1 SF Residential	DU	1,187.00	11,751	1,236.00	12,236	49.00	485
	6 Other	--	--	766	--	1,088	--	322
	SUB-TOTAL			12,517		13,324		807
390	1 SF Residential	DU	150.00	1,485	150.00	1,485	0.00	0
	SUB-TOTAL			1,485		1,485		0
391	3 Commercial Retail	TSF	16.33	605	16.33	605	0.00	0
	5 Industrial Park	TSF	376.36	1,919	446.36	2,339	70.00	420
	SUB-TOTAL			2,524		2,944		420
392	1 SF Residential	DU	723.00	5,958	757.00	6,193	34.00	235
	3 Commercial Retail	TSF	20.80	771	102.48	5,187	81.68	4,416
	5 Industrial Park	TSF	--	--	500.00	2,550	500.00	2,550
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			7,817		15,018		7,201
393	1 SF Residential	DU	162.00	1,604	162.00	1,604	0.00	0
	2 MF Residential	DU	100.00	800	100.00	800	0.00	0
	3 Commercial Retail	TSF	52.27	4,446	52.27	4,446	0.00	0
	6 Other	--	--	350	--	679	--	329
	SUB-TOTAL			7,200		7,529		329

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
394	1 SF Residential	DU	325.00	3,217	325.00	3,217	0.00	0
	6 Other	--	--	5,527	--	5,571	--	44
	SUB-TOTAL			8,744		8,788		44
395	2 MF Residential	DU	185.00	1,277	185.00	1,277	0.00	0
	3 Commercial Retail	TSF	165.53	8,949	165.53	8,949	0.00	0
	6 Other	--	--	1,740	--	1,740	--	0
	SUB-TOTAL			11,966		11,966		0
396	3 Commercial Retail	TSF	76.23	6,484	110.00	9,357	33.77	2,873
	SUB-TOTAL			6,484		9,357		2,873
397	1 SF Residential	DU	220.00	1,665	549.00	3,935	329.00	2,270
	2 MF Residential	DU	579.00	4,558	579.00	4,558	0.00	0
	3 Commercial Retail	TSF	310.98	16,812	384.98	23,106	74.00	6,294
	6 Other	--		--	--	1,084	--	1,084
	SUB-TOTAL			23,035		32,683		9,648
398	1 SF Residential	DU	1,120.00	11,088	1,120.00	11,088	0.00	0
	2 MF Residential	DU	120.00	960	120.00	960	0.00	0
	3 Commercial Retail	TSF	261.13	22,465	261.13	22,465	0.00	0
	6 Other	--	--	2,533	--	2,533	--	0
	SUB-TOTAL			37,046		37,046		0
399	1 SF Residential	DU	859.00	8,504	880.00	8,712	21.00	208
	6 Other	--	--	790	--	1,228	--	438
	SUB-TOTAL			9,294		9,940		646
400	1 SF Residential	DU	--	--	12.00	119	12.00	119
	SUB-TOTAL			--		119		119
401	1 SF Residential	DU	--	--	835.00	8,267	835.00	8,267
	2 MF Residential	DU	--	--	482.00	3,856	482.00	3,856
	SUB-TOTAL			--		12,123		12,123
402	1 SF Residential	DU	300.00	2,970	1,129.00	11,177	829.00	8,207
	3 Commercial Retail	TSF	--	--	150.00	8,109	150.00	8,109
	6 Other	--	--	951	--	2,027	--	1,076
	SUB-TOTAL			3,921		21,313		17,392
403	1 SF Residential	DU	111.00	1,099	111.00	1,099	0.00	0
	2 MF Residential	DU	--	--	300.00	2,070	300.00	2,070
	3 Commercial Retail	TSF	12.00	1,021	46.00	3,913	34.00	2,892
	SUB-TOTAL			2,120		7,082		4,962
404	1 SF Residential	DU	10.00	99	177.00	1,752	167.00	1,653
	SUB-TOTAL			99		1,752		1,653

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
405	1 SF Residential	DU	24.00	238	296.00	2,930	272.00	2,692
	SUB-TOTAL			238		2,930		2,692
406	1 SF Residential	DU	38.00	376	353.00	3,495	315.00	3,119
	SUB-TOTAL			376		3,495		3,119
407	1 SF Residential	DU	--	--	47.00	465	47.00	465
	SUB-TOTAL			--		465		465
408	1 SF Residential	DU	47.00	465	380.00	3,762	333.00	3,297
	SUB-TOTAL			465		3,762		3,297
409	1 SF Residential	DU	--	--	77.00	762	77.00	762
	SUB-TOTAL			--		762		762
410	1 SF Residential	DU	25.00	247	249.00	2,162	224.00	1,915
	5 Industrial Park	TSF	--	--	44.00	264	44.00	264
	SUB-TOTAL			247		2,426		2,179
411	1 SF Residential	DU	--	--	675.00	6,682	675.00	6,682
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			--		7,770		7,770
412	1 SF Residential	DU	120.00	1,188	120.00	1,188	0.00	0
	3 Commercial Retail	TSF	--	--	40.00	2,162	40.00	2,162
	SUB-TOTAL			1,188		3,350		2,162
413	1 SF Residential	DU	29.00	287	146.00	1,325	117.00	1,038
	2 MF Residential	DU	246.00	1,697	514.00	3,547	268.00	1,850
	3 Commercial Retail	TSF	26.94	2,292	44.60	3,794	17.66	1,502
	4 Commercial Office	TSF	36.59	423	36.59	423	0.00	0
	5 Industrial Park	TSF	45.21	231	93.75	522	48.54	291
	SUB-TOTAL			4,930		9,611		4,681
414	1 SF Residential	DU	265.00	1,874	290.00	2,121	25.00	247
	2 MF Residential	DU	1,358.00	10,864	1,635.00	12,860	277.00	1,996
	3 Commercial Retail	TSF	95.83	3,551	175.00	6,486	79.17	2,935
	SUB-TOTAL			16,289		21,467		5,178
415	1 SF Residential	DU	75.00	743	75.00	743	0.00	0
	3 Commercial Retail	TSF	--	--	63.71	3,444	63.71	3,444
	5 Industrial Park	TSF	27.80	142	27.80	142	0.00	0
	SUB-TOTAL			885		4,329		3,444

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
416	1 SF Residential	DU	496.00	4,250	496.00	4,250	0.00	0
	2 MF Residential	DU	57.00	456	57.00	456	0.00	0
	3 Commercial Retail	TSF	15.00	556	15.00	556	0.00	0
	4 Commercial Office	TSF	--	--	100.00	1,156	100.00	1,156
	6 Other	--	--	39	--	225	--	186
	SUB-TOTAL			5,301		6,643		1,342
417	1 SF Residential	DU	662.00	6,554	950.00	9,405	288.00	2,851
	2 MF Residential	DU	240.00	1,920	255.00	2,040	15.00	120
	3 Commercial Retail	TSF	--	--	10.00	851	10.00	851
	6 Other	--	--	1,088	--	16,488	--	15,400
	SUB-TOTAL			9,562		28,784		19,222
418	1 SF Residential	DU	90.00	621	90.00	621	0.00	0
	2 MF Residential	DU	706.00	5,393	1,229.00	9,002	523.00	3,609
	3 Commercial Retail	TSF	128.43	6,943	228.00	12,326	99.57	5,383
	SUB-TOTAL			12,957		21,949		8,992
419	2 MF Residential	DU	1,834.00	14,672	1,834.00	14,672	0.00	0
	SUB-TOTAL			14,672		14,672		0
420	2 MF Residential	DU	40.00	320	56.00	448	16.00	128
	SUB-TOTAL			320		448		128
421	1 SF Residential	DU	--	--	250.00	2,475	250.00	2,475
	2 MF Residential	DU	752.00	6,016	1,500.00	12,000	748.00	5,984
	3 Commercial Retail	TSF	--	--	400.00	21,624	400.00	21,624
	4 Commercial Office	TSF	--	--	600.00	6,936	600.00	6,936
	6 Other	--		--	--	1,677	--	1,677
	SUB-TOTAL			6,016		44,712		38,696
422	1 SF Residential	DU	100.00	750	100.00	750	0.00	0
	3 Commercial Retail	TSF	4.00	340	10.00	851	6.00	511
	6 Other	--	--	1,185	--	1,523	--	338
	SUB-TOTAL			2,275		3,124		849
423	1 SF Residential	DU	353.00	3,495	464.00	4,324	111.00	829
	3 Commercial Retail	TSF	98.01	8,337	98.01	8,337	0.00	0
	4 Commercial Office	TSF	10.89	126	10.89	126	0.00	0
	SUB-TOTAL			11,958		12,787		829
424	1 SF Residential	DU	86.00	851	350.00	3,465	264.00	2,614
	SUB-TOTAL			851		3,465		2,614
425	1 SF Residential	DU	39.00	386	114.00	1,129	75.00	743
	2 MF Residential	DU	--	--	80.00	640	80.00	640
	6 Other	--		--	--	81	--	81
	SUB-TOTAL			386		1,850		1,464

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
426	1 SF Residential	DU	100.00	990	630.00	6,237	530.00	5,247
	5 Industrial Park	TSF	39.60	202	39.60	202	0.00	0
	SUB-TOTAL			1,192		6,439		5,247
427	1 SF Residential	DU	249.00	2,465	249.00	2,465	0.00	0
	SUB-TOTAL			2,465		2,465		0
428	1 SF Residential	DU	540.00	5,346	1,313.00	12,999	773.00	7,653
	3 Commercial Retail	TSF	--	--	86.60	5,896	86.60	5,896
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			5,346		19,983		14,637
429	1 SF Residential	DU	42.00	416	55.00	545	13.00	129
	SUB-TOTAL			416		545		129
430	1 SF Residential	DU	2.00	20	2.00	20	0.00	0
	SUB-TOTAL			20		20		0
431	1 SF Residential	DU	3.00	30	3.00	30	0.00	0
	SUB-TOTAL			30		30		0
433	1 SF Residential	DU	8.00	79	155.00	1,535	147.00	1,456
	SUB-TOTAL			79		1,535		1,456
434	1 SF Residential	DU	25.00	247	25.00	247	0.00	0
	SUB-TOTAL			247		247		0
437	4 Commercial Office	TSF	--	--	250.00	2,550	250.00	2,550
	6 Other	--		--	--	1,284	--	1,284
	SUB-TOTAL			--		3,834		3,834
438	1 SF Residential	DU	--	--	10.00	99	10.00	99
	4 Commercial Office	TSF	--	--	250.00	2,550	250.00	2,550
	SUB-TOTAL			--		2,649		2,649
439	1 SF Residential	DU	164.00	1,624	175.00	1,732	11.00	108
	3 Commercial Retail	TSF	--	--	41.65	2,252	41.65	2,252
	SUB-TOTAL			1,624		3,984		2,360
440	5 Industrial Park	TSF	--	--	50.00	300	50.00	300
	SUB-TOTAL			--		300		300
441	1 SF Residential	DU	150.00	1,485	490.00	4,371	340.00	2,886
	3 Commercial Retail	TSF	--	--	30.00	1,112	30.00	1,112
	6 Other	--	--	522	--	1,088	--	566
	SUB-TOTAL			2,007		6,571		4,564
442	1 SF Residential	DU	288.00	2,851	328.00	3,247	40.00	396
	SUB-TOTAL			2,851		3,247		396

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
443	1 SF Residential	DU	499.00	4,940	763.00	7,554	264.00	2,614
	3 Commercial Retail	TSF	30.00	1,112	30.00	1,112	0.00	0
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			7,140		9,754		2,614
444	2 MF Residential	DU	440.00	3,520	440.00	3,520	0.00	0
	3 Commercial Retail	TSF	--	--	200.00	10,812	200.00	10,812
	6 Other	--	--	37	--	37	--	0
	SUB-TOTAL			3,557		14,369		10,812
445	1 SF Residential	DU	29.00	287	41.00	406	12.00	119
	SUB-TOTAL			287		406		119
446	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	SUB-TOTAL			198		198		0
447	1 SF Residential	DU	--	--	300.00	2,970	300.00	2,970
	6 Other	--	--	1,194	--	1,194	--	0
	SUB-TOTAL			1,194		4,164		2,970
448	1 SF Residential	DU	606.00	5,999	691.00	6,841	85.00	842
	SUB-TOTAL			5,999		6,841		842
449	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	SUB-TOTAL			198		198		0
450	1 SF Residential	DU	--	--	27.00	267	27.00	267
	SUB-TOTAL			--		267		267
451	1 SF Residential	DU	40.00	396	140.00	1,386	100.00	990
	5 Industrial Park	TSF	--	--	47.00	282	47.00	282
	SUB-TOTAL			396		1,668		1,272
452	1 SF Residential	DU	6.00	59	38.00	376	32.00	317
	SUB-TOTAL			59		376		317
453	1 SF Residential	DU	172.00	1,703	1,020.00	10,098	848.00	8,395
	3 Commercial Retail	TSF	--	--	16.00	593	16.00	593
	6 Other	--	--	711	--	1,088	--	377
	SUB-TOTAL			2,414		11,779		9,365
454	1 SF Residential	DU	116.00	1,148	650.00	6,435	534.00	5,287
	3 Commercial Retail	TSF	6.14	228	40.28	2,074	34.14	1,846
	6 Other	--	--	3,779	--	5,482	--	1,703
	SUB-TOTAL			5,155		13,991		8,836
455	1 SF Residential	DU	80.00	792	100.00	990	20.00	198
	SUB-TOTAL			792		990		198

Land Use and Trip Generation Comparison – 2004 and OVOV Buildout								
			2004		OVOV Buildout		Difference	
	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
1.	SF Residential	DU	48,251.00	471,153	81,395.00	795,563	33,144.00	324,410
2.	MF Residential	DU	24,387.00	191,023	67,679.00	514,809	43,292.00	323,786
3.	Commercial Retail	TSF	9,157.63	515,716	23,585.06	1,230,042	14,427.43	714,326
4.	Commercial Office	TSF	2,072.12	25,996	17,311.53	205,851	15,239.41	179,855
5.	Industrial Park	TSF	18,332.42	107,565	40,735.96	240,697	22,403.54	133,132
6.	Other	--	--	176,541	--	301,424	--	124,883
TOTAL				**1,487,994**		**3,288,386**		**1,800,392**

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
1	1 SF Residential	DU	567.00	5,613	567.00	5,613	0.00	0
	5 Industrial Park	TSF	--	--	275.00	1,650	275.00	1,650
	SUB-TOTAL			5,613		7,263		1,650
2	1 SF Residential	DU	535.00	5,297	535.00	5,297	0.00	0
	SUB-TOTAL			5,297		5,297		0
3	1 SF Residential	DU	3,753.00	37,155	3,313.00	32,799	-440.00	-4,356
	2 MF Residential	DU	648.00	5,184	1,288.00	9,600	640.00	4,416
	3 Commercial Retail	TSF	320.00	17,299	320.00	17,299	0.00	0
	5 Industrial Park	TSF	334.28	1,936	334.29	1,936	0.01	0
	6 Other	--	--	9,942	--	1,088	--	-8,854
	SUB-TOTAL			71,516		62,722		-8,794
4	5 Industrial Park	TSF	389.00	2,334	--	--	-389.00	-2,334
	SUB-TOTAL			2,334		--		-2,334
5	1 SF Residential	DU	651.00	6,445	229.00	2,267	-422.00	-4,178
	2 MF Residential	DU	100.00	800	--	--	-100.00	-800
	3 Commercial Retail	TSF	27.01	2,201	27.01	2,201	0.00	0
	6 Other	--	--	233		--	--	-233
	SUB-TOTAL			9,679		4,468		-5,211
6	1 SF Residential	DU	330.00	3,267	409.00	4,049	79.00	782
	2 MF Residential	DU	141.00	1,128	--	--	-141.00	-1,128
	SUB-TOTAL			4,395		4,049		-346
7	1 SF Residential	DU	714.00	7,069	722.00	7,148	8.00	79
	SUB-TOTAL			7,069		7,148		79
8	1 SF Residential	DU	70.00	693	97.00	960	27.00	267
	SUB-TOTAL			693		960		267
9	1 SF Residential	DU	166.00	1,643	320.00	3,168	154.00	1,525
	SUB-TOTAL			1,643		3,168		1,525
10	1 SF Residential	DU	12.00	119	12.00	119	0.00	0
	2 MF Residential	DU	184.00	1,472	184.00	1,472	0.00	0
	3 Commercial Retail	TSF	33.64	3,440	300.00	12,018	266.36	8,578
	SUB-TOTAL			5,031		13,609		8,578
11	1 SF Residential	DU	108.00	1,070	108.00	1,070	0.00	0
	2 MF Residential	DU	237.00	1,817	237.00	1,817	0.00	0
	3 Commercial Retail	TSF	62.97	5,589	62.97	5,589	0.00	0
	4 Commercial Office	TSF	1.23	14	1.23	14	0.00	0
	5 Industrial Park	TSF	41.82	251	41.82	251	0.00	0
	6 Other	--	--	5	--	5	--	0
	SUB-TOTAL			8,746		8,746		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
12	1 SF Residential	DU	252.00	2,495	252.00	2,495	0.00	0
	6 Other	--	--	996	--	996	--	0
	SUB-TOTAL			3,491		3,491		0
13	1 SF Residential	DU	641.00	6,346	641.00	6,346	0.00	0
	2 MF Residential	DU	54.00	432	54.00	432	0.00	0
	3 Commercial Retail	TSF	114.56	6,193	25.00	2,127	-89.56	-4,066
	4 Commercial Office	TSF	21.82	252	--	--	-21.82	-252
	5 Industrial Park	TSF	32.93	198	--	--	-32.93	-198
	SUB-TOTAL			13,421		8,905		-4,516
14	1 SF Residential	DU	291.00	2,881	117.00	1,158	-174.00	-1,723
	6 Other	--	--	1,194		--	--	-1,194
	SUB-TOTAL			4,075		1,158		-2,917
15	1 SF Residential	DU	294.00	2,911	370.00	3,663	76.00	752
	SUB-TOTAL			2,911		3,663		752
16	1 SF Residential	DU	14.00	139	291.00	2,881	277.00	2,742
	SUB-TOTAL			139		2,881		2,742
17	1 SF Residential	DU	248.00	2,455	380.00	3,762	132.00	1,307
	SUB-TOTAL			2,455		3,762		1,307
18	1 SF Residential	DU	474.00	4,354	568.00	5,285	94.00	931
	2 MF Residential	DU	109.00	872	109.00	872	0.00	0
	3 Commercial Retail	TSF	50.00	4,253	21.00	1,786	-29.00	-2,467
	6 Other	--	--	18	--	18	--	0
	SUB-TOTAL			9,497		7,961		-1,536
19	1 SF Residential	DU	1,577.00	15,612	1,577.00	15,612	0.00	0
	6 Other	--	--	4,392	--	4,022	--	-370
	SUB-TOTAL			20,004		19,634		-370
20	1 SF Residential	DU	245.00	2,426	245.00	2,426	0.00	0
	2 MF Residential	DU	136.00	1,088	136.00	1,088	0.00	0
	5 Industrial Park	TSF	174.00	1,044	174.00	1,044	0.00	0
	SUB-TOTAL			4,558		4,558		0
21	1 SF Residential	DU	655.00	6,485	655.00	6,485	0.00	0
	3 Commercial Retail	TSF	70.00	5,954	70.00	5,954	0.00	0
	SUB-TOTAL			12,439		12,439		0
22	1 SF Residential	DU	350.00	3,465	350.00	3,465	0.00	0
	SUB-TOTAL			3,465		3,465		0
23	1 SF Residential	DU	373.00	3,693	373.00	3,693	0.00	0
	SUB-TOTAL			3,693		3,693		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
24	1 SF Residential	DU	422.00	4,178	422.00	4,178	0.00	0
	SUB-TOTAL			4,178		4,178		0
25	6 Other	--	--	725	--	1,088	--	363
	SUB-TOTAL			725		1,088		363
26	3 Commercial Retail	TSF	72.90	2,702	72.90	2,702	0.00	0
	SUB-TOTAL			2,702		2,702		0
27	2 MF Residential	DU	256.00	1,766	256.00	1,766	0.00	0
	SUB-TOTAL			1,766		1,766		0
28	1 SF Residential	DU	1,077.00	10,662	1,077.00	10,662	0.00	0
	6 Other	--	--	725	--	1,088	--	363
	SUB-TOTAL			11,387		11,750		363
29	2 MF Residential	DU	115.00	794	--	--	-115.00	-794
	6 Other	--		--	--	52	--	52
	SUB-TOTAL			794		52		-742
30	2 MF Residential	DU	275.00	2,200	275.00	2,200	0.00	0
	SUB-TOTAL			2,200		2,200		0
31	1 SF Residential	DU	65.00	644	65.00	644	0.00	0
	2 MF Residential	DU	200.00	1,600	200.00	1,600	0.00	0
	6 Other	--	--	2,175	--	1,740	--	-435
	SUB-TOTAL			4,419		3,984		-435
32	2 MF Residential	DU	94.00	752	94.00	752	0.00	0
	SUB-TOTAL			752		752		0
33	3 Commercial Retail	TSF	61.00	5,189	61.00	5,189	0.00	0
	SUB-TOTAL			5,189		5,189		0
34	3 Commercial Retail	TSF	107.10	9,110	107.10	5,790	0.00	-3,320
	SUB-TOTAL			9,110		5,790		-3,320
35	1 SF Residential	DU	616.00	6,098	616.00	6,098	0.00	0
	2 MF Residential	DU	260.00	1,860	260.00	1,860	0.00	0
	SUB-TOTAL			7,958		7,958		0
36	1 SF Residential	DU	483.00	4,782	190.00	1,881	-293.00	-2,901
	2 MF Residential	DU	268.00	2,144	268.00	2,144	0.00	0
	SUB-TOTAL			6,926		4,025		-2,901
37	1 SF Residential	DU	212.00	2,099	212.00	2,099	0.00	0
	2 MF Residential	DU	128.00	1,024	128.00	1,024	0.00	0
	6 Other	--	--	186	--	186	--	0
	SUB-TOTAL			3,309		3,309		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
38	2 MF Residential	DU	331.00	2,399	331.00	2,399	0.00	0
	3 Commercial Retail	TSF	50.00	4,253	50.00	4,253	0.00	0
	SUB-TOTAL			6,652		6,652		0
39	3 Commercial Retail	TSF	150.40	8,131	150.40	8,131	0.00	0
	5 Industrial Park	TSF	4,000.00	24,000	4,000.00	24,000	0.00	0
	SUB-TOTAL			32,131		32,131		0
40	1 SF Residential	DU	45.00	445	--	--	-45.00	-445
	3 Commercial Retail	TSF	--	--	200.00	10,812	200.00	10,812
	4 Commercial Office	TSF	116.70	1,190	116.70	1,190	0.00	0
	6 Other	--	--	24	--	24	--	0
	SUB-TOTAL			1,659		12,026		10,367
41	4 Commercial Office	TSF	177.60	2,053	177.60	2,053	0.00	0
	5 Industrial Park	TSF	685.94	4,116	685.94	4,116	0.00	0
	SUB-TOTAL			6,169		6,169		0
42	4 Commercial Office	TSF	696.85	8,056	696.85	8,056	0.00	0
	SUB-TOTAL			8,056		8,056		0
43	3 Commercial Retail	TSF	27.00	1,001	27.00	1,001	0.00	0
	4 Commercial Office	TSF	100.75	1,165	100.75	1,165	0.00	0
	SUB-TOTAL			2,166		2,166		0
44	1 SF Residential	DU	445.00	4,406	445.00	4,406	0.00	0
	3 Commercial Retail	TSF	35.00	2,498	35.00	2,498	0.00	0
	6 Other	--	--	1,087	--	1,450	--	363
	SUB-TOTAL			7,991		8,354		363
45	4 Commercial Office	TSF	464.93	5,375	464.94	5,375	0.01	0
	5 Industrial Park	TSF	1,215.00	7,290	1,215.00	7,290	0.00	0
	SUB-TOTAL			12,665		12,665		0
46	3 Commercial Retail	TSF	77.00	2,854	77.00	2,854	0.00	0
	5 Industrial Park	TSF	445.80	2,675	445.80	2,675	0.00	0
	SUB-TOTAL			5,529		5,529		0
47	5 Industrial Park	TSF	4,254.10	25,525	4,254.10	25,525	0.00	0
	SUB-TOTAL			25,525		25,525		0
48	5 Industrial Park	TSF	720.00	4,320	720.00	4,320	0.00	0
	SUB-TOTAL			4,320		4,320		0
49	5 Industrial Park	TSF	764.30	4,586	764.30	4,586	0.00	0
	SUB-TOTAL			4,586		4,586		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
50	1 SF Residential	DU	133.00	1,317	350.00	3,465	217.00	2,148
	6 Other	--	--	2,000	--	2,000	--	0
	SUB-TOTAL			3,317		5,465		2,148
51	5 Industrial Park	TSF	1,221.36	7,328	1,221.36	7,328	0.00	0
	SUB-TOTAL			7,328		7,328		0
52	1 SF Residential	DU	1,015.00	10,049	100.00	990	-915.00	-9,059
	SUB-TOTAL			10,049		990		-9,059
53	1 SF Residential	DU	250.00	2,475	35.00	347	-215.00	-2,128
	SUB-TOTAL			2,475		347		-2,128
54	1 SF Residential	DU	62.00	614	62.00	614	0.00	0
	2 MF Residential	DU	589.00	4,712	589.00	4,712	0.00	0
	SUB-TOTAL			5,326		5,326		0
55	1 SF Residential	DU	164.00	1,624	164.00	1,624	0.00	0
	2 MF Residential	DU	922.00	7,376	922.00	7,376	0.00	0
	6 Other	--	--	15	--	15	--	0
	SUB-TOTAL			9,015		9,015		0
56	1 SF Residential	DU	19.00	188	19.00	188	0.00	0
	2 MF Residential	DU	23.00	184	23.00	184	0.00	0
	SUB-TOTAL			372		372		0
57	3 Commercial Retail	TSF	55.40	4,712	55.40	4,712	0.00	0
	4 Commercial Office	TSF	1,274.60	13,144	1,274.60	13,144	0.00	0
	SUB-TOTAL			17,856		17,856		0
58	5 Industrial Park	TSF	1,123.00	6,738	1,123.00	6,738	0.00	0
	SUB-TOTAL			6,738		6,738		0
59	5 Industrial Park	TSF	764.00	3,820	764.00	3,820	0.00	0
	SUB-TOTAL			3,820		3,820		0
60	3 Commercial Retail	TSF	34.80	1,290	34.80	1,290	0.00	0
	4 Commercial Office	TSF	27.20	314	27.20	314	0.00	0
	5 Industrial Park	TSF	160.50	963	160.50	963	0.00	0
	SUB-TOTAL			2,567		2,567		0
61	4 Commercial Office	TSF	48.80	564	48.80	564	0.00	0
	5 Industrial Park	TSF	825.65	4,954	825.65	4,954	0.00	0
	SUB-TOTAL			5,518		5,518		0
62	3 Commercial Retail	TSF	19.50	723	19.50	723	0.00	0
	5 Industrial Park	TSF	430.64	2,584	430.64	2,584	0.00	0
	SUB-TOTAL			3,307		3,307		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
63	5 Industrial Park	TSF	575.00	3,450	575.00	3,450	0.00	0
	6 Other	--		--	--	2,444	--	2,444
	SUB-TOTAL			3,450		5,894		2,444
64	5 Industrial Park	TSF	3,161.48	18,969	3,161.48	18,969	0.00	0
	SUB-TOTAL			18,969		18,969		0
65	3 Commercial Retail	TSF	155.00	6,209	155.00	8,379	0.00	2,170
	5 Industrial Park	TSF	329.00	1,974	329.00	1,974	0.00	0
	SUB-TOTAL			8,183		10,353		2,170
66	3 Commercial Retail	TSF	170.45	6,828	170.45	9,215	0.00	2,387
	5 Industrial Park	TSF	329.00	1,974	329.00	1,974	0.00	0
	SUB-TOTAL			8,802		11,189		2,387
67	1 SF Residential	DU	163.00	1,614	163.00	1,614	0.00	0
	2 MF Residential	DU	90.00	720	90.00	720	0.00	0
	SUB-TOTAL			2,334		2,334		0
68	2 MF Residential	DU	208.00	1,435	208.00	1,435	0.00	0
	SUB-TOTAL			1,435		1,435		0
69	1 SF Residential	DU	76.00	752	76.00	752	0.00	0
	SUB-TOTAL			752		752		0
70	3 Commercial Retail	TSF	147.00	7,947	147.00	7,947	0.00	0
	5 Industrial Park	TSF	604.00	3,557	604.00	3,557	0.00	0
	6 Other	--	--	3,518	--	3,518	--	0
	SUB-TOTAL			15,022		15,022		0
71	6 Other	--	--	4,475	--	4,475	--	0
	SUB-TOTAL			4,475		4,475		0
72	3 Commercial Retail	TSF	60.00	2,224	60.00	2,224	0.00	0
	6 Other	--	--	508	--	508	--	0
	SUB-TOTAL			2,732		2,732		0
74	1 SF Residential	DU	153.00	1,515	153.00	1,515	0.00	0
	2 MF Residential	DU	147.00	1,176	147.00	1,176	0.00	0
	SUB-TOTAL			2,691		2,691		0
75	2 MF Residential	DU	149.00	1,192	149.00	1,192	0.00	0
	6 Other	--	--	9	--	46	--	37
	SUB-TOTAL			1,201		1,238		37
76	2 MF Residential	DU	188.00	1,297	188.00	1,297	0.00	0
	3 Commercial Retail	TSF	11.00	936	11.00	936	0.00	0
	SUB-TOTAL			2,233		2,233		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
78	5 Industrial Park	TSF	1,776.00	10,656	1,776.00	10,656	0.00	0
	SUB-TOTAL			10,656		10,656		0
79	5 Industrial Park	TSF	685.00	4,110	685.00	4,110	0.00	0
	SUB-TOTAL			4,110		4,110		0
80	5 Industrial Park	TSF	880.00	5,280	880.00	5,280	0.00	0
	SUB-TOTAL			5,280		5,280		0
81	5 Industrial Park	TSF	711.00	4,266	711.00	4,266	0.00	0
	SUB-TOTAL			4,266		4,266		0
82	5 Industrial Park	TSF	1,007.55	6,045	1,007.55	6,045	0.00	0
	SUB-TOTAL			6,045		6,045		0
83	5 Industrial Park	TSF	876.00	5,256	876.00	5,256	0.00	0
	SUB-TOTAL			5,256		5,256		0
84	5 Industrial Park	TSF	333.00	1,998	333.00	1,998	0.00	0
	SUB-TOTAL			1,998		1,998		0
86	1 SF Residential	DU	346.00	3,425	--	--	-346.00	-3,425
	3 Commercial Retail	TSF	82.76	8,257	82.76	8,196	0.00	-61
	6 Other	--	--	296	--	296	--	0
	SUB-TOTAL			11,978		8,492		-3,486
87	5 Industrial Park	TSF	1,274.13	7,645	--	--	-1,274.13	-7,645
	SUB-TOTAL			7,645		--		-7,645
89	6 Other	--	--	3,000	--	3,000	--	0
	SUB-TOTAL			3,000		3,000		0
90	2 MF Residential	DU	360.00	2,880	360.00	2,880	0.00	0
	3 Commercial Retail	TSF	1,305.35	57,648	1,305.35	57,648	0.00	0
	5 Industrial Park	TSF	163.88	983	163.88	983	0.00	0
	SUB-TOTAL			61,511		61,511		0
91	3 Commercial Retail	TSF	247.38	13,373	247.38	13,373	0.00	0
	SUB-TOTAL			13,373		13,373		0
92	2 MF Residential	DU	1,333.00	10,664	1,333.00	10,664	0.00	0
	3 Commercial Retail	TSF	618.00	24,757	618.00	24,757	0.00	0
	4 Commercial Office	TSF	629.00	7,271	629.00	7,271	0.00	0
	6 Other	--	--	2,469	--	2,469	--	0
	SUB-TOTAL			45,161		45,161		0
93	3 Commercial Retail	TSF	20.00	741	20.00	741	0.00	0
	6 Other	--	--	1,391	--	1,391	--	0
	SUB-TOTAL			2,132		2,132		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
94	6 Other	--	--	24,000	--	24,000	--	0
	SUB-TOTAL			24,000		24,000		0
96	1 SF Residential	DU	123.00	1,218	123.00	1,218	0.00	0
	2 MF Residential	DU	881.00	7,048	881.00	7,048	0.00	0
	SUB-TOTAL			8,266		8,266		0
97	6 Other	--	--	2,620	--	2,620	--	0
	SUB-TOTAL			2,620		2,620		0
98	3 Commercial Retail	TSF	6.20	527	6.20	527	0.00	0
	4 Commercial Office	TSF	691.50	7,053	691.50	7,053	0.00	0
	SUB-TOTAL			7,580		7,580		0
99	2 MF Residential	DU	470.00	3,760	470.00	3,760	0.00	0
	6 Other	--	--	53	--	53	--	0
	SUB-TOTAL			3,813		3,813		0
100	3 Commercial Retail	TSF	23.00	1,956	23.00	1,956	0.00	0
	4 Commercial Office	TSF	220.00	2,543	220.00	2,543	0.00	0
	SUB-TOTAL			4,499		4,499		0
101	3 Commercial Retail	TSF	491.60	19,693	491.60	19,693	0.00	0
	SUB-TOTAL			19,693		19,693		0
102	1 SF Residential	DU	38.00	376	38.00	376	0.00	0
	2 MF Residential	DU	460.00	3,510	460.00	3,510	0.00	0
	3 Commercial Retail	TSF	10.50	893	10.50	893	0.00	0
	4 Commercial Office	TSF	9.50	110	9.50	110	0.00	0
	SUB-TOTAL			4,889		4,889		0
103	1 SF Residential	DU	95.00	940	95.00	940	0.00	0
	2 MF Residential	DU	169.00	1,352	169.00	1,352	0.00	0
	3 Commercial Retail	TSF	48.00	3,627	48.00	3,627	0.00	0
	6 Other	--	--	1,130	--	1,130	--	0
	SUB-TOTAL			7,049		7,049		0
104	1 SF Residential	DU	175.00	1,732	175.00	1,732	0.00	0
	2 MF Residential	DU	363.00	2,737	363.00	2,737	0.00	0
	3 Commercial Retail	TSF	252.00	13,623	252.00	13,623	0.00	0
	4 Commercial Office	TSF	370.00	4,277	370.00	4,277	0.00	0
	SUB-TOTAL			22,369		22,369		0
105	2 MF Residential	DU	144.00	994	144.00	994	0.00	0
	3 Commercial Retail	TSF	27.10	2,305	27.10	2,305	0.00	0
	4 Commercial Office	TSF	315.90	3,652	315.90	3,652	0.00	0
	SUB-TOTAL			6,951		6,951		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
106	2 MF Residential	DU	520.00	3,588	520.00	3,588	0.00	0
	SUB-TOTAL			3,588		3,588		0
107	1 SF Residential	DU	461.00	4,564	461.00	4,564	0.00	0
	2 MF Residential	DU	326.00	2,608	326.00	2,608	0.00	0
	6 Other	--	--	6,089	--	6,268	--	179
	SUB-TOTAL			13,261		13,440		179
108	2 MF Residential	DU	2,189.00	17,512	2,189.00	17,512	0.00	0
	6 Other	--	--	1,328	--	1,111	--	-217
	SUB-TOTAL			18,840		18,623		-217
109	1 SF Residential	DU	38.00	376	38.00	376	0.00	0
	SUB-TOTAL			376		376		0
110	1 SF Residential	DU	184.00	1,822	184.00	1,822	0.00	0
	2 MF Residential	DU	548.00	4,384	548.00	4,384	0.00	0
	6 Other	--	--	1,329	--	1,112	--	-217
	SUB-TOTAL			7,535		7,318		-217
111	6 Other	--	--	238	--	238	--	0
	SUB-TOTAL			238		238		0
112	1 SF Residential	DU	246.00	2,435	246.00	2,435	0.00	0
	6 Other	--	--	1,433	--	1,433	--	0
	SUB-TOTAL			3,868		3,868		0
113	2 MF Residential	DU	354.00	2,832	354.00	2,832	0.00	0
	SUB-TOTAL			2,832		2,832		0
114	2 MF Residential	DU	560.00	4,480	560.00	4,480	0.00	0
	SUB-TOTAL			4,480		4,480		0
115	1 SF Residential	DU	603.00	5,970	603.00	5,970	0.00	0
	SUB-TOTAL			5,970		5,970		0
116	2 MF Residential	DU	1,262.00	10,096	1,262.00	10,096	0.00	0
	3 Commercial Retail	TSF	628.50	25,178	628.50	25,178	0.00	0
	SUB-TOTAL			35,274		35,274		0
117	2 MF Residential	DU	1,261.00	10,088	1,261.00	10,088	0.00	0
	3 Commercial Retail	TSF	628.50	25,178	628.50	25,178	0.00	0
	SUB-TOTAL			35,266		35,266		0
118	2 MF Residential	DU	161.00	1,288	161.00	1,288	0.00	0
	SUB-TOTAL			1,288		1,288		0
119	2 MF Residential	DU	1,679.00	11,585	1,679.00	11,585	0.00	0
	SUB-TOTAL			11,585		11,585		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
120	2 MF Residential	DU	2,425.00	19,400	2,425.00	19,400	0.00	0
	3 Commercial Retail	TSF	283.30	15,043	283.30	15,043	0.00	0
	4 Commercial Office	TSF	75.00	867	75.00	867	0.00	0
	6 Other	--	--	1,327	--	1,110	--	-217
	SUB-TOTAL			36,637		36,420		-217
121	1 SF Residential	DU	168.00	1,663	168.00	1,663	0.00	0
	2 MF Residential	DU	418.00	3,344	418.00	3,344	0.00	0
	SUB-TOTAL			5,007		5,007		0
122	2 MF Residential	DU	176.00	1,408	176.00	1,408	0.00	0
	SUB-TOTAL			1,408		1,408		0
123	1 SF Residential	DU	452.00	4,475	452.00	4,475	0.00	0
	2 MF Residential	DU	272.00	2,176	272.00	2,176	0.00	0
	3 Commercial Retail	TSF	17.20	637	17.20	637	0.00	0
	SUB-TOTAL			7,288		7,288		0
124	2 MF Residential	DU	1,343.00	4,983	1,343.00	4,983	0.00	0
	SUB-TOTAL			4,983		4,983		0
125	6 Other	--	--	6,036	--	6,215	--	179
	SUB-TOTAL			6,036		6,215		179
126	3 Commercial Retail	TSF	150.00	8,109	150.00	8,109	0.00	0
	4 Commercial Office	TSF	336.00	3,884	336.00	3,884	0.00	0
	SUB-TOTAL			11,993		11,993		0
127	2 MF Residential	DU	888.00	7,104	888.00	7,104	0.00	0
	SUB-TOTAL			7,104		7,104		0
128	1 SF Residential	DU	450.00	4,455	450.00	4,455	0.00	0
	SUB-TOTAL			4,455		4,455		0
129	1 SF Residential	DU	177.00	1,752	177.00	1,752	0.00	0
	SUB-TOTAL			1,752		1,752		0
130	1 SF Residential	DU	708.00	7,009	708.00	7,009	0.00	0
	SUB-TOTAL			7,009		7,009		0
131	1 SF Residential	DU	14.00	139	14.00	139	0.00	0
	2 MF Residential	DU	1,273.00	10,184	1,273.00	10,184	0.00	0
	6 Other	--	--	249	--	249	--	0
	SUB-TOTAL			10,572		10,572		0
132	1 SF Residential	DU	436.00	4,316	436.00	4,316	0.00	0
	6 Other	--	--	1,347	--	1,130	--	-217
	SUB-TOTAL			5,663		5,446		-217

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
133	3 Commercial Retail	TSF	27.00	1,460	27.00	1,460	0.00	0
	SUB-TOTAL			1,460		1,460		0
134	1 SF Residential	DU	482.00	4,772	482.00	4,772	0.00	0
	SUB-TOTAL			4,772		4,772		0
135	1 SF Residential	DU	174.00	1,723	174.00	1,723	0.00	0
	2 MF Residential	DU	172.00	1,376	172.00	1,376	0.00	0
	6 Other	--	--	1,656	--	1,656	--	0
	SUB-TOTAL			4,755		4,755		0
137	4 Commercial Office	TSF	72.00	832	72.00	832	0.00	0
	SUB-TOTAL			832		832		0
138	3 Commercial Retail	TSF	120.00	6,487	120.00	6,487	0.00	0
	SUB-TOTAL			6,487		6,487		0
139	2 MF Residential	DU	474.00	3,271	474.00	3,271	0.00	0
	SUB-TOTAL			3,271		3,271		0
140	1 SF Residential	DU	428.00	4,237	428.00	4,237	0.00	0
	2 MF Residential	DU	1,266.00	10,128	1,266.00	10,128	0.00	0
	3 Commercial Retail	TSF	20.00	1,701	20.00	1,701	0.00	0
	4 Commercial Office	TSF	31.00	358	31.00	358	0.00	0
	6 Other	--	--	593	--	593	--	0
	SUB-TOTAL			17,017		17,017		0
141	3 Commercial Retail	TSF	30.40	7,657	30.40	7,657	0.00	0
	4 Commercial Office	TSF	--	--	50.00	578	50.00	578
	SUB-TOTAL			7,657		8,235		578
142	2 MF Residential	DU	670.00	5,360	670.00	5,360	0.00	0
	SUB-TOTAL			5,360		5,360		0
143	1 SF Residential	DU	578.00	5,722	578.00	5,722	0.00	0
	2 MF Residential	DU	160.00	1,280	160.00	1,280	0.00	0
	6 Other	--	--	1,251	--	2,846	--	1,595
	SUB-TOTAL			8,253		9,848		1,595
144	1 SF Residential	DU	6.00	59	6.00	59	0.00	0
	SUB-TOTAL			59		59		0
145	3 Commercial Retail	TSF	874.22	40,255	874.22	40,255	0.00	0
	5 Industrial Park	TSF	74.50	380	74.50	380	0.00	0
	SUB-TOTAL			40,635		40,635		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
146	1 SF Residential	DU	314.00	3,109	314.00	3,109	0.00	0
	2 MF Residential	DU	296.00	2,368	296.00	2,368	0.00	0
	SUB-TOTAL			5,477		5,477		0
147	1 SF Residential	DU	140.00	1,386	140.00	1,386	0.00	0
	2 MF Residential	DU	667.00	4,712	667.00	4,712	0.00	0
	6 Other	--	--	1,246	--	1,101	--	-145
	SUB-TOTAL			7,344		7,199		-145
148	3 Commercial Retail	TSF	196.58	13,426	196.58	13,426	0.00	0
	SUB-TOTAL			13,426		13,426		0
149	1 SF Residential	DU	535.00	5,297	535.00	5,297	0.00	0
	2 MF Residential	DU	500.00	4,000	500.00	4,000	0.00	0
	3 Commercial Retail	TSF	34.85	2,964	34.85	2,964	0.00	0
	SUB-TOTAL			12,261		12,261		0
150	1 SF Residential	DU	114.00	1,129	114.00	1,129	0.00	0
	SUB-TOTAL			1,129		1,129		0
151	1 SF Residential	DU	71.00	703	71.00	703	0.00	0
	SUB-TOTAL			703		703		0
152	1 SF Residential	DU	279.00	2,762	892.00	8,831	613.00	6,069
	6 Other	--	--	47	--	47	--	0
	SUB-TOTAL			2,809		8,878		6,069
153	1 SF Residential	DU	424.00	4,198	424.00	4,198	0.00	0
	SUB-TOTAL			4,198		4,198		0
158	1 SF Residential	DU	100.00	990	--	--	-100.00	-990
	SUB-TOTAL			990		--		-990
159	1 SF Residential	DU	4.00	40	4.00	40	0.00	0
	5 Industrial Park	TSF	--	--	16.00	80	16.00	80
	6 Other	--		--	--	233	--	233
	SUB-TOTAL			40		353		313
160	1 SF Residential	DU	95.00	940	95.00	940	0.00	0
	2 MF Residential	DU	95.00	352	95.00	352	0.00	0
	SUB-TOTAL			1,292		1,292		0
161	1 SF Residential	DU	667.00	6,603	640.00	6,336	-27.00	-267
	2 MF Residential	DU	650.00	5,200	650.00	5,200	0.00	0
	3 Commercial Retail	TSF	151.82	18,358	151.82	18,358	0.00	0
	4 Commercial Office	TSF	282.41	3,265	282.41	3,265	0.00	0
	6 Other	--	--	7,903	--	2,329	--	-5,574
	SUB-TOTAL			41,329		35,488		-5,841

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
162	1 SF Residential	DU	248.00	2,455	335.00	3,055	87.00	600
	3 Commercial Retail	TSF	102.42	5,537	102.42	5,537	0.00	0
	5 Industrial Park	TSF	240.00	1,440	240.00	1,440	0.00	0
	SUB-TOTAL			9,432		10,032		600
163	5 Industrial Park	TSF	2,567.08	15,402	1,000.00	6,000	-1,567.08	-9,402
	SUB-TOTAL			15,402		6,000		-9,402
164	1 SF Residential	DU	204.00	2,020	204.00	2,020	0.00	0
	2 MF Residential	DU	--	--	86.00	319	86.00	319
	5 Industrial Park	TSF	--	--	30.00	180	30.00	180
	6 Other	--	--	1,154	--	73	--	-1,081
	SUB-TOTAL			3,174		2,592		-582
165	1 SF Residential	DU	86.00	851	86.00	851	0.00	0
	2 MF Residential	DU	80.00	640	287.00	2,296	207.00	1,656
	3 Commercial Retail	TSF	151.78	9,310	127.83	6,188	-23.95	-3,122
	4 Commercial Office	TSF	13.81	160	13.81	160	0.00	0
	5 Industrial Park	TSF	1,893.36	11,358	3,402.47	20,413	1,509.11	9,055
	6 Other	--	--	414	--	414	--	0
	SUB-TOTAL			22,733		30,322		7,589
166	1 SF Residential	DU	431.00	4,267	431.00	4,267	0.00	0
	2 MF Residential	DU	292.00	2,336	462.00	3,696	170.00	1,360
	3 Commercial Retail	TSF	74.36	5,495	74.36	7,082	0.00	1,587
	4 Commercial Office	TSF	30.10	348	30.10	348	0.00	0
	5 Industrial Park	TSF	11.00	56	11.00	56	0.00	0
	6 Other	--	--	648	--	242	--	-406
	SUB-TOTAL			13,150		15,691		2,541
167	1 SF Residential	DU	327.00	3,237	196.00	1,940	-131.00	-1,297
	SUB-TOTAL			3,237		1,940		-1,297
168	1 SF Residential	DU	247.00	2,445	247.00	2,445	0.00	0
	SUB-TOTAL			2,445		2,445		0
169	1 SF Residential	DU	127.00	1,257	127.00	1,257	0.00	0
	2 MF Residential	DU	94.00	752	94.00	752	0.00	0
	3 Commercial Retail	TSF	200.00	8,012	300.00	12,018	100.00	4,006
	4 Commercial Office	TSF	--	--	20.00	684	20.00	684
	6 Other	--		--	--	152	--	152
	SUB-TOTAL			10,021		14,863		4,842
170	1 SF Residential	DU	163.00	1,614	60.00	594	-103.00	-1,020
	SUB-TOTAL			1,614		594		-1,020
171	1 SF Residential	DU	32.00	317	60.00	594	28.00	277
	6 Other	--	--	979	--	1,088	--	109
	SUB-TOTAL			1,296		1,682		386

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
172	1 SF Residential	DU	185.00	1,831	185.00	1,831	0.00	0
	SUB-TOTAL			1,831		1,831		0
173	1 SF Residential	DU	386.00	3,821	386.00	3,821	0.00	0
	SUB-TOTAL			3,821		3,821		0
174	2 MF Residential	DU	--	--	400.00	2,342	400.00	2,342
	3 Commercial Retail	TSF	337.20	18,229	350.00	18,535	12.80	306
	4 Commercial Office	TSF	--	--	350.00	4,046	350.00	4,046
	6 Other	--		--	--	2,469	--	2,469
	SUB-TOTAL			18,229		27,392		9,163
175	1 SF Residential	DU	162.00	1,604	380.00	3,108	218.00	1,504
	2 MF Residential	DU	160.00	1,280	210.00	1,625	50.00	345
	3 Commercial Retail	TSF	98.01	5,298	98.01	5,298	0.00	0
	6 Other	--	--	1,367	--	1,295	--	-72
	SUB-TOTAL			9,549		11,326		1,777
176	1 SF Residential	DU	762.00	7,544	762.00	7,544	0.00	0
	2 MF Residential	DU	135.00	1,080	270.00	2,012	135.00	932
	3 Commercial Retail	TSF	337.59	13,100	337.59	13,100	0.00	0
	6 Other	--		--	--	326	--	326
	SUB-TOTAL			21,724		22,982		1,258
177	1 SF Residential	DU	542.00	5,366	477.00	4,722	-65.00	-644
	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	3 Commercial Retail	TSF	97.57	5,275	97.57	5,275	0.00	0
	6 Other	--	--	776	--	1,264	--	488
	SUB-TOTAL			13,529		13,373		-156
178	1 SF Residential	DU	333.00	3,297	333.00	3,297	0.00	0
	3 Commercial Retail	TSF	28.31	1,419	28.31	1,419	0.00	0
	4 Commercial Office	TSF	50.81	587	50.81	587	0.00	0
	6 Other	--		--	--	102	--	102
	SUB-TOTAL			5,303		5,405		102
179	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	2 MF Residential	DU	--	--	209.00	775	209.00	775
	3 Commercial Retail	TSF	46.25	2,130	28.78	4,280	-17.47	2,150
	4 Commercial Office	TSF	24.83	849	52.00	1,778	27.17	929
	6 Other	--	--	207	--	207	--	0
	SUB-TOTAL			4,839		8,693		3,854
180	1 SF Residential	DU	428.00	4,237	428.00	4,237	0.00	0
	6 Other	--		--	--	653	--	653
	SUB-TOTAL			4,237		4,890		653

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
181	1 SF Residential	DU	282.00	2,792	282.00	2,792	0.00	0
	6 Other	--	--	1,124	--	1,088	--	-36
	SUB-TOTAL			3,916		3,880		-36
182	1 SF Residential	DU	514.00	4,374	276.00	2,732	-238.00	-1,642
	2 MF Residential	DU	229.00	1,832	238.00	1,904	9.00	72
	3 Commercial Retail	TSF	76.23	4,121	96.23	5,202	20.00	1,081
	6 Other	--	--	280	--	280	--	0
	SUB-TOTAL			10,607		10,118		-489
183	2 MF Residential	DU	634.00	5,072	634.00	5,072	0.00	0
	3 Commercial Retail	TSF	3.50	298	3.50	298	0.00	0
	6 Other	--	--	5,838	--	6,956	--	1,118
	SUB-TOTAL			11,208		12,326		1,118
184	4 Commercial Office	TSF	250.00	2,890	100.00	1,156	-150.00	-1,734
	6 Other	--		--	--	528	--	528
	SUB-TOTAL			2,890		1,684		-1,206
185	1 SF Residential	DU	344.00	3,406	344.00	3,406	0.00	0
	SUB-TOTAL			3,406		3,406		0
186	1 SF Residential	DU	150.00	1,485	150.00	1,485	0.00	0
	4 Commercial Office	TSF	308.90	10,564	402.00	13,748	93.10	3,184
	6 Other	--	--	4,244	--	5,720	--	1,476
	SUB-TOTAL			16,293		20,953		4,660
187	1 SF Residential	DU	111.00	1,099	111.00	1,099	0.00	0
	2 MF Residential	DU	307.00	2,456	426.00	2,897	119.00	441
	6 Other	--	--	554	--	36	--	-518
	SUB-TOTAL			4,109		4,032		-77
188	1 SF Residential	DU	72.00	713	72.00	713	0.00	0
	2 MF Residential	DU	216.00	1,728	216.00	1,728	0.00	0
	SUB-TOTAL			2,441		2,441		0
189	3 Commercial Retail	TSF	--	--	3.00	255	3.00	255
	4 Commercial Office	TSF	28.44	329	--	--	-28.44	-329
	6 Other	--	--	30,800	--	30,800	--	0
	SUB-TOTAL			31,129		31,055		-74
190	1 SF Residential	DU	171.00	1,693	171.00	1,693	0.00	0
	SUB-TOTAL			1,693		1,693		0
191	4 Commercial Office	TSF	78.56	2,687	78.56	2,687	0.00	0
	SUB-TOTAL			2,687		2,687		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
192	1 SF Residential	DU	164.00	1,624	164.00	1,624	0.00	0
	2 MF Residential	DU	660.00	5,280	660.00	5,280	0.00	0
	6 Other	--		--	--	520	--	520
	SUB-TOTAL			6,904		7,424		520
193	4 Commercial Office	TSF	250.00	2,550	250.00	2,550	0.00	0
	SUB-TOTAL			2,550		2,550		0
194	6 Other	--	--	796	--	796	--	0
	SUB-TOTAL			796		796		0
195	1 SF Residential	DU	76.00	752	--	--	-76.00	-752
	2 MF Residential	DU	--	--	76.00	608	76.00	608
	SUB-TOTAL			752		608		-144
196	2 MF Residential	DU	--	--	10.00	80	10.00	80
	3 Commercial Retail	TSF	16.00	593	2.50	93	-13.50	-500
	4 Commercial Office	TSF	--	--	34.55	399	34.55	399
	6 Other	--		--	--	1,646	--	1,646
	SUB-TOTAL			593		2,218		1,625
197	3 Commercial Retail	TSF	--	--	13.00	1,106	13.00	1,106
	4 Commercial Office	TSF	400.00	4,080	400.00	4,080	0.00	0
	SUB-TOTAL			4,080		5,186		1,106
198	1 SF Residential	DU	331.00	3,277	331.00	3,277	0.00	0
	SUB-TOTAL			3,277		3,277		0
199	3 Commercial Retail	TSF	5.00	652	5.00	652	0.00	0
	6 Other	--	--	1,951	--	1,951	--	0
	SUB-TOTAL			2,603		2,603		0
200	4 Commercial Office	TSF	578.00	5,896	578.00	5,896	0.00	0
	SUB-TOTAL			5,896		5,896		0
201	4 Commercial Office	TSF	250.00	2,550	160.00	1,632	-90.00	-918
	SUB-TOTAL			2,550		1,632		-918
202	2 MF Residential	DU	560.00	3,864	560.00	3,864	0.00	0
	3 Commercial Retail	TSF	22.00	815	22.00	815	0.00	0
	4 Commercial Office	TSF	13.00	150	13.00	150	0.00	0
	6 Other	--	--	4,218	--	4,218	--	0
	SUB-TOTAL			9,047		9,047		0
203	2 MF Residential	DU	--	--	450.00	3,105	450.00	3,105
	3 Commercial Retail	TSF	1,504.00	60,250	2,000.00	80,120	496.00	19,870
	4 Commercial Office	TSF	125.00	1,445	125.00	1,445	0.00	0
	SUB-TOTAL			61,695		84,670		22,975

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
204	3 Commercial Retail	TSF	62.00	2,298	62.00	2,298	0.00	0
	4 Commercial Office	TSF	400.00	4,624	400.00	4,624	0.00	0
	6 Other	--	--	5,808	--	5,808	--	0
	SUB-TOTAL			12,730		12,730		0
205	3 Commercial Retail	TSF	47.30	2,557	100.00	5,406	52.70	2,849
	4 Commercial Office	TSF	198.89	2,299	850.00	9,826	651.11	7,527
	6 Other	--	--	1,700	--	3,399	--	1,699
	SUB-TOTAL			6,556		18,631		12,075
206	3 Commercial Retail	TSF	187.61	11,782	187.61	11,782	0.00	0
	SUB-TOTAL			11,782		11,782		0
207	3 Commercial Retail	TSF	--	--	6.00	782	6.00	782
	4 Commercial Office	TSF	230.00	2,659	350.00	4,046	120.00	1,387
	SUB-TOTAL			2,659		4,828		2,169
208	2 MF Residential	DU	234.00	1,872	234.00	1,872	0.00	0
	SUB-TOTAL			1,872		1,872		0
209	1 SF Residential	DU	414.00	4,099	414.00	4,099	0.00	0
	2 MF Residential	DU	352.00	2,816	352.00	2,816	0.00	0
	6 Other	--	--	1,160	--	1,088	--	-72
	SUB-TOTAL			8,075		8,003		-72
210	1 SF Residential	DU	205.00	2,029	205.00	2,029	0.00	0
	2 MF Residential	DU	208.00	1,664	208.00	1,664	0.00	0
	3 Commercial Retail	TSF	148.10	8,006	148.10	8,006	0.00	0
	SUB-TOTAL			11,699		11,699		0
211	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	SUB-TOTAL			1,653		1,653		0
212	1 SF Residential	DU	252.00	2,495	252.00	2,495	0.00	0
	2 MF Residential	DU	272.00	2,176	272.00	2,176	0.00	0
	6 Other	--	--	179	--	179	--	0
	SUB-TOTAL			4,850		4,850		0
213	1 SF Residential	DU	275.00	2,723	275.00	2,723	0.00	0
	6 Other	--	--	233	--	233	--	0
	SUB-TOTAL			2,956		2,956		0
214	1 SF Residential	DU	--	--	49.00	485	49.00	485
	2 MF Residential	DU	307.00	2,118	181.00	1,330	-126.00	-788
	6 Other	--		--	--	74	--	74
	SUB-TOTAL			2,118		1,889		-229

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
215	1 SF Residential	DU	105.00	1,040	80.00	792	-25.00	-248
	2 MF Residential	DU	52.00	416	52.00	416	0.00	0
	3 Commercial Retail	TSF	143.56	7,020	143.56	7,020	0.00	0
	6 Other	--	--	5,822	--	6,027	--	205
	SUB-TOTAL			14,298		14,255		-43
216	1 SF Residential	DU	22.00	218	22.00	218	0.00	0
	2 MF Residential	DU	378.00	3,024	448.00	3,507	70.00	483
	3 Commercial Retail	TSF	204.96	11,080	204.96	11,080	0.00	0
	4 Commercial Office	TSF	65.45	757	65.45	757	0.00	0
	SUB-TOTAL			15,079		15,562		483
217	1 SF Residential	DU	202.00	2,000	202.00	2,000	0.00	0
	2 MF Residential	DU	316.00	2,528	386.00	3,011	70.00	483
	3 Commercial Retail	TSF	110.75	5,222	110.75	5,222	0.00	0
	4 Commercial Office	TSF	22.44	259	22.44	259	0.00	0
	5 Industrial Park	TSF	22.44	135	22.44	135	0.00	0
	6 Other	--	--	82		--	--	-82
	SUB-TOTAL			10,226		10,627		401
218	1 SF Residential	DU	511.00	4,606	511.00	4,606	0.00	0
	2 MF Residential	DU	641.00	5,128	810.00	6,414	169.00	1,286
	3 Commercial Retail	TSF	557.87	24,488	557.87	24,488	0.00	0
	6 Other	--	--	88	--	1,176	--	1,088
	SUB-TOTAL			34,310		36,684		2,374
219	1 SF Residential	DU	230.00	2,277	20.00	198	-210.00	-2,079
	2 MF Residential	DU	--	--	250.00	2,000	250.00	2,000
	4 Commercial Office	TSF	--	--	100.00	1,020	100.00	1,020
	SUB-TOTAL			2,277		3,218		941
220	1 SF Residential	DU	8.00	79	8.00	79	0.00	0
	4 Commercial Office	TSF	--	--	100.00	1,020	100.00	1,020
	6 Other	--	--	1,348	--	1,348	--	0
	SUB-TOTAL			1,427		2,447		1,020
221	1 SF Residential	DU	438.00	4,246	380.00	3,672	-58.00	-574
	2 MF Residential	DU	6.00	48	6.00	48	0.00	0
	4 Commercial Office	TSF	--	--	50.00	510	50.00	510
	5 Industrial Park	TSF	144.40	866	144.40	866	0.00	0
	6 Other	--	--	1,417	--	1,417	--	0
	SUB-TOTAL			6,577		6,513		-64
222	1 SF Residential	DU	105.00	1,040	55.00	545	-50.00	-495
	2 MF Residential	DU	112.00	896	--	--	-112.00	-896
	5 Industrial Park	TSF	124.15	745	--	--	-124.15	-745
	6 Other	--	--	3,861	--	3,861	--	0
	SUB-TOTAL			6,542		4,406		-2,136

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
223	1 SF Residential	DU	32.00	317	--	--	-32.00	-317
	2 MF Residential	DU	641.00	5,128	--	--	-641.00	-5,128
	3 Commercial Retail	TSF	67.50	5,742	110.00	5,947	42.50	205
	4 Commercial Office	TSF	150.00	1,734	248.00	2,867	98.00	1,133
	5 Industrial Park	TSF	415.00	2,490	242.00	1,452	-173.00	-1,038
	6 Other	--	--	1,249	--	823	--	-426
	SUB-TOTAL			16,660		11,089		-5,571
224	1 SF Residential	DU	356.00	3,434	280.00	2,682	-76.00	-752
	2 MF Residential	DU	525.00	4,200	550.00	4,400	25.00	200
	3 Commercial Retail	TSF	116.68	4,324	116.68	4,324	0.00	0
	6 Other	--	--	3,970	--	4,011	--	41
	SUB-TOTAL			15,928		15,417		-511
225	1 SF Residential	DU	156.00	1,544	156.00	1,544	0.00	0
	2 MF Residential	DU	151.00	1,208	--	--	-151.00	-1,208
	6 Other	--	--	2,368	--	1,776	--	-592
	SUB-TOTAL			5,120		3,320		-1,800
226	1 SF Residential	DU	300.00	2,970	300.00	2,970	0.00	0
	2 MF Residential	DU	292.00	2,336	292.00	2,336	0.00	0
	3 Commercial Retail	TSF	85.38	3,431	85.38	3,917	0.00	486
	6 Other	--	--	74	--	354	--	280
	SUB-TOTAL			8,811		9,577		766
227	1 SF Residential	DU	172.00	1,703	118.00	1,168	-54.00	-535
	2 MF Residential	DU	184.00	1,472	786.00	6,288	602.00	4,816
	4 Commercial Office	TSF	563.56	5,748	--	--	-563.56	-5,748
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			8,923		8,544		-379
228	1 SF Residential	DU	358.00	3,544	385.00	3,811	27.00	267
	SUB-TOTAL			3,544		3,811		267
229	1 SF Residential	DU	178.00	1,763	178.00	1,763	0.00	0
	SUB-TOTAL			1,763		1,763		0
230	1 SF Residential	DU	10.00	99	10.00	99	0.00	0
	SUB-TOTAL			99		99		0
231	1 SF Residential	DU	5.00	50	5.00	50	0.00	0
	2 MF Residential	DU	51.00	408	51.00	408	0.00	0
	6 Other	--	--	69	--	69	--	0
	SUB-TOTAL			527		527		0
232	1 SF Residential	DU	10.00	99	10.00	99	0.00	0
	2 MF Residential	DU	--	--	850.00	5,865	850.00	5,865
	SUB-TOTAL			99		5,964		5,865

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
233	4 Commercial Office	TSF	569.47	5,809	--	--	-569.47	-5,809
	SUB-TOTAL			5,809		--		-5,809
234	3 Commercial Retail	TSF	100.00	5,406	100.00	5,406	0.00	0
	4 Commercial Office	TSF	470.24	4,796	470.24	4,796	0.00	0
	SUB-TOTAL			10,202		10,202		0
235	3 Commercial Retail	TSF	20.00	1,081	240.00	12,974	220.00	11,893
	4 Commercial Office	TSF	130.00	1,326	80.00	816	-50.00	-510
	SUB-TOTAL			2,407		13,790		11,383
236	1 SF Residential	DU	808.00	8,000	808.00	8,000	0.00	0
	6 Other	--	--	951	--	1,101	--	150
	SUB-TOTAL			8,951		9,101		150
237	1 SF Residential	DU	225.00	2,228	225.00	2,228	0.00	0
	2 MF Residential	DU	570.00	3,933	570.00	3,933	0.00	0
	4 Commercial Office	TSF	99.00	1,144	99.00	1,144	0.00	0
	6 Other	--	--	63	--	63	--	0
	SUB-TOTAL			7,368		7,368		0
238	1 SF Residential	DU	399.00	3,950	399.00	3,950	0.00	0
	2 MF Residential	DU	123.00	984	123.00	984	0.00	0
	3 Commercial Retail	TSF	184.00	12,575	184.00	12,479	0.00	-96
	4 Commercial Office	TSF	340.00	3,621	340.00	3,621	0.00	0
	5 Industrial Park	TSF	944.00	5,664	944.00	5,664	0.00	0
	6 Other	--	--	67	--	67	--	0
	SUB-TOTAL			26,861		26,765		-96
239	3 Commercial Retail	TSF	337.29	12,500	337.29	12,500	0.00	0
	4 Commercial Office	TSF	262.87	3,039	262.87	3,039	0.00	0
	5 Industrial Park	TSF	1,939.67	10,240	387.07	2,322	-1,552.60	-7,918
	6 Other	--	--	895	--	895	--	0
	SUB-TOTAL			26,674		18,756		-7,918
240	3 Commercial Retail	TSF	181.00	12,417	181.00	14,181	0.00	1,764
	SUB-TOTAL			12,417		14,181		1,764
241	3 Commercial Retail	TSF	44.00	2,665	--	--	-44.00	-2,665
	4 Commercial Office	TSF	--	--	1,228.00	13,198	1,228.00	13,198
	6 Other	--		--	--	1,128	--	1,128
	SUB-TOTAL			2,665		14,326		11,661
242	4 Commercial Office	TSF	368.00	3,910	368.00	3,910	0.00	0
	SUB-TOTAL			3,910		3,910		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
243	1 SF Residential	DU	211.00	2,089	211.00	2,089	0.00	0
	2 MF Residential	DU	816.00	6,099	816.00	6,099	0.00	0
	3 Commercial Retail	TSF	129.00	9,138	129.00	10,188	0.00	1,050
	4 Commercial Office	TSF	164.00	1,896	164.00	1,896	0.00	0
	SUB-TOTAL			19,222		20,272		1,050
244	1 SF Residential	DU	512.00	5,068	322.00	3,188	-190.00	-1,880
	2 MF Residential	DU	157.00	1,256	--	--	-157.00	-1,256
	SUB-TOTAL			6,324		3,188		-3,136
245	1 SF Residential	DU	--	--	20.00	198	20.00	198
	2 MF Residential	DU	148.00	1,184	--	--	-148.00	-1,184
	5 Industrial Park	TSF	406.74	2,385	--	--	-406.74	-2,385
	6 Other	--		--	--	34	--	34
	SUB-TOTAL			3,569		232		-3,337
246	3 Commercial Retail	TSF	36.00	3,062	--	--	-36.00	-3,062
	5 Industrial Park	TSF	58.81	300	120.00	612	61.19	312
	SUB-TOTAL			3,362		612		-2,750
247	3 Commercial Retail	TSF	71.37	3,858	500.00	20,030	428.63	16,172
	SUB-TOTAL			3,858		20,030		16,172
248	1 SF Residential	DU	2.00	20	2.00	20	0.00	0
	2 MF Residential	DU	4.00	32	4.00	32	0.00	0
	5 Industrial Park	TSF	882.09	5,293	1,200.00	7,200	317.91	1,907
	SUB-TOTAL			5,345		7,252		1,907
249	4 Commercial Office	TSF	150.00	1,734	250.00	2,890	100.00	1,156
	5 Industrial Park	TSF	291.68	1,488	291.68	1,488	0.00	0
	SUB-TOTAL			3,222		4,378		1,156
250	2 MF Residential	DU	--	--	450.00	3,435	450.00	3,435
	3 Commercial Retail	TSF	148.66	7,050	448.66	17,799	300.00	10,749
	4 Commercial Office	TSF	--	--	300.00	3,264	300.00	3,264
	SUB-TOTAL			7,050		24,498		17,448
251	5 Industrial Park	TSF	400.00	2,400	400.00	2,400	0.00	0
	SUB-TOTAL			2,400		2,400		0
252	4 Commercial Office	TSF	858.00	8,752	858.00	8,752	0.00	0
	SUB-TOTAL			8,752		8,752		0
253	1 SF Residential	DU	84.00	832	32.00	317	-52.00	-515
	SUB-TOTAL			832		317		-515
254	3 Commercial Retail	TSF	116.21	6,134	116.21	6,134	0.00	0
	SUB-TOTAL			6,134		6,134		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
255	1 SF Residential	DU	69.00	683	20.00	198	-49.00	-485
	SUB-TOTAL			683		198		-485
256	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	SUB-TOTAL			198		198		0
257	1 SF Residential	DU	304.00	3,009	170.00	1,683	-134.00	-1,326
	2 MF Residential	DU	11.00	88	--	--	-11.00	-88
	SUB-TOTAL			3,097		1,683		-1,414
258	1 SF Residential	DU	97.00	960	130.00	1,287	33.00	327
	5 Industrial Park	TSF	125.00	638	125.00	638	0.00	0
	6 Other	--		--	--	3,324	--	3,324
	SUB-TOTAL			1,598		5,249		3,651
259	1 SF Residential	DU	14.00	139	10.00	99	-4.00	-40
	2 MF Residential	DU	237.00	1,896	--	--	-237.00	-1,896
	SUB-TOTAL			2,035		99		-1,936
260	1 SF Residential	DU	402.00	3,980	402.00	3,980	0.00	0
	SUB-TOTAL			3,980		3,980		0
261	1 SF Residential	DU	295.00	2,921	25.00	247	-270.00	-2,674
	SUB-TOTAL			2,921		247		-2,674
262	1 SF Residential	DU	790.00	7,821	790.00	7,821	0.00	0
	2 MF Residential	DU	--	--	100.00	800	100.00	800
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			8,909		9,709		800
263	2 MF Residential	DU	140.00	1,120	200.00	1,600	60.00	480
	SUB-TOTAL			1,120		1,600		480
264	1 SF Residential	DU	63.00	624	63.00	624	0.00	0
	2 MF Residential	DU	--	--	264.00	2,026	264.00	2,026
	SUB-TOTAL			624		2,650		2,026
265	2 MF Residential	DU	1,338.00	10,704	670.00	4,975	-668.00	-5,729
	SUB-TOTAL			10,704		4,975		-5,729
266	2 MF Residential	DU	--	--	200.00	742	200.00	742
	3 Commercial Retail	TSF	101.04	5,462	120.00	6,487	18.96	1,025
	5 Industrial Park	TSF	--	--	75.00	383	75.00	383
	SUB-TOTAL			5,462		7,612		2,150
267	3 Commercial Retail	TSF	100.00	5,406	200.00	10,812	100.00	5,406
	SUB-TOTAL			5,406		10,812		5,406

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
268	2 MF Residential	DU	400.00	3,200	180.00	1,440	-220.00	-1,760
	3 Commercial Retail	TSF	182.33	9,857	182.33	9,857	0.00	0
	5 Industrial Park	TSF	75.00	383	112.00	571	37.00	188
	SUB-TOTAL			13,440		11,868		-1,572
269	1 SF Residential	DU	687.00	6,801	266.00	2,633	-421.00	-4,168
	2 MF Residential	DU	--	--	25.00	93	25.00	93
	6 Other	--	--	2,735	--	737	--	-1,998
	SUB-TOTAL			9,536		3,463		-6,073
270	1 SF Residential	DU	8.00	79	308.00	3,049	300.00	2,970
	2 MF Residential	DU	--	--	75.00	278	75.00	278
	SUB-TOTAL			79		3,327		3,248
271	2 MF Residential	DU	155.00	1,070	171.00	1,180	16.00	110
	3 Commercial Retail	TSF	690.66	27,668	630.00	25,238	-60.66	-2,430
	SUB-TOTAL			28,738		26,418		-2,320
272	1 SF Residential	DU	967.00	9,573	967.00	9,573	0.00	0
	2 MF Residential	DU	823.00	6,584	180.00	1,440	-643.00	-5,144
	3 Commercial Retail	TSF	8.12	691	8.12	691	0.00	0
	6 Other	--	--	1,088	--	1,088	--	0
	SUB-TOTAL			17,936		12,792		-5,144
273	1 SF Residential	DU	101.00	1,000	101.00	1,000	0.00	0
	SUB-TOTAL			1,000		1,000		0
274	1 SF Residential	DU	362.00	3,584	80.00	792	-282.00	-2,792
	4 Commercial Office	TSF	110.06	1,123	110.06	1,123	0.00	0
	SUB-TOTAL			4,707		1,915		-2,792
275	1 SF Residential	DU	225.00	2,228	225.00	2,228	0.00	0
	SUB-TOTAL			2,228		2,228		0
276	1 SF Residential	DU	75.00	743	75.00	743	0.00	0
	2 MF Residential	DU	539.00	4,312	539.00	4,312	0.00	0
	3 Commercial Retail	TSF	98.01	8,337	98.01	8,337	0.00	0
	6 Other	--	--	73	--	73	--	0
	SUB-TOTAL			13,465		13,465		0
277	3 Commercial Retail	TSF	7.91	809	73.00	4,175	65.09	3,366
	4 Commercial Office	TSF	--	--	110.00	3,536	110.00	3,536
	5 Industrial Park	TSF	--	--	150.00	765	150.00	765
	SUB-TOTAL			809		8,476		7,667
278	2 MF Residential	DU	757.00	6,056	757.00	6,056	0.00	0
	3 Commercial Retail	TSF	81.89	6,966	81.89	6,966	0.00	0
	6 Other	--	--	398	--	398	--	0
	SUB-TOTAL			13,420		13,420		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
279	1 SF Residential	DU	313.00	2,160	313.00	2,160	0.00	0
	3 Commercial Retail	TSF	26.33	2,240	26.33	2,240	0.00	0
	4 Commercial Office	TSF	0.20	2	0.20	2	0.00	0
	5 Industrial Park	TSF	58.00	348	58.00	348	0.00	0
	SUB-TOTAL			4,750		4,750		0
280	4 Commercial Office	TSF	38.18	389	38.18	389	0.00	0
	SUB-TOTAL			389		389		0
281	2 MF Residential	DU	150.00	1,200	150.00	1,200	0.00	0
	SUB-TOTAL			1,200		1,200		0
282	2 MF Residential	DU	486.00	3,888	700.00	5,600	214.00	1,712
	3 Commercial Retail	TSF	17.90	968	17.90	968	0.00	0
	SUB-TOTAL			4,856		6,568		1,712
283	1 SF Residential	DU	161.00	1,594	175.00	1,732	14.00	138
	2 MF Residential	DU	400.00	3,200	667.00	5,336	267.00	2,136
	6 Other	--	--	1,618	--	1,740	--	122
	SUB-TOTAL			6,412		8,808		2,396
284	1 SF Residential	DU	392.00	2,842	2.00	20	-390.00	-2,822
	2 MF Residential	DU	--	--	254.00	2,032	254.00	2,032
	SUB-TOTAL			2,842		2,052		-790
285	1 SF Residential	DU	80.00	792	80.00	792	0.00	0
	3 Commercial Retail	TSF	246.99	9,894	246.99	9,894	0.00	0
	4 Commercial Office	TSF	--	--	150.00	1,530	150.00	1,530
	SUB-TOTAL			10,686		12,216		1,530
286	1 SF Residential	DU	82.00	812	182.00	1,802	100.00	990
	SUB-TOTAL			812		1,802		990
287	1 SF Residential	DU	111.00	1,099	35.00	347	-76.00	-752
	2 MF Residential	DU	--	--	120.00	960	120.00	960
	SUB-TOTAL			1,099		1,307		208
288	1 SF Residential	DU	--	--	167.00	1,653	167.00	1,653
	6 Other	--	--	4,475	--	4,475	--	0
	SUB-TOTAL			4,475		6,128		1,653
289	1 SF Residential	DU	166.00	1,643	166.00	1,643	0.00	0
	2 MF Residential	DU	--	--	350.00	2,415	350.00	2,415
	4 Commercial Office	TSF	57.17	583	57.17	583	0.00	0
	SUB-TOTAL			2,226		4,641		2,415

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
290	1 SF Residential	DU	64.00	634	104.00	1,030	40.00	396
	2 MF Residential	DU	93.00	744	93.00	744	0.00	0
	SUB-TOTAL			1,378		1,774		396
291	1 SF Residential	DU	74.00	733	74.00	733	0.00	0
	2 MF Residential	DU	--	--	350.00	2,415	350.00	2,415
	4 Commercial Office	TSF	181.63	1,853	181.63	1,853	0.00	0
	SUB-TOTAL			2,586		5,001		2,415
292	1 SF Residential	DU	161.00	1,594	140.00	1,386	-21.00	-208
	SUB-TOTAL			1,594		1,386		-208
293	1 SF Residential	DU	133.00	1,317	180.00	1,782	47.00	465
	2 MF Residential	DU	368.00	2,944	684.00	5,217	316.00	2,273
	SUB-TOTAL			4,261		6,999		2,738
294	2 MF Residential	DU	180.00	1,242	276.00	1,904	96.00	662
	3 Commercial Retail	TSF	364.00	19,678	155.00	8,379	-209.00	-11,299
	4 Commercial Office	TSF	349.98	3,570	--	--	-349.98	-3,570
	5 Industrial Park	TSF	210.00	1,260	300.00	1,800	90.00	540
	6 Other	--	--	99		--	--	-99
	SUB-TOTAL			25,849		12,083		-13,766
295	4 Commercial Office	TSF	56.00	647	56.00	647	0.00	0
	5 Industrial Park	TSF	1,020.58	5,205	1,020.58	5,205	0.00	0
	6 Other	--	--	56	--	156	--	100
	SUB-TOTAL			5,908		6,008		100
296	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			--		1,701		1,701
297	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			--		1,701		1,701
298	2 MF Residential	DU	830.00	5,727	830.00	5,727	0.00	0
	3 Commercial Retail	TSF	--	--	20.00	1,701	20.00	1,701
	SUB-TOTAL			5,727		7,428		1,701
299	3 Commercial Retail	TSF	184.00	9,947	184.00	9,947	0.00	0
	SUB-TOTAL			9,947		9,947		0
300	3 Commercial Retail	TSF	272.00	10,896	300.00	12,018	28.00	1,122
	SUB-TOTAL			10,896		12,018		1,122
301	3 Commercial Retail	TSF	49.24	1,825	49.24	1,825	0.00	0
	6 Other	--	--	7,904	--	8,635	--	731
	SUB-TOTAL			9,729		10,460		731

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
302	3 Commercial Retail	TSF	414.42	17,952	30.00	2,552	-384.42	-15,400
	6 Other	--	--	1,163	--	3,750	--	2,587
	SUB-TOTAL			19,115		6,302		-12,813
303	6 Other	--	--	5,625	--	5,625	--	0
	SUB-TOTAL			5,625		5,625		0
304	3 Commercial Retail	TSF	48.00	3,739	48.00	3,739	0.00	0
	6 Other	--	--	3,113	--	3,113	--	0
	SUB-TOTAL			6,852		6,852		0
305	2 MF Residential	DU	--	--	76.00	524	76.00	524
	3 Commercial Retail	TSF	202.65	11,364	202.65	11,364	0.00	0
	5 Industrial Park	TSF	100.00	510	100.00	510	0.00	0
	SUB-TOTAL			11,874		12,398		524
306	2 MF Residential	DU	--	--	250.00	1,863	250.00	1,863
	3 Commercial Retail	TSF	143.90	7,779	143.90	7,779	0.00	0
	4 Commercial Office	TSF	--	--	50.00	1,710	50.00	1,710
	6 Other	--	--	336	--	336	--	0
	SUB-TOTAL			8,115		11,688		3,573
307	3 Commercial Retail	TSF	132.80	9,301	132.80	9,301	0.00	0
	SUB-TOTAL			9,301		9,301		0
308	2 MF Residential	DU	245.00	1,691	200.00	1,380	-45.00	-311
	3 Commercial Retail	TSF	180.51	15,599	175.11	14,895	-5.40	-704
	5 Industrial Park	TSF	29.40	150	45.00	230	15.60	80
	SUB-TOTAL			17,440		16,505		-935
309	3 Commercial Retail	TSF	3.00	111	3.00	111	0.00	0
	SUB-TOTAL			111		111		0
310	6 Other	--	--	4,208	--	4,208	--	0
	SUB-TOTAL			4,208		4,208		0
311	1 SF Residential	DU	132.00	1,307	132.00	1,307	0.00	0
	2 MF Residential	DU	63.00	504	63.00	504	0.00	0
	SUB-TOTAL			1,811		1,811		0
312	3 Commercial Retail	TSF	180.00	9,731	180.00	9,731	0.00	0
	6 Other	--	--	200	--	200	--	0
	SUB-TOTAL			9,931		9,931		0
313	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	SUB-TOTAL			2,112		2,112		0
314	3 Commercial Retail	TSF	178.00	9,623	178.00	9,623	0.00	0
	SUB-TOTAL			9,623		9,623		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
315	1 SF Residential	DU	--	--	56.00	554	56.00	554
	2 MF Residential	DU	582.00	4,656	168.00	1,344	-414.00	-3,312
	SUB-TOTAL			4,656		1,898		-2,758
316	1 SF Residential	DU	121.00	1,198	121.00	1,198	0.00	0
	SUB-TOTAL			1,198		1,198		0
317	6 Other	--	--	1,387	--	1,135	--	-252
	SUB-TOTAL			1,387		1,135		-252
318	1 SF Residential	DU	21.00	208	21.00	208	0.00	0
	2 MF Residential	DU	252.00	2,016	252.00	2,016	0.00	0
	SUB-TOTAL			2,224		2,224		0
319	3 Commercial Retail	TSF	130.00	7,028	130.00	7,028	0.00	0
	6 Other	--	--	279	--	292	--	13
	SUB-TOTAL			7,307		7,320		13
320	1 SF Residential	DU	125.00	1,238	125.00	1,238	0.00	0
	SUB-TOTAL			1,238		1,238		0
321	1 SF Residential	DU	155.00	1,535	155.00	1,535	0.00	0
	2 MF Residential	DU	66.00	528	66.00	528	0.00	0
	SUB-TOTAL			2,063		2,063		0
322	1 SF Residential	DU	87.00	861	87.00	861	0.00	0
	SUB-TOTAL			861		861		0
323	1 SF Residential	DU	161.00	1,594	161.00	1,594	0.00	0
	2 MF Residential	DU	132.00	1,056	132.00	1,056	0.00	0
	SUB-TOTAL			2,650		2,650		0
325	1 SF Residential	DU	205.00	2,029	205.00	2,029	0.00	0
	SUB-TOTAL			2,029		2,029		0
326	1 SF Residential	DU	101.00	1,000	101.00	1,000	0.00	0
	SUB-TOTAL			1,000		1,000		0
327	1 SF Residential	DU	105.00	1,040	105.00	1,040	0.00	0
	SUB-TOTAL			1,040		1,040		0
328	1 SF Residential	DU	110.00	1,089	110.00	1,089	0.00	0
	SUB-TOTAL			1,089		1,089		0
329	1 SF Residential	DU	50.00	495	--	--	-50.00	-495
	6 Other	--	--	1,340	--	1,088	--	-252
	SUB-TOTAL			1,835		1,088		-747

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
330	1 SF Residential	DU	143.00	1,416	143.00	1,416	0.00	0
	SUB-TOTAL			1,416		1,416		0
331	1 SF Residential	DU	167.00	1,653	167.00	1,653	0.00	0
	SUB-TOTAL			1,653		1,653		0
332	1 SF Residential	DU	114.00	1,129	114.00	1,129	0.00	0
	2 MF Residential	DU	102.00	816	102.00	816	0.00	0
	SUB-TOTAL			1,945		1,945		0
333	1 SF Residential	DU	803.00	7,950	803.00	7,950	0.00	0
	2 MF Residential	DU	360.00	2,880	360.00	2,880	0.00	0
	3 Commercial Retail	TSF	25.05	928	25.05	928	0.00	0
	6 Other	--	--	1,340	--	1,740	--	400
	SUB-TOTAL			13,098		13,498		400
334	1 SF Residential	DU	164.00	1,624	164.00	1,624	0.00	0
	SUB-TOTAL			1,624		1,624		0
335	1 SF Residential	DU	194.00	1,921	194.00	1,921	0.00	0
	SUB-TOTAL			1,921		1,921		0
336	1 SF Residential	DU	589.00	5,831	589.00	5,831	0.00	0
	6 Other	--	--	1,359	--	1,107	--	-252
	SUB-TOTAL			7,190		6,938		-252
337	1 SF Residential	DU	390.00	3,861	390.00	3,861	0.00	0
	SUB-TOTAL			3,861		3,861		0
338	3 Commercial Retail	TSF	92.00	4,974	92.00	4,974	0.00	0
	SUB-TOTAL			4,974		4,974		0
339	1 SF Residential	DU	289.00	2,861	289.00	2,861	0.00	0
	6 Other	--	--	1,358	--	1,106	--	-252
	SUB-TOTAL			4,219		3,967		-252
340	1 SF Residential	DU	394.00	3,901	394.00	3,901	0.00	0
	2 MF Residential	DU	264.00	2,112	264.00	2,112	0.00	0
	SUB-TOTAL			6,013		6,013		0
341	2 MF Residential	DU	325.00	2,243	325.00	2,243	0.00	0
	6 Other	--	--	1,175	--	1,175	--	0
	SUB-TOTAL			3,418		3,418		0
342	2 MF Residential	DU	168.00	1,344	168.00	1,344	0.00	0
	SUB-TOTAL			1,344		1,344		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
343	1 SF Residential	DU	179.00	1,772	179.00	1,772	0.00	0
	2 MF Residential	DU	132.00	1,056	132.00	1,056	0.00	0
	SUB-TOTAL			2,828		2,828		0
344	1 SF Residential	DU	415.00	4,109	415.00	4,109	0.00	0
	3 Commercial Retail	TSF	40.00	2,162	40.00	2,162	0.00	0
	SUB-TOTAL			6,271		6,271		0
345	1 SF Residential	DU	23.00	228	81.00	802	58.00	574
	SUB-TOTAL			228		802		574
346	1 SF Residential	DU	--	--	10.00	99	10.00	99
	SUB-TOTAL			--		99		99
347	1 SF Residential	DU	313.00	3,099	313.00	3,099	0.00	0
	SUB-TOTAL			3,099		3,099		0
348	1 SF Residential	DU	517.00	5,118	517.00	5,118	0.00	0
	SUB-TOTAL			5,118		5,118		0
349	2 MF Residential	DU	83.00	664	388.00	3,104	305.00	2,440
	3 Commercial Retail	TSF	8.00	680	8.00	680	0.00	0
	6 Other	--	--	226	--	226	--	0
	SUB-TOTAL			1,570		4,010		2,440
350	6 Other	--	--	1,010	--	1,860	--	850
	SUB-TOTAL			1,010		1,860		850
352	1 SF Residential	DU	592.00	5,861	592.00	5,861	0.00	0
	6 Other	--		--	--	1,363	--	1,363
	SUB-TOTAL			5,861		7,224		1,363
353	1 SF Residential	DU	259.00	2,564	259.00	2,564	0.00	0
	6 Other	--		--	--	26	--	26
	SUB-TOTAL			2,564		2,590		26
355	1 SF Residential	DU	500.00	4,950	500.00	4,950	0.00	0
	6 Other	--	--	1,101	--	1,101	--	0
	SUB-TOTAL			6,051		6,051		0
356	1 SF Residential	DU	385.00	3,811	385.00	3,811	0.00	0
	3 Commercial Retail	TSF	--	--	60.00	5,104	60.00	5,104
	SUB-TOTAL			3,811		8,915		5,104
357	1 SF Residential	DU	90.00	891	90.00	891	0.00	0
	SUB-TOTAL			891		891		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
358	1 SF Residential	DU	421.00	4,168	275.00	2,723	-146.00	-1,445
	2 MF Residential	DU	255.00	2,040	121.00	968	-134.00	-1,072
	6 Other	--	--	993	--	1,138	--	145
	SUB-TOTAL			7,201		4,829		-2,372
359	1 SF Residential	DU	570.00	5,643	570.00	5,643	0.00	0
	2 MF Residential	DU	192.00	1,536	192.00	1,536	0.00	0
	SUB-TOTAL			7,179		7,179		0
360	1 SF Residential	DU	538.00	5,326	538.00	5,326	0.00	0
	2 MF Residential	DU	248.00	1,984	248.00	1,984	0.00	0
	3 Commercial Retail	TSF	119.00	10,122	135.00	11,483	16.00	1,361
	6 Other	--	--	938	--	1,088	--	150
	SUB-TOTAL			18,370		19,881		1,511
361	1 SF Residential	DU	250.00	2,475	601.00	5,407	351.00	2,932
	6 Other	--		--	--	28	--	28
	SUB-TOTAL			2,475		5,435		2,960
362	1 SF Residential	DU	173.00	1,713	173.00	1,713	0.00	0
	3 Commercial Retail	TSF	68.28	3,691	--	--	-68.28	-3,691
	SUB-TOTAL			5,404		1,713		-3,691
363	1 SF Residential	DU	44.00	436	44.00	436	0.00	0
	SUB-TOTAL			436		436		0
364	1 SF Residential	DU	199.00	1,970	199.00	1,970	0.00	0
	SUB-TOTAL			1,970		1,970		0
365	1 SF Residential	DU	201.00	1,990	201.00	1,990	0.00	0
	2 MF Residential	DU	102.00	816	102.00	816	0.00	0
	3 Commercial Retail	TSF	40.28	3,426	11.00	936	-29.28	-2,490
	SUB-TOTAL			6,232		3,742		-2,490
366	1 SF Residential	DU	600.00	5,940	600.00	5,940	0.00	0
	SUB-TOTAL			5,940		5,940		0
367	1 SF Residential	DU	437.00	4,326	437.00	4,326	0.00	0
	SUB-TOTAL			4,326		4,326		0
368	1 SF Residential	DU	1,070.00	10,593	1,070.00	10,593	0.00	0
	3 Commercial Retail	TSF	--	--	35.00	2,977	35.00	2,977
	6 Other	--	--	1,500	--	1,629	--	129
	SUB-TOTAL			12,093		15,199		3,106
369	1 SF Residential	DU	202.00	2,000	202.00	2,000	0.00	0
	SUB-TOTAL			2,000		2,000		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
370	1 SF Residential	DU	1,080.00	10,692	1,080.00	10,692	0.00	0
	6 Other	--	--	5,012	--	4,475	--	-537
	SUB-TOTAL			15,704		15,167		-537
371	1 SF Residential	DU	673.00	6,663	673.00	6,663	0.00	0
	6 Other	--	--	996	--	1,088	--	92
	SUB-TOTAL			7,659		7,751		92
372	1 SF Residential	DU	287.00	2,841	287.00	2,841	0.00	0
	2 MF Residential	DU	230.00	1,840	230.00	1,840	0.00	0
	3 Commercial Retail	TSF	153.55	8,301	80.00	4,325	-73.55	-3,976
	SUB-TOTAL			12,982		9,006		-3,976
373	1 SF Residential	DU	236.00	2,336	236.00	2,336	0.00	0
	6 Other	--	--	889	--	1,307	--	418
	SUB-TOTAL			3,225		3,643		418
374	1 SF Residential	DU	--	--	300.00	2,970	300.00	2,970
	2 MF Residential	DU	304.00	2,098	304.00	2,098	0.00	0
	3 Commercial Retail	TSF	150.00	8,109	150.00	8,109	0.00	0
	6 Other	--		--	--	78	--	78
	SUB-TOTAL			10,207		13,255		3,048
375	3 Commercial Retail	TSF	45.00	5,883	45.00	5,883	0.00	0
	SUB-TOTAL			5,883		5,883		0
376	1 SF Residential	DU	205.00	2,029	--	--	-205.00	-2,029
	6 Other	--	--	13		--	--	-13
	SUB-TOTAL			2,042		--		-2,042
377	3 Commercial Retail	TSF	57.50	2,131	57.50	2,131	0.00	0
	SUB-TOTAL			2,131		2,131		0
378	1 SF Residential	DU	332.00	2,291	332.00	2,291	0.00	0
	2 MF Residential	DU	437.00	3,496	407.00	3,256	-30.00	-240
	3 Commercial Retail	TSF	51.00	1,890	51.00	1,890	0.00	0
	4 Commercial Office	TSF	166.00	1,843	56.00	571	-110.00	-1,272
	5 Industrial Park	TSF	--	--	110.00	660	110.00	660
	SUB-TOTAL			9,520		8,668		-852
379	1 SF Residential	DU	214.00	2,119	--	--	-214.00	-2,119
	SUB-TOTAL			2,119		--		-2,119
380	1 SF Residential	DU	--	--	125.00	1,238	125.00	1,238
	2 MF Residential	DU	400.00	2,760	400.00	2,760	0.00	0
	SUB-TOTAL			2,760		3,998		1,238
381	6 Other	--	--	130	--	223	--	93
	SUB-TOTAL			130		223		93

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
382	6 Other	--	--	180	--	180	--	0
	SUB-TOTAL			180		180		0
383	1 SF Residential	DU	266.00	2,633	266.00	2,633	0.00	0
	3 Commercial Retail	TSF	8.71	323	8.71	323	0.00	0
	SUB-TOTAL			2,956		2,956		0
384	1 SF Residential	DU	354.00	3,505	354.00	3,505	0.00	0
	3 Commercial Retail	TSF	23.07	1,962	--	--	-23.07	-1,962
	SUB-TOTAL			5,467		3,505		-1,962
385	1 SF Residential	DU	75.00	743	75.00	743	0.00	0
	SUB-TOTAL			743		743		0
386	1 SF Residential	DU	162.00	1,604	--	--	-162.00	-1,604
	SUB-TOTAL			1,604		--		-1,604
387	1 SF Residential	DU	1,070.00	10,593	800.00	7,920	-270.00	-2,673
	2 MF Residential	DU	954.00	7,632	700.00	5,600	-254.00	-2,032
	SUB-TOTAL			18,225		13,520		-4,705
388	1 SF Residential	DU	312.00	3,089	99.00	980	-213.00	-2,109
	2 MF Residential	DU	187.00	1,496	400.00	3,200	213.00	1,704
	6 Other	--	--	2,320	--	2,320	--	0
	SUB-TOTAL			6,905		6,500		-405
389	1 SF Residential	DU	1,187.00	11,751	1,236.00	12,236	49.00	485
	6 Other	--	--	766	--	1,088	--	322
	SUB-TOTAL			12,517		13,324		807
390	1 SF Residential	DU	150.00	1,485	150.00	1,485	0.00	0
	SUB-TOTAL			1,485		1,485		0
391	3 Commercial Retail	TSF	16.33	605	16.33	605	0.00	0
	5 Industrial Park	TSF	446.36	2,339	446.36	2,339	0.00	0
	SUB-TOTAL			2,944		2,944		0
392	1 SF Residential	DU	723.00	5,958	757.00	6,193	34.00	235
	3 Commercial Retail	TSF	102.48	5,187	102.48	5,187	0.00	0
	5 Industrial Park	TSF	--	--	500.00	2,550	500.00	2,550
	6 Other	--	--	1,450	--	1,088	--	-362
	SUB-TOTAL			12,595		15,018		2,423
393	1 SF Residential	DU	162.00	1,604	162.00	1,604	0.00	0
	2 MF Residential	DU	100.00	800	100.00	800	0.00	0
	3 Commercial Retail	TSF	52.27	4,446	52.27	4,446	0.00	0
	6 Other	--	--	350	--	679	--	329
	SUB-TOTAL			7,200		7,529		329

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
394	1 SF Residential	DU	325.00	3,217	325.00	3,217	0.00	0
	6 Other	--	--	7,317	--	5,571	--	-1,746
	SUB-TOTAL			10,534		8,788		-1,746
395	1 SF Residential	DU	185.00	1,831	--	--	-185.00	-1,831
	2 MF Residential	DU	--	--	185.00	1,277	185.00	1,277
	3 Commercial Retail	TSF	165.53	8,949	165.53	8,949	0.00	0
	6 Other	--	--	2,182	--	1,740	--	-442
	SUB-TOTAL			12,962		11,966		-996
396	3 Commercial Retail	TSF	76.23	6,484	110.00	9,357	33.77	2,873
	SUB-TOTAL			6,484		9,357		2,873
397	1 SF Residential	DU	220.00	1,665	549.00	3,935	329.00	2,270
	2 MF Residential	DU	579.00	4,558	579.00	4,558	0.00	0
	3 Commercial Retail	TSF	384.98	23,106	384.98	23,106	0.00	0
	6 Other	--		--	--	1,084	--	1,084
	SUB-TOTAL			29,329		32,683		3,354
398	1 SF Residential	DU	1,120.00	11,088	1,120.00	11,088	0.00	0
	2 MF Residential	DU	120.00	960	120.00	960	0.00	0
	3 Commercial Retail	TSF	261.13	22,465	261.13	22,465	0.00	0
	6 Other	--	--	2,634	--	2,533	--	-101
	SUB-TOTAL			37,147		37,046		-101
399	1 SF Residential	DU	859.00	8,504	880.00	8,712	21.00	208
	6 Other	--	--	790	--	1,228	--	438
	SUB-TOTAL			9,294		9,940		646
400	1 SF Residential	DU	12.00	119	12.00	119	0.00	0
	SUB-TOTAL			119		119		0
401	1 SF Residential	DU	835.00	8,267	835.00	8,267	0.00	0
	2 MF Residential	DU	482.00	3,856	482.00	3,856	0.00	0
	SUB-TOTAL			12,123		12,123		0
402	1 SF Residential	DU	1,129.00	11,177	1,129.00	11,177	0.00	0
	3 Commercial Retail	TSF	150.00	8,109	150.00	8,109	0.00	0
	6 Other	--	--	951	--	2,027	--	1,076
	SUB-TOTAL			20,237		21,313		1,076
403	1 SF Residential	DU	111.00	1,099	111.00	1,099	0.00	0
	2 MF Residential	DU	--	--	300.00	2,070	300.00	2,070
	3 Commercial Retail	TSF	46.00	3,913	46.00	3,913	0.00	0
	SUB-TOTAL			5,012		7,082		2,070
404	1 SF Residential	DU	177.00	1,752	177.00	1,752	0.00	0
	SUB-TOTAL			1,752		1,752		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
405	1 SF Residential	DU	296.00	2,930	296.00	2,930	0.00	0
	SUB-TOTAL			2,930		2,930		0
406	1 SF Residential	DU	353.00	3,495	353.00	3,495	0.00	0
	SUB-TOTAL			3,495		3,495		0
407	1 SF Residential	DU	47.00	465	47.00	465	0.00	0
	SUB-TOTAL			465		465		0
408	1 SF Residential	DU	648.00	6,415	380.00	3,762	-268.00	-2,653
	SUB-TOTAL			6,415		3,762		-2,653
409	1 SF Residential	DU	154.00	1,525	77.00	762	-77.00	-763
	SUB-TOTAL			1,525		762		-763
410	1 SF Residential	DU	349.00	3,152	249.00	2,162	-100.00	-990
	5 Industrial Park	TSF	44.00	264	44.00	264	0.00	0
	SUB-TOTAL			3,416		2,426		-990
411	1 SF Residential	DU	675.00	6,682	675.00	6,682	0.00	0
	6 Other	--	--	1,160	--	1,088	--	-72
	SUB-TOTAL			7,842		7,770		-72
412	1 SF Residential	DU	120.00	1,188	120.00	1,188	0.00	0
	3 Commercial Retail	TSF	--	--	40.00	2,162	40.00	2,162
	SUB-TOTAL			1,188		3,350		2,162
413	1 SF Residential	DU	106.00	1,049	146.00	1,325	40.00	276
	2 MF Residential	DU	614.00	4,912	514.00	3,547	-100.00	-1,365
	3 Commercial Retail	TSF	44.60	3,794	44.60	3,794	0.00	0
	4 Commercial Office	TSF	36.59	423	36.59	423	0.00	0
	5 Industrial Park	TSF	93.75	522	93.75	522	0.00	0
	SUB-TOTAL			10,700		9,611		-1,089
414	1 SF Residential	DU	290.00	2,121	290.00	2,121	0.00	0
	2 MF Residential	DU	1,358.00	10,864	1,635.00	12,860	277.00	1,996
	3 Commercial Retail	TSF	95.83	3,551	175.00	6,486	79.17	2,935
	4 Commercial Office	TSF	125.00	1,445	--	--	-125.00	-1,445
	SUB-TOTAL			17,981		21,467		3,486
415	1 SF Residential	DU	211.00	2,089	75.00	743	-136.00	-1,346
	3 Commercial Retail	TSF	63.71	3,444	63.71	3,444	0.00	0
	5 Industrial Park	TSF	153.25	895	27.80	142	-125.45	-753
	6 Other	--	--	12,320		--	--	-12,320
	SUB-TOTAL			18,748		4,329		-14,419

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
416	1 SF Residential	DU	579.00	5,732	496.00	4,250	-83.00	-1,482
	2 MF Residential	DU	148.00	1,184	57.00	456	-91.00	-728
	3 Commercial Retail	TSF	15.00	556	15.00	556	0.00	0
	4 Commercial Office	TSF	--	--	100.00	1,156	100.00	1,156
	6 Other	--	--	39	--	225	--	186
	SUB-TOTAL			7,511		6,643		-868
417	1 SF Residential	DU	579.00	5,732	950.00	9,405	371.00	3,673
	2 MF Residential	DU	149.00	1,192	255.00	2,040	106.00	848
	3 Commercial Retail	TSF	--	--	10.00	851	10.00	851
	6 Other	--	--	1,102	--	16,488	--	15,386
	SUB-TOTAL			8,026		28,784		20,758
418	1 SF Residential	DU	90.00	621	90.00	621	0.00	0
	2 MF Residential	DU	706.00	5,393	1,229.00	9,002	523.00	3,609
	3 Commercial Retail	TSF	128.43	6,943	228.00	12,326	99.57	5,383
	SUB-TOTAL			12,957		21,949		8,992
419	1 SF Residential	DU	1,018.00	10,078	--	--	-1,018.00	-10,078
	2 MF Residential	DU	1,834.00	14,672	1,834.00	14,672	0.00	0
	SUB-TOTAL			24,750		14,672		-10,078
420	2 MF Residential	DU	40.00	320	56.00	448	16.00	128
	SUB-TOTAL			320		448		128
421	1 SF Residential	DU	100.00	990	250.00	2,475	150.00	1,485
	2 MF Residential	DU	1,952.00	13,900	1,500.00	12,000	-452.00	-1,900
	3 Commercial Retail	TSF	100.00	5,406	400.00	21,624	300.00	16,218
	4 Commercial Office	TSF	100.00	1,156	600.00	6,936	500.00	5,780
	6 Other	--	--	1,659	--	1,677	--	18
	SUB-TOTAL			23,111		44,712		21,601
422	1 SF Residential	DU	76.00	752	100.00	750	24.00	-2
	2 MF Residential	DU	80.00	640	--	--	-80.00	-640
	3 Commercial Retail	TSF	136.00	7,476	10.00	851	-126.00	-6,625
	6 Other	--	--	1,185	--	1,523	--	338
	SUB-TOTAL			10,053		3,124		-6,929
423	1 SF Residential	DU	374.00	3,703	464.00	4,324	90.00	621
	3 Commercial Retail	TSF	98.01	8,337	98.01	8,337	0.00	0
	4 Commercial Office	TSF	10.89	126	10.89	126	0.00	0
	SUB-TOTAL			12,166		12,787		621
424	1 SF Residential	DU	189.00	1,871	350.00	3,465	161.00	1,594
	2 MF Residential	DU	194.00	1,552	--	--	-194.00	-1,552
	SUB-TOTAL			3,423		3,465		42

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
425	1 SF Residential	DU	241.00	2,386	114.00	1,129	-127.00	-1,257
	2 MF Residential	DU	80.00	640	80.00	640	0.00	0
	6 Other	--	--	81	--	81	--	0
	SUB-TOTAL			3,107		1,850		-1,257
426	1 SF Residential	DU	630.00	6,237	630.00	6,237	0.00	0
	5 Industrial Park	TSF	39.60	202	39.60	202	0.00	0
	SUB-TOTAL			6,439		6,439		0
427	1 SF Residential	DU	249.00	2,465	249.00	2,465	0.00	0
	SUB-TOTAL			2,465		2,465		0
428	1 SF Residential	DU	2,124.00	21,028	1,313.00	12,999	-811.00	-8,029
	3 Commercial Retail	TSF	86.60	5,896	86.60	5,896	0.00	0
	6 Other	--		--	--	1,088	--	1,088
	SUB-TOTAL			26,924		19,983		-6,941
429	1 SF Residential	DU	55.00	545	55.00	545	0.00	0
	SUB-TOTAL			545		545		0
430	1 SF Residential	DU	2.00	20	2.00	20	0.00	0
	SUB-TOTAL			20		20		0
431	1 SF Residential	DU	3.00	30	3.00	30	0.00	0
	SUB-TOTAL			30		30		0
433	1 SF Residential	DU	155.00	1,535	155.00	1,535	0.00	0
	SUB-TOTAL			1,535		1,535		0
434	1 SF Residential	DU	25.00	247	25.00	247	0.00	0
	SUB-TOTAL			247		247		0
437	1 SF Residential	DU	250.00	2,475	--	--	-250.00	-2,475
	2 MF Residential	DU	13.00	104	--	--	-13.00	-104
	4 Commercial Office	TSF	--	--	250.00	2,550	250.00	2,550
	6 Other	--	--	1,284	--	1,284	--	0
	SUB-TOTAL			3,863		3,834		-29
438	1 SF Residential	DU	568.00	5,623	10.00	99	-558.00	-5,524
	2 MF Residential	DU	13.00	104	--	--	-13.00	-104
	4 Commercial Office	TSF	--	--	250.00	2,550	250.00	2,550
	SUB-TOTAL			5,727		2,649		-3,078
439	1 SF Residential	DU	1,031.00	10,207	175.00	1,732	-856.00	-8,475
	3 Commercial Retail	TSF	41.65	2,252	41.65	2,252	0.00	0
	SUB-TOTAL			12,459		3,984		-8,475

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
440	1 SF Residential	DU	568.00	5,623	--	--	-568.00	-5,623
	5 Industrial Park	TSF	--	--	50.00	300	50.00	300
	SUB-TOTAL			5,623		300		-5,323
441	1 SF Residential	DU	284.00	2,812	490.00	4,371	206.00	1,559
	3 Commercial Retail	TSF	--	--	30.00	1,112	30.00	1,112
	6 Other	--	--	522	--	1,088	--	566
	SUB-TOTAL			3,334		6,571		3,237
442	1 SF Residential	DU	552.00	5,464	328.00	3,247	-224.00	-2,217
	SUB-TOTAL			5,464		3,247		-2,217
443	1 SF Residential	DU	763.00	7,554	763.00	7,554	0.00	0
	3 Commercial Retail	TSF	--	--	30.00	1,112	30.00	1,112
	4 Commercial Office	TSF	108.90	1,259	--	--	-108.90	-1,259
	6 Other	--	--	1,932	--	1,088	--	-844
	SUB-TOTAL			10,745		9,754		-991
444	1 SF Residential	DU	882.00	8,732	--	--	-882.00	-8,732
	2 MF Residential	DU	19.00	152	440.00	3,520	421.00	3,368
	3 Commercial Retail	TSF	110.00	5,947	200.00	10,812	90.00	4,865
	6 Other	--	--	37	--	37	--	0
	SUB-TOTAL			14,868		14,369		-499
445	1 SF Residential	DU	41.00	406	41.00	406	0.00	0
	SUB-TOTAL			406		406		0
446	1 SF Residential	DU	231.00	2,287	20.00	198	-211.00	-2,089
	SUB-TOTAL			2,287		198		-2,089
447	1 SF Residential	DU	125.00	1,238	300.00	2,970	175.00	1,732
	6 Other	--	--	1,194	--	1,194	--	0
	SUB-TOTAL			2,432		4,164		1,732
448	1 SF Residential	DU	691.00	6,841	691.00	6,841	0.00	0
	SUB-TOTAL			6,841		6,841		0
449	1 SF Residential	DU	20.00	198	20.00	198	0.00	0
	SUB-TOTAL			198		198		0
450	1 SF Residential	DU	27.00	267	27.00	267	0.00	0
	SUB-TOTAL			267		267		0
451	1 SF Residential	DU	67.00	663	140.00	1,386	73.00	723
	5 Industrial Park	TSF	47.00	282	47.00	282	0.00	0
	SUB-TOTAL			945		1,668		723
452	1 SF Residential	DU	38.00	376	38.00	376	0.00	0
	SUB-TOTAL			376		376		0

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
Zone	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
453	1 SF Residential	DU	875.00	8,663	1,020.00	10,098	145.00	1,435
	3 Commercial Retail	TSF	16.00	641	16.00	593	0.00	-48
	6 Other	--	--	711	--	1,088	--	377
	SUB-TOTAL			10,015		11,779		1,764
454	1 SF Residential	DU	625.00	6,188	650.00	6,435	25.00	247
	3 Commercial Retail	TSF	40.28	2,074	40.28	2,074	0.00	0
	6 Other	--	--	5,482	--	5,482	--	0
	SUB-TOTAL			13,744		13,991		247
455	1 SF Residential	DU	80.00	792	100.00	990	20.00	198
	SUB-TOTAL			792		990		198

Land Use and Trip Generation Comparison – Current General Plan and OVOV Buildout								
			Current GP		OVOV Buildout		Difference	
	Land Use Category	Units	Amount	ADT	Amount	ADT	Amount	ADT
1.	SF Residential	DU	89,373.00	877,112	81,395.00	795,563	-7,978.00	-81,549
2.	MF Residential	DU	62,543.00	481,988	67,679.00	514,809	5,136.00	32,821
3.	Commercial Retail	TSF	21,561.65	1,134,793	23,585.06	1,230,042	2,023.41	95,249
4.	Commercial Office	TSF	14,746.77	169,850	17,311.53	205,851	2,564.76	36,001
5.	Industrial Park	TSF	43,144.21	254,465	40,735.96	240,697	-2,408.25	-13,768
6.	Other	--	--	288,885	--	301,424	--	12,539
TOTAL				**3,207,093**		**3,288,386**		**81,293**

Appendix C

OVOV BUILDOUT TRIP GENERATION BY TAZ – AM, PM AND ADT

See Appendix D for Traffic Analysis Zone (TAZ) map and trip generation rates.

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
1.	2 Single Family (1-5du/ac)	367.00 DU	70	206	276	235	136	371	3,633
	3 Single Family (6-10du/ac)	200.00 DU	38	112	150	128	74	202	1,980
	30 Industrial Park	275.00 TSF	151	28	179	36	143	179	1,650
SUB-TOTAL			259	346	605	399	353	752	7,263
2.	2 Single Family (1-5du/ac)	535.00 DU	102	300	402	342	198	540	5,297
SUB-TOTAL			102	300	402	342	198	540	5,297
3.	2 Single Family (1-5du/ac)	3,313.00 DU	629	1,855	2,484	2,120	1,226	3,346	32,799
	4 Condominium/Townhouse	648.00 DU	65	311	376	305	168	473	5,184
	5 Apartment	640.00 DU	51	275	326	262	134	396	4,416
	11 Commercial Center(10-30a)	320.00 TSF	234	150	384	762	826	1,588	17,299
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	30 Industrial Park	256.80 TSF	141	26	167	33	134	167	1,541
	32 Manufacturing/Warehouse	77.49 TSF	43	13	56	21	36	57	395
SUB-TOTAL			1,358	2,780	4,138	3,563	2,592	6,155	62,722
5.	2 Single Family (1-5du/ac)	229.00 DU	44	128	172	147	85	232	2,267
	12 Commercial Center (<10ac)	25.00 TSF	27	17	44	83	90	173	2,127
	13 Commercial Shops	2.01 TSF	1	1	2	4	4	8	74
SUB-TOTAL			72	146	218	234	179	413	4,468
6.	2 Single Family (1-5du/ac)	409.00 DU	78	229	307	262	151	413	4,049
SUB-TOTAL			78	229	307	262	151	413	4,049
7.	1 Single Family (<1du/ac)	8.00 DU	2	5	7	7	3	10	79
	3 Single Family (6-10du/ac)	714.00 DU	136	400	536	457	264	721	7,069
SUB-TOTAL			138	405	543	464	267	731	7,148
8.	2 Single Family (1-5du/ac)	97.00 DU	18	54	72	62	36	98	960
SUB-TOTAL			18	54	72	62	36	98	960
9.	2 Single Family (1-5du/ac)	320.00 DU	61	179	240	205	118	323	3,168
SUB-TOTAL			61	179	240	205	118	323	3,168
10.	2 Single Family (1-5du/ac)	12.00 DU	2	7	9	8	4	12	119
	4 Condominium/Townhouse	184.00 DU	18	88	106	86	48	134	1,472
	10 Commercial Center (>30ac)	300.00 TSF	141	90	231	492	534	1,026	12,018
SUB-TOTAL			161	185	346	586	586	1,172	13,609
11.	2 Single Family (1-5du/ac)	24.00 DU	5	13	18	15	9	24	238
	3 Single Family (6-10du/ac)	84.00 DU	16	47	63	54	31	85	832
	4 Condominium/Townhouse	165.00 DU	17	79	96	78	43	121	1,320
	5 Apartment	72.00 DU	6	31	37	30	15	45	497
	12 Commercial Center (<10ac)	52.76 TSF	58	36	94	175	190	365	4,488
	13 Commercial Shops	2.46 TSF	2	1	3	4	4	8	91
	15 Sit-Down Restaurant	7.75 TSF	37	34	71	51	34	85	1,010
	30 Industrial Park	41.82 TSF	23	4	27	5	22	27	251
	40 Commercial Office	1.23 TSF	2	0	2	0	2	2	14
	51 Developed Park	2.00 AC	0	0	0	0	0	0	5
SUB-TOTAL			166	245	411	412	350	762	8,746
12.	2 Single Family (1-5du/ac)	213.00 DU	40	119	159	136	79	215	2,109
	3 Single Family (6-10du/ac)	39.00 DU	7	22	29	25	14	39	386
	14 Hotel	121.00 ROOM	41	27	68	39	35	74	996
SUB-TOTAL			88	168	256	200	128	328	3,491

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
13.	2 Single Family (1-5du/ac)	641.00 DU	122	359	481	410	237	647	6,346
	4 Condominium/Townhouse	54.00 DU	5	26	31	25	14	39	432
	12 Commercial Center (<10ac)	25.00 TSF	27	17	44	83	90	173	2,127
SUB-TOTAL			154	402	556	518	341	859	8,905
14.	2 Single Family (1-5du/ac)	117.00 DU	22	66	88	75	43	118	1,158
SUB-TOTAL			22	66	88	75	43	118	1,158
15.	2 Single Family (1-5du/ac)	370.00 DU	70	207	277	237	137	374	3,663
	SUB-TOTAL		70	207	277	237	137	374	3,663
16.	2 Single Family (1-5du/ac)	291.00 DU	55	163	218	186	108	294	2,881
	SUB-TOTAL		55	163	218	186	108	294	2,881
17.	2 Single Family (1-5du/ac)	380.00 DU	72	213	285	243	141	384	3,762
	SUB-TOTAL		72	213	285	243	141	384	3,762
18.	2 Single Family (1-5du/ac)	455.00 DU	86	255	341	291	168	459	4,505
	4 Condominium/Townhouse	109.00 DU	11	52	63	51	28	79	872
	6 Mobile Home	113.00 DU	9	36	45	40	24	64	780
	12 Commercial Center (<10ac)	21.00 TSF	23	14	37	70	76	146	1,786
	51 Developed Park	7.00 AC	0	0	0	0	0	0	18
	SUB-TOTAL		129	357	486	452	296	748	7,961
19.	2 Single Family (1-5du/ac)	1,577.00 DU	300	883	1,183	1,009	583	1,592	15,612
	20 Elementary/Middle School	1,950.00 STU	507	390	897	156	176	332	2,828
	50 Golf Course	150.00 AC	23	9	32	15	30	45	1,194
	SUB-TOTAL		830	1,282	2,112	1,180	789	1,969	19,634
20.	2 Single Family (1-5du/ac)	245.00 DU	47	137	184	157	91	248	2,426
	4 Condominium/Townhouse	136.00 DU	14	65	79	64	35	99	1,088
	30 Industrial Park	174.00 TSF	96	17	113	23	90	113	1,044
	SUB-TOTAL		157	219	376	244	216	460	4,558
21.	2 Single Family (1-5du/ac)	620.00 DU	118	347	465	397	229	626	6,138
	3 Single Family (6-10du/ac)	35.00 DU	7	20	27	22	13	35	347
	12 Commercial Center (<10ac)	70.00 TSF	76	48	124	232	252	484	5,954
	SUB-TOTAL		201	415	616	651	494	1,145	12,439
22.	2 Single Family (1-5du/ac)	350.00 DU	67	196	263	224	130	354	3,465
	SUB-TOTAL		67	196	263	224	130	354	3,465
23.	2 Single Family (1-5du/ac)	373.00 DU	71	209	280	239	138	377	3,693
	SUB-TOTAL		71	209	280	239	138	377	3,693
24.	2 Single Family (1-5du/ac)	422.00 DU	80	236	316	270	156	426	4,178
	SUB-TOTAL		80	236	316	270	156	426	4,178
25.	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		195	150	345	60	68	128	1,088
26.	13 Commercial Shops	72.90 TSF	52	35	87	131	131	262	2,702
	SUB-TOTAL		52	35	87	131	131	262	2,702
27.	5 Apartment	256.00 DU	20	110	130	105	54	159	1,766
	SUB-TOTAL		20	110	130	105	54	159	1,766

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
28.	3 Single Family (6-10du/ac)	1,077.00 DU	205	603	808	689	398	1,087	10,662
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		400	753	1,153	749	466	1,215	11,750
29.	51 Developed Park	20.00 AC	0	0	0	1	1	2	52
	SUB-TOTAL		0	0	0	1	1	2	52
30.	4 Condominium/Townhouse	275.00 DU	28	132	160	129	72	201	2,200
	SUB-TOTAL		28	132	160	129	72	201	2,200
31.	3 Single Family (6-10du/ac)	65.00 DU	12	36	48	42	24	66	644
	4 Condominium/Townhouse	200.00 DU	20	96	116	94	52	146	1,600
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	SUB-TOTAL		344	372	716	232	184	416	3,984
32.	4 Condominium/Townhouse	94.00 DU	9	45	54	44	24	68	752
	SUB-TOTAL		9	45	54	44	24	68	752
33.	12 Commercial Center (<10ac)	61.00 TSF	66	42	108	203	220	423	5,189
	SUB-TOTAL		66	42	108	203	220	423	5,189
34.	11 Commercial Center(10-30a)	107.10 TSF	78	50	128	255	276	531	5,790
	SUB-TOTAL		78	50	128	255	276	531	5,790
35.	3 Single Family (6-10du/ac)	616.00 DU	117	345	462	394	228	622	6,098
	4 Condominium/Townhouse	60.00 DU	6	29	35	28	16	44	480
	5 Apartment	200.00 DU	16	86	102	82	42	124	1,380
	SUB-TOTAL		139	460	599	504	286	790	7,958
36.	2 Single Family (1-5du/ac)	190.00 DU	36	106	142	122	70	192	1,881
	4 Condominium/Townhouse	268.00 DU	27	129	156	126	70	196	2,144
	SUB-TOTAL		63	235	298	248	140	388	4,025
37.	2 Single Family (1-5du/ac)	212.00 DU	40	119	159	136	78	214	2,099
	4 Condominium/Townhouse	128.00 DU	13	61	74	60	33	93	1,024
	25 Church	20.00 TSF	8	7	15	7	6	13	186
	SUB-TOTAL		61	187	248	203	117	320	3,309
38.	4 Condominium/Townhouse	105.00 DU	11	50	61	49	27	76	840
	5 Apartment	226.00 DU	18	97	115	93	47	140	1,559
	12 Commercial Center (<10ac)	50.00 TSF	55	35	90	166	180	346	4,253
	SUB-TOTAL		84	182	266	308	254	562	6,652
39.	11 Commercial Center(10-30a)	150.40 TSF	110	71	181	358	388	746	8,131
	30 Industrial Park	4,000.00 TSF	2,200	400	2,600	520	2,080	2,600	24,000
	SUB-TOTAL		2,310	471	2,781	878	2,468	3,346	32,131
40.	11 Commercial Center(10-30a)	200.00 TSF	146	94	240	476	516	992	10,812
	31 Business Park	116.70 TSF	140	27	167	35	116	151	1,190
	34 Utilities	10.00 TSF	0	0	0	0	0	0	24
	SUB-TOTAL		286	121	407	511	632	1,143	12,026
41.	30 Industrial Park	685.94 TSF	377	69	446	89	357	446	4,116
	40 Commercial Office	177.60 TSF	275	34	309	37	229	266	2,053
	SUB-TOTAL		652	103	755	126	586	712	6,169

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
42.	40 Commercial Office	696.85 TSF	1,080	132	1,212	146	899	1,045	8,056
	SUB-TOTAL		1,080	132	1,212	146	899	1,045	8,056
43.	13 Commercial Shops	27.00 TSF	19	13	32	49	49	98	1,001
	40 Commercial Office	100.75 TSF	156	19	175	21	130	151	1,165
	SUB-TOTAL		175	32	207	70	179	249	2,166
44.	2 Single Family (1-5du/ac)	445.00 DU	85	249	334	285	165	450	4,406
	12 Commercial Center (<10ac)	25.00 TSF	27	17	44	83	90	173	2,127
	13 Commercial Shops	10.00 TSF	7	5	12	18	18	36	371
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	26 Day Care	80.00 STU	34	30	64	32	37	69	362
	SUB-TOTAL		348	451	799	478	378	856	8,354
45.	30 Industrial Park	1,215.00 TSF	668	122	790	158	632	790	7,290
	40 Commercial Office	464.94 TSF	721	88	809	98	600	698	5,375
	SUB-TOTAL		1,389	210	1,599	256	1,232	1,488	12,665
46.	13 Commercial Shops	77.00 TSF	55	37	92	139	139	278	2,854
	30 Industrial Park	445.80 TSF	245	45	290	58	232	290	2,675
	SUB-TOTAL		300	82	382	197	371	568	5,529
47.	30 Industrial Park	4,254.10 TSF	2,340	425	2,765	553	2,212	2,765	25,525
	SUB-TOTAL		2,340	425	2,765	553	2,212	2,765	25,525
48.	30 Industrial Park	720.00 TSF	396	72	468	94	374	468	4,320
	SUB-TOTAL		396	72	468	94	374	468	4,320
49.	30 Industrial Park	764.30 TSF	420	76	496	99	397	496	4,586
	SUB-TOTAL		420	76	496	99	397	496	4,586
50.	2 Single Family (1-5du/ac)	350.00 DU	67	196	263	224	130	354	3,465
	58 Landfill	20.00 SG	60	40	100	80	120	200	2,000
	SUB-TOTAL		127	236	363	304	250	554	5,465
51.	30 Industrial Park	1,221.36 TSF	672	122	794	159	635	794	7,328
	SUB-TOTAL		672	122	794	159	635	794	7,328
52.	2 Single Family (1-5du/ac)	100.00 DU	19	56	75	64	37	101	990
	SUB-TOTAL		19	56	75	64	37	101	990
53.	1 Single Family (<1du/ac)	35.00 DU	10	23	33	29	13	42	347
	SUB-TOTAL		10	23	33	29	13	42	347
54.	3 Single Family (6-10du/ac)	62.00 DU	12	35	47	40	23	63	614
	4 Condominium/Townhouse	589.00 DU	59	283	342	277	153	430	4,712
	SUB-TOTAL		71	318	389	317	176	493	5,326
55.	3 Single Family (6-10du/ac)	164.00 DU	31	92	123	105	61	166	1,624
	4 Condominium/Townhouse	922.00 DU	92	443	535	433	240	673	7,376
	51 Developed Park	5.80 AC	0	0	0	0	0	0	15
	SUB-TOTAL		123	535	658	538	301	839	9,015

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
56.	2 Single Family (1-5du/ac)	19.00 DU	4	11	15	12	7	19	188
	4 Condominium/Townhouse	23.00 DU	2	11	13	11	6	17	184
	SUB-TOTAL		6	22	28	23	13	36	372
57.	12 Commercial Center (<10ac)	55.40 TSF	60	38	98	184	199	383	4,712
	31 Business Park	1,169.60 TSF	1,404	269	1,673	351	1,158	1,509	11,930
	40 Commercial Office	105.00 TSF	163	20	183	22	135	157	1,214
	SUB-TOTAL		1,627	327	1,954	557	1,492	2,049	17,856
58.	30 Industrial Park	1,123.00 TSF	618	112	730	146	584	730	6,738
	SUB-TOTAL		618	112	730	146	584	730	6,738
59.	35 Regional Post Office	764.00 TSF	153	115	268	115	115	230	3,820
	SUB-TOTAL		153	115	268	115	115	230	3,820
60.	13 Commercial Shops	34.80 TSF	25	17	42	63	63	126	1,290
	30 Industrial Park	160.50 TSF	88	16	104	21	83	104	963
	40 Commercial Office	27.20 TSF	42	5	47	6	35	41	314
	SUB-TOTAL		155	38	193	90	181	271	2,567
61.	30 Industrial Park	825.65 TSF	454	83	537	107	429	536	4,954
	40 Commercial Office	48.80 TSF	76	9	85	10	63	73	564
	SUB-TOTAL		530	92	622	117	492	609	5,518
62.	13 Commercial Shops	19.50 TSF	14	9	23	35	35	70	723
	30 Industrial Park	430.64 TSF	237	43	280	56	224	280	2,584
	SUB-TOTAL		251	52	303	91	259	350	3,307
63.	14 Hotel	297.00 ROOM	101	65	166	95	86	181	2,444
	30 Industrial Park	575.00 TSF	316	58	374	75	299	374	3,450
	SUB-TOTAL		417	123	540	170	385	555	5,894
64.	30 Industrial Park	3,161.48 TSF	1,739	316	2,055	411	1,644	2,055	18,969
	SUB-TOTAL		1,739	316	2,055	411	1,644	2,055	18,969
65.	11 Commercial Center(10-30a)	155.00 TSF	113	73	186	369	400	769	8,379
	30 Industrial Park	329.00 TSF	181	33	214	43	171	214	1,974
	SUB-TOTAL		294	106	400	412	571	983	10,353
66.	11 Commercial Center(10-30a)	170.45 TSF	124	80	204	406	440	846	9,215
	30 Industrial Park	329.00 TSF	181	33	214	43	171	214	1,974
	SUB-TOTAL		305	113	418	449	611	1,060	11,189
67.	3 Single Family (6-10du/ac)	163.00 DU	31	91	122	104	60	164	1,614
	4 Condominium/Townhouse	90.00 DU	9	43	52	42	23	65	720
	SUB-TOTAL		40	134	174	146	83	229	2,334
68.	5 Apartment	208.00 DU	17	89	106	85	44	129	1,435
	SUB-TOTAL		17	89	106	85	44	129	1,435
69.	3 Single Family (6-10du/ac)	76.00 DU	14	43	57	49	28	77	752
	SUB-TOTAL		14	43	57	49	28	77	752

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
70.	11 Commercial Center(10-30a)	147.00 TSF	107	69	176	350	379	729	7,947
	18 Health Club	71.00 TSF	68	45	113	153	102	255	2,840
	26 Day Care	150.00 STU	65	57	122	60	69	129	678
	30 Industrial Park	529.00 TSF	291	53	344	69	275	344	3,174
	32 Manufacturing/Warehouse	75.00 TSF	42	13	55	20	35	55	383
	SUB-TOTAL		573	237	810	652	860	1,512	15,022
71.	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	SUB-TOTAL		800	350	1,150	150	225	375	4,475
72.	13 Commercial Shops	60.00 TSF	43	29	72	108	108	216	2,224
	20 Elementary/Middle School	350.00 STU	91	70	161	28	32	60	508
	SUB-TOTAL		134	99	233	136	140	276	2,732
74.	3 Single Family (6-10du/ac)	153.00 DU	29	86	115	98	57	155	1,515
	4 Condominium/Townhouse	147.00 DU	15	71	86	69	38	107	1,176
	SUB-TOTAL		44	157	201	167	95	262	2,691
75.	4 Condominium/Townhouse	149.00 DU	15	72	87	70	39	109	1,192
	51 Developed Park	17.50 AC	0	0	0	1	1	2	46
	SUB-TOTAL		15	72	87	71	40	111	1,238
76.	5 Apartment	188.00 DU	15	81	96	77	39	116	1,297
	12 Commercial Center (<10ac)	11.00 TSF	12	8	20	37	40	77	936
	SUB-TOTAL		27	89	116	114	79	193	2,233
78.	30 Industrial Park	1,776.00 TSF	977	178	1,155	231	924	1,155	10,656
	SUB-TOTAL		977	178	1,155	231	924	1,155	10,656
79.	30 Industrial Park	685.00 TSF	377	69	446	89	356	445	4,110
	SUB-TOTAL		377	69	446	89	356	445	4,110
80.	30 Industrial Park	880.00 TSF	484	88	572	114	458	572	5,280
	SUB-TOTAL		484	88	572	114	458	572	5,280
81.	30 Industrial Park	711.00 TSF	391	71	462	92	370	462	4,266
	SUB-TOTAL		391	71	462	92	370	462	4,266
82.	30 Industrial Park	1,007.55 TSF	554	101	655	131	524	655	6,045
	SUB-TOTAL		554	101	655	131	524	655	6,045
83.	30 Industrial Park	876.00 TSF	482	88	570	114	456	570	5,256
	SUB-TOTAL		482	88	570	114	456	570	5,256
84.	30 Industrial Park	333.00 TSF	183	33	216	43	173	216	1,998
	SUB-TOTAL		183	33	216	43	173	216	1,998
86.	12 Commercial Center (<10ac)	15.00 TSF	16	10	26	50	54	104	1,276
	13 Commercial Shops	20.50 TSF	15	10	25	37	37	74	760
	14 Hotel	36.00 ROOM	12	8	20	12	10	22	296
	15 Sit-Down Restaurant	47.26 TSF	228	210	438	308	205	513	6,160
	SUB-TOTAL		271	238	509	407	306	713	8,492
89.	53 Wayside Honor Ranch	30.00 SG	90	60	150	120	180	300	3,000
	SUB-TOTAL		90	60	150	120	180	300	3,000

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
90.	4 Condominium/Townhouse	360.00 DU	36	173	209	169	94	263	2,880
	10 Commercial Center (>30ac)	1,093.35 TSF	514	328	842	1,793	1,946	3,739	43,800
	11 Commercial Center(10-30a)	135.00 TSF	99	63	162	321	348	669	7,298
	12 Commercial Center (<10ac)	77.00 TSF	84	53	137	256	277	533	6,550
	30 Industrial Park	163.88 TSF	90	16	106	21	85	106	983
	SUB-TOTAL		823	633	1,456	2,560	2,750	5,310	61,511
91.	11 Commercial Center(10-30a)	247.38 TSF	181	116	297	589	638	1,227	13,373
	SUB-TOTAL		181	116	297	589	638	1,227	13,373
92.	4 Condominium/Townhouse	1,333.00 DU	133	640	773	627	347	974	10,664
	10 Commercial Center (>30ac)	618.00 TSF	290	185	475	1,014	1,100	2,114	24,757
	14 Hotel	300.00 ROOM	102	66	168	96	87	183	2,469
	40 Commercial Office	629.00 TSF	975	120	1,095	132	811	943	7,271
	SUB-TOTAL		1,500	1,011	2,511	1,869	2,345	4,214	45,161
93.	13 Commercial Shops	20.00 TSF	14	10	24	36	36	72	741
	14 Hotel	169.00 ROOM	57	37	94	54	49	103	1,391
	SUB-TOTAL		71	47	118	90	85	175	2,132
94.	54 Six Flags Magic Mtn	240.00 SG	720	480	1,200	960	1,440	2,400	24,000
	SUB-TOTAL		720	480	1,200	960	1,440	2,400	24,000
96.	2 Single Family (1-5du/ac)	123.00 DU	23	69	92	79	46	125	1,218
	4 Condominium/Townhouse	881.00 DU	88	423	511	414	229	643	7,048
	SUB-TOTAL		111	492	603	493	275	768	8,266
97.	55 Travel Village	26.20 SG	79	52	131	105	157	262	2,620
	SUB-TOTAL		79	52	131	105	157	262	2,620
98.	12 Commercial Center (<10ac)	6.20 TSF	7	4	11	21	22	43	527
	31 Business Park	691.50 TSF	830	159	989	207	685	892	7,053
	SUB-TOTAL		837	163	1,000	228	707	935	7,580
99.	4 Condominium/Townhouse	470.00 DU	47	226	273	221	122	343	3,760
	51 Developed Park	20.20 AC	0	0	0	1	1	2	53
	SUB-TOTAL		47	226	273	222	123	345	3,813
100.	12 Commercial Center (<10ac)	23.00 TSF	25	16	41	76	83	159	1,956
	40 Commercial Office	220.00 TSF	341	42	383	46	284	330	2,543
	SUB-TOTAL		366	58	424	122	367	489	4,499
101.	10 Commercial Center (>30ac)	491.60 TSF	231	147	378	806	875	1,681	19,693
	SUB-TOTAL		231	147	378	806	875	1,681	19,693
102.	3 Single Family (6-10du/ac)	38.00 DU	7	21	28	24	14	38	376
	4 Condominium/Townhouse	305.00 DU	31	146	177	143	79	222	2,440
	5 Apartment	155.00 DU	12	67	79	64	33	97	1,070
	12 Commercial Center (<10ac)	10.50 TSF	11	7	18	35	38	73	893
	40 Commercial Office	9.50 TSF	15	2	17	2	12	14	110
	SUB-TOTAL		76	243	319	268	176	444	4,889

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
103.	3 Single Family (6-10du/ac)	95.00 DU	18	53	71	61	35	96	940
	4 Condominium/Townhouse	169.00 DU	17	81	98	79	44	123	1,352
	12 Commercial Center (<10ac)	38.50 TSF	42	27	69	128	139	267	3,275
	13 Commercial Shops	9.50 TSF	7	5	12	17	17	34	352
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	16.10 AC	0	0	0	0	1	1	42
	SUB-TOTAL		279	316	595	345	304	649	7,049
104.	3 Single Family (6-10du/ac)	175.00 DU	33	98	131	112	65	177	1,732
	4 Condominium/Townhouse	211.00 DU	21	101	122	99	55	154	1,688
	5 Apartment	152.00 DU	12	65	77	62	32	94	1,049
	11 Commercial Center(10-30a)	252.00 TSF	184	118	302	600	650	1,250	13,623
	40 Commercial Office	370.00 TSF	574	70	644	78	477	555	4,277
	SUB-TOTAL		824	452	1,276	951	1,279	2,230	22,369
105.	5 Apartment	144.00 DU	12	62	74	59	30	89	994
	12 Commercial Center (<10ac)	27.10 TSF	30	19	49	90	98	188	2,305
	40 Commercial Office	315.90 TSF	490	60	550	66	408	474	3,652
	SUB-TOTAL		532	141	673	215	536	751	6,951
106.	5 Apartment	520.00 DU	42	224	266	213	109	322	3,588
	SUB-TOTAL		42	224	266	213	109	322	3,588
107.	2 Single Family (1-5du/ac)	461.00 DU	88	258	346	295	171	466	4,564
	4 Condominium/Townhouse	326.00 DU	33	156	189	153	85	238	2,608
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	51 Developed Park	20.50 AC	0	0	0	1	1	2	53
	SUB-TOTAL		1,233	1,004	2,237	695	590	1,285	13,440
108.	4 Condominium/Townhouse	2,189.00 DU	219	1,051	1,270	1,029	569	1,598	17,512
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	8.70 AC	0	0	0	0	0	0	23
	SUB-TOTAL		414	1,201	1,615	1,089	637	1,726	18,623
109.	3 Single Family (6-10du/ac)	38.00 DU	7	21	28	24	14	38	376
	SUB-TOTAL		7	21	28	24	14	38	376
110.	2 Single Family (1-5du/ac)	184.00 DU	35	103	138	118	68	186	1,822
	4 Condominium/Townhouse	548.00 DU	55	263	318	258	142	400	4,384
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	9.40 AC	0	0	0	0	0	0	24
	SUB-TOTAL		285	516	801	436	278	714	7,318
111.	34 Utilities	100.00 TSF	0	0	0	0	0	0	238
	SUB-TOTAL		0	0	0	0	0	0	238
112.	2 Single Family (1-5du/ac)	90.00 DU	17	50	67	58	33	91	891
	3 Single Family (6-10du/ac)	156.00 DU	30	87	117	100	58	158	1,544
	50 Golf Course	180.00 AC	27	11	38	18	36	54	1,433
	SUB-TOTAL		74	148	222	176	127	303	3,868
113.	4 Condominium/Townhouse	354.00 DU	35	170	205	166	92	258	2,832
	SUB-TOTAL		35	170	205	166	92	258	2,832

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
114.	4 Condominium/Townhouse	560.00 DU	56	269	325	263	146	409	4,480
	SUB-TOTAL		56	269	325	263	146	409	4,480
115.	3 Single Family (6-10du/ac)	603.00 DU	115	338	453	386	223	609	5,970
	SUB-TOTAL		115	338	453	386	223	609	5,970
116.	4 Condominium/Townhouse	1,262.00 DU	126	606	732	593	328	921	10,096
	10 Commercial Center (>30ac)	628.50 TSF	295	189	484	1,031	1,119	2,150	25,178
	SUB-TOTAL		421	795	1,216	1,624	1,447	3,071	35,274
117.	4 Condominium/Townhouse	1,261.00 DU	126	605	731	593	328	921	10,088
	10 Commercial Center (>30ac)	628.50 TSF	295	189	484	1,031	1,119	2,150	25,178
	SUB-TOTAL		421	794	1,215	1,624	1,447	3,071	35,266
118.	4 Condominium/Townhouse	161.00 DU	16	77	93	76	42	118	1,288
	SUB-TOTAL		16	77	93	76	42	118	1,288
119.	5 Apartment	1,679.00 DU	134	722	856	688	353	1,041	11,585
	SUB-TOTAL		134	722	856	688	353	1,041	11,585
120.	4 Condominium/Townhouse	2,425.00 DU	243	1,164	1,407	1,140	631	1,771	19,400
	11 Commercial Center(10-30a)	267.30 TSF	195	126	321	636	690	1,326	14,450
	13 Commercial Shops	16.00 TSF	12	8	20	29	29	58	593
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	40 Commercial Office	75.00 TSF	116	14	130	16	97	113	867
	51 Developed Park	8.40 AC	0	0	0	0	0	0	22
	SUB-TOTAL		761	1,462	2,223	1,881	1,515	3,396	36,420
121.	2 Single Family (1-5du/ac)	168.00 DU	32	94	126	108	62	170	1,663
	4 Condominium/Townhouse	418.00 DU	42	201	243	196	109	305	3,344
	SUB-TOTAL		74	295	369	304	171	475	5,007
122.	4 Condominium/Townhouse	176.00 DU	18	84	102	83	46	129	1,408
	SUB-TOTAL		18	84	102	83	46	129	1,408
123.	2 Single Family (1-5du/ac)	452.00 DU	86	253	339	289	167	456	4,475
	4 Condominium/Townhouse	272.00 DU	27	131	158	128	71	199	2,176
	13 Commercial Shops	17.20 TSF	12	8	20	31	31	62	637
	SUB-TOTAL		125	392	517	448	269	717	7,288
124.	7 Senior (Active)	1,343.00 DU	107	161	268	215	134	349	4,983
	SUB-TOTAL		107	161	268	215	134	349	4,983
125.	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	SUB-TOTAL		1,112	590	1,702	246	333	579	6,215
126.	11 Commercial Center(10-30a)	150.00 TSF	110	71	181	357	387	744	8,109
	40 Commercial Office	336.00 TSF	521	64	585	71	433	504	3,884
	SUB-TOTAL		631	135	766	428	820	1,248	11,993
127.	4 Condominium/Townhouse	888.00 DU	89	426	515	417	231	648	7,104
	SUB-TOTAL		89	426	515	417	231	648	7,104
128.	3 Single Family (6-10du/ac)	450.00 DU	86	252	338	288	167	455	4,455
	SUB-TOTAL		86	252	338	288	167	455	4,455

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
129.	3 Single Family (6-10du/ac)	177.00 DU	34	99	133	113	65	178	1,752
	SUB-TOTAL		34	99	133	113	65	178	1,752
130.	2 Single Family (1-5du/ac)	708.00 DU	135	396	531	453	262	715	7,009
	SUB-TOTAL		135	396	531	453	262	715	7,009
131.	2 Single Family (1-5du/ac)	14.00 DU	3	8	11	9	5	14	139
	4 Condominium/Townhouse	1,273.00 DU	127	611	738	598	331	929	10,184
	25 Church	20.00 TSF	8	7	15	7	6	13	186
	51 Developed Park	24.20 AC	0	0	0	1	1	2	63
	SUB-TOTAL		138	626	764	615	343	958	10,572
132.	2 Single Family (1-5du/ac)	436.00 DU	83	244	327	279	161	440	4,316
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	16.00 AC	0	0	0	0	1	1	42
	SUB-TOTAL		278	394	672	339	230	569	5,446
133.	11 Commercial Center(10-30a)	27.00 TSF	20	13	33	64	70	134	1,460
	SUB-TOTAL		20	13	33	64	70	134	1,460
134.	2 Single Family (1-5du/ac)	482.00 DU	92	270	362	308	178	486	4,772
	SUB-TOTAL		92	270	362	308	178	486	4,772
135.	2 Single Family (1-5du/ac)	174.00 DU	33	97	130	111	64	175	1,723
	4 Condominium/Townhouse	172.00 DU	17	83	100	81	45	126	1,376
	50 Golf Course	208.00 AC	31	12	43	21	42	63	1,656
	SUB-TOTAL		81	192	273	213	151	364	4,755
137.	40 Commercial Office	72.00 TSF	112	14	126	15	93	108	832
	SUB-TOTAL		112	14	126	15	93	108	832
138.	11 Commercial Center(10-30a)	120.00 TSF	88	56	144	286	310	596	6,487
	SUB-TOTAL		88	56	144	286	310	596	6,487
139.	5 Apartment	474.00 DU	38	204	242	194	100	294	3,271
	SUB-TOTAL		38	204	242	194	100	294	3,271
140.	3 Single Family (6-10du/ac)	428.00 DU	81	240	321	274	158	432	4,237
	4 Condominium/Townhouse	1,266.00 DU	127	608	735	595	329	924	10,128
	12 Commercial Center (<10ac)	20.00 TSF	22	14	36	66	72	138	1,701
	20 Elementary/Middle School	400.00 STU	104	80	184	32	36	68	580
	40 Commercial Office	31.00 TSF	48	6	54	7	40	47	358
	51 Developed Park	5.00 AC	0	0	0	0	0	0	13
	SUB-TOTAL		382	948	1,330	974	635	1,609	17,017
141.	15 Sit-Down Restaurant	20.30 TSF	98	90	188	132	88	220	2,646
	16 Fast Food Restaurant	10.10 TSF	257	247	504	176	162	338	5,011
	40 Commercial Office	50.00 TSF	78	10	88	11	65	76	578
	SUB-TOTAL		433	347	780	319	315	634	8,235
142.	4 Condominium/Townhouse	670.00 DU	67	322	389	315	174	489	5,360
	SUB-TOTAL		67	322	389	315	174	489	5,360

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
143.	2 Single Family (1-5du/ac)	96.00 DU	18	54	72	61	36	97	950
	3 Single Family (6-10du/ac)	482.00 DU	92	270	362	308	178	486	4,772
	4 Condominium/Townhouse	160.00 DU	16	77	93	75	42	117	1,280
	20 Elementary/Middle School	1,950.00 STU	507	390	897	156	176	332	2,828
	51 Developed Park	7.00 AC	0	0	0	0	0	0	18
	SUB-TOTAL		633	791	1,424	600	432	1,032	9,848
144.	2 Single Family (1-5du/ac)	6.00 DU	1	3	4	4	2	6	59
	SUB-TOTAL		1	3	4	4	2	6	59
145.	10 Commercial Center (>30ac)	778.00 TSF	366	233	599	1,276	1,385	2,661	31,167
	12 Commercial Center (<10ac)	36.00 TSF	39	25	64	120	130	250	3,062
	13 Commercial Shops	45.74 TSF	33	22	55	82	82	164	1,695
	15 Sit-Down Restaurant	7.80 TSF	38	35	73	51	34	85	1,017
	16 Fast Food Restaurant	6.68 TSF	170	163	333	116	107	223	3,314
	32 Manufacturing/Warehouse	74.50 TSF	42	13	55	20	35	55	380
	SUB-TOTAL		688	491	1,179	1,665	1,773	3,438	40,635
146.	2 Single Family (1-5du/ac)	314.00 DU	60	176	236	201	116	317	3,109
	4 Condominium/Townhouse	296.00 DU	30	142	172	139	77	216	2,368
	SUB-TOTAL		90	318	408	340	193	533	5,477
147.	3 Single Family (6-10du/ac)	140.00 DU	27	78	105	90	52	142	1,386
	4 Condominium/Townhouse	100.00 DU	10	48	58	47	26	73	800
	5 Apartment	567.00 DU	45	244	289	232	119	351	3,912
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	5.00 AC	0	0	0	0	0	0	13
	SUB-TOTAL		277	520	797	429	265	694	7,199
148.	11 Commercial Center(10-30a)	183.88 TSF	134	86	220	438	474	912	9,941
	15 Sit-Down Restaurant	7.70 TSF	37	34	71	50	33	83	1,004
	16 Fast Food Restaurant	5.00 TSF	127	122	249	87	80	167	2,481
	SUB-TOTAL		298	242	540	575	587	1,162	13,426
149.	2 Single Family (1-5du/ac)	535.00 DU	102	300	402	342	198	540	5,297
	4 Condominium/Townhouse	500.00 DU	50	240	290	235	130	365	4,000
	12 Commercial Center (<10ac)	34.85 TSF	38	24	62	116	125	241	2,964
	SUB-TOTAL		190	564	754	693	453	1,146	12,261
150.	2 Single Family (1-5du/ac)	114.00 DU	22	64	86	73	42	115	1,129
	SUB-TOTAL		22	64	86	73	42	115	1,129
151.	1 Single Family (<1du/ac)	71.00 DU	21	48	69	60	26	86	703
	SUB-TOTAL		21	48	69	60	26	86	703
152.	2 Single Family (1-5du/ac)	892.00 DU	169	500	669	571	330	901	8,831
	51 Developed Park	18.00 AC	0	0	0	1	1	2	47
	SUB-TOTAL		169	500	669	572	331	903	8,878
153.	3 Single Family (6-10du/ac)	424.00 DU	81	237	318	271	157	428	4,198
	SUB-TOTAL		81	237	318	271	157	428	4,198
159.	2 Single Family (1-5du/ac)	4.00 DU	1	2	3	3	1	4	40
	25 Church	25.00 TSF	10	8	18	9	8	17	233
	35 Regional Post Office	16.00 TSF	3	2	5	2	2	4	80
	SUB-TOTAL		14	12	26	14	11	25	353

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
160.	3 Single Family (6-10du/ac)	95.00 DU	18	53	71	61	35	96	940
	7 Senior (Active)	95.00 DU	8	11	19	15	10	25	352
	SUB-TOTAL		26	64	90	76	45	121	1,292
161.	1 Single Family (<1du/ac)	60.00 DU	17	40	57	50	22	72	594
	2 Single Family (1-5du/ac)	580.00 DU	110	325	435	371	215	586	5,742
	4 Condominium/Townhouse	650.00 DU	65	312	377	306	169	475	5,200
	11 Commercial Center(10-30a)	48.00 TSF	35	23	58	114	124	238	2,595
	12 Commercial Center (<10ac)	54.22 TSF	59	37	96	180	195	375	4,612
	13 Commercial Shops	12.50 TSF	9	6	15	23	23	46	463
	14 Hotel	283.00 ROOM	96	62	158	91	82	173	2,329
	15 Sit-Down Restaurant	21.10 TSF	102	94	196	138	92	230	2,750
	16 Fast Food Restaurant	16.00 TSF	407	391	798	279	257	536	7,938
	40 Commercial Office	282.41 TSF	438	54	492	59	364	423	3,265
	SUB-TOTAL		1,338	1,344	2,682	1,611	1,543	3,154	35,488
162.	2 Single Family (1-5du/ac)	248.00 DU	47	139	186	159	92	251	2,455
	6 Mobile Home	87.00 DU	7	28	35	30	18	48	600
	11 Commercial Center(10-30a)	102.42 TSF	75	48	123	244	264	508	5,537
	30 Industrial Park	240.00 TSF	132	24	156	31	125	156	1,440
	SUB-TOTAL		261	239	500	464	499	963	10,032
163.	30 Industrial Park	1,000.00 TSF	550	100	650	130	520	650	6,000
	SUB-TOTAL		550	100	650	130	520	650	6,000
164.	2 Single Family (1-5du/ac)	204.00 DU	39	114	153	131	75	206	2,020
	7 Senior (Active)	86.00 DU	7	10	17	14	9	23	319
	30 Industrial Park	30.00 TSF	17	3	20	4	16	20	180
	52 Undeveloped Park	145.00 AC	0	0	0	0	0	0	73
	SUB-TOTAL		63	127	190	149	100	249	2,592
165.	2 Single Family (1-5du/ac)	86.00 DU	16	48	64	55	32	87	851
	4 Condominium/Townhouse	287.00 DU	29	138	167	135	75	210	2,296
	12 Commercial Center (<10ac)	30.23 TSF	33	21	54	100	109	209	2,571
	13 Commercial Shops	97.60 TSF	70	47	117	176	176	352	3,617
	23 Hospital	24.66 TSF	18	6	24	5	17	22	414
	30 Industrial Park	3,400.00 TSF	1,870	340	2,210	442	1,768	2,210	20,400
	32 Manufacturing/Warehouse	2.47 TSF	1	0	1	1	1	2	13
	40 Commercial Office	13.81 TSF	21	3	24	3	18	21	160
	SUB-TOTAL		2,058	603	2,661	917	2,196	3,113	30,322
166.	2 Single Family (1-5du/ac)	431.00 DU	82	241	323	276	159	435	4,267
	4 Condominium/Townhouse	462.00 DU	46	222	268	217	120	337	3,696
	12 Commercial Center (<10ac)	48.64 TSF	53	34	87	161	175	336	4,137
	13 Commercial Shops	21.38 TSF	15	10	25	38	38	76	792
	16 Fast Food Restaurant	4.34 TSF	110	106	216	76	70	146	2,153
	25 Church	26.00 TSF	10	9	19	9	8	17	242
	32 Manufacturing/Warehouse	11.00 TSF	6	2	8	3	5	8	56
	40 Commercial Office	30.10 TSF	47	6	53	6	39	45	348
	SUB-TOTAL		369	630	999	786	614	1,400	15,691
167.	2 Single Family (1-5du/ac)	196.00 DU	37	110	147	125	73	198	1,940
	SUB-TOTAL		37	110	147	125	73	198	1,940

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
168.	2 Single Family (1-5du/ac)	247.00 DU	47	138	185	158	91	249	2,445
	SUB-TOTAL		47	138	185	158	91	249	2,445
169.	2 Single Family (1-5du/ac)	127.00 DU	24	71	95	81	47	128	1,257
	4 Condominium/Townhouse	94.00 DU	9	45	54	44	24	68	752
	10 Commercial Center (>30ac)	300.00 TSF	141	90	231	492	534	1,026	12,018
	20 Elementary/Middle School	60.00 STU	16	12	28	5	5	10	87
	25 Church	7.00 TSF	3	2	5	3	2	5	65
	42 Medical Office	20.00 TSF	39	10	49	20	53	73	684
	SUB-TOTAL		232	230	462	645	665	1,310	14,863
170.	2 Single Family (1-5du/ac)	60.00 DU	11	34	45	38	22	60	594
	SUB-TOTAL		11	34	45	38	22	60	594
171.	2 Single Family (1-5du/ac)	60.00 DU	11	34	45	38	22	60	594
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		206	184	390	98	90	188	1,682
172.	2 Single Family (1-5du/ac)	185.00 DU	35	104	139	118	68	186	1,831
	SUB-TOTAL		35	104	139	118	68	186	1,831
173.	2 Single Family (1-5du/ac)	386.00 DU	73	216	289	247	143	390	3,821
	SUB-TOTAL		73	216	289	247	143	390	3,821
174.	4 Condominium/Townhouse	200.00 DU	20	96	116	94	52	146	1,600
	7 Senior (Active)	200.00 DU	16	24	40	32	20	52	742
	10 Commercial Center (>30ac)	300.00 TSF	141	90	231	492	534	1,026	12,018
	14 Hotel	300.00 ROOM	M 102	66	168	96	87	183	2,469
	15 Sit-Down Restaurant	50.00 TSF	241	222	463	326	217	543	6,517
	40 Commercial Office	350.00 TSF	543	67	610	74	452	526	4,046
	SUB-TOTAL		1,063	565	1,628	1,114	1,362	2,476	27,392
175.	2 Single Family (1-5du/ac)	162.00 DU	31	91	122	104	60	164	1,604
	4 Condominium/Townhouse	160.00 DU	16	77	93	75	42	117	1,280
	5 Apartment	50.00 DU	4	22	26	21	11	32	345
	6 Mobile Home	218.00 DU	17	70	87	76	46	122	1,504
	11 Commercial Center(10-30a)	98.01 TSF	72	46	118	233	253	486	5,298
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	34 Utilities	87.12 TSF	0	0	0	0	0	0	207
	SUB-TOTAL		335	456	791	569	480	1,049	11,326
176.	2 Single Family (1-5du/ac)	762.00 DU	145	427	572	488	282	770	7,544
	4 Condominium/Townhouse	135.00 DU	14	65	79	63	35	98	1,080
	5 Apartment	135.00 DU	11	58	69	55	28	83	932
	10 Commercial Center (>30ac)	196.02 TSF	92	59	151	321	349	670	7,853
	13 Commercial Shops	141.57 TSF	102	68	170	255	255	510	5,247
	25 Church	35.00 TSF	14	12	26	13	11	24	326
	SUB-TOTAL		378	689	1,067	1,195	960	2,155	22,982
177.	2 Single Family (1-5du/ac)	477.00 DU	91	267	358	305	176	481	4,722
	4 Condominium/Townhouse	264.00 DU	26	127	153	124	69	193	2,112
	11 Commercial Center(10-30a)	97.57 TSF	71	46	117	232	252	484	5,275
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	25 Church	17.00 TSF	7	6	13	6	5	11	158
	51 Developed Park	7.00 AC	0	0	0	0	0	0	18
	SUB-TOTAL		390	596	986	727	570	1,297	13,373

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
178.	2 Single Family (1-5du/ac)	333.00 DU	63	186	249	213	123	336	3,297
	11 Commercial Center(10-30a)	21.78 TSF	16	10	26	52	56	108	1,177
	13 Commercial Shops	6.53 TSF	5	3	8	12	12	24	242
	25 Church	11.00 TSF	4	4	8	4	3	7	102
	40 Commercial Office	50.81 TSF	79	10	89	11	66	77	587
	SUB-TOTAL		167	213	380	292	260	552	5,405
179.	2 Single Family (1-5du/ac)	167.00 DU	32	94	126	107	62	169	1,653
	7 Senior (Active)	209.00 DU	17	25	42	33	21	54	775
	13 Commercial Shops	21.78 TSF	16	10	26	39	39	78	807
	16 Fast Food Restaurant	7.00 TSF	178	171	349	122	112	234	3,473
	34 Utilities	87.12 TSF	0	0	0	0	0	0	207
	42 Medical Office	52.00 TSF	101	25	126	51	139	190	1,778
	SUB-TOTAL		344	325	669	352	373	725	8,693
180.	2 Single Family (1-5du/ac)	428.00 DU	81	240	321	274	158	432	4,237
	20 Elementary/Middle School	450.00 STU	117	90	207	36	41	77	653
	SUB-TOTAL		198	330	528	310	199	509	4,890
181.	3 Single Family (6-10du/ac)	282.00 DU	54	158	212	180	104	284	2,792
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		249	308	557	240	172	412	3,880
182.	3 Single Family (6-10du/ac)	276.00 DU	52	155	207	177	102	279	2,732
	4 Condominium/Townhouse	238.00 DU	24	114	138	112	62	174	1,904
	11 Commercial Center(10-30a)	96.23 TSF	70	45	115	229	248	477	5,202
	20 Elementary/Middle School	83.00 STU	22	17	39	7	7	14	120
	25 Church	17.25 TSF	7	6	13	6	5	11	160
	SUB-TOTAL		175	337	512	531	424	955	10,118
183.	4 Condominium/Townhouse	634.00 DU	63	304	367	298	165	463	5,072
	12 Commercial Center (<10ac)	3.50 TSF	4	2	6	12	13	25	298
	22 College	4,000.00 STU	520	40	560	280	560	840	6,160
	50 Golf Course	100.00 AC	15	6	21	10	20	30	796
	SUB-TOTAL		602	352	954	600	758	1,358	12,326
184.	17 Movie Theater	300.00 SEA	T 0	0	0	15	6	21	528
	40 Commercial Office	100.00 TSF	155	19	174	21	129	150	1,156
	SUB-TOTAL		155	19	174	36	135	171	1,684
185.	2 Single Family (1-5du/ac)	133.00 DU	25	74	99	85	49	134	1,317
	3 Single Family (6-10du/ac)	211.00 DU	40	118	158	135	78	213	2,089
	SUB-TOTAL		65	192	257	220	127	347	3,406
186.	3 Single Family (6-10du/ac)	150.00 DU	29	84	113	96	56	152	1,485
	23 Hospital	340.50 TSF	242	89	331	75	238	313	5,720
	42 Medical Office	402.00 TSF	780	197	977	398	1,073	1,471	13,748
	SUB-TOTAL		1,051	370	1,421	569	1,367	1,936	20,953
187.	2 Single Family (1-5du/ac)	111.00 DU	21	62	83	71	41	112	1,099
	4 Condominium/Townhouse	307.00 DU	31	147	178	144	80	224	2,456
	7 Senior (Active)	119.00 DU	10	14	24	19	12	31	441
	51 Developed Park	14.00 AC	0	0	0	0	1	1	36
	SUB-TOTAL		62	223	285	234	134	368	4,032

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
188.	2 Single Family (1-5du/ac)	72.00 DU	14	40	54	46	27	73	713
	4 Condominium/Townhouse	216.00 DU	22	104	126	102	56	158	1,728
	SUB-TOTAL		36	144	180	148	83	231	2,441
189.	12 Commercial Center (<10ac)	3.00 TSF	3	2	5	10	11	21	255
	22 College	20,000.00 STU	2,600	200	2,800	1,400	2,800	4,200	30,800
	SUB-TOTAL		2,603	202	2,805	1,410	2,811	4,221	31,055
190.	2 Single Family (1-5du/ac)	171.00 DU	32	96	128	109	63	172	1,693
	SUB-TOTAL		32	96	128	109	63	172	1,693
191.	42 Medical Office	78.56 TSF	152	38	190	78	210	288	2,687
	SUB-TOTAL		152	38	190	78	210	288	2,687
192.	2 Single Family (1-5du/ac)	164.00 DU	31	92	123	105	61	166	1,624
	4 Condominium/Townhouse	660.00 DU	66	317	383	310	172	482	5,280
	18 Health Club	13.00 TSF	12	8	20	28	19	47	520
	SUB-TOTAL		109	417	526	443	252	695	7,424
193.	31 Business Park	250.00 TSF	300	58	358	75	248	323	2,550
	SUB-TOTAL		300	58	358	75	248	323	2,550
194.	50 Golf Course	100.00 AC	15	6	21	10	20	30	796
	SUB-TOTAL		15	6	21	10	20	30	796
195.	4 Condominium/Townhouse	76.00 DU	8	36	44	36	20	56	608
	SUB-TOTAL		8	36	44	36	20	56	608
196.	4 Condominium/Townhouse	10.00 DU	1	5	6	5	3	8	80
	13 Commercial Shops	2.50 TSF	2	1	3	5	5	10	93
	14 Hotel	200.00 ROOM	68	44	112	64	58	122	1,646
	40 Commercial Office	34.55 TSF	54	7	61	7	45	52	399
	SUB-TOTAL		125	57	182	81	111	192	2,218
197.	12 Commercial Center (<10ac)	13.00 TSF	14	9	23	43	47	90	1,106
	31 Business Park	400.00 TSF	480	92	572	120	396	516	4,080
	SUB-TOTAL		494	101	595	163	443	606	5,186
198.	2 Single Family (1-5du/ac)	179.00 DU	34	100	134	115	66	181	1,772
	3 Single Family (6-10du/ac)	152.00 DU	29	85	114	97	56	153	1,505
	SUB-TOTAL		63	185	248	212	122	334	3,277
199.	14 Hotel	237.00 ROOM	81	52	133	76	69	145	1,951
	15 Sit-Down Restaurant	5.00 TSF	24	22	46	33	22	55	652
	SUB-TOTAL		105	74	179	109	91	200	2,603
200.	31 Business Park	578.00 TSF	694	133	827	173	572	745	5,896
	SUB-TOTAL		694	133	827	173	572	745	5,896
201.	31 Business Park	160.00 TSF	192	37	229	48	158	206	1,632
	SUB-TOTAL		192	37	229	48	158	206	1,632

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
202.	5 Apartment	560.00 DU	45	241	286	230	118	348	3,864
	13 Commercial Shops	22.00 TSF	16	11	27	40	40	80	815
	14 Hotel	250.00 ROOM	85	55	140	80	73	153	2,058
	18 Health Club	54.00 TSF	52	35	87	117	78	195	2,160
	40 Commercial Office	13.00 TSF	20	2	22	3	17	20	150
	SUB-TOTAL		218	344	562	470	326	796	9,047
203.	5 Apartment	450.00 DU	36	194	230	185	95	280	3,105
	10 Commercial Center (>30ac)	2,000.00 TSF	940	600	1,540	3,280	3,560	6,840	80,120
	40 Commercial Office	125.00 TSF	194	24	218	26	161	187	1,445
	SUB-TOTAL		1,170	818	1,988	3,491	3,816	7,307	84,670
204.	13 Commercial Shops	62.00 TSF	45	30	75	112	112	224	2,298
	17 Movie Theater	3,300.00 SEA	T 0	0	0	165	66	231	5,808
	40 Commercial Office	400.00 TSF	620	76	696	84	516	600	4,624
	SUB-TOTAL		665	106	771	361	694	1,055	12,730
205.	11 Commercial Center(10-30a)	100.00 TSF	73	47	120	238	258	496	5,406
	24 Library	40.00 TSF	30	12	42	136	148	284	3,399
	40 Commercial Office	850.00 TSF	1,318	162	1,480	179	1,097	1,276	9,826
	SUB-TOTAL		1,421	221	1,642	553	1,503	2,056	18,631
206.	11 Commercial Center(10-30a)	166.11 TSF	121	78	199	395	429	824	8,980
	15 Sit-Down Restaurant	21.50 TSF	104	96	200	140	93	233	2,802
	SUB-TOTAL		225	174	399	535	522	1,057	11,782
207.	15 Sit-Down Restaurant	6.00 TSF	29	27	56	39	26	65	782
	40 Commercial Office	350.00 TSF	543	67	610	74	452	526	4,046
	SUB-TOTAL		572	94	666	113	478	591	4,828
208.	4 Condominium/Townhouse	234.00 DU	23	112	135	110	61	171	1,872
	SUB-TOTAL		23	112	135	110	61	171	1,872
209.	2 Single Family (1-5du/ac)	414.00 DU	79	232	311	265	153	418	4,099
	4 Condominium/Townhouse	352.00 DU	35	169	204	165	92	257	2,816
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		309	551	860	490	313	803	8,003
210.	2 Single Family (1-5du/ac)	205.00 DU	39	115	154	131	76	207	2,029
	4 Condominium/Townhouse	208.00 DU	21	100	121	98	54	152	1,664
	11 Commercial Center(10-30a)	148.10 TSF	108	70	178	352	382	734	8,006
	SUB-TOTAL		168	285	453	581	512	1,093	11,699
211.	2 Single Family (1-5du/ac)	167.00 DU	32	94	126	107	62	169	1,653
	SUB-TOTAL		32	94	126	107	62	169	1,653
212.	2 Single Family (1-5du/ac)	252.00 DU	48	141	189	161	93	254	2,495
	4 Condominium/Townhouse	272.00 DU	27	131	158	128	71	199	2,176
	25 Church	18.03 TSF	7	6	13	6	5	11	168
	51 Developed Park	4.20 AC	0	0	0	0	0	0	11
	SUB-TOTAL		82	278	360	295	169	464	4,850
213.	2 Single Family (1-5du/ac)	275.00 DU	52	154	206	176	102	278	2,723
	25 Church	25.09 TSF	10	8	18	9	8	17	233
	SUB-TOTAL		62	162	224	185	110	295	2,956

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
214.	3 Single Family (6-10du/ac)	49.00 DU	9	27	36	31	18	49	485
	4 Condominium/Townhouse	74.00 DU	7	36	43	35	19	54	592
	5 Apartment	107.00 DU	9	46	55	44	22	66	738
	25 Church	8.00 TSF	3	3	6	3	2	5	74
	SUB-TOTAL		28	112	140	113	61	174	1,889
215.	2 Single Family (1-5du/ac)	80.00 DU	15	45	60	51	30	81	792
	4 Condominium/Townhouse	52.00 DU	5	25	30	24	14	38	416
	11 Commercial Center(10-30a)	100.00 TSF	73	47	120	238	258	496	5,406
	13 Commercial Shops	43.56 TSF	31	21	52	78	78	156	1,614
	20 Elementary/Middle School	350.00 STU	91	70	161	28	32	60	508
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	25 Church	100.00 TSF	39	33	72	36	30	66	930
	34 Utilities	47.92 TSF	0	0	0	0	0	0	114
	SUB-TOTAL		1,054	591	1,645	605	667	1,272	14,255
216.	3 Single Family (6-10du/ac)	22.00 DU	4	12	16	14	8	22	218
	4 Condominium/Townhouse	378.00 DU	38	181	219	178	98	276	3,024
	5 Apartment	70.00 DU	6	30	36	29	15	44	483
	11 Commercial Center(10-30a)	204.96 TSF	150	96	246	488	529	1,017	11,080
	40 Commercial Office	65.45 TSF	101	12	113	14	84	98	757
	SUB-TOTAL		299	331	630	723	734	1,457	15,562
217.	2 Single Family (1-5du/ac)	202.00 DU	38	113	151	129	75	204	2,000
	4 Condominium/Townhouse	316.00 DU	32	152	184	149	82	231	2,528
	5 Apartment	70.00 DU	6	30	36	29	15	44	483
	11 Commercial Center(10-30a)	65.75 TSF	48	31	79	156	170	326	3,554
	13 Commercial Shops	45.00 TSF	32	22	54	81	81	162	1,668
	30 Industrial Park	22.44 TSF	12	2	14	3	12	15	135
	40 Commercial Office	22.44 TSF	35	4	39	5	29	34	259
	SUB-TOTAL		203	354	557	552	464	1,016	10,627
218.	2 Single Family (1-5du/ac)	360.00 DU	68	202	270	230	133	363	3,564
	4 Condominium/Townhouse	750.00 DU	75	360	435	353	195	548	6,000
	5 Apartment	60.00 DU	5	26	31	25	13	38	414
	6 Mobile Home	151.00 DU	12	48	60	53	32	85	1,042
	10 Commercial Center (>30ac)	327.00 TSF	154	98	252	536	582	1,118	13,100
	11 Commercial Center(10-30a)	166.62 TSF	122	78	200	397	430	827	9,007
	13 Commercial Shops	64.25 TSF	46	31	77	116	116	232	2,381
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	25 Church	9.41 TSF	4	3	7	3	3	6	88
	SUB-TOTAL		681	996	1,677	1,773	1,572	3,345	36,684
219.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	4 Condominium/Townhouse	250.00 DU	25	120	145	118	65	183	2,000
	31 Business Park	100.00 TSF	120	23	143	30	99	129	1,020
	SUB-TOTAL		149	154	303	161	171	332	3,218
220.	2 Single Family (1-5du/ac)	8.00 DU	2	4	6	5	3	8	79
	31 Business Park	100.00 TSF	120	23	143	30	99	129	1,020
	34 Utilities	566.28 TSF	0	0	0	0	0	0	1,348
	SUB-TOTAL		122	27	149	35	102	137	2,447

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
221.	2 Single Family (1-5du/ac)	350.00 DU	67	196	263	224	130	354	3,465
	4 Condominium/Townhouse	6.00 DU	1	3	4	3	2	5	48
	6 Mobile Home	30.00 DU	2	10	12	11	6	17	207
	22 College	362.00 STU	47	4	51	25	51	76	557
	25 Church	92.52 TSF	36	31	67	33	28	61	860
	30 Industrial Park	144.40 TSF	79	14	93	19	75	94	866
	31 Business Park	50.00 TSF	60	12	72	15	50	65	510
	SUB-TOTAL		292	270	562	330	342	672	6,513
222.	2 Single Family (1-5du/ac)	55.00 DU	10	31	41	35	20	55	545
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	22 College	1,700.00 STU	221	17	238	119	238	357	2,618
	25 Church	16.70 TSF	7	6	13	6	5	11	155
	SUB-TOTAL		433	204	637	220	331	551	4,406
223.	11 Commercial Center(10-30a)	110.00 TSF	80	52	132	262	284	546	5,947
	14 Hotel	100.00 ROOM	34	22	56	32	29	61	823
	30 Industrial Park	242.00 TSF	133	24	157	31	126	157	1,452
	40 Commercial Office	248.00 TSF	384	47	431	52	320	372	2,867
	SUB-TOTAL		631	145	776	377	759	1,136	11,089
224.	2 Single Family (1-5du/ac)	250.00 DU	48	140	188	160	93	253	2,475
	4 Condominium/Townhouse	550.00 DU	55	264	319	259	143	402	4,400
	6 Mobile Home	30.00 DU	2	10	12	11	6	17	207
	13 Commercial Shops	116.68 TSF	84	56	140	210	210	420	4,324
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	24 Library	34.40 TSF	26	10	36	117	127	244	2,923
	SUB-TOTAL		410	630	1,040	817	647	1,464	15,417
225.	2 Single Family (1-5du/ac)	156.00 DU	30	87	117	100	58	158	1,544
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	51 Developed Park	14.00 AC	0	0	0	0	1	1	36
	SUB-TOTAL		342	327	669	196	167	363	3,320
226.	2 Single Family (1-5du/ac)	300.00 DU	57	168	225	192	111	303	2,970
	4 Condominium/Townhouse	292.00 DU	29	140	169	137	76	213	2,336
	12 Commercial Center (<10ac)	15.68 TSF	17	11	28	52	56	108	1,334
	13 Commercial Shops	69.70 TSF	50	33	83	125	125	250	2,583
	14 Hotel	34.00 ROOM	12	7	19	11	10	21	280
	25 Church	8.00 TSF	3	3	6	3	2	5	74
	SUB-TOTAL		168	362	530	520	380	900	9,577
227.	2 Single Family (1-5du/ac)	118.00 DU	22	66	88	76	44	120	1,168
	4 Condominium/Townhouse	786.00 DU	79	377	456	369	204	573	6,288
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		296	593	889	505	316	821	8,544
228.	2 Single Family (1-5du/ac)	385.00 DU	73	216	289	246	142	388	3,811
	SUB-TOTAL		73	216	289	246	142	388	3,811
229.	1 Single Family (<1du/ac)	74.00 DU	21	50	71	62	27	89	733
	2 Single Family (1-5du/ac)	104.00 DU	20	58	78	67	38	105	1,030
	SUB-TOTAL		41	108	149	129	65	194	1,763
230.	1 Single Family (<1du/ac)	10.00 DU	3	7	10	8	4	12	99
	SUB-TOTAL		3	7	10	8	4	12	99

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
231.	2 Single Family (1-5du/ac)	5.00 DU	1	3	4	3	2	5	50
	4 Condominium/Townhouse	51.00 DU	5	24	29	24	13	37	408
	34 Utilities	29.00 TSF	0	0	0	0	0	0	69
	SUB-TOTAL		6	27	33	27	15	42	527
232.	1 Single Family (<1du/ac)	10.00 DU	3	7	10	8	4	12	99
	5 Apartment	850.00 DU	68	366	434	349	179	528	5,865
	SUB-TOTAL		71	373	444	357	183	540	5,964
234.	11 Commercial Center(10-30a)	100.00 TSF	73	47	120	238	258	496	5,406
	31 Business Park	470.24 TSF	564	108	672	141	466	607	4,796
	SUB-TOTAL		637	155	792	379	724	1,103	10,202
235.	11 Commercial Center(10-30a)	240.00 TSF	175	113	288	571	619	1,190	12,974
	31 Business Park	80.00 TSF	96	18	114	24	79	103	816
	SUB-TOTAL		271	131	402	595	698	1,293	13,790
236.	2 Single Family (1-5du/ac)	204.00 DU	39	114	153	131	75	206	2,020
	3 Single Family (6-10du/ac)	604.00 DU	115	338	453	387	223	610	5,980
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	5.00 AC	0	0	0	0	0	0	13
	SUB-TOTAL		349	602	951	578	366	944	9,101
237.	2 Single Family (1-5du/ac)	225.00 DU	43	126	169	144	83	227	2,228
	5 Apartment	570.00 DU	46	245	291	234	120	354	3,933
	40 Commercial Office	99.00 TSF	153	19	172	21	128	149	1,144
	51 Developed Park	24.40 AC	0	0	0	1	1	2	63
	SUB-TOTAL		242	390	632	400	332	732	7,368
238.	2 Single Family (1-5du/ac)	163.00 DU	31	91	122	104	60	164	1,614
	3 Single Family (6-10du/ac)	236.00 DU	45	132	177	151	87	238	2,336
	4 Condominium/Townhouse	123.00 DU	12	59	71	58	32	90	984
	11 Commercial Center(10-30a)	82.00 TSF	60	39	99	195	212	407	4,433
	12 Commercial Center (<10ac)	50.00 TSF	55	35	90	166	180	346	4,253
	13 Commercial Shops	32.00 TSF	23	15	38	58	58	116	1,186
	15 Sit-Down Restaurant	20.00 TSF	96	89	185	130	87	217	2,607
	30 Industrial Park	944.00 TSF	519	94	613	123	491	614	5,664
	31 Business Park	227.00 TSF	272	52	324	68	225	293	2,315
	40 Commercial Office	113.00 TSF	175	21	196	24	146	170	1,306
	51 Developed Park	25.90 AC	0	0	0	1	1	2	67
	SUB-TOTAL		1,288	627	1,915	1,078	1,579	2,657	26,765
239.	13 Commercial Shops	337.29 TSF	243	162	405	607	607	1,214	12,500
	21 High School	500.00 STU	160	70	230	30	45	75	895
	30 Industrial Park	387.07 TSF	213	39	252	50	201	251	2,322
	40 Commercial Office	262.87 TSF	407	50	457	55	339	394	3,039
	SUB-TOTAL		1,023	321	1,344	742	1,192	1,934	18,756
240.	11 Commercial Center(10-30a)	126.00 TSF	92	59	151	300	325	625	6,812
	12 Commercial Center (<10ac)	40.00 TSF	44	28	72	133	144	277	3,402
	15 Sit-Down Restaurant	9.50 TSF	46	42	88	62	41	103	1,238
	16 Fast Food Restaurant	5.50 TSF	140	134	274	96	88	184	2,729
	SUB-TOTAL		322	263	585	591	598	1,189	14,181

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
241.	21 High School	500.00 STU	160	70	230	30	45	75	895
	25 Church	25.00 TSF	10	8	18	9	8	17	233
	31 Business Park	1,200.00 TSF	1,440	276	1,716	360	1,188	1,548	12,240
	42 Medical Office	28.00 TSF	54	14	68	28	75	103	958
	SUB-TOTAL		1,664	368	2,032	427	1,316	1,743	14,326
242.	31 Business Park	253.00 TSF	304	58	362	76	250	326	2,581
	40 Commercial Office	115.00 TSF	178	22	200	24	148	172	1,329
	SUB-TOTAL		482	80	562	100	398	498	3,910
243.	2 Single Family (1-5du/ac)	211.00 DU	40	118	158	135	78	213	2,089
	4 Condominium/Townhouse	426.00 DU	43	204	247	200	111	311	3,408
	5 Apartment	390.00 DU	31	168	199	160	82	242	2,691
	11 Commercial Center(10-30a)	75.00 TSF	55	35	90	179	194	373	4,055
	12 Commercial Center (<10ac)	20.00 TSF	22	14	36	66	72	138	1,701
	15 Sit-Down Restaurant	34.00 TSF	164	151	315	222	148	370	4,432
	40 Commercial Office	164.00 TSF	254	31	285	34	212	246	1,896
	SUB-TOTAL		609	721	1,330	996	897	1,893	20,272
244.	2 Single Family (1-5du/ac)	322.00 DU	61	180	241	206	119	325	3,188
	SUB-TOTAL		61	180	241	206	119	325	3,188
245.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	51 Developed Park	13.00 AC	0	0	0	0	1	1	34
	SUB-TOTAL		4	11	15	13	8	21	232
246.	32 Manufacturing/Warehouse	120.00 TSF	67	20	87	32	56	88	612
	SUB-TOTAL		67	20	87	32	56	88	612
247.	10 Commercial Center (>30ac)	500.00 TSF	235	150	385	820	890	1,710	20,030
	SUB-TOTAL		235	150	385	820	890	1,710	20,030
248.	2 Single Family (1-5du/ac)	2.00 DU	0	1	1	1	1	2	20
	4 Condominium/Townhouse	4.00 DU	0	2	2	2	1	3	32
	30 Industrial Park	1,200.00 TSF	660	120	780	156	624	780	7,200
	SUB-TOTAL		660	123	783	159	626	785	7,252
249.	32 Manufacturing/Warehouse	291.68 TSF	163	50	213	79	137	216	1,488
	40 Commercial Office	250.00 TSF	388	48	436	53	323	376	2,890
	SUB-TOTAL		551	98	649	132	460	592	4,378
250.	4 Condominium/Townhouse	300.00 DU	30	144	174	141	78	219	2,400
	5 Apartment	150.00 DU	12	65	77	62	31	93	1,035
	10 Commercial Center (>30ac)	390.66 TSF	184	117	301	641	695	1,336	15,650
	13 Commercial Shops	58.00 TSF	42	28	70	104	104	208	2,149
	41 High-Rise Office	300.00 TSF	411	57	468	75	372	447	3,264
	SUB-TOTAL		679	411	1,090	1,023	1,280	2,303	24,498
251.	30 Industrial Park	400.00 TSF	220	40	260	52	208	260	2,400
	SUB-TOTAL		220	40	260	52	208	260	2,400
252.	31 Business Park	858.00 TSF	1,030	197	1,227	257	849	1,106	8,752
	SUB-TOTAL		1,030	197	1,227	257	849	1,106	8,752
253.	1 Single Family (<1du/ac)	32.00 DU	9	21	30	27	12	39	317
	SUB-TOTAL		9	21	30	27	12	39	317

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
254.	11 Commercial Center(10-30a)	107.50 TSF	78	51	129	256	277	533	5,811
	13 Commercial Shops	8.71 TSF	6	4	10	16	16	32	323
	SUB-TOTAL		84	55	139	272	293	565	6,134
255.	1 Single Family (<1du/ac)	20.00 DU	6	13	19	17	7	24	198
	SUB-TOTAL		6	13	19	17	7	24	198
256.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	SUB-TOTAL		4	11	15	13	7	20	198
257.	2 Single Family (1-5du/ac)	170.00 DU	32	95	127	109	63	172	1,683
	SUB-TOTAL		32	95	127	109	63	172	1,683
258.	2 Single Family (1-5du/ac)	130.00 DU	25	73	98	83	48	131	1,287
	25 Church	15.00 TSF	6	5	11	5	5	10	140
	32 Manufacturing/Warehouse	125.00 TSF	70	21	91	34	59	93	638
	50 Golf Course	400.00 AC	60	24	84	40	80	120	3,184
	SUB-TOTAL		161	123	284	162	192	354	5,249
259.	3 Single Family (6-10du/ac)	10.00 DU	2	6	8	6	4	10	99
	SUB-TOTAL		2	6	8	6	4	10	99
260.	2 Single Family (1-5du/ac)	402.00 DU	76	225	301	257	149	406	3,980
	SUB-TOTAL		76	225	301	257	149	406	3,980
261.	2 Single Family (1-5du/ac)	25.00 DU	5	14	19	16	9	25	247
	SUB-TOTAL		5	14	19	16	9	25	247
262.	2 Single Family (1-5du/ac)	596.00 DU	113	334	447	381	221	602	5,900
	3 Single Family (6-10du/ac)	194.00 DU	37	109	146	124	72	196	1,921
	4 Condominium/Townhouse	100.00 DU	10	48	58	47	26	73	800
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		355	641	996	612	387	999	9,709
263.	4 Condominium/Townhouse	200.00 DU	20	96	116	94	52	146	1,600
	SUB-TOTAL		20	96	116	94	52	146	1,600
264.	3 Single Family (6-10du/ac)	63.00 DU	12	35	47	40	23	63	624
	4 Condominium/Townhouse	186.00 DU	19	89	108	87	48	135	1,488
	5 Apartment	78.00 DU	6	34	40	32	16	48	538
	SUB-TOTAL		37	158	195	159	87	246	2,650
265.	4 Condominium/Townhouse	320.00 DU	32	154	186	150	83	233	2,560
	5 Apartment	350.00 DU	28	151	179	144	74	218	2,415
	SUB-TOTAL		60	305	365	294	157	451	4,975
266.	7 Senior (Active)	200.00 DU	16	24	40	32	20	52	742
	11 Commercial Center(10-30a)	120.00 TSF	88	56	144	286	310	596	6,487
	32 Manufacturing/Warehouse	75.00 TSF	42	13	55	20	35	55	383
	SUB-TOTAL		146	93	239	338	365	703	7,612
267.	11 Commercial Center(10-30a)	200.00 TSF	146	94	240	476	516	992	10,812
	SUB-TOTAL		146	94	240	476	516	992	10,812

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
268.	4 Condominium/Townhouse	180.00 DU	18	86	104	85	47	132	1,440
	11 Commercial Center(10-30a)	182.33 TSF	133	86	219	434	470	904	9,857
	32 Manufacturing/Warehouse	112.00 TSF	63	19	82	30	53	83	571
	SUB-TOTAL		214	191	405	549	570	1,119	11,868
269.	2 Single Family (1-5du/ac)	250.00 DU	48	140	188	160	93	253	2,475
	3 Single Family (6-10du/ac)	16.00 DU	3	9	12	10	6	16	158
	7 Senior (Active)	25.00 DU	2	3	5	4	3	7	93
	20 Elementary/Middle School	500.00 STU	130	100	230	40	45	85	725
	51 Developed Park	4.50 AC	0	0	0	0	0	0	12
	SUB-TOTAL		183	252	435	214	147	361	3,463
270.	1 Single Family (<1du/ac)	8.00 DU	2	5	7	7	3	10	79
	3 Single Family (6-10du/ac)	300.00 DU	57	168	225	192	111	303	2,970
	7 Senior (Active)	75.00 DU	6	9	15	12	8	20	278
	SUB-TOTAL		65	182	247	211	122	333	3,327
271.	5 Apartment	171.00 DU	14	74	88	70	36	106	1,180
	10 Commercial Center (>30ac)	630.00 TSF	296	189	485	1,033	1,121	2,154	25,238
	SUB-TOTAL		310	263	573	1,103	1,157	2,260	26,418
272.	2 Single Family (1-5du/ac)	665.00 DU	126	372	498	426	246	672	6,583
	3 Single Family (6-10du/ac)	302.00 DU	57	169	226	193	112	305	2,990
	4 Condominium/Townhouse	180.00 DU	18	86	104	85	47	132	1,440
	12 Commercial Center (<10ac)	8.12 TSF	9	6	15	27	29	56	691
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		405	783	1,188	791	502	1,293	12,792
273.	2 Single Family (1-5du/ac)	101.00 DU	19	57	76	65	37	102	1,000
	SUB-TOTAL		19	57	76	65	37	102	1,000
274.	2 Single Family (1-5du/ac)	80.00 DU	15	45	60	51	30	81	792
	31 Business Park	110.06 TSF	132	25	157	33	109	142	1,123
	SUB-TOTAL		147	70	217	84	139	223	1,915
275.	2 Single Family (1-5du/ac)	225.00 DU	43	126	169	144	83	227	2,228
	SUB-TOTAL		43	126	169	144	83	227	2,228
276.	3 Single Family (6-10du/ac)	75.00 DU	14	42	56	48	28	76	743
	4 Condominium/Townhouse	539.00 DU	54	259	313	253	140	393	4,312
	12 Commercial Center (<10ac)	98.01 TSF	107	68	175	325	353	678	8,337
	25 Church	7.84 TSF	3	3	6	3	2	5	73
	SUB-TOTAL		178	372	550	629	523	1,152	13,465
277.	11 Commercial Center(10-30a)	70.00 TSF	51	33	84	167	181	348	3,784
	15 Sit-Down Restaurant	3.00 TSF	14	13	27	20	13	33	391
	32 Manufacturing/Warehouse	150.00 TSF	84	26	110	41	71	112	765
	40 Commercial Office	10.00 TSF	16	2	18	2	13	15	116
	42 Medical Office	100.00 TSF	194	49	243	99	267	366	3,420
	SUB-TOTAL		359	123	482	329	545	874	8,476
278.	4 Condominium/Townhouse	757.00 DU	76	363	439	356	197	553	6,056
	12 Commercial Center (<10ac)	81.89 TSF	89	57	146	272	295	567	6,966
	50 Golf Course	50.00 AC	8	3	11	5	10	15	398
	SUB-TOTAL		173	423	596	633	502	1,135	13,420

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
279.	6 Mobile Home	313.00 DU	25	100	125	110	66	176	2,160
	12 Commercial Center (<10ac)	26.33 TSF	29	18	47	87	95	182	2,240
	30 Industrial Park	58.00 TSF	32	6	38	8	30	38	348
	40 Commercial Office	0.20 TSF	0	0	0	0	0	0	2
	SUB-TOTAL		86	124	210	205	191	396	4,750
280.	31 Business Park	38.18 TSF	46	9	55	11	38	49	389
	SUB-TOTAL		46	9	55	11	38	49	389
281.	4 Condominium/Townhouse	150.00 DU	15	72	87	71	39	110	1,200
	SUB-TOTAL		15	72	87	71	39	110	1,200
282.	4 Condominium/Townhouse	700.00 DU	70	336	406	329	182	511	5,600
	11 Commercial Center(10-30a)	17.90 TSF	13	8	21	43	46	89	968
	SUB-TOTAL		83	344	427	372	228	600	6,568
283.	2 Single Family (1-5du/ac)	175.00 DU	33	98	131	112	65	177	1,732
	4 Condominium/Townhouse	667.00 DU	67	320	387	313	173	486	5,336
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	SUB-TOTAL		412	658	1,070	521	346	867	8,808
284.	2 Single Family (1-5du/ac)	2.00 DU	0	1	1	1	1	2	20
	4 Condominium/Townhouse	254.00 DU	25	122	147	119	66	185	2,032
	SUB-TOTAL		25	123	148	120	67	187	2,052
285.	2 Single Family (1-5du/ac)	80.00 DU	15	45	60	51	30	81	792
	10 Commercial Center (>30ac)	246.99 TSF	116	74	190	405	440	845	9,894
	31 Business Park	150.00 TSF	180	35	215	45	149	194	1,530
	SUB-TOTAL		311	154	465	501	619	1,120	12,216
286.	2 Single Family (1-5du/ac)	182.00 DU	35	102	137	116	67	183	1,802
	SUB-TOTAL		35	102	137	116	67	183	1,802
287.	2 Single Family (1-5du/ac)	35.00 DU	7	20	27	22	13	35	347
	4 Condominium/Townhouse	120.00 DU	12	58	70	56	31	87	960
	SUB-TOTAL		19	78	97	78	44	122	1,307
288.	3 Single Family (6-10du/ac)	167.00 DU	32	94	126	107	62	169	1,653
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	SUB-TOTAL		832	444	1,276	257	287	544	6,128
289.	2 Single Family (1-5du/ac)	166.00 DU	32	93	125	106	61	167	1,643
	5 Apartment	350.00 DU	28	151	179	144	74	218	2,415
	31 Business Park	57.17 TSF	69	13	82	17	57	74	583
	SUB-TOTAL		129	257	386	267	192	459	4,641
290.	2 Single Family (1-5du/ac)	104.00 DU	20	58	78	67	38	105	1,030
	4 Condominium/Townhouse	93.00 DU	9	45	54	44	24	68	744
	SUB-TOTAL		29	103	132	111	62	173	1,774
291.	2 Single Family (1-5du/ac)	74.00 DU	14	41	55	47	27	74	733
	5 Apartment	350.00 DU	28	151	179	144	74	218	2,415
	31 Business Park	181.63 TSF	218	42	260	54	180	234	1,853
	SUB-TOTAL		260	234	494	245	281	526	5,001

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
292.	2 Single Family (1-5du/ac)	140.00 DU	27	78	105	90	52	142	1,386
	SUB-TOTAL		27	78	105	90	52	142	1,386
293.	2 Single Family (1-5du/ac)	180.00 DU	34	101	135	115	67	182	1,782
	4 Condominium/Townhouse	452.00 DU	45	217	262	212	118	330	3,616
	5 Apartment	232.00 DU	19	100	119	95	49	144	1,601
	SUB-TOTAL		98	418	516	422	234	656	6,999
294.	5 Apartment	276.00 DU	22	119	141	113	58	171	1,904
	11 Commercial Center(10-30a)	155.00 TSF	113	73	186	369	400	769	8,379
	30 Industrial Park	300.00 TSF	165	30	195	39	156	195	1,800
	SUB-TOTAL		300	222	522	521	614	1,135	12,083
295.	32 Manufacturing/Warehouse	1,020.58 TSF	572	173	745	276	480	756	5,205
	40 Commercial Office	56.00 TSF	87	11	98	12	72	84	647
	51 Developed Park	60.00 AC	0	0	0	2	2	4	156
	SUB-TOTAL		659	184	843	290	554	844	6,008
296.	12 Commercial Center (<10ac)	20.00 TSF	22	14	36	66	72	138	1,701
	SUB-TOTAL		22	14	36	66	72	138	1,701
297.	12 Commercial Center (<10ac)	20.00 TSF	22	14	36	66	72	138	1,701
	SUB-TOTAL		22	14	36	66	72	138	1,701
298.	5 Apartment	830.00 DU	66	357	423	340	174	514	5,727
	12 Commercial Center (<10ac)	20.00 TSF	22	14	36	66	72	138	1,701
	SUB-TOTAL		88	371	459	406	246	652	7,428
299.	11 Commercial Center(10-30a)	184.00 TSF	134	86	220	438	475	913	9,947
	SUB-TOTAL		134	86	220	438	475	913	9,947
300.	10 Commercial Center (>30ac)	300.00 TSF	141	90	231	492	534	1,026	12,018
	SUB-TOTAL		141	90	231	492	534	1,026	12,018
301.	13 Commercial Shops	49.24 TSF	35	24	59	89	89	178	1,825
	19 Car Dealership	86.00 TSF	138	52	190	96	144	240	3,225
	43 Post Office	50.00 TSF	209	193	402	275	265	540	5,410
	SUB-TOTAL		382	269	651	460	498	958	10,460
302.	12 Commercial Center (<10ac)	30.00 TSF	33	21	54	100	108	208	2,552
	19 Car Dealership	100.00 TSF	161	60	221	112	168	280	3,750
	SUB-TOTAL		194	81	275	212	276	488	6,302
303.	19 Car Dealership	150.00 TSF	242	90	332	168	252	420	5,625
	SUB-TOTAL		242	90	332	168	252	420	5,625
304.	11 Commercial Center(10-30a)	33.00 TSF	24	16	40	79	85	164	1,784
	15 Sit-Down Restaurant	15.00 TSF	72	67	139	98	65	163	1,955
	19 Car Dealership	83.00 TSF	134	50	184	93	139	232	3,113
	SUB-TOTAL		230	133	363	270	289	559	6,852
305.	5 Apartment	76.00 DU	6	33	39	31	16	47	524
	11 Commercial Center(10-30a)	197.29 TSF	144	93	237	470	509	979	10,665
	15 Sit-Down Restaurant	5.36 TSF	26	24	50	35	23	58	699
	32 Manufacturing/Warehouse	100.00 TSF	56	17	73	27	47	74	510
	SUB-TOTAL		232	167	399	563	595	1,158	12,398

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
306.	4 Condominium/Townhouse	125.00 DU	13	60	73	59	33	92	1,000
	5 Apartment	125.00 DU	10	54	64	51	26	77	863
	11 Commercial Center(10-30a)	143.90 TSF	105	68	173	342	371	713	7,779
	25 Church	36.10 TSF	14	12	26	13	11	24	336
	42 Medical Office	50.00 TSF	97	25	122	50	134	184	1,710
	SUB-TOTAL		239	219	458	515	575	1,090	11,688
307.	11 Commercial Center(10-30a)	128.00 TSF	93	60	153	305	330	635	6,920
	16 Fast Food Restaurant	4.80 TSF	122	117	239	84	77	161	2,381
	SUB-TOTAL		215	177	392	389	407	796	9,301
308.	5 Apartment	200.00 DU	16	86	102	82	42	124	1,380
	12 Commercial Center (<10ac)	175.11 TSF	191	121	312	581	630	1,211	14,895
	32 Manufacturing/Warehouse	45.00 TSF	25	8	33	12	21	33	230
	SUB-TOTAL		232	215	447	675	693	1,368	16,505
309.	13 Commercial Shops	3.00 TSF	2	1	3	5	5	10	111
	SUB-TOTAL		2	1	3	5	5	10	111
310.	19 Car Dealership	111.00 TSF	179	67	246	124	186	310	4,163
	51 Developed Park	17.20 AC	0	0	0	1	1	2	45
	SUB-TOTAL		179	67	246	125	187	312	4,208
311.	3 Single Family (6-10du/ac)	132.00 DU	25	74	99	84	49	133	1,307
	4 Condominium/Townhouse	63.00 DU	6	30	36	30	16	46	504
	SUB-TOTAL		31	104	135	114	65	179	1,811
312.	11 Commercial Center(10-30a)	180.00 TSF	131	85	216	428	464	892	9,731
	34 Utilities	84.00 TSF	0	0	0	0	0	0	200
	SUB-TOTAL		131	85	216	428	464	892	9,931
313.	4 Condominium/Townhouse	264.00 DU	26	127	153	124	69	193	2,112
	SUB-TOTAL		26	127	153	124	69	193	2,112
314.	11 Commercial Center(10-30a)	178.00 TSF	130	84	214	424	459	883	9,623
	SUB-TOTAL		130	84	214	424	459	883	9,623
315.	3 Single Family (6-10du/ac)	56.00 DU	11	31	42	36	21	57	554
	4 Condominium/Townhouse	168.00 DU	17	81	98	79	44	123	1,344
	SUB-TOTAL		28	112	140	115	65	180	1,898
316.	2 Single Family (1-5du/ac)	121.00 DU	23	68	91	77	45	122	1,198
	SUB-TOTAL		23	68	91	77	45	122	1,198
317.	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	18.00 AC	0	0	0	1	1	2	47
	SUB-TOTAL		195	150	345	61	69	130	1,135
318.	2 Single Family (1-5du/ac)	21.00 DU	4	12	16	13	8	21	208
	4 Condominium/Townhouse	252.00 DU	25	121	146	118	66	184	2,016
	SUB-TOTAL		29	133	162	131	74	205	2,224

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
319.	11 Commercial Center(10-30a)	130.00 TSF	95	61	156	309	335	644	7,028
	25 Church	30.00 TSF	12	10	22	11	9	20	279
	51 Developed Park	5.00 AC	0	0	0	0	0	0	13
	SUB-TOTAL		107	71	178	320	344	664	7,320
320.	2 Single Family (1-5du/ac)	125.00 DU	24	70	94	80	46	126	1,238
	SUB-TOTAL		24	70	94	80	46	126	1,238
321.	3 Single Family (6-10du/ac)	155.00 DU	29	87	116	99	57	156	1,535
	4 Condominium/Townhouse	66.00 DU	7	32	39	31	17	48	528
	SUB-TOTAL		36	119	155	130	74	204	2,063
322.	3 Single Family (6-10du/ac)	87.00 DU	17	49	66	56	32	88	861
	SUB-TOTAL		17	49	66	56	32	88	861
323.	3 Single Family (6-10du/ac)	161.00 DU	31	90	121	103	60	163	1,594
	4 Condominium/Townhouse	132.00 DU	13	63	76	62	34	96	1,056
	SUB-TOTAL		44	153	197	165	94	259	2,650
325.	3 Single Family (6-10du/ac)	205.00 DU	39	115	154	131	76	207	2,029
	SUB-TOTAL		39	115	154	131	76	207	2,029
326.	2 Single Family (1-5du/ac)	101.00 DU	19	57	76	65	37	102	1,000
	SUB-TOTAL		19	57	76	65	37	102	1,000
327.	2 Single Family (1-5du/ac)	105.00 DU	20	59	79	67	39	106	1,040
	SUB-TOTAL		20	59	79	67	39	106	1,040
328.	2 Single Family (1-5du/ac)	110.00 DU	21	62	83	70	41	111	1,089
	SUB-TOTAL		21	62	83	70	41	111	1,089
329.	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		195	150	345	60	68	128	1,088
330.	2 Single Family (1-5du/ac)	143.00 DU	27	80	107	92	53	145	1,416
	SUB-TOTAL		27	80	107	92	53	145	1,416
331.	2 Single Family (1-5du/ac)	167.00 DU	32	94	126	107	62	169	1,653
	SUB-TOTAL		32	94	126	107	62	169	1,653
332.	2 Single Family (1-5du/ac)	114.00 DU	22	64	86	73	42	115	1,129
	4 Condominium/Townhouse	102.00 DU	10	49	59	48	27	75	816
	SUB-TOTAL		32	113	145	121	69	190	1,945
333.	2 Single Family (1-5du/ac)	803.00 DU	153	450	603	514	297	811	7,950
	4 Condominium/Townhouse	360.00 DU	36	173	209	169	94	263	2,880
	13 Commercial Shops	25.05 TSF	18	12	30	45	45	90	928
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	SUB-TOTAL		519	875	1,394	824	544	1,368	13,498
334.	2 Single Family (1-5du/ac)	164.00 DU	31	92	123	105	61	166	1,624
	SUB-TOTAL		31	92	123	105	61	166	1,624
335.	2 Single Family (1-5du/ac)	194.00 DU	37	109	146	124	72	196	1,921
	SUB-TOTAL		37	109	146	124	72	196	1,921

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
336.	2 Single Family (1-5du/ac)	589.00 DU	112	330	442	377	218	595	5,831
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	7.30 AC	0	0	0	0	0	0	19
	SUB-TOTAL		307	480	787	437	286	723	6,938
337.	2 Single Family (1-5du/ac)	390.00 DU	74	218	292	250	144	394	3,861
	SUB-TOTAL		74	218	292	250	144	394	3,861
338.	11 Commercial Center(10-30a)	92.00 TSF	67	43	110	219	237	456	4,974
	SUB-TOTAL		67	43	110	219	237	456	4,974
339.	2 Single Family (1-5du/ac)	128.00 DU	24	72	96	82	47	129	1,267
	3 Single Family (6-10du/ac)	161.00 DU	31	90	121	103	60	163	1,594
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	7.00 AC	0	0	0	0	0	0	18
	SUB-TOTAL		250	312	562	245	175	420	3,967
340.	2 Single Family (1-5du/ac)	270.00 DU	51	151	202	173	100	273	2,673
	3 Single Family (6-10du/ac)	124.00 DU	24	69	93	79	46	125	1,228
	4 Condominium/Townhouse	264.00 DU	26	127	153	124	69	193	2,112
	SUB-TOTAL		101	347	448	376	215	591	6,013
341.	5 Apartment	325.00 DU	26	140	166	133	68	201	2,243
	26 Day Care	260.00 STU	112	99	211	104	120	224	1,175
	SUB-TOTAL		138	239	377	237	188	425	3,418
342.	4 Condominium/Townhouse	168.00 DU	17	81	98	79	44	123	1,344
	SUB-TOTAL		17	81	98	79	44	123	1,344
343.	2 Single Family (1-5du/ac)	90.00 DU	17	50	67	58	33	91	891
	3 Single Family (6-10du/ac)	89.00 DU	17	50	67	57	33	90	881
	4 Condominium/Townhouse	132.00 DU	13	63	76	62	34	96	1,056
	SUB-TOTAL		47	163	210	177	100	277	2,828
344.	2 Single Family (1-5du/ac)	415.00 DU	79	232	311	266	154	420	4,109
	11 Commercial Center(10-30a)	40.00 TSF	29	19	48	95	103	198	2,162
	SUB-TOTAL		108	251	359	361	257	618	6,271
345.	2 Single Family (1-5du/ac)	81.00 DU	15	45	60	52	30	82	802
	SUB-TOTAL		15	45	60	52	30	82	802
346.	2 Single Family (1-5du/ac)	10.00 DU	2	6	8	6	4	10	99
	SUB-TOTAL		2	6	8	6	4	10	99
347.	2 Single Family (1-5du/ac)	313.00 DU	59	175	234	200	116	316	3,099
	SUB-TOTAL		59	175	234	200	116	316	3,099
348.	2 Single Family (1-5du/ac)	517.00 DU	98	290	388	331	191	522	5,118
	SUB-TOTAL		98	290	388	331	191	522	5,118
349.	4 Condominium/Townhouse	388.00 DU	39	186	225	182	101	283	3,104
	12 Commercial Center (<10ac)	8.00 TSF	9	6	15	27	29	56	680
	26 Day Care	50.00 STU	22	19	41	20	23	43	226
	SUB-TOTAL		70	211	281	229	153	382	4,010

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
350.	25 Church	200.00 TSF	78	66	144	72	60	132	1,860
	SUB-TOTAL		78	66	144	72	60	132	1,860
352.	2 Single Family (1-5du/ac)	592.00 DU	112	332	444	379	219	598	5,861
	20 Elementary/Middle School	924.00 STU	240	185	425	74	83	157	1,340
	51 Developed Park	9.00 AC	0	0	0	0	0	0	23
	SUB-TOTAL		352	517	869	453	302	755	7,224
353.	2 Single Family (1-5du/ac)	259.00 DU	49	145	194	166	96	262	2,564
	51 Developed Park	10.00 AC	0	0	0	0	0	0	26
	SUB-TOTAL		49	145	194	166	96	262	2,590
355.	2 Single Family (1-5du/ac)	500.00 DU	95	280	375	320	185	505	4,950
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	5.00 AC	0	0	0	0	0	0	13
	SUB-TOTAL		290	430	720	380	253	633	6,051
356.	2 Single Family (1-5du/ac)	385.00 DU	73	216	289	246	142	388	3,811
	12 Commercial Center (<10ac)	60.00 TSF	65	41	106	199	216	415	5,104
	SUB-TOTAL		138	257	395	445	358	803	8,915
357.	2 Single Family (1-5du/ac)	90.00 DU	17	50	67	58	33	91	891
	SUB-TOTAL		17	50	67	58	33	91	891
358.	2 Single Family (1-5du/ac)	275.00 DU	52	154	206	176	102	278	2,723
	4 Condominium/Townhouse	121.00 DU	12	58	70	57	31	88	968
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	19.20 AC	0	0	0	1	1	2	50
	SUB-TOTAL		259	362	621	294	202	496	4,829
359.	2 Single Family (1-5du/ac)	570.00 DU	108	319	427	365	211	576	5,643
	4 Condominium/Townhouse	192.00 DU	19	92	111	90	50	140	1,536
	SUB-TOTAL		127	411	538	455	261	716	7,179
360.	2 Single Family (1-5du/ac)	538.00 DU	102	301	403	344	199	543	5,326
	4 Condominium/Townhouse	248.00 DU	25	119	144	117	64	181	1,984
	12 Commercial Center (<10ac)	135.00 TSF	147	93	240	448	486	934	11,483
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		469	663	1,132	969	817	1,786	19,881
361.	2 Single Family (1-5du/ac)	420.00 DU	80	235	315	269	155	424	4,158
	6 Mobile Home	181.00 DU	14	58	72	63	38	101	1,249
	25 Church	3.00 TSF	1	1	2	1	1	2	28
	SUB-TOTAL		95	294	389	333	194	527	5,435
362.	2 Single Family (1-5du/ac)	173.00 DU	33	97	130	111	64	175	1,713
	SUB-TOTAL		33	97	130	111	64	175	1,713
363.	2 Single Family (1-5du/ac)	44.00 DU	8	25	33	28	16	44	436
	SUB-TOTAL		8	25	33	28	16	44	436
364.	3 Single Family (6-10du/ac)	199.00 DU	38	111	149	127	74	201	1,970
	SUB-TOTAL		38	111	149	127	74	201	1,970

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
365.	2 Single Family (1-5du/ac)	201.00 DU	38	113	151	129	74	203	1,990
	4 Condominium/Townhouse	102.00 DU	10	49	59	48	27	75	816
	12 Commercial Center (<10ac)	11.00 TSF	12	8	20	37	40	77	936
	SUB-TOTAL		60	170	230	214	141	355	3,742
366.	2 Single Family (1-5du/ac)	600.00 DU	114	336	450	384	222	606	5,940
	SUB-TOTAL		114	336	450	384	222	606	5,940
367.	3 Single Family (6-10du/ac)	437.00 DU	83	245	328	280	162	442	4,326
	SUB-TOTAL		83	245	328	280	162	442	4,326
368.	2 Single Family (1-5du/ac)	1,070.00 DU	203	599	802	685	396	1,081	10,593
	12 Commercial Center (<10ac)	35.00 TSF	38	24	62	116	126	242	2,977
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	25 Church	56.00 TSF	22	18	40	20	17	37	521
	51 Developed Park	7.50 AC	0	0	0	0	0	0	20
	SUB-TOTAL		458	791	1,249	881	607	1,488	15,199
369.	2 Single Family (1-5du/ac)	202.00 DU	38	113	151	129	75	204	2,000
	SUB-TOTAL		38	113	151	129	75	204	2,000
370.	2 Single Family (1-5du/ac)	1,080.00 DU	205	605	810	691	400	1,091	10,692
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	SUB-TOTAL		1,005	955	1,960	841	625	1,466	15,167
371.	2 Single Family (1-5du/ac)	673.00 DU	128	377	505	431	249	680	6,663
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		323	527	850	491	317	808	7,751
372.	2 Single Family (1-5du/ac)	287.00 DU	55	161	216	184	106	290	2,841
	4 Condominium/Townhouse	230.00 DU	23	110	133	108	60	168	1,840
	11 Commercial Center(10-30a)	80.00 TSF	58	38	96	190	206	396	4,325
	SUB-TOTAL		136	309	445	482	372	854	9,006
373.	2 Single Family (1-5du/ac)	236.00 DU	45	132	177	151	87	238	2,336
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	25 Church	23.52 TSF	9	8	17	8	7	15	219
	SUB-TOTAL		249	290	539	219	162	381	3,643
374.	2 Single Family (1-5du/ac)	300.00 DU	57	168	225	192	111	303	2,970
	5 Apartment	304.00 DU	24	131	155	125	64	189	2,098
	11 Commercial Center(10-30a)	150.00 TSF	110	71	181	357	387	744	8,109
	51 Developed Park	30.00 AC	0	0	0	1	1	2	78
	SUB-TOTAL		191	370	561	675	563	1,238	13,255
375.	12 Commercial Center (<10ac)	40.00 TSF	44	28	72	133	144	277	3,402
	16 Fast Food Restaurant	5.00 TSF	127	122	249	87	80	167	2,481
	SUB-TOTAL		171	150	321	220	224	444	5,883
377.	13 Commercial Shops	57.50 TSF	41	28	69	104	104	208	2,131
	SUB-TOTAL		41	28	69	104	104	208	2,131

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
378.	4 Condominium/Townhouse	407.00 DU	41	195	236	191	106	297	3,256
	6 Mobile Home	332.00 DU	27	106	133	116	70	186	2,291
	13 Commercial Shops	51.00 TSF	37	24	61	92	92	184	1,890
	30 Industrial Park	110.00 TSF	61	11	72	14	57	71	660
	31 Business Park	56.00 TSF	67	13	80	17	55	72	571
	SUB-TOTAL		233	349	582	430	380	810	8,668
380.	2 Single Family (1-5du/ac)	125.00 DU	24	70	94	80	46	126	1,238
	5 Apartment	400.00 DU	32	172	204	164	84	248	2,760
	SUB-TOTAL		56	242	298	244	130	374	3,998
381.	25 Church	10.00 TSF	4	3	7	4	3	7	93
	51 Developed Park	50.00 AC	0	0	0	2	2	4	130
	SUB-TOTAL		4	3	7	6	5	11	223
382.	34 Utilities	21.00 TSF	0	0	0	0	0	0	50
	51 Developed Park	50.00 AC	0	0	0	2	2	4	130
	SUB-TOTAL		0	0	0	2	2	4	180
383.	2 Single Family (1-5du/ac)	266.00 DU	51	149	200	170	98	268	2,633
	13 Commercial Shops	8.71 TSF	6	4	10	16	16	32	323
	SUB-TOTAL		57	153	210	186	114	300	2,956
384.	2 Single Family (1-5du/ac)	354.00 DU	67	198	265	227	131	358	3,505
	SUB-TOTAL		67	198	265	227	131	358	3,505
385.	2 Single Family (1-5du/ac)	75.00 DU	14	42	56	48	28	76	743
	SUB-TOTAL		14	42	56	48	28	76	743
387.	2 Single Family (1-5du/ac)	800.00 DU	152	448	600	512	296	808	7,920
	4 Condominium/Townhouse	700.00 DU	70	336	406	329	182	511	5,600
	SUB-TOTAL		222	784	1,006	841	478	1,319	13,520
388.	2 Single Family (1-5du/ac)	99.00 DU	19	55	74	63	37	100	980
	4 Condominium/Townhouse	400.00 DU	40	192	232	188	104	292	3,200
	20 Elementary/Middle School	1,600.00 STU	416	320	736	128	144	272	2,320
	SUB-TOTAL		475	567	1,042	379	285	664	6,500
389.	2 Single Family (1-5du/ac)	1,110.00 DU	211	622	833	710	411	1,121	10,989
	3 Single Family (6-10du/ac)	126.00 DU	24	71	95	81	47	128	1,247
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		430	843	1,273	851	526	1,377	13,324
390.	2 Single Family (1-5du/ac)	150.00 DU	29	84	113	96	56	152	1,485
	SUB-TOTAL		29	84	113	96	56	152	1,485
391.	13 Commercial Shops	16.33 TSF	12	8	20	29	29	58	605
	30 Industrial Park	70.00 TSF	39	7	46	9	36	45	420
	32 Manufacturing/Warehouse	376.36 TSF	211	64	275	102	177	279	1,919
	SUB-TOTAL		262	79	341	140	242	382	2,944

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
392.	2 Single Family (1-5du/ac)	323.00 DU	61	181	242	207	120	327	3,198
	6 Mobile Home	434.00 DU	35	139	174	152	91	243	2,995
	11 Commercial Center(10-30a)	81.68 TSF	60	38	98	194	211	405	4,416
	13 Commercial Shops	20.80 TSF	15	10	25	37	37	74	771
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	32 Manufacturing/Warehouse	500.00 TSF	280	85	365	135	235	370	2,550
	SUB-TOTAL		646	603	1,249	785	762	1,547	15,018
393.	3 Single Family (6-10du/ac)	162.00 DU	31	91	122	104	60	164	1,604
	4 Condominium/Townhouse	100.00 DU	10	48	58	47	26	73	800
	12 Commercial Center (<10ac)	52.27 TSF	57	36	93	174	188	362	4,446
	25 Church	73.00 TSF	28	24	52	26	22	48	679
	SUB-TOTAL		126	199	325	351	296	647	7,529
394.	2 Single Family (1-5du/ac)	325.00 DU	62	182	244	208	120	328	3,217
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	21 High School	2,500.00 STU	800	350	1,150	150	225	375	4,475
	51 Developed Park	3.20 AC	0	0	0	0	0	0	8
	SUB-TOTAL		1,057	682	1,739	418	413	831	8,788
395.	5 Apartment	185.00 DU	15	80	95	76	39	115	1,277
	11 Commercial Center(10-30a)	165.53 TSF	121	78	199	394	427	821	8,949
	20 Elementary/Middle School	1,200.00 STU	312	240	552	96	108	204	1,740
	SUB-TOTAL		448	398	846	566	574	1,140	11,966
396.	12 Commercial Center (<10ac)	110.00 TSF	120	76	196	365	396	761	9,357
	SUB-TOTAL		120	76	196	365	396	761	9,357
397.	3 Single Family (6-10du/ac)	49.00 DU	9	27	36	31	18	49	485
	4 Condominium/Townhouse	512.00 DU	51	246	297	241	133	374	4,096
	5 Apartment	67.00 DU	5	29	34	27	14	41	462
	6 Mobile Home	500.00 DU	40	160	200	175	105	280	3,450
	11 Commercial Center(10-30a)	310.98 TSF	227	146	373	740	802	1,542	16,812
	12 Commercial Center (<10ac)	74.00 TSF	81	51	132	246	266	512	6,294
	20 Elementary/Middle School	600.00 STU	156	120	276	48	54	102	870
	25 Church	23.00 TSF	9	8	17	8	7	15	214
	SUB-TOTAL		578	787	1,365	1,516	1,399	2,915	32,683
398.	2 Single Family (1-5du/ac)	1,120.00 DU	213	627	840	717	414	1,131	11,088
	4 Condominium/Townhouse	120.00 DU	12	58	70	56	31	87	960
	12 Commercial Center (<10ac)	250.00 TSF	273	173	446	830	900	1,730	21,265
	13 Commercial Shops	2.68 TSF	2	1	3	5	5	10	99
	15 Sit-Down Restaurant	8.45 TSF	41	38	79	55	37	92	1,101
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	24 Library	17.00 TSF	13	5	18	58	63	121	1,445
	SUB-TOTAL		749	1,052	1,801	1,781	1,518	3,299	37,046
399.	2 Single Family (1-5du/ac)	800.00 DU	152	448	600	512	296	808	7,920
	3 Single Family (6-10du/ac)	80.00 DU	15	45	60	51	30	81	792
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	25 Church	15.00 TSF	6	5	11	5	5	10	140
	SUB-TOTAL		368	648	1,016	628	399	1,027	9,940
400.	2 Single Family (1-5du/ac)	12.00 DU	2	7	9	8	4	12	119
	SUB-TOTAL		2	7	9	8	4	12	119

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
401.	2 Single Family (1-5du/ac)	835.00 DU	159	468	627	534	309	843	8,267
	4 Condominium/Townhouse	482.00 DU	48	231	279	227	125	352	3,856
	SUB-TOTAL		207	699	906	761	434	1,195	12,123
402.	2 Single Family (1-5du/ac)	1,129.00 DU	215	632	847	723	418	1,141	11,177
	11 Commercial Center(10-30a)	150.00 TSF	110	71	181	357	387	744	8,109
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	51 Developed Park	361.00 AC	0	0	0	11	14	25	939
	SUB-TOTAL		520	853	1,373	1,151	887	2,038	21,313
403.	2 Single Family (1-5du/ac)	111.00 DU	21	62	83	71	41	112	1,099
	5 Apartment	300.00 DU	24	129	153	123	63	186	2,070
	12 Commercial Center (<10ac)	46.00 TSF	50	32	82	153	166	319	3,913
	SUB-TOTAL		95	223	318	347	270	617	7,082
404.	2 Single Family (1-5du/ac)	177.00 DU	34	99	133	113	65	178	1,752
	SUB-TOTAL		34	99	133	113	65	178	1,752
405.	2 Single Family (1-5du/ac)	296.00 DU	56	166	222	189	110	299	2,930
	SUB-TOTAL		56	166	222	189	110	299	2,930
406.	2 Single Family (1-5du/ac)	353.00 DU	67	198	265	226	131	357	3,495
	SUB-TOTAL		67	198	265	226	131	357	3,495
407.	2 Single Family (1-5du/ac)	47.00 DU	9	26	35	30	17	47	465
	SUB-TOTAL		9	26	35	30	17	47	465
408.	2 Single Family (1-5du/ac)	380.00 DU	72	213	285	243	141	384	3,762
	SUB-TOTAL		72	213	285	243	141	384	3,762
409.	2 Single Family (1-5du/ac)	77.00 DU	15	43	58	49	28	77	762
	SUB-TOTAL		15	43	58	49	28	77	762
410.	2 Single Family (1-5du/ac)	148.00 DU	28	83	111	95	55	150	1,465
	6 Mobile Home	101.00 DU	8	32	40	35	21	56	697
	30 Industrial Park	44.00 TSF	24	4	28	6	23	29	264
	SUB-TOTAL		60	119	179	136	99	235	2,426
411.	2 Single Family (1-5du/ac)	675.00 DU	128	378	506	432	250	682	6,682
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		323	528	851	492	318	810	7,770
412.	1 Single Family (<1du/ac)	120.00 DU	35	80	115	101	43	144	1,188
	11 Commercial Center(10-30a)	40.00 TSF	29	19	48	95	103	198	2,162
	SUB-TOTAL		64	99	163	196	146	342	3,350
413.	2 Single Family (1-5du/ac)	106.00 DU	20	59	79	68	39	107	1,049
	5 Apartment	514.00 DU	41	221	262	211	108	319	3,547
	6 Mobile Home	40.00 DU	3	13	16	14	8	22	276
	12 Commercial Center (<10ac)	44.60 TSF	49	31	80	148	161	309	3,794
	30 Industrial Park	48.54 TSF	27	5	32	6	25	31	291
	32 Manufacturing/Warehouse	45.21 TSF	25	8	33	12	21	33	231
	40 Commercial Office	36.59 TSF	57	7	64	8	47	55	423
	SUB-TOTAL		222	344	566	467	409	876	9,611

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
414.	2 Single Family (1-5du/ac)	40.00 DU	8	22	30	26	15	41	396
	4 Condominium/Townhouse	1,435.00 DU	144	689	833	674	373	1,047	11,480
	5 Apartment	200.00 DU	16	86	102	82	42	124	1,380
	6 Mobile Home	250.00 DU	20	80	100	88	53	141	1,725
	13 Commercial Shops	175.00 TSF	126	84	210	315	315	630	6,486
	SUB-TOTAL		314	961	1,275	1,185	798	1,983	21,467
415.	2 Single Family (1-5du/ac)	75.00 DU	14	42	56	48	28	76	743
	11 Commercial Center(10-30a)	63.71 TSF	47	30	77	152	164	316	3,444
	32 Manufacturing/Warehouse	27.80 TSF	16	5	21	8	13	21	142
	SUB-TOTAL		77	77	154	208	205	413	4,329
416.	2 Single Family (1-5du/ac)	276.00 DU	52	155	207	177	102	279	2,732
	4 Condominium/Townhouse	57.00 DU	6	27	33	27	15	42	456
	6 Mobile Home	220.00 DU	18	70	88	77	46	123	1,518
	13 Commercial Shops	15.00 TSF	11	7	18	27	27	54	556
	25 Church	20.00 TSF	8	7	15	7	6	13	186
	40 Commercial Office	100.00 TSF	155	19	174	21	129	150	1,156
	51 Developed Park	15.00 AC	0	0	0	0	1	1	39
	SUB-TOTAL		250	285	535	336	326	662	6,643
417.	2 Single Family (1-5du/ac)	950.00 DU	181	532	713	608	352	960	9,405
	4 Condominium/Townhouse	255.00 DU	26	122	148	120	66	186	2,040
	12 Commercial Center (<10ac)	10.00 TSF	11	7	18	33	36	69	851
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	22 College	10,000.00 STU	1,300	100	1,400	700	1,400	2,100	15,400
	SUB-TOTAL		1,713	911	2,624	1,521	1,922	3,443	28,784
418.	4 Condominium/Townhouse	474.00 DU	47	228	275	223	123	346	3,792
	5 Apartment	755.00 DU	60	325	385	310	159	469	5,210
	6 Mobile Home	90.00 DU	7	29	36	32	19	51	621
	11 Commercial Center(10-30a)	228.00 TSF	166	107	273	543	588	1,131	12,326
	SUB-TOTAL		280	689	969	1,108	889	1,997	21,949
419.	4 Condominium/Townhouse	1,834.00 DU	183	880	1,063	862	477	1,339	14,672
	SUB-TOTAL		183	880	1,063	862	477	1,339	14,672
420.	4 Condominium/Townhouse	56.00 DU	6	27	33	26	15	41	448
	SUB-TOTAL		6	27	33	26	15	41	448
421.	3 Single Family (6-10du/ac)	250.00 DU	48	140	188	160	93	253	2,475
	4 Condominium/Townhouse	1,500.00 DU	150	720	870	705	390	1,095	12,000
	11 Commercial Center(10-30a)	400.00 TSF	292	188	480	952	1,032	1,984	21,624
	14 Hotel	200.00 ROOM	68	44	112	64	58	122	1,646
	40 Commercial Office	600.00 TSF	930	114	1,044	126	774	900	6,936
	51 Developed Park	12.00 AC	0	0	0	0	0	0	31
	SUB-TOTAL		1,488	1,206	2,694	2,007	2,347	4,354	44,712
422.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	6 Mobile Home	80.00 DU	6	26	32	28	17	45	552
	12 Commercial Center (<10ac)	10.00 TSF	11	7	18	33	36	69	851
	20 Elementary/Middle School	1,050.00 STU	273	210	483	84	95	179	1,523
	SUB-TOTAL		294	254	548	158	155	313	3,124

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
423.	2 Single Family (1-5du/ac)	353.00 DU	67	198	265	226	131	357	3,495
	3 Single Family (6-10du/ac)	21.00 DU	4	12	16	13	8	21	208
	6 Mobile Home	90.00 DU	7	29	36	32	19	51	621
	12 Commercial Center (<10ac)	98.01 TSF	107	68	175	325	353	678	8,337
	40 Commercial Office	10.89 TSF	17	2	19	2	14	16	126
	SUB-TOTAL		202	309	511	598	525	1,123	12,787
424.	2 Single Family (1-5du/ac)	350.00 DU	67	196	263	224	130	354	3,465
	SUB-TOTAL		67	196	263	224	130	354	3,465
425.	2 Single Family (1-5du/ac)	114.00 DU	22	64	86	73	42	115	1,129
	4 Condominium/Townhouse	80.00 DU	8	38	46	38	21	59	640
	51 Developed Park	31.00 AC	0	0	0	1	1	2	81
	SUB-TOTAL		30	102	132	112	64	176	1,850
426.	2 Single Family (1-5du/ac)	560.00 DU	106	314	420	358	207	565	5,544
	3 Single Family (6-10du/ac)	70.00 DU	13	39	52	45	26	71	693
	32 Manufacturing/Warehouse	39.60 TSF	22	7	29	11	19	30	202
	SUB-TOTAL		141	360	501	414	252	666	6,439
427.	2 Single Family (1-5du/ac)	249.00 DU	47	139	186	159	92	251	2,465
	SUB-TOTAL		47	139	186	159	92	251	2,465
428.	2 Single Family (1-5du/ac)	1,313.00 DU	249	735	984	840	486	1,326	12,999
	11 Commercial Center(10-30a)	47.40 TSF	35	22	57	113	122	235	2,562
	12 Commercial Center (<10ac)	39.20 TSF	43	27	70	130	141	271	3,334
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		522	934	1,456	1,143	817	1,960	19,983
429.	2 Single Family (1-5du/ac)	55.00 DU	10	31	41	35	20	55	545
	SUB-TOTAL		10	31	41	35	20	55	545
430.	2 Single Family (1-5du/ac)	2.00 DU	0	1	1	1	1	2	20
	SUB-TOTAL		0	1	1	1	1	2	20
431.	2 Single Family (1-5du/ac)	3.00 DU	1	2	3	2	1	3	30
	SUB-TOTAL		1	2	3	2	1	3	30
433.	2 Single Family (1-5du/ac)	155.00 DU	29	87	116	99	57	156	1,535
	SUB-TOTAL		29	87	116	99	57	156	1,535
434.	2 Single Family (1-5du/ac)	25.00 DU	5	14	19	16	9	25	247
	SUB-TOTAL		5	14	19	16	9	25	247
437.	31 Business Park	250.00 TSF	300	58	358	75	248	323	2,550
	59 Cemex	12.84 SG	46	48	94	26	29	55	1,284
	SUB-TOTAL		346	106	452	101	277	378	3,834
438.	2 Single Family (1-5du/ac)	10.00 DU	2	6	8	6	4	10	99
	31 Business Park	250.00 TSF	300	58	358	75	248	323	2,550
	SUB-TOTAL		302	64	366	81	252	333	2,649
439.	2 Single Family (1-5du/ac)	175.00 DU	33	98	131	112	65	177	1,732
	11 Commercial Center(10-30a)	41.65 TSF	30	20	50	99	107	206	2,252
	SUB-TOTAL		63	118	181	211	172	383	3,984

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
440.	30 Industrial Park	50.00 TSF	28	5	33	7	26	33	300
	SUB-TOTAL		28	5	33	7	26	33	300
441.	2 Single Family (1-5du/ac)	330.00 DU	63	185	248	211	122	333	3,267
	6 Mobile Home	160.00 DU	13	51	64	56	34	90	1,104
	13 Commercial Shops	30.00 TSF	22	14	36	54	54	108	1,112
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		293	400	693	381	278	659	6,571
442.	2 Single Family (1-5du/ac)	112.00 DU	21	63	84	72	41	113	1,109
	3 Single Family (6-10du/ac)	216.00 DU	41	121	162	138	80	218	2,138
	SUB-TOTAL		62	184	246	210	121	331	3,247
443.	2 Single Family (1-5du/ac)	763.00 DU	145	427	572	488	282	770	7,554
	13 Commercial Shops	30.00 TSF	22	14	36	54	54	108	1,112
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		362	591	953	602	404	1,006	9,754
444.	4 Condominium/Townhouse	440.00 DU	44	211	255	207	114	321	3,520
	11 Commercial Center(10-30a)	200.00 TSF	146	94	240	476	516	992	10,812
	25 Church	4.00 TSF	2	1	3	1	1	2	37
	SUB-TOTAL		192	306	498	684	631	1,315	14,369
445.	2 Single Family (1-5du/ac)	41.00 DU	8	23	31	26	15	41	406
	SUB-TOTAL		8	23	31	26	15	41	406
446.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	SUB-TOTAL		4	11	15	13	7	20	198
447.	2 Single Family (1-5du/ac)	300.00 DU	57	168	225	192	111	303	2,970
	50 Golf Course	150.00 AC	23	9	32	15	30	45	1,194
	SUB-TOTAL		80	177	257	207	141	348	4,164
448.	2 Single Family (1-5du/ac)	691.00 DU	131	387	518	442	256	698	6,841
	SUB-TOTAL		131	387	518	442	256	698	6,841
449.	2 Single Family (1-5du/ac)	20.00 DU	4	11	15	13	7	20	198
	SUB-TOTAL		4	11	15	13	7	20	198
450.	2 Single Family (1-5du/ac)	27.00 DU	5	15	20	17	10	27	267
	SUB-TOTAL		5	15	20	17	10	27	267
451.	2 Single Family (1-5du/ac)	140.00 DU	27	78	105	90	52	142	1,386
	30 Industrial Park	47.00 TSF	26	5	31	6	24	30	282
	SUB-TOTAL		53	83	136	96	76	172	1,668
452.	2 Single Family (1-5du/ac)	38.00 DU	7	21	28	24	14	38	376
	SUB-TOTAL		7	21	28	24	14	38	376
453.	2 Single Family (1-5du/ac)	1,020.00 DU	194	571	765	653	377	1,030	10,098
	13 Commercial Shops	16.00 TSF	12	8	20	29	29	58	593
	20 Elementary/Middle School	750.00 STU	195	150	345	60	68	128	1,088
	SUB-TOTAL		401	729	1,130	742	474	1,216	11,779

OVOV Buildout Land Use and Trip Generation by TAZ									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	In	Out	Total	In	Out	Total	ADT
454.	2 Single Family (1-5du/ac)	650.00 DU	124	364	488	416	241	657	6,435
	11 Commercial Center(10-30a)	34.14 TSF	25	16	41	81	88	169	1,846
	13 Commercial Shops	6.14 TSF	4	3	7	11	11	22	228
	52 Undeveloped Park	745.00 AC	0	0	0	0	0	0	373
	57 Agua Dulce Airport	51.09 SG	153	102	255	204	307	511	5,109
	SUB-TOTAL		306	485	791	712	647	1,359	13,991
455.	2 Single Family (1-5du/ac)	100.00 DU	19	56	75	64	37	101	990
	SUB-TOTAL		19	56	75	64	37	101	990

OVOV Buildout - Land Use and Trip Generation Summary									
			AM Peak Hour			PM Peak Hour			
Land Use Type	Units		In	Out	Total	In	Out	Total	ADT
1. Single Family (<1du/ac)	448.00	DU	129	299	428	376	164	540	4,436
2. Single Family (1-5du/ac)	64,889.00	DU	12,331	36,339	48,670	41,526	24,005	65,531	642,412
3. Single Family (6-10du/ac)	12,638.00	DU	2,405	7,077	9,482	8,085	4,678	12,763	125,116
4. Condominium/Townhouse	50,296.00	DU	5,033	24,142	29,175	23,638	13,082	36,720	402,368
5. Apartment	15,031.00	DU	1,203	6,471	7,674	6,166	3,160	9,326	103,716
6. Mobile Home	3,420.00	DU	272	1,095	1,367	1,199	719	1,918	23,599
7. Senior (Active)	2,352.00	DU	189	281	470	376	237	613	8,725
10. Commercial Center (>30ac)	9,728.62	TSF	4,572	2,918	7,490	15,955	17,317	33,272	389,730
11. Commercial Center(10-30a)	8,933.07	TSF	6,522	4,200	10,722	21,263	23,045	44,308	482,923
12. Commercial Center (<10ac)	2,465.12	TSF	2,690	1,705	4,395	8,184	8,877	17,061	209,685
13. Commercial Shops	2,104.11	TSF	1,513	1,010	2,523	3,790	3,790	7,580	77,980
14. Hotel	2,527.00	ROOM	859	555	1,414	810	733	1,543	20,798
15. Sit-Down Restaurant	289.72	TSF	1,397	1,288	2,685	1,890	1,258	3,148	37,763
16. Fast Food Restaurant	64.42	TSF	1,638	1,573	3,211	1,123	1,033	2,156	31,961
17. Movie Theater	3,600.00	SEAT	0	0	0	180	72	252	6,336
18. Health Club	138.00	TSF	132	88	220	298	199	497	5,520
19. Car Dealership	530.00	TSF	854	319	1,173	593	889	1,482	19,876
20. Elementary/Middle School	51,667.00	STU	13,434	10,334	23,768	4,134	4,674	8,808	74,942
21. High School	18,500.00	STU	5,920	2,590	8,510	1,110	1,665	2,775	33,115
22. College	36,062.00	STU	4,688	361	5,049	2,524	5,049	7,573	55,535
23. Hospital	365.16	TSF	260	95	355	80	255	335	6,134
24. Library	91.40	TSF	69	27	96	311	338	649	7,767
25. Church	997.46	TSF	392	333	725	356	301	657	9,278
26. Day Care	540.00	STU	233	205	438	216	249	465	2,441
30. Industrial Park	36,687.27	TSF	20,179	3,670	23,849	4,769	19,077	23,846	220,124
31. Business Park	7,797.08	TSF	9,358	1,795	11,153	2,337	7,722	10,059	79,530
32. Manufacturing/Warehouse	3,268.69	TSF	1,830	557	2,387	884	1,536	2,420	16,673
34. Utilities	1,032.44	TSF	0	0	0	0	0	0	2,457
35. Regional Post Office	780.00	TSF	156	117	273	117	117	234	3,900
40. Commercial Office	8,483.89	TSF	13,154	1,615	14,769	1,784	10,947	12,731	98,072
41. High-Rise Office	300.00	TSF	411	57	468	75	372	447	3,264
42. Medical Office	730.56	TSF	1,417	358	1,775	724	1,951	2,675	24,985
43. Post Office	50.00	TSF	209	193	402	275	265	540	5,410
50. Golf Course	1,338.00	AC	202	80	282	134	268	402	10,651
51. Developed Park	1,040.20	AC	0	0	0	30	39	69	2,705
52. Undeveloped Park	890.00	AC	0	0	0	0	0	0	446
53. Wayside Honor Ranch	30.00	SG	90	60	150	120	180	300	3,000
54. Six Flags Magic Mtn	240.00	SG	720	480	1,200	960	1,440	2,400	24,000
55. Travel Village	26.20	SG	79	52	131	105	157	262	2,620
57. Agua Dulce Airport	51.09	SG	153	102	255	204	307	511	5,109
58. Landfill	20.00	SG	60	40	100	80	120	200	2,000
59. Cemex	12.84	SG	46	48	94	26	29	55	1,284
TOTAL			**114,799**	**112,529**	**227,328**	**156,807**	**160,316**	**317,123**	**3,288,386**

Appendix D

TRAFFIC MODEL DATA

SCVCTM 5.0 Traffic Analysis Zones

DRAFT

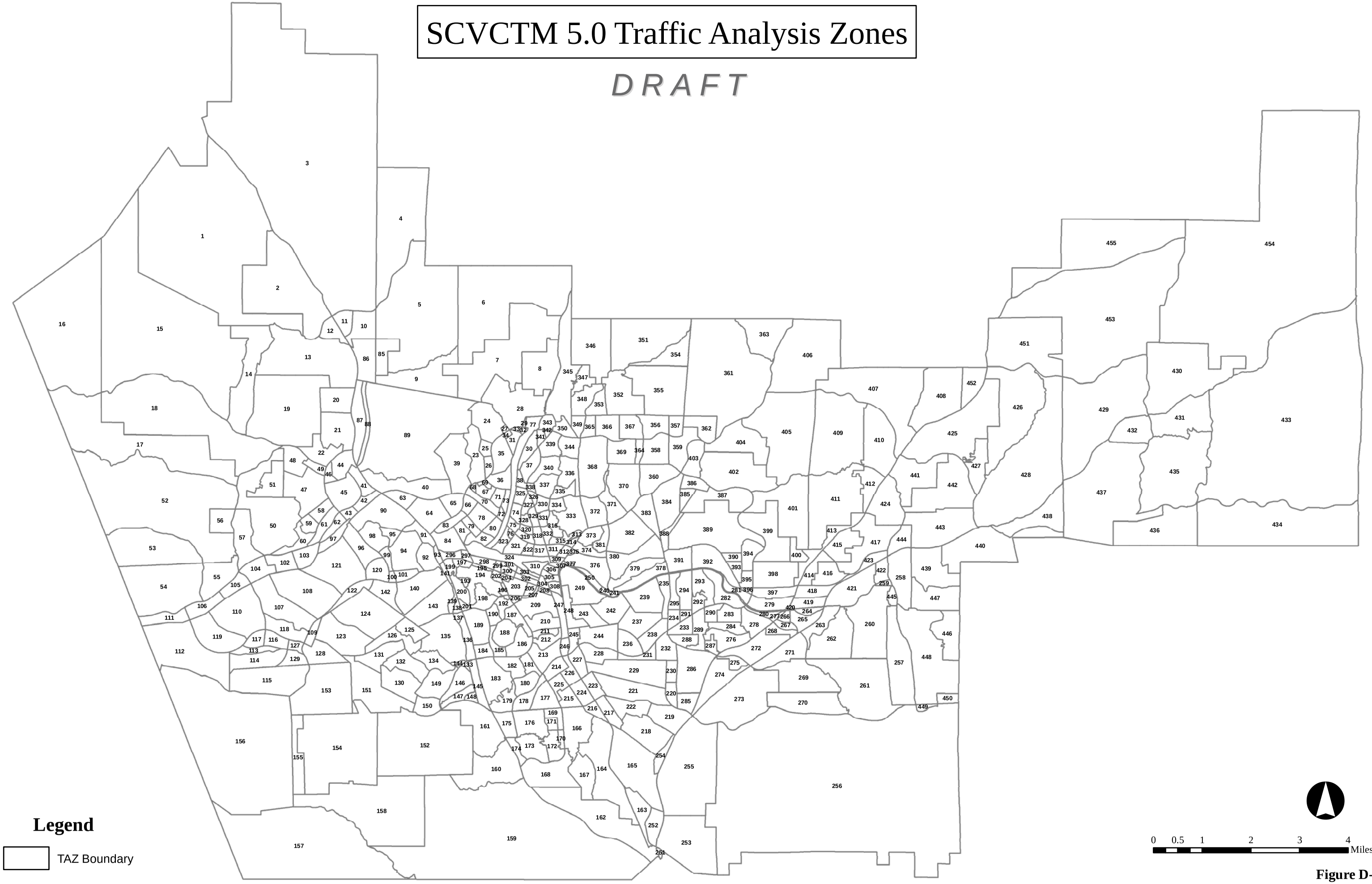


Figure D-1

Peak Hour and ADT Trip Rates									
			AM Peak Hour			PM Peak Hour			
Zone	Land Use Type	Units	Inbound	Outbound	Total	Inbound	Outbound	Total	ADT
1.	Single Family (<1du/ac)	DU	.29	.67	.96	.84	.36	1.20	9.90
2.	Single Family (1-5du/ac)	DU	.19	.56	.75	.64	.37	1.01	9.90
3.	Single Family (6-10du/ac)	DU	.19	.56	.75	.64	.37	1.01	9.90
4.	Condominium/Townhouse	DU	.10	.48	.58	.47	.26	.73	8.00
5.	Apartment	DU	.08	.43	.51	.41	.21	.62	6.90
6.	Mobile Home	DU	.08	.32	.40	.35	.21	.56	6.90
7.	Senior (Active)	DU	.08	.12	.20	.16	.10	.26	3.71
10.	Commercial Center (>30ac)	TSF	.47	.30	.77	1.64	1.78	3.42	40.06
11.	Commercial Center(10-30a)	TSF	.73	.47	1.20	2.38	2.58	4.96	54.06
12.	Commercial Center (<10ac)	TSF	1.09	.69	1.78	3.32	3.60	6.92	85.06
13.	Commercial Shops	TSF	.72	.48	1.20	1.80	1.80	3.60	37.06
14.	Hotel	ROOM	.34	.22	.56	.32	.29	.61	8.23
15.	Sit-Down Restaurant	TSF	4.82	4.45	9.27	6.52	4.34	10.86	130.34
16.	Fast Food Restaurant	TSF	25.43	24.43	49.86	17.41	16.07	33.48	496.12
17.	Movie Theater	SEAT	.00	.00	.00	.05	.02	.07	1.76
18.	Health Club	TSF	.96	.64	1.60	2.16	1.44	3.60	40.00
19.	Car Dealership	TSF	1.61	.60	2.21	1.12	1.68	2.80	37.50
20.	Elementary/Middle School	STU	.26	.20	.46	.08	.09	.17	1.45
21.	High School	STU	.32	.14	.46	.06	.09	.15	1.79
22.	College	STU	.13	.01	.14	.07	.14	.21	1.54
23.	Hospital	TSF	.71	.26	.97	.22	.70	.92	16.80
24.	Library	TSF	.76	.30	1.06	3.40	3.69	7.09	84.98
25.	Church	TSF	.39	.33	.72	.36	.30	.66	9.30
26.	Day Care	STU	.43	.38	.81	.40	.46	.86	4.52
30.	Industrial Park	TSF	.55	.10	.65	.13	.52	.65	6.00
31.	Business Park	TSF	1.20	.23	1.43	.30	.99	1.29	10.20
32.	Manufacturing/Warehouse	TSF	.56	.17	.73	.27	.47	.74	5.10
33.	Science/Research	TSF	1.03	.21	1.24	.16	.92	1.08	10.20
34.	Utilities	TSF	.00	.00	.00	.00	.00	.00	2.38
35.	Regional Post Office	TSF	.20	.15	.35	.15	.15	.30	5.00
40.	Commercial Office	TSF	1.55	.19	1.74	.21	1.29	1.50	11.56
41.	High-Rise Office	TSF	1.37	.19	1.56	.25	1.24	1.49	10.88
42.	Medical Office	TSF	1.94	.49	2.43	.99	2.67	3.66	34.20
43.	Post Office	TSF	4.17	3.85	8.02	5.50	5.29	10.79	108.19
50.	Golf Course	AC	.15	.06	.21	.10	.20	.30	7.96
51.	Developed Park	AC	.00	.00	.00	.03	.04	.07	2.60
52.	Undeveloped Park	AC	.00	.00	.00	.00	.00	.00	.50
53.	Wayside Honor Ranch	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
54.	Six Flags Magic Mtn	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
55.	Travel Village	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
56.	CHP Office	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
57.	Agua Dulce Airport	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
58.	Landfill	SG	3.00	2.00	5.00	4.00	6.00	10.00	100.00
59.	Cemex	SG	3.60	3.75	7.35	2.00	2.25	4.25	100.00
Peak Hour Reduction Factors			12.0%	12.9%	--	12.5%	12.2%	--	--
Peak Period to Peak Hour Factors				.60			.35		--

ADT Trip Rates and P&A Splitting Factors

	Land Use Type	Units	ADT	Productions						Attractions					
				H-W	H-S	H-O	O-W	O-O	Total	H-W	H-S	H-O	O-W	O-O	Total
1.	Single Family (<1du/ac)	DU	9.90	.220	.100	.320	.020	.110	.770	.000	.000	.100	.020	.110	.230
2.	Single Family (1-5du/ac)	DU	9.90	.220	.100	.320	.020	.110	.770	.000	.000	.100	.020	.110	.230
3.	Single Family (6-10du/ac)	DU	9.90	.220	.100	.320	.020	.110	.770	.000	.000	.100	.020	.110	.230
4.	Condominium/Townhouse	DU	8.00	.200	.140	.370	.020	.090	.820	.000	.000	.070	.020	.090	.180
5.	Apartment	DU	6.90	.200	.140	.370	.020	.090	.820	.000	.000	.070	.020	.090	.180
6.	Mobile Home	DU	6.90	.200	.140	.370	.020	.090	.820	.000	.000	.070	.020	.090	.180
7.	Senior (Active)	DU	3.71	.050	.220	.410	.020	.100	.800	.000	.000	.080	.020	.100	.200
10.	Commercial Center (>30ac)	TSF	40.06	.000	.000	.000	.030	.300	.330	.090	.140	.110	.030	.300	.670
11.	Commercial Center(10-30a)	TSF	54.06	.000	.000	.000	.030	.300	.330	.090	.140	.110	.030	.300	.670
12.	Commercial Center (<10ac)	TSF	85.06	.000	.000	.000	.030	.340	.370	.060	.110	.090	.030	.340	.630
13.	Commercial Shops	TSF	37.06	.000	.000	.000	.030	.340	.370	.060	.110	.090	.030	.340	.630
14.	Hotel	ROOM	8.23	.000	.000	.000	.060	.180	.240	.120	.000	.400	.060	.180	.760
15.	Sit-Down Restaurant	TSF	130.34	.000	.000	.000	.060	.240	.300	.040	.000	.360	.060	.240	.700
16.	Fast Food Restaurant	TSF	496.12	.000	.000	.000	.070	.310	.380	.010	.000	.230	.070	.310	.620
17.	Movie Theater	SEAT	1.76	.000	.000	.000	.000	.310	.310	.080	.000	.300	.000	.310	.690
18.	Health Club	TSF	40.00	.000	.000	.000	.010	.250	.260	.060	.000	.420	.010	.250	.740
19.	Car Dealership	TSF	37.50	.000	.000	.000	.030	.250	.280	.080	.210	.150	.030	.250	.720
20.	Elementary/Middle School	STU	1.45	.000	.000	.000	.000	.030	.030	.100	.000	.840	.000	.030	.970
21.	High School	STU	1.79	.000	.000	.000	.000	.030	.030	.100	.000	.840	.000	.030	.970
22.	College	STU	1.54	.000	.000	.000	.000	.230	.230	.060	.000	.480	.000	.230	.770
23.	Hospital	TSF	16.80	.000	.000	.000	.000	.050	.050	.320	.000	.580	.000	.050	.950
24.	Library	TSF	84.98	.000	.000	.000	.090	.170	.260	.160	.000	.320	.090	.170	.740
25.	Church	TSF	9.30	.000	.000	.000	.050	.100	.150	.350	.000	.350	.050	.100	.850
26.	Day Care	STU	4.52	.000	.000	.000	.000	.030	.030	.100	.000	.840	.000	.030	.970
30.	Industrial Park	TSF	6.00	.000	.000	.000	.070	.210	.280	.390	.000	.050	.070	.210	.720
31.	Business Park	TSF	10.20	.000	.000	.000	.070	.210	.280	.390	.000	.050	.070	.210	.720
32.	Manufacturing/Warehouse	TSF	5.10	.000	.000	.000	.070	.210	.280	.390	.000	.050	.070	.210	.720
33.	Science/Research	TSF	10.20	.000	.000	.000	.070	.210	.280	.390	.000	.050	.070	.210	.720
34.	Utilities	TSF	2.38	.000	.000	.000	.090	.170	.260	.190	.000	.290	.090	.170	.740
35.	Regional Post Office	TSF	5.00	.000	.000	.000	.070	.210	.280	.390	.000	.050	.070	.210	.720
40.	Commercial Office	TSF	11.56	.000	.000	.000	.110	.180	.290	.270	.000	.150	.110	.180	.710
41.	High-Rise Office	TSF	10.88	.000	.000	.000	.110	.180	.290	.270	.000	.150	.110	.180	.710
42.	Medical Office	TSF	34.20	.000	.000	.000	.030	.260	.290	.140	.000	.280	.030	.260	.710
43.	Post Office	TSF	108.19	.000	.000	.000	.090	.220	.310	.150	.000	.230	.090	.220	.690
50.	Golf Course	AC	7.96	.000	.000	.000	.000	.270	.270	.080	.000	.380	.000	.270	.730
51.	Developed Park	AC	2.60	.000	.000	.000	.000	.120	.120	.010	.000	.750	.000	.120	.880
52.	Undeveloped Park	AC	.50	.000	.000	.000	.000	.120	.120	.010	.000	.750	.000	.120	.880
53.	Wayside Honor Ranch	SG	100.00	.000	.000	.000	.000	.170	.170	.330	.000	.330	.000	.170	.830
54.	Six Flags Magic Mtn	SG	100.00	.000	.000	.000	.010	.180	.190	.150	.000	.470	.010	.180	.810
55.	Travel Village	SG	100.00	.000	.000	.000	.010	.250	.260	.060	.000	.420	.010	.250	.740
56.	CHP Office	SG	100.00	.000	.000	.000	.110	.180	.290	.270	.000	.150	.110	.180	.710
57.	Agua Dulce Airport	SG	100.00	.000	.000	.000	.040	.180	.220	.160	.000	.400	.040	.180	.780
58.	Landfill	SG	100.00	.000	.000	.000	.110	.180	.290	.270	.000	.150	.110	.180	.710
59.	Cemex	SG	100.00	.000	.000	.000	.110	.180	.290	.270	.000	.150	.110	.180	.710
Peak Period to Peak Hour Factors		AM	.60	PM	.35										

Network Speed and Capacity Table							
	Speed by Link Classification					One Hour	Off Peak
Facility Type	**1**	**2**	**3**	**4**	**5**	**Capacity**	**Capacity**
1 - Freeway	65	60	55	50	65	2,200	22,500
2 - Major Hwy (6+ Lanes)	40	35	30	45	50	1,000	9,000
3 - Secondary Hwy (4 Lanes)	35	30	25	40	45	850	8,000
4 - Limited Secondary Hwy (2 Lanes)	30	25	20	35	40	750	7,000
5 - Local/Industrial Collector (2-4 Lanes)	25	20	15	30	35	750	7,000
6 - Centroid Connector	15	15	15	15	15	unrestricted	unrestricted
7 - Expressway	45	40	35	50	55	1,400	14,000
8 - Freeway Ramp	30	30	30	30	30	1,500	12,000

Note: Capacities are per lane and are for one direction

Appendix E

FREEWAY D/C CALCULATIONS

Table E-1: Freeway D/C Calculations - Existing Lanes

			Existing Conditions				Current GP Buildout				Proposed OVOV Buildout			
			AM		PM		AM		PM		AM		PM	
Segment	**Lanes**	**Capacity**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**
Northbound														
I-5 s/o Parker	4M	8,000	1,860	0.23	3,570	0.45	5,140	0.64	8,760	**1.10**	4,090	0.51	8,770	**1.10**
I-5 s/o Valencia	4M	8,000	5,430	0.68	6,050	0.76	8,540	**1.07**	9,730	**1.22**	7,860	0.98	9,190	**1.15**
I-5 s/o Calgrove	4M	8,000	5,600	0.70	6,970	0.87	8,710	**1.09**	10,530	**1.32**	7,540	0.94	8,700	**1.09**
SR-14 s/o Aqua Dulce	3M+1H	8,000	1,970	0.25	5,130	0.64	4,260	0.53	11,300	**1.41**	2,700	0.34	10,590	**1.32**
SR-14 s/o Sierra Hwy	4M+1H	10,000	2,510	0.25	7,500	0.75	5,020	0.50	15,430	**1.54**	3,900	0.39	13,580	**1.36**
SR-14 n/o I-5	5M+1H	12,000	2,950	0.25	8,430	0.70	6,320	0.53	16,250	**1.35**	5,100	0.43	13,390	**1.12**
Southbound														
I-5 s/o Parker	4M	8,000	2,190	0.27	3,070	0.38	6,950	0.87	7,980	1.00	6,770	0.85	7,640	0.96
I-5 s/o Valencia	4M	8,000	5,310	0.66	6,420	0.80	9,970	**1.25**	10,320	**1.29**	8,200	**1.03**	10,300	**1.29**
I-5 s/o Calgrove	4M	6,400	6,610	**1.03**	6,410	**1.00**	10,430	**1.63**	10,800	**1.69**	7,380	**1.15**	10,480	**1.64**
SR-14 s/o Aqua Dulce	3M+1H	8,000	5,580	0.70	2,810	0.35	11,970	**1.50**	5,190	0.65	11,780	**1.47**	3,350	0.42
SR-14 s/o Sierra Hwy	4M+1H	10,000	7,090	0.71	3,380	0.34	15,330	**1.53**	7,100	0.71	14,350	**1.44**	5,150	0.52
SR-14 n/o I-5	5M+1H	12,000	8,350	0.70	4,100	0.34	16,170	**1.35**	8,490	0.71	13,920	**1.16**	6,820	0.57

Capacities:

Mix-Flow Lane (M)	2,000 vphpl (1,600 vphpl for extended uphill grades)
HOV Lane (H)	2,000 vphpl
Truck Lane (T)	1,200 vphpl
Auxiliary Lane (A)	1,000 vphpl

Abbreviations:

Vol = Volume
D/C = Demand/Capacity Ratio
HOV = High Occupancy Vehicle

Table E-2: Freeway D/C Calculations - Future Lanes

			Existing Conditions				Current GP Buildout				Proposed OVOV Buildout			
			AM		PM		AM		PM		AM		PM	
Segment	**Lanes**	**Capacity**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**	**Vol**	**D/C**
Northbound														
I-5 s/o Parker	4M+1H	10,000	1,860	0.19	3,570	0.36	5,140	0.51	8,760	0.88	4,090	0.41	8,770	0.88
I-5 s/o Valencia	4M+1H	10,000	5,430	0.54	6,050	0.61	8,540	0.85	9,730	0.97	7,860	0.79	9,190	0.92
I-5 s/o Calgrove	4M+1H+1T	11,200	5,600	0.50	6,970	0.62	8,710	0.78	10,530	0.94	7,540	0.67	8,700	0.78
SR-14 s/o Aqua Dulce	3M+2H	10,000	1,970	0.20	5,130	0.51	4,260	0.43	11,300	**1.13**	2,700	0.27	10,590	**1.06**
SR-14 s/o Sierra Hwy	4M+2H	12,000	2,510	0.21	7,500	0.63	5,020	0.42	15,430	**1.29**	3,900	0.33	13,580	**1.13**
SR-14 n/o I-5	5M+2H	14,000	2,950	0.21	8,430	0.60	6,320	0.45	16,250	**1.16**	5,100	0.36	13,390	0.96
Southbound														
I-5 s/o Parker	4M+1H	10,000	2,190	0.22	3,070	0.31	6,950	0.70	7,980	0.80	6,770	0.68	7,640	0.76
I-5 s/o Valencia	4M+1H	11,000	5,310	0.48	6,420	0.58	9,970	0.91	10,320	0.94	8,200	0.75	10,300	0.94
I-5 s/o Calgrove	4M+1H+2T	12,400	6,610	0.53	6,410	0.52	10,430	0.84	10,800	0.87	7,380	0.60	10,480	0.85
SR-14 s/o Aqua Dulce	3M+2H	10,000	5,580	0.56	2,810	0.28	11,970	**1.20**	5,190	0.52	11,780	**1.18**	3,350	0.34
SR-14 s/o Sierra Hwy	4M+2H	12,000	7,090	0.59	3,380	0.28	15,330	**1.28**	7,100	0.59	14,350	**1.20**	5,150	0.43
SR-14 n/o I-5	5M+2H	14,000	8,350	0.60	4,100	0.29	16,170	**1.16**	8,490	0.61	13,920	0.99	6,820	0.49

Capacities:

Mix-Flow Lane (M)	2,000 vphpl (1,600 vphpl for extended uphill grades)
HOV Lane (H)	2,000 vphpl
Truck Lane (T)	1,200 vphpl
Auxiliary Lane (A)	1,000 vphpl

Abbreviations:

Vol = Volume
D/C = Demand/Capacity Ratio
HOV = High Occupancy Vehicle

APPENDIX 3.3

Air Quality Emission Calculation

Existing Operational Emissions

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Comm'l.urb924

Project Name: 112-23 OVOV Existing Commercial 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	57.33	59.72	57.44	0.00	0.13	0.13	71,575.84

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	4,089.43	6,218.14	54,530.90	57.76	9,513.24	1,850.80	5,638,883.05

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	4,146.76	6,277.86	54,588.34	57.76	9,513.37	1,850.93	5,710,458.89

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.33	59.64	50.10	0.00	0.11	0.11	71,564.80
Hearth - No Summer Emissions							
Landscape	0.64	0.08	7.34	0.00	0.02	0.02	11.04
Consumer Products	0.00						
Architectural Coatings	52.36						
TOTALS (lbs/day, unmitigated)	57.33	59.72	57.44	0.00	0.13	0.13	71,575.84

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	777.11	1,175.79	10,311.24	10.92	1,798.86	349.97	1,066,255.74
Comm'l Ctr 10-30 ac	1,989.47	3,026.35	26,540.01	28.11	4,630.06	900.78	2,744,425.53
Comm'l Ctr <10 ac	925.08	1,415.18	12,410.64	13.15	2,165.11	421.22	1,283,348.62
Comm'l Shops	397.77	600.82	5,269.01	5.58	919.21	178.83	544,853.16
TOTALS (lbs/day, unmitigated)	4,089.43	6,218.14	54,530.90	57.76	9,513.24	1,850.80	5,638,883.05

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	2,221.66	88,999.70	1,041,296.46
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	4,237.43	229,075.48	2,680,183.09
Comm'l Ctr <10 ac		85.06	1000 sq ft	1,259.35	107,120.31	1,253,307.56
Comm'l Shops		37.06	1000 sq ft	1,227.16	45,478.55	532,099.06
					470,674.04	5,506,886.17

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Comm'l.urb924

Project Name: 112-23 OVOV Existing Commercial 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	56.69	59.64	50.10	0.00	0.11	0.11	71,564.80

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	4,752.55	7,497.69	52,077.19	48.03	9,513.24	1,850.80	5,104,178.97

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	4,809.24	7,557.33	52,127.29	48.03	9,513.35	1,850.91	5,175,743.77

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	4.33	59.64	50.10	0.00	0.11	0.11	71,564.80
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	52.36						
TOTALS (lbs/day, unmitigated)	56.69	59.64	50.10	0.00	0.11	0.11	71,564.80

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	900.39	1,417.74	9,847.27	9.08	1,798.86	349.97	965,148.61
Comm'l Ctr 10-30 ac	2,312.67	3,649.10	25,345.80	23.38	4,630.06	900.78	2,484,186.84
Comm'l Ctr <10 ac	1,079.10	1,706.39	11,852.20	10.93	2,165.11	421.22	1,161,655.77
Comm'l Shops	460.39	724.46	5,031.92	4.64	919.21	178.83	493,187.75
TOTALS (lbs/day, unmitigated)	4,752.55	7,497.69	52,077.19	48.03	9,513.24	1,850.80	5,104,178.97

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	2,221.66	88,999.70	1,041,296.46
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	4,237.43	229,075.48	2,680,183.09
Comm'l Ctr <10 ac		85.06	1000 sq ft	1,259.35	107,120.31	1,253,307.56
Comm'l Shops		37.06	1000 sq ft	1,227.16	45,478.55	532,099.06
					470,674.04	5,506,886.17

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Summary Report for Summer Emissions (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Institutional.urb924

Project Name: 112-23 OVOV Existing Institutional 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	221.96	324.17	285.04	0.00	0.61	0.61	388,864.18

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,332.06	1,378.03	12,174.61	12.82	2,105.37	409.73	1,249,903.26

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,554.02	1,702.20	12,459.65	12.82	2,105.98	410.34	1,638,767.44

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Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Institutional.urb924

Project Name: 112-23 OVOV Existing Institutional 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	220.83	324.04	272.19	0.00	0.58	0.58	388,844.86

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,246.32	1,661.73	11,614.55	10.65	2,105.37	409.73	1,131,578.16

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,467.15	1,985.77	11,886.74	10.65	2,105.95	410.31	1,520,423.02

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	23.53	324.04	272.19	0.00	0.58	0.58	388,844.86
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	197.30						
TOTALS (lbs/day, unmitigated)	220.83	324.04	272.19	0.00	0.58	0.58	388,844.86

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Elementary school	536.69	692.51	4,861.87	4.44	876.47	170.61	471,670.49
High school	223.63	299.75	2,091.99	1.92	379.91	73.93	204,105.67
Junior college (2 yrs)	344.37	451.07	3,138.65	2.89	572.09	111.31	307,097.30
Library	46.05	72.74	506.15	0.47	92.26	17.95	49,523.76
Place of worship	47.15	72.29	502.41	0.46	91.71	17.84	49,213.75
Hospital	26.07	40.25	283.43	0.26	50.91	9.91	27,419.51
Day Care	22.36	33.12	230.05	0.21	42.02	8.18	22,547.68
TOTALS (lbs/day, unmitigated)	1,246.32	1,661.73	11,614.55	10.65	2,105.37	409.73	1,131,578.16

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Elementary school		1.45	1000 sq ft	29,902.00	43,357.90	507,287.44
High school		1.79	students	10,500.00	18,795.00	219,901.49
Junior college (2 yrs)		1.54	students	18,379.00	28,303.66	331,152.81
Library		84.95	1000 sq ft	53.73	4,564.36	53,403.05
Place of worship		9.30	1000 sq ft	487.89	4,537.38	53,087.31
Hospital		16.80	1000 sq ft	149.90	2,518.32	29,464.34
Day Care		4.52	1000 sq ft	460.00	2,079.20	24,326.64
					104,155.82	1,218,623.08

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Elementary school				20.0	10.0	70.0
High school				10.0	5.0	85.0
Junior college (2 yrs)				5.0	2.5	92.5
Library				5.0	2.5	92.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Place of worship				3.0	1.5	95.5
Hospital				25.0	12.5	62.5
Day Care				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Res'l.urb924

Project Name: 112-23 OVOV Existing Residential 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	4,600.95	1,048.26	3,032.98	0.13	8.99	8.89	1,313,719.80

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	6,446.64	8,816.78	80,437.25	82.10	13,389.92	2,609.50	8,006,351.55

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	11,047.59	9,865.04	83,470.23	82.23	13,398.91	2,618.39	9,320,071.35

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	79.27	1,026.36	436.75	0.01	1.97	1.94	1,310,250.40
Hearth - No Summer Emissions							
Landscape	467.23	21.90	2,596.23	0.12	7.02	6.95	3,469.40
Consumer Products	3,838.12						
Architectural Coatings	216.33						
TOTALS (lbs/day, unmitigated)	4,600.95	1,048.26	3,032.98	0.13	8.99	8.89	1,313,719.80

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	4,411.74	6,073.02	55,405.32	56.55	9,223.00	1,797.43	5,514,788.17
Apartments mid rise	201.44	268.45	2,449.16	2.50	407.70	79.45	243,778.46
Condo/townhouse general	1,675.10	2,265.15	20,665.41	21.09	3,440.05	670.42	2,056,938.91
Mobile home park	150.28	200.28	1,827.23	1.87	304.17	59.28	181,874.41
Retirement community	8.08	9.88	90.13	0.09	15.00	2.92	8,971.60
TOTALS (lbs/day, unmitigated)	6,446.64	8,816.78	80,437.25	82.10	13,389.92	2,609.50	8,006,351.55

Operational Settings:

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Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	15,357.00	9.90	dwelling units	46,071.00	456,102.88	5,336,403.64
Apartments mid rise	76.89	6.90	dwelling units	2,922.00	20,161.80	235,893.06
Condo/townhouse general	1,329.06	8.00	dwelling units	21,265.00	170,120.00	1,990,403.97
Mobile home park	363.33	6.90	dwelling units	2,180.00	15,042.00	175,991.40
Retirement community	40.00	3.71	dwelling units	200.00	742.00	8,681.40
					662,168.68	7,747,373.47

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Res'l.urb924

Project Name: 112-23 OVOV Existing Residential 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	15,517.55	2,003.68	32,004.27	88.62	4,897.32	4,714.61	2,619,891.79

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	7,113.03	10,634.94	76,646.60	68.40	13,389.92	2,609.50	7,254,102.10

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	22,630.58	12,638.62	108,650.87	157.02	18,287.24	7,324.11	9,873,993.89

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	79.27	1,026.36	436.75	0.01	1.97	1.94	1,310,250.40
Hearth	11,383.83	977.32	31,567.52	88.61	4,895.35	4,712.67	1,309,641.39
Landscaping - No Winter Emissions							
Consumer Products	3,838.12						
Architectural Coatings	216.33						
TOTALS (lbs/day, unmitigated)	15,517.55	2,003.68	32,004.27	88.62	4,897.32	4,714.61	2,619,891.79

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	4,886.56	7,325.36	52,794.30	47.12	9,223.00	1,797.43	4,996,637.50
Apartments mid rise	218.89	323.81	2,333.75	2.08	407.70	79.45	220,873.87
Condo/townhouse general	1,835.91	2,732.26	19,691.54	17.57	3,440.05	670.42	1,863,675.95
Mobile home park	163.31	241.59	1,741.12	1.55	304.17	59.28	164,786.12
Retirement community	8.36	11.92	85.89	0.08	15.00	2.92	8,128.66
TOTALS (lbs/day, unmitigated)	7,113.03	10,634.94	76,646.60	68.40	13,389.92	2,609.50	7,254,102.10

Operational Settings:

4/21/2009 1:17:45 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	15,357.00	9.90	dwelling units	46,071.00	456,102.88	5,336,403.64
Apartments mid rise	76.89	6.90	dwelling units	2,922.00	20,161.80	235,893.06
Condo/townhouse general	1,329.06	8.00	dwelling units	21,265.00	170,120.00	1,990,403.97
Mobile home park	363.33	6.90	dwelling units	2,180.00	15,042.00	175,991.40
Retirement community	40.00	3.71	dwelling units	200.00	742.00	8,681.40
					662,168.68	7,747,373.47

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. SG.urb924

Project Name: 112-23 OVOV Existing Special Generator 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	32.71	0.09	9.18	0.00	0.02	0.02	13.80

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	207.25	317.41	2,783.59	2.94	485.61	94.47	287,842.10

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	239.96	317.50	2,792.77	2.94	485.63	94.49	287,855.90

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth - No Summer Emissions							
Landscape	0.81	0.09	9.18	0.00	0.02	0.02	13.80
Consumer Products	0.00						
Architectural Coatings	31.90						
TOTALS (lbs/day, unmitigated)	32.71	0.09	9.18	0.00	0.02	0.02	13.80

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Wayside Honor Ranch	8.70	13.21	115.86	0.12	20.21	3.93	11,980.44
Six Flags Magic Mtn	137.97	211.38	1,853.71	1.96	323.39	62.92	191,687.07
Travel Village	22.59	34.61	303.55	0.32	52.96	10.30	31,388.76
Agua Dulce Airport	29.37	45.00	394.61	0.42	68.84	13.39	40,805.39
Landfill	8.62	13.21	115.86	0.12	20.21	3.93	11,980.44
TOTALS (lbs/day, unmitigated)	207.25	317.41	2,783.59	2.94	485.61	94.47	287,842.10

Operational Settings:

4/21/2009 1:41:20 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Wayside Honor Ranch		50.00	acres	20.00	1,000.00	11,700.00
Six Flags Magic Mtn		100.00	acres	160.00	16,000.00	187,200.00
Travel Village		100.00	acres	26.20	2,620.00	30,654.00
Agua Dulce Airport		100.00	acres	34.06	3,406.00	39,850.20
Landfill		100.00	acres	10.00	1,000.00	11,700.00
					24,026.00	281,104.20

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. SG.urb924

Project Name: 112-23 OVOV Existing Special Generator 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	31.90	0.00	0.00	0.00	0.00	0.00	0.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	241.93	382.73	2,658.32	2.45	485.61	94.47	260,547.63

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	273.83	382.73	2,658.32	2.45	485.61	94.47	260,547.63

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	31.90						
TOTALS (lbs/day, unmitigated)	31.90	0.00	0.00	0.00	0.00	0.00	0.00

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Wayside Honor Ranch	10.10	15.93	110.64	0.10	20.21	3.93	10,844.40
Six Flags Magic Mtn	161.09	254.87	1,770.30	1.63	323.39	62.92	173,510.45
Travel Village	26.38	41.74	289.89	0.27	52.96	10.30	28,412.34
Agua Dulce Airport	34.29	54.26	376.85	0.35	68.84	13.39	36,936.04
Landfill	10.07	15.93	110.64	0.10	20.21	3.93	10,844.40
TOTALS (lbs/day, unmitigated)	241.93	382.73	2,658.32	2.45	485.61	94.47	260,547.63

Operational Settings:

4/21/2009 1:41:39 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Wayside Honor Ranch		50.00	acres	20.00	1,000.00	11,700.00
Six Flags Magic Mtn		100.00	acres	160.00	16,000.00	187,200.00
Travel Village		100.00	acres	26.20	2,620.00	30,654.00
Agua Dulce Airport		100.00	acres	34.06	3,406.00	39,850.20
Landfill		100.00	acres	10.00	1,000.00	11,700.00
					24,026.00	281,104.20

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Non-Res'l.urb924

Project Name: 112-23 OVOV Existing Non-Residential 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	30.04	35.83	41.03	0.00	0.09	0.09	42,882.11

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	711.71	1,042.05	9,152.84	9.68	1,593.80	310.09	945,027.74

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	741.75	1,077.88	9,193.87	9.68	1,593.89	310.18	987,909.85

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	2.59	35.72	30.01	0.00	0.06	0.06	42,865.55
Hearth - No Summer Emissions							
Landscape	0.97	0.11	11.02	0.00	0.03	0.03	16.56
Consumer Products	0.00						
Architectural Coatings	26.48						
TOTALS (lbs/day, unmitigated)	30.04	35.83	41.03	0.00	0.09	0.09	42,882.11

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	43.76	66.08	580.76	0.61	101.06	19.66	59,930.65
High turnover (sit-down) rest.	184.89	283.29	2,489.65	2.63	433.24	84.29	256,915.67
Fast food rest. w/ drive thru	202.64	311.98	2,741.82	2.90	477.12	92.83	282,937.30
Hotel	75.84	106.05	932.03	0.99	162.19	31.56	96,179.71
Movie Theater	73.58	76.73	672.90	0.71	117.39	22.84	69,582.41
Car Dealership	131.00	197.92	1,735.68	1.84	302.80	58.91	179,482.00
TOTALS (lbs/day, unmitigated)	711.71	1,042.05	9,152.84	9.68	1,593.80	310.09	945,027.74

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	125.00	5,000.00	58,500.00
High turnover (sit-down) rest.		130.34	1000 sq ft	164.45	21,434.41	250,782.62
Fast food rest. w/ drive thru		496.12	1000 sq ft	47.58	23,605.39	276,183.06
Hotel		8.23	rooms	975.00	8,024.25	93,883.72
Movie Theater		1.76	1000 sq ft	3,300.00	5,808.00	67,953.60
Car Dealership		37.50	1000 sq ft	399.50	14,981.25	175,280.62
					78,853.30	922,583.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Non-Res'l.urb924

Project Name: 112-23 OVOV Existing Non-Residential 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	29.07	35.72	30.01	0.00	0.06	0.06	42,865.55

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	808.57	1,256.51	8,739.05	8.05	1,593.80	310.09	855,447.29

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	837.64	1,292.23	8,769.06	8.05	1,593.86	310.15	898,312.84

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	2.59	35.72	30.01	0.00	0.06	0.06	42,865.55
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	26.48						
TOTALS (lbs/day, unmitigated)	29.07	35.72	30.01	0.00	0.06	0.06	42,865.55

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	50.66	79.68	554.46	0.51	101.06	19.66	54,250.46
High turnover (sit-down) rest.	215.98	341.59	2,376.91	2.19	433.24	84.29	232,565.34
Fast food rest. w/ drive thru	237.42	376.19	2,617.65	2.41	477.12	92.83	256,120.65
Hotel	83.83	127.88	889.83	0.82	162.19	31.56	87,063.84
Movie Theater	69.04	92.52	642.62	0.59	117.39	22.84	62,984.29
Car Dealership	151.64	238.65	1,657.58	1.53	302.80	58.91	162,462.71
TOTALS (lbs/day, unmitigated)	808.57	1,256.51	8,739.05	8.05	1,593.80	310.09	855,447.29

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	125.00	5,000.00	58,500.00
High turnover (sit-down) rest.		130.34	1000 sq ft	164.45	21,434.41	250,782.62
Fast food rest. w/ drive thru		496.12	1000 sq ft	47.58	23,605.39	276,183.06
Hotel		8.23	rooms	975.00	8,024.25	93,883.72
Movie Theater		1.76	1000 sq ft	3,300.00	5,808.00	67,953.60
Car Dealership		37.50	1000 sq ft	399.50	14,981.25	175,280.62
					78,853.30	922,583.62

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Office.urb924

Project Name: 112-23 OVOV Existing Office 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	14.35	14.50	19.45	0.00	0.05	0.05	17,310.40

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	110.27	146.09	1,281.73	1.36	223.48	43.47	132,478.58

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	124.62	160.59	1,301.18	1.36	223.53	43.52	149,788.98

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.05	14.42	12.11	0.00	0.03	0.03	17,299.36
Hearth - No Summer Emissions							
Landscape	0.64	0.08	7.34	0.00	0.02	0.02	11.04
Consumer Products	0.00						
Architectural Coatings	12.66						
TOTALS (lbs/day, unmitigated)	14.35	14.50	19.45	0.00	0.05	0.05	17,310.40

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	13.46	19.24	169.29	0.18	29.41	5.72	17,445.13
Regional Post Office	21.09	24.02	210.67	0.22	36.75	7.15	21,784.28
Post Office	14.98	22.59	198.12	0.21	34.56	6.72	20,486.56
Commercial Office	60.74	80.24	703.65	0.75	122.76	23.88	72,762.61
TOTALS (lbs/day, unmitigated)	110.27	146.09	1,281.73	1.36	223.48	43.47	132,478.58

Operational Settings:

4/21/2009 1:44:33 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	133.73	1,454.98	17,023.29
Regional Post Office		2.38	1000 sq ft	764.00	1,818.32	21,274.34
Post Office		34.20	1000 sq ft	50.00	1,710.00	20,007.00
Commercial Office		5.00	1000 sq ft	1,214.69	6,073.45	71,059.36
					11,056.75	129,363.99

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Office.urb924

Project Name: 112-23 OVOV Existing Office 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	13.71	14.42	12.11	0.00	0.03	0.03	17,299.36

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	118.05	176.15	1,223.97	1.13	223.48	43.47	119,917.68

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	131.76	190.57	1,236.08	1.13	223.51	43.50	137,217.04

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	1.05	14.42	12.11	0.00	0.03	0.03	17,299.36
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	12.66						
TOTALS (lbs/day, unmitigated)	13.71	14.42	12.11	0.00	0.03	0.03	17,299.36

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	15.08	23.19	161.59	0.15	29.41	5.72	15,792.21
Regional Post Office	20.74	28.97	201.19	0.19	36.75	7.15	19,718.60
Post Office	17.32	27.24	189.20	0.17	34.56	6.72	18,543.93
Commercial Office	64.91	96.75	671.99	0.62	122.76	23.88	65,862.94
TOTALS (lbs/day, unmitigated)	118.05	176.15	1,223.97	1.13	223.48	43.47	119,917.68

Operational Settings:

4/21/2009 1:44:54 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	133.73	1,454.98	17,023.29
Regional Post Office		2.38	1000 sq ft	764.00	1,818.32	21,274.34
Post Office		34.20	1000 sq ft	50.00	1,710.00	20,007.00
Commercial Office		5.00	1000 sq ft	1,214.69	6,073.45	71,059.36
					11,056.75	129,363.99

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Recreation.urb924

Project Name: 112-23 OVOV Existing Recreation 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	225.08	0.06	5.51	0.00	0.01	0.01	8.28

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	612.98	927.34	8,132.48	8.61	1,418.76	276.02	840,957.13

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	838.06	927.40	8,137.99	8.61	1,418.77	276.03	840,965.41

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth - No Summer Emissions							
Landscape	0.48	0.06	5.51	0.00	0.01	0.01	8.28
Consumer Products	0.00						
Architectural Coatings	224.60						
TOTALS (lbs/day, unmitigated)	225.08	0.06	5.51	0.00	0.01	0.01	8.28

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	566.87	869.02	7,621.02	8.07	1,329.53	258.66	788,067.75
Developed Park	19.87	27.75	243.37	0.26	42.46	8.26	25,166.64
Undeveloped Park	26.24	30.57	268.09	0.28	46.77	9.10	27,722.74
TOTALS (lbs/day, unmitigated)	612.98	927.34	8,132.48	8.61	1,418.76	276.02	840,957.13

Operational Settings:

Does not include correction for passby trips

4/21/2009 1:36:46 PM

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	608.00	65,779.52	769,620.39
Developed Park		7.96	acres	263.90	2,100.64	24,577.53
Undeveloped Park		2.60	acres	890.00	2,314.00	27,073.80
					70,194.16	821,271.72

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Recreation.urb924

Project Name: 112-23 OVOV Existing Recreation 2004 Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	224.60	0.00	0.00	0.00	0.00	0.00	0.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	710.17	1,118.17	7,766.55	7.16	1,418.76	276.02	761,213.82

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	934.77	1,118.17	7,766.55	7.16	1,418.76	276.02	761,213.82

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	224.60						
TOTALS (lbs/day, unmitigated)	224.60	0.00	0.00	0.00	0.00	0.00	0.00

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	662.11	1,047.85	7,278.10	6.71	1,329.53	258.66	713,339.64
Developed Park	21.94	33.46	232.42	0.21	42.46	8.26	22,780.23
Undeveloped Park	26.12	36.86	256.03	0.24	46.77	9.10	25,093.95
TOTALS (lbs/day, unmitigated)	710.17	1,118.17	7,766.55	7.16	1,418.76	276.02	761,213.82

Operational Settings:

Does not include correction for passby trips

4/21/2009 1:37:11 PM

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	608.00	65,779.52	769,620.39
Developed Park		7.96	acres	263.90	2,100.64	24,577.53
Undeveloped Park		2.60	acres	890.00	2,314.00	27,073.80
					70,194.16	821,271.72

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Ind'l.urb924

Project Name: 112-23 Existing 2004 Industrial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	113.25	12.46	10.47	0.00	0.02	0.02	14,950.01

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,292.36	1,926.78	13,659.25	12.36	2,433.01	473.85	1,312,918.34

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,405.61	1,939.24	13,669.72	12.36	2,433.03	473.87	1,327,868.35

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.90	12.46	10.47	0.00	0.02	0.02	14,950.01
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	112.35						
TOTALS (lbs/day, unmitigated)	113.25	12.46	10.47	0.00	0.02	0.02	14,950.01

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Industrial park	1,017.42	1,511.00	10,742.50	9.70	1,906.69	371.39	1,029,740.52
Manufacturing	103.08	151.40	1,080.42	0.97	190.87	37.19	103,195.13
Business Park	76.44	117.59	816.74	0.75	149.20	29.03	80,050.56
Utilities	95.42	146.79	1,019.59	0.94	186.25	36.24	99,932.13
TOTALS (lbs/day, unmitigated)	1,292.36	1,926.78	13,659.25	12.36	2,433.01	473.85	1,312,918.34

Operational Settings:

4/20/2009 6:45:00 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Industrial park		6.00	1000 sq ft	15,717.43	94,304.58	1,103,363.55
Manufacturing		5.10	1000 sq ft	1,850.99	9,440.05	110,448.57
Business Park		10.20	1000 sq ft	723.70	7,381.74	86,366.36
Utilities		10.20	1000 sq ft	903.44	9,215.09	107,816.53
					120,341.46	1,407,995.01

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Industrial park				41.5	20.8	37.8
Manufacturing				48.0	24.0	28.0
Business Park				2.0	1.0	97.0
Utilities				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. Ind'l.urb924

Project Name: 112-23 Existing 2004 Industrial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	113.89	12.54	17.81	0.00	0.04	0.04	14,961.05

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,194.99	1,597.47	14,351.69	14.87	2,433.01	473.85	1,449,630.94

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,308.88	1,610.01	14,369.50	14.87	2,433.05	473.89	1,464,591.99

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.90	12.46	10.47	0.00	0.02	0.02	14,950.01
Hearth - No Summer Emissions							
Landscape	0.64	0.08	7.34	0.00	0.02	0.02	11.04
Consumer Products	0.00						
Architectural Coatings	112.35						
TOTALS (lbs/day, unmitigated)	113.89	12.54	17.81	0.00	0.04	0.04	14,961.05

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Industrial park	944.35	1,252.70	11,292.40	11.66	1,906.69	371.39	1,136,874.20
Manufacturing	96.94	125.51	1,136.43	1.17	190.87	37.19	113,919.40
Business Park	68.36	97.52	855.23	0.91	149.20	29.03	88,436.51
Utilities	85.34	121.74	1,067.63	1.13	186.25	36.24	110,400.83
TOTALS (lbs/day, unmitigated)	1,194.99	1,597.47	14,351.69	14.87	2,433.01	473.85	1,449,630.94

Operational Settings:

4/20/2009 6:44:32 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Industrial park		6.00	1000 sq ft	15,717.43	94,304.58	1,103,363.55
Manufacturing		5.10	1000 sq ft	1,850.99	9,440.05	110,448.57
Business Park		10.20	1000 sq ft	723.70	7,381.74	86,366.36
Utilities		10.20	1000 sq ft	903.44	9,215.09	107,816.53
					120,341.46	1,407,995.01

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Industrial park				41.5	20.8	37.8
Manufacturing				48.0	24.0	28.0
Business Park				2.0	1.0	97.0
Utilities				2.0	1.0	97.0

Construction Air Emissions

for Existing General Plan and Area Plan

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Comm'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Commercial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	137.74	634.00	1,125.32	1.28	5,640.28	29.81	5,670.10	1,178.73	27.20	1,205.93
2010 TOTALS (lbs/day mitigated)	137.74	634.00	1,125.32	1.28	1,005.16	29.81	1,034.97	210.73	27.20	237.93
2011 TOTALS (lbs/day unmitigated)	131.44	587.90	1,051.02	1.28	5,640.28	27.52	5,667.80	1,178.73	25.09	1,203.82
2011 TOTALS (lbs/day mitigated)	131.44	587.90	1,051.02	1.28	1,005.16	27.52	1,032.68	210.73	25.09	235.82
2012 TOTALS (lbs/day unmitigated)	125.79	543.25	981.68	1.28	5,640.28	25.38	5,665.66	1,178.73	23.11	1,201.84
2012 TOTALS (lbs/day mitigated)	125.79	543.25	981.68	1.28	1,005.16	25.38	1,030.53	210.73	23.11	233.84
2013 TOTALS (lbs/day unmitigated)	120.98	500.94	916.12	1.28	5,640.28	23.44	5,663.72	1,178.73	21.31	1,200.04
2013 TOTALS (lbs/day mitigated)	120.98	500.94	916.12	1.28	1,005.16	23.44	1,028.60	210.73	21.31	232.04
2014 TOTALS (lbs/day unmitigated)	115.94	458.55	857.51	1.28	5,640.28	21.60	5,661.88	1,178.73	19.62	1,198.34
2014 TOTALS (lbs/day mitigated)	115.94	458.55	857.51	1.28	1,005.16	21.60	1,026.75	210.73	19.62	230.35
2015 TOTALS (lbs/day unmitigated)	110.95	416.73	802.48	1.28	5,640.28	19.93	5,660.21	1,178.73	18.09	1,196.81
2015 TOTALS (lbs/day mitigated)	110.95	416.73	802.48	1.28	1,005.16	19.93	1,025.09	210.73	18.09	228.81
2016 TOTALS (lbs/day unmitigated)	106.61	379.77	754.35	1.28	5,640.28	18.36	5,658.64	1,178.73	16.64	1,195.36
2016 TOTALS (lbs/day mitigated)	106.61	379.77	754.35	1.28	1,005.16	18.36	1,023.51	210.73	16.64	227.36
2017 TOTALS (lbs/day unmitigated)	102.78	345.86	708.60	1.28	5,640.28	16.82	5,657.11	1,178.73	15.23	1,193.95
2017 TOTALS (lbs/day mitigated)	102.78	345.86	708.60	1.28	1,005.16	16.82	1,021.98	210.73	15.23	225.95
2018 TOTALS (lbs/day unmitigated)	98.85	314.91	666.99	1.28	5,640.28	15.42	5,655.71	1,178.73	13.93	1,192.66
2018 TOTALS (lbs/day mitigated)	98.85	314.91	666.99	1.28	1,005.16	15.42	1,020.58	210.73	13.93	224.66
2019 TOTALS (lbs/day unmitigated)	95.66	287.13	628.30	1.28	5,640.28	14.07	5,654.36	1,178.73	12.69	1,191.42
2019 TOTALS (lbs/day mitigated)	95.66	287.13	628.30	1.28	1,005.16	14.07	1,019.23	210.73	12.69	223.42

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Comm'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Commercial

2020 TOTALS (lbs/day unmitigated)	92.30	262.08	592.44	1.28	5,640.28	12.99	5,653.27	1,178.73	11.69	1,190.41
2020 TOTALS (lbs/day mitigated)	92.30	262.08	592.44	1.28	1,005.16	12.99	1,018.14	210.73	11.69	222.41
2021 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2021 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2022 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2022 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2023 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2023 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2024 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2024 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2025 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2025 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2026 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2026 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2027 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2027 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2028 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2028 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2029 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2029 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2030 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2030 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Comm'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Commercial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	137.74	634.00	1,125.32	1.28	5,640.28	29.81	5,670.10	1,178.73	27.20	1,205.93
2010 TOTALS (lbs/day mitigated)	137.74	634.00	1,125.32	1.28	1,005.16	29.81	1,034.97	210.73	27.20	237.93
2011 TOTALS (lbs/day unmitigated)	131.44	587.90	1,051.02	1.28	5,640.28	27.52	5,667.80	1,178.73	25.09	1,203.82
2011 TOTALS (lbs/day mitigated)	131.44	587.90	1,051.02	1.28	1,005.16	27.52	1,032.68	210.73	25.09	235.82
2012 TOTALS (lbs/day unmitigated)	125.79	543.25	981.68	1.28	5,640.28	25.38	5,665.66	1,178.73	23.11	1,201.84
2012 TOTALS (lbs/day mitigated)	125.79	543.25	981.68	1.28	1,005.16	25.38	1,030.53	210.73	23.11	233.84
2013 TOTALS (lbs/day unmitigated)	120.98	500.94	916.12	1.28	5,640.28	23.44	5,663.72	1,178.73	21.31	1,200.04
2013 TOTALS (lbs/day mitigated)	120.98	500.94	916.12	1.28	1,005.16	23.44	1,028.60	210.73	21.31	232.04
2014 TOTALS (lbs/day unmitigated)	115.94	458.55	857.51	1.28	5,640.28	21.60	5,661.88	1,178.73	19.62	1,198.34
2014 TOTALS (lbs/day mitigated)	115.94	458.55	857.51	1.28	1,005.16	21.60	1,026.75	210.73	19.62	230.35
2015 TOTALS (lbs/day unmitigated)	110.95	416.73	802.48	1.28	5,640.28	19.93	5,660.21	1,178.73	18.09	1,196.81
2015 TOTALS (lbs/day mitigated)	110.95	416.73	802.48	1.28	1,005.16	19.93	1,025.09	210.73	18.09	228.81
2016 TOTALS (lbs/day unmitigated)	106.61	379.77	754.35	1.28	5,640.28	18.36	5,658.64	1,178.73	16.64	1,195.36
2016 TOTALS (lbs/day mitigated)	106.61	379.77	754.35	1.28	1,005.16	18.36	1,023.51	210.73	16.64	227.36
2017 TOTALS (lbs/day unmitigated)	102.78	345.86	708.60	1.28	5,640.28	16.82	5,657.11	1,178.73	15.23	1,193.95
2017 TOTALS (lbs/day mitigated)	102.78	345.86	708.60	1.28	1,005.16	16.82	1,021.98	210.73	15.23	225.95
2018 TOTALS (lbs/day unmitigated)	98.85	314.91	666.99	1.28	5,640.28	15.42	5,655.71	1,178.73	13.93	1,192.66
2018 TOTALS (lbs/day mitigated)	98.85	314.91	666.99	1.28	1,005.16	15.42	1,020.58	210.73	13.93	224.66
2019 TOTALS (lbs/day unmitigated)	95.66	287.13	628.30	1.28	5,640.28	14.07	5,654.36	1,178.73	12.69	1,191.42
2019 TOTALS (lbs/day mitigated)	95.66	287.13	628.30	1.28	1,005.16	14.07	1,019.23	210.73	12.69	223.42

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Comm'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Commercial

2020 TOTALS (lbs/day unmitigated)	92.30	262.08	592.44	1.28	5,640.28	12.99	5,653.27	1,178.73	11.69	1,190.41
2020 TOTALS (lbs/day mitigated)	92.30	262.08	592.44	1.28	1,005.16	12.99	1,018.14	210.73	11.69	222.41
2021 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2021 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2022 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2022 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2023 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2023 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2024 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2024 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2025 TOTALS (lbs/day unmitigated)	87.22	239.28	468.97	1.28	5,640.28	12.38	5,652.67	1,178.73	11.14	1,189.86
2025 TOTALS (lbs/day mitigated)	87.22	239.28	468.97	1.28	1,005.16	12.38	1,017.54	210.73	11.14	221.86
2026 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2026 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2027 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2027 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2028 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2028 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2029 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2029 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67
2030 TOTALS (lbs/day unmitigated)	84.43	229.71	402.11	1.28	5,640.28	12.17	5,652.45	1,178.73	10.94	1,189.67
2030 TOTALS (lbs/day mitigated)	84.43	229.71	402.11	1.28	1,005.16	12.17	1,017.33	210.73	10.94	221.67

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	537.94	3,917.09	5,027.69	8.63	14,614.03	167.27	14,781.30	3,056.70	153.00	3,209.69
2010 TOTALS (lbs/day mitigated)	537.94	3,917.09	5,027.69	8.63	2,620.68	167.27	2,787.95	552.01	153.00	705.00
2011 TOTALS (lbs/day unmitigated)	505.89	3,549.41	4,669.75	8.63	14,614.03	150.54	14,764.57	3,056.70	137.58	3,194.28
2011 TOTALS (lbs/day mitigated)	505.89	3,549.41	4,669.75	8.63	2,620.68	150.54	2,771.22	552.01	137.58	689.59
2012 TOTALS (lbs/day unmitigated)	475.11	3,190.40	4,330.51	8.63	14,614.03	134.82	14,748.84	3,056.70	123.09	3,179.79
2012 TOTALS (lbs/day mitigated)	475.11	3,190.40	4,330.51	8.63	2,620.68	134.82	2,755.50	552.01	123.09	675.10
2013 TOTALS (lbs/day unmitigated)	445.99	2,845.70	4,005.47	8.63	14,614.03	119.90	14,733.93	3,056.70	109.31	3,166.00
2013 TOTALS (lbs/day mitigated)	445.99	2,845.70	4,005.47	8.63	2,620.68	119.90	2,740.58	552.01	109.31	661.31
2014 TOTALS (lbs/day unmitigated)	417.81	2,521.74	3,710.03	8.63	14,614.03	106.92	14,720.95	3,056.70	97.38	3,154.07
2014 TOTALS (lbs/day mitigated)	417.81	2,521.74	3,710.03	8.63	2,620.68	106.92	2,727.60	552.01	97.38	649.38
2015 TOTALS (lbs/day unmitigated)	391.25	2,226.45	3,435.48	8.63	14,614.03	94.91	14,708.93	3,056.70	86.31	3,143.00
2015 TOTALS (lbs/day mitigated)	391.25	2,226.45	3,435.48	8.63	2,620.68	94.91	2,715.59	552.01	86.31	638.31
2016 TOTALS (lbs/day unmitigated)	369.17	1,981.58	3,199.15	8.63	14,614.03	85.25	14,699.28	3,056.70	77.42	3,134.11
2016 TOTALS (lbs/day mitigated)	369.17	1,981.58	3,199.15	8.63	2,620.68	85.25	2,705.93	552.01	77.42	629.42
2017 TOTALS (lbs/day unmitigated)	349.92	1,774.03	2,981.79	8.63	14,614.03	76.77	14,690.79	3,056.70	69.61	3,126.31
2017 TOTALS (lbs/day mitigated)	349.92	1,774.03	2,981.79	8.63	2,620.68	76.77	2,697.45	552.01	69.61	621.62
2018 TOTALS (lbs/day unmitigated)	332.37	1,596.95	2,785.06	8.63	14,614.03	69.76	14,683.79	3,056.70	63.15	3,119.84
2018 TOTALS (lbs/day mitigated)	332.37	1,596.95	2,785.06	8.63	2,620.68	69.76	2,690.45	552.01	63.15	615.15
2019 TOTALS (lbs/day unmitigated)	317.42	1,445.38	2,605.37	8.63	14,614.03	63.60	14,677.63	3,056.70	57.48	3,114.18
2019 TOTALS (lbs/day mitigated)	317.42	1,445.38	2,605.37	8.63	2,620.68	63.60	2,684.28	552.01	57.48	609.49

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

2020 TOTALS (lbs/day unmitigated)	303.47	1,316.00	2,440.46	8.63	14,614.03	58.61	14,672.64	3,056.70	52.89	3,109.58
2020 TOTALS (lbs/day mitigated)	303.47	1,316.00	2,440.46	8.63	2,620.68	58.61	2,679.29	552.01	52.89	604.89
2021 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2021 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2022 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2022 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2023 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2023 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2024 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2024 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2025 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2025 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2026 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2026 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2027 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2027 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2028 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2028 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2029 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2029 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2030 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2030 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	537.94	3,917.09	5,027.69	8.63	14,614.03	167.27	14,781.30	3,056.70	153.00	3,209.69
2010 TOTALS (lbs/day mitigated)	537.94	3,917.09	5,027.69	8.63	2,620.68	167.27	2,787.95	552.01	153.00	705.00
2011 TOTALS (lbs/day unmitigated)	505.89	3,549.41	4,669.75	8.63	14,614.03	150.54	14,764.57	3,056.70	137.58	3,194.28
2011 TOTALS (lbs/day mitigated)	505.89	3,549.41	4,669.75	8.63	2,620.68	150.54	2,771.22	552.01	137.58	689.59
2012 TOTALS (lbs/day unmitigated)	475.11	3,190.40	4,330.51	8.63	14,614.03	134.82	14,748.84	3,056.70	123.09	3,179.79
2012 TOTALS (lbs/day mitigated)	475.11	3,190.40	4,330.51	8.63	2,620.68	134.82	2,755.50	552.01	123.09	675.10
2013 TOTALS (lbs/day unmitigated)	445.99	2,845.70	4,005.47	8.63	14,614.03	119.90	14,733.93	3,056.70	109.31	3,166.00
2013 TOTALS (lbs/day mitigated)	445.99	2,845.70	4,005.47	8.63	2,620.68	119.90	2,740.58	552.01	109.31	661.31
2014 TOTALS (lbs/day unmitigated)	417.81	2,521.74	3,710.03	8.63	14,614.03	106.92	14,720.95	3,056.70	97.38	3,154.07
2014 TOTALS (lbs/day mitigated)	417.81	2,521.74	3,710.03	8.63	2,620.68	106.92	2,727.60	552.01	97.38	649.38
2015 TOTALS (lbs/day unmitigated)	391.25	2,226.45	3,435.48	8.63	14,614.03	94.91	14,708.93	3,056.70	86.31	3,143.00
2015 TOTALS (lbs/day mitigated)	391.25	2,226.45	3,435.48	8.63	2,620.68	94.91	2,715.59	552.01	86.31	638.31
2016 TOTALS (lbs/day unmitigated)	369.17	1,981.58	3,199.15	8.63	14,614.03	85.25	14,699.28	3,056.70	77.42	3,134.11
2016 TOTALS (lbs/day mitigated)	369.17	1,981.58	3,199.15	8.63	2,620.68	85.25	2,705.93	552.01	77.42	629.42
2017 TOTALS (lbs/day unmitigated)	349.92	1,774.03	2,981.79	8.63	14,614.03	76.77	14,690.79	3,056.70	69.61	3,126.31
2017 TOTALS (lbs/day mitigated)	349.92	1,774.03	2,981.79	8.63	2,620.68	76.77	2,697.45	552.01	69.61	621.62
2018 TOTALS (lbs/day unmitigated)	332.37	1,596.95	2,785.06	8.63	14,614.03	69.76	14,683.79	3,056.70	63.15	3,119.84
2018 TOTALS (lbs/day mitigated)	332.37	1,596.95	2,785.06	8.63	2,620.68	69.76	2,690.45	552.01	63.15	615.15
2019 TOTALS (lbs/day unmitigated)	317.42	1,445.38	2,605.37	8.63	14,614.03	63.60	14,677.63	3,056.70	57.48	3,114.18
2019 TOTALS (lbs/day mitigated)	317.42	1,445.38	2,605.37	8.63	2,620.68	63.60	2,684.28	552.01	57.48	609.49

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

2020 TOTALS (lbs/day unmitigated)	303.47	1,316.00	2,440.46	8.63	14,614.03	58.61	14,672.64	3,056.70	52.89	3,109.58
2020 TOTALS (lbs/day mitigated)	303.47	1,316.00	2,440.46	8.63	2,620.68	58.61	2,679.29	552.01	52.89	604.89
2021 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2021 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2022 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2022 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2023 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2023 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2024 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2024 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2025 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85
2025 TOTALS (lbs/day mitigated)	264.02	982.18	1,851.59	8.62	2,620.68	46.94	2,667.62	552.01	42.16	594.16
2026 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2026 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2027 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2027 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2028 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2028 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2029 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2029 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43
2030 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12
2030 TOTALS (lbs/day mitigated)	245.58	858.78	1,545.33	8.62	2,620.68	42.86	2,663.54	552.01	38.42	590.43

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Instit'l.urb924

Project Name: 112-23 Construction Emissions Institutional Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	68.47	375.17	481.47	0.45	1,983.55	19.23	2,002.78	414.53	17.61	432.15
2010 TOTALS (lbs/day mitigated)	68.47	375.17	481.47	0.45	353.51	19.23	372.74	74.12	17.61	91.73
2011 TOTALS (lbs/day unmitigated)	64.99	349.66	452.01	0.45	1,983.55	17.84	2,001.40	414.53	16.34	430.87
2011 TOTALS (lbs/day mitigated)	64.99	349.66	452.01	0.45	353.51	17.84	371.36	74.12	16.34	90.45
2012 TOTALS (lbs/day unmitigated)	61.87	324.95	424.69	0.45	1,983.55	16.41	1,999.96	414.53	15.01	429.54
2012 TOTALS (lbs/day mitigated)	61.87	324.95	424.69	0.45	353.51	16.41	369.92	74.12	15.01	89.13
2013 TOTALS (lbs/day unmitigated)	59.26	301.60	398.87	0.45	1,983.55	15.12	1,998.67	414.53	13.82	428.35
2013 TOTALS (lbs/day mitigated)	59.26	301.60	398.87	0.45	353.51	15.12	368.63	74.12	13.82	87.94
2014 TOTALS (lbs/day unmitigated)	56.46	277.98	375.94	0.45	1,983.55	13.79	1,997.34	414.53	12.59	427.13
2014 TOTALS (lbs/day mitigated)	56.46	277.98	375.94	0.45	353.51	13.79	367.30	74.12	12.59	86.71
2015 TOTALS (lbs/day unmitigated)	53.65	253.69	354.33	0.45	1,983.55	12.71	1,996.26	414.53	11.60	426.13
2015 TOTALS (lbs/day mitigated)	53.65	253.69	354.33	0.45	353.51	12.71	366.22	74.12	11.60	85.72
2016 TOTALS (lbs/day unmitigated)	51.17	231.87	335.56	0.45	1,983.55	11.54	1,995.10	414.53	10.53	425.06
2016 TOTALS (lbs/day mitigated)	51.17	231.87	335.56	0.45	353.51	11.54	365.05	74.12	10.53	84.65
2017 TOTALS (lbs/day unmitigated)	48.96	211.62	317.71	0.45	1,983.55	10.49	1,994.05	414.53	9.57	424.10
2017 TOTALS (lbs/day mitigated)	48.96	211.62	317.71	0.45	353.51	10.49	364.01	74.12	9.57	83.68
2018 TOTALS (lbs/day unmitigated)	46.65	192.90	301.63	0.45	1,983.55	9.50	1,993.06	414.53	8.65	423.18
2018 TOTALS (lbs/day mitigated)	46.65	192.90	301.63	0.45	353.51	9.50	363.01	74.12	8.65	82.77
2019 TOTALS (lbs/day unmitigated)	44.79	176.01	286.65	0.45	1,983.55	8.53	1,992.08	414.53	7.75	422.29
2019 TOTALS (lbs/day mitigated)	44.79	176.01	286.65	0.45	353.51	8.53	362.04	74.12	7.75	81.87

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Instit'l.urb924

Project Name: 112-23 Construction Emissions Institutional Existing General Plan

2020 TOTALS (lbs/day unmitigated)	42.84	160.73	272.95	0.45	1,983.55	7.80	1,991.36	414.53	7.09	421.62
2020 TOTALS (lbs/day mitigated)	42.84	160.73	272.95	0.45	353.51	7.80	361.31	74.12	7.09	81.20
2021 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2021 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2022 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2022 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2023 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2023 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2024 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2024 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2025 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2025 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2026 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2026 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2027 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2027 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2028 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2028 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2029 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2029 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2030 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2030 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Instit'l.urb924

Project Name: 112-23 Construction Emissions Institutional Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	68.47	375.17	481.47	0.45	1,983.55	19.23	2,002.78	414.53	17.61	432.15
2010 TOTALS (lbs/day mitigated)	68.47	375.17	481.47	0.45	353.51	19.23	372.74	74.12	17.61	91.73
2011 TOTALS (lbs/day unmitigated)	64.99	349.66	452.01	0.45	1,983.55	17.84	2,001.40	414.53	16.34	430.87
2011 TOTALS (lbs/day mitigated)	64.99	349.66	452.01	0.45	353.51	17.84	371.36	74.12	16.34	90.45
2012 TOTALS (lbs/day unmitigated)	61.87	324.95	424.69	0.45	1,983.55	16.41	1,999.96	414.53	15.01	429.54
2012 TOTALS (lbs/day mitigated)	61.87	324.95	424.69	0.45	353.51	16.41	369.92	74.12	15.01	89.13
2013 TOTALS (lbs/day unmitigated)	59.26	301.60	398.87	0.45	1,983.55	15.12	1,998.67	414.53	13.82	428.35
2013 TOTALS (lbs/day mitigated)	59.26	301.60	398.87	0.45	353.51	15.12	368.63	74.12	13.82	87.94
2014 TOTALS (lbs/day unmitigated)	56.46	277.98	375.94	0.45	1,983.55	13.79	1,997.34	414.53	12.59	427.13
2014 TOTALS (lbs/day mitigated)	56.46	277.98	375.94	0.45	353.51	13.79	367.30	74.12	12.59	86.71
2015 TOTALS (lbs/day unmitigated)	53.65	253.69	354.33	0.45	1,983.55	12.71	1,996.26	414.53	11.60	426.13
2015 TOTALS (lbs/day mitigated)	53.65	253.69	354.33	0.45	353.51	12.71	366.22	74.12	11.60	85.72
2016 TOTALS (lbs/day unmitigated)	51.17	231.87	335.56	0.45	1,983.55	11.54	1,995.10	414.53	10.53	425.06
2016 TOTALS (lbs/day mitigated)	51.17	231.87	335.56	0.45	353.51	11.54	365.05	74.12	10.53	84.65
2017 TOTALS (lbs/day unmitigated)	48.96	211.62	317.71	0.45	1,983.55	10.49	1,994.05	414.53	9.57	424.10
2017 TOTALS (lbs/day mitigated)	48.96	211.62	317.71	0.45	353.51	10.49	364.01	74.12	9.57	83.68
2018 TOTALS (lbs/day unmitigated)	46.65	192.90	301.63	0.45	1,983.55	9.50	1,993.06	414.53	8.65	423.18
2018 TOTALS (lbs/day mitigated)	46.65	192.90	301.63	0.45	353.51	9.50	363.01	74.12	8.65	82.77
2019 TOTALS (lbs/day unmitigated)	44.79	176.01	286.65	0.45	1,983.55	8.53	1,992.08	414.53	7.75	422.29
2019 TOTALS (lbs/day mitigated)	44.79	176.01	286.65	0.45	353.51	8.53	362.04	74.12	7.75	81.87
2020 TOTALS (lbs/day unmitigated)	42.84	160.73	272.95	0.45	1,983.55	7.80	1,991.36	414.53	7.09	421.62

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Instit'l.urb924

Project Name: 112-23 Construction Emissions Institutional Existing General Plan

2020 TOTALS (lbs/day mitigated)	42.84	160.73	272.95	0.45	353.51	7.80	361.31	74.12	7.09	81.20
2021 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2021 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2022 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2022 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2023 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2023 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2024 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2024 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2025 TOTALS (lbs/day unmitigated)	41.03	152.68	228.90	0.45	1,983.55	7.59	1,991.14	414.53	6.89	421.42
2025 TOTALS (lbs/day mitigated)	41.03	152.68	228.90	0.45	353.51	7.59	361.10	74.12	6.89	81.01
2026 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2026 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2027 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2027 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2028 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2028 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2029 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2029 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94
2030 TOTALS (lbs/day unmitigated)	40.03	149.29	205.04	0.45	1,983.55	7.52	1,991.07	414.53	6.82	421.36
2030 TOTALS (lbs/day mitigated)	40.03	149.29	205.04	0.45	353.51	7.52	361.03	74.12	6.82	80.94

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Non-Res'l.urb924

Project Name: 112-23 Construction Emissions Non Residential Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	24.06	152.61	124.23	0.06	245.07	9.01	254.08	51.22	8.28	59.50
2010 TOTALS (lbs/day mitigated)	24.06	152.61	124.23	0.06	43.70	9.01	52.71	9.17	8.28	17.44
2011 TOTALS (lbs/day unmitigated)	22.64	143.18	118.48	0.06	245.07	8.50	253.57	51.22	7.80	59.03
2011 TOTALS (lbs/day mitigated)	22.64	143.18	118.48	0.06	43.70	8.50	52.20	9.17	7.80	16.97
2012 TOTALS (lbs/day unmitigated)	21.37	134.10	113.26	0.06	245.07	7.78	252.86	51.22	7.15	58.37
2012 TOTALS (lbs/day mitigated)	21.37	134.10	113.26	0.06	43.70	7.78	51.49	9.17	7.15	16.32
2013 TOTALS (lbs/day unmitigated)	20.18	125.48	108.32	0.06	245.07	7.13	252.20	51.22	6.54	57.77
2013 TOTALS (lbs/day mitigated)	20.18	125.48	108.32	0.06	43.70	7.13	50.83	9.17	6.54	15.71
2014 TOTALS (lbs/day unmitigated)	18.99	116.71	103.87	0.06	245.07	6.42	251.50	51.22	5.90	57.12
2014 TOTALS (lbs/day mitigated)	18.99	116.71	103.87	0.06	43.70	6.42	50.13	9.17	5.90	15.06
2015 TOTALS (lbs/day unmitigated)	17.79	107.26	99.68	0.06	245.07	5.91	250.98	51.22	5.43	56.65
2015 TOTALS (lbs/day mitigated)	17.79	107.26	99.68	0.06	43.70	5.91	49.61	9.17	5.43	14.59
2016 TOTALS (lbs/day unmitigated)	16.72	98.61	96.03	0.06	245.07	5.36	250.43	51.22	4.92	56.14
2016 TOTALS (lbs/day mitigated)	16.72	98.61	96.03	0.06	43.70	5.36	49.06	9.17	4.92	14.09
2017 TOTALS (lbs/day unmitigated)	15.82	90.55	92.59	0.06	245.07	4.83	249.91	51.22	4.43	55.65
2017 TOTALS (lbs/day mitigated)	15.82	90.55	92.59	0.06	43.70	4.83	48.54	9.17	4.43	13.60
2018 TOTALS (lbs/day unmitigated)	14.80	83.05	89.49	0.06	245.07	4.33	249.40	51.22	3.97	55.19
2018 TOTALS (lbs/day mitigated)	14.80	83.05	89.49	0.06	43.70	4.33	48.03	9.17	3.97	13.13
2019 TOTALS (lbs/day unmitigated)	13.90	76.13	86.62	0.06	245.07	3.84	248.91	51.22	3.52	54.74
2019 TOTALS (lbs/day mitigated)	13.90	76.13	86.62	0.06	43.70	3.84	47.54	9.17	3.52	12.68

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Non-Res'l.urb924

Project Name: 112-23 Construction Emissions Non Residential Existing General Plan

2020 TOTALS (lbs/day unmitigated)	13.12	69.94	84.10	0.06	245.07	3.52	248.59	51.22	3.22	54.45
2020 TOTALS (lbs/day mitigated)	13.12	69.94	84.10	0.06	43.70	3.52	47.22	9.17	3.22	12.39
2021 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2021 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2022 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2022 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2023 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2023 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2024 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2024 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2025 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2025 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2026 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2026 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2027 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2027 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2028 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2028 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2029 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2029 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2030 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2030 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Non-Res'l.urb924

Project Name: 112-23 Construction Emissions Non Residential Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	24.06	152.61	124.23	0.06	245.07	9.01	254.08	51.22	8.28	59.50
2010 TOTALS (lbs/day mitigated)	24.06	152.61	124.23	0.06	43.70	9.01	52.71	9.17	8.28	17.44
2011 TOTALS (lbs/day unmitigated)	22.64	143.18	118.48	0.06	245.07	8.50	253.57	51.22	7.80	59.03
2011 TOTALS (lbs/day mitigated)	22.64	143.18	118.48	0.06	43.70	8.50	52.20	9.17	7.80	16.97
2012 TOTALS (lbs/day unmitigated)	21.37	134.10	113.26	0.06	245.07	7.78	252.86	51.22	7.15	58.37
2012 TOTALS (lbs/day mitigated)	21.37	134.10	113.26	0.06	43.70	7.78	51.49	9.17	7.15	16.32
2013 TOTALS (lbs/day unmitigated)	20.18	125.48	108.32	0.06	245.07	7.13	252.20	51.22	6.54	57.77
2013 TOTALS (lbs/day mitigated)	20.18	125.48	108.32	0.06	43.70	7.13	50.83	9.17	6.54	15.71
2014 TOTALS (lbs/day unmitigated)	18.99	116.71	103.87	0.06	245.07	6.42	251.50	51.22	5.90	57.12
2014 TOTALS (lbs/day mitigated)	18.99	116.71	103.87	0.06	43.70	6.42	50.13	9.17	5.90	15.06
2015 TOTALS (lbs/day unmitigated)	17.79	107.26	99.68	0.06	245.07	5.91	250.98	51.22	5.43	56.65
2015 TOTALS (lbs/day mitigated)	17.79	107.26	99.68	0.06	43.70	5.91	49.61	9.17	5.43	14.59
2016 TOTALS (lbs/day unmitigated)	16.72	98.61	96.03	0.06	245.07	5.36	250.43	51.22	4.92	56.14
2016 TOTALS (lbs/day mitigated)	16.72	98.61	96.03	0.06	43.70	5.36	49.06	9.17	4.92	14.09
2017 TOTALS (lbs/day unmitigated)	15.82	90.55	92.59	0.06	245.07	4.83	249.91	51.22	4.43	55.65
2017 TOTALS (lbs/day mitigated)	15.82	90.55	92.59	0.06	43.70	4.83	48.54	9.17	4.43	13.60
2018 TOTALS (lbs/day unmitigated)	14.80	83.05	89.49	0.06	245.07	4.33	249.40	51.22	3.97	55.19
2018 TOTALS (lbs/day mitigated)	14.80	83.05	89.49	0.06	43.70	4.33	48.03	9.17	3.97	13.13
2019 TOTALS (lbs/day unmitigated)	13.90	76.13	86.62	0.06	245.07	3.84	248.91	51.22	3.52	54.74
2019 TOTALS (lbs/day mitigated)	13.90	76.13	86.62	0.06	43.70	3.84	47.54	9.17	3.52	12.68

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Non-Res'l.urb924

Project Name: 112-23 Construction Emissions Non Residential Existing General Plan

2020 TOTALS (lbs/day unmitigated)	13.12	69.94	84.10	0.06	245.07	3.52	248.59	51.22	3.22	54.45
2020 TOTALS (lbs/day mitigated)	13.12	69.94	84.10	0.06	43.70	3.52	47.22	9.17	3.22	12.39
2021 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2021 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2022 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2022 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2023 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2023 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2024 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2024 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2025 TOTALS (lbs/day unmitigated)	12.87	68.90	77.88	0.06	245.07	3.49	248.57	51.22	3.20	54.42
2025 TOTALS (lbs/day mitigated)	12.87	68.90	77.88	0.06	43.70	3.49	47.20	9.17	3.20	12.37
2026 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2026 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2027 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2027 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2028 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2028 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2029 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2029 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36
2030 TOTALS (lbs/day unmitigated)	12.74	68.46	74.51	0.06	245.07	3.48	248.56	51.22	3.19	54.41
2030 TOTALS (lbs/day mitigated)	12.74	68.46	74.51	0.06	43.70	3.48	47.19	9.17	3.19	12.36

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Office.urb924
Project Name: 112-23 Construction Emissions Office Existing General Plan

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	18.04	115.24	86.12	0.04	128.16	6.96	135.12	26.79	6.40	33.18
2010 TOTALS (lbs/day mitigated)	18.04	115.24	86.12	0.04	22.87	6.96	29.82	4.80	6.40	11.19
2011 TOTALS (lbs/day unmitigated)	16.95	108.11	82.54	0.04	128.16	6.57	134.73	26.79	6.04	32.83
2011 TOTALS (lbs/day mitigated)	16.95	108.11	82.54	0.04	22.87	6.57	29.44	4.80	6.04	10.84
2012 TOTALS (lbs/day unmitigated)	15.97	101.25	79.32	0.04	128.16	6.02	134.18	26.79	5.53	32.32
2012 TOTALS (lbs/day mitigated)	15.97	101.25	79.32	0.04	22.87	6.02	28.89	4.80	5.53	10.33
2013 TOTALS (lbs/day unmitigated)	15.02	94.73	76.30	0.04	128.16	5.51	133.67	26.79	5.07	31.85
2013 TOTALS (lbs/day mitigated)	15.02	94.73	76.30	0.04	22.87	5.51	28.38	4.80	5.07	9.86
2014 TOTALS (lbs/day unmitigated)	14.10	88.10	73.54	0.04	128.16	4.96	133.12	26.79	4.56	31.35
2014 TOTALS (lbs/day mitigated)	14.10	88.10	73.54	0.04	22.87	4.96	27.83	4.80	4.56	9.36
2015 TOTALS (lbs/day unmitigated)	13.16	80.88	70.98	0.04	128.16	4.57	132.73	26.79	4.20	30.99
2015 TOTALS (lbs/day mitigated)	13.16	80.88	70.98	0.04	22.87	4.57	27.44	4.80	4.20	9.00
2016 TOTALS (lbs/day unmitigated)	12.34	74.24	68.76	0.04	128.16	4.12	132.28	26.79	3.79	30.57
2016 TOTALS (lbs/day mitigated)	12.34	74.24	68.76	0.04	22.87	4.12	26.99	4.80	3.79	8.59
2017 TOTALS (lbs/day unmitigated)	11.62	68.05	66.67	0.04	128.16	3.71	131.87	26.79	3.41	30.20
2017 TOTALS (lbs/day mitigated)	11.62	68.05	66.67	0.04	22.87	3.71	26.58	4.80	3.41	8.21
2018 TOTALS (lbs/day unmitigated)	10.83	62.31	64.79	0.04	128.16	3.32	131.48	26.79	3.05	29.84
2018 TOTALS (lbs/day mitigated)	10.83	62.31	64.79	0.04	22.87	3.32	26.19	4.80	3.05	7.85
2019 TOTALS (lbs/day unmitigated)	10.13	57.01	63.04	0.04	128.16	2.95	131.11	26.79	2.71	29.49
2019 TOTALS (lbs/day mitigated)	10.13	57.01	63.04	0.04	22.87	2.95	25.82	4.80	2.71	7.51

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Office.urb924

Project Name: 112-23 Construction Emissions Office Existing General Plan

2020 TOTALS (lbs/day unmitigated)	9.51	52.29	61.52	0.04	128.16	2.68	130.84	26.79	2.46	29.25
2020 TOTALS (lbs/day mitigated)	9.51	52.29	61.52	0.04	22.87	2.68	25.55	4.80	2.46	7.26
2021 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2021 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2022 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2022 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2023 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2023 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2024 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2024 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2025 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2025 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2026 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2026 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2027 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2027 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2028 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2028 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2029 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2029 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2030 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2030 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Office.urb924
Project Name: 112-23 Construction Emissions Office Existing General Plan

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	18.04	115.24	86.12	0.04	128.16	6.96	135.12	26.79	6.40	33.18
2010 TOTALS (lbs/day mitigated)	18.04	115.24	86.12	0.04	22.87	6.96	29.82	4.80	6.40	11.19
2011 TOTALS (lbs/day unmitigated)	16.95	108.11	82.54	0.04	128.16	6.57	134.73	26.79	6.04	32.83
2011 TOTALS (lbs/day mitigated)	16.95	108.11	82.54	0.04	22.87	6.57	29.44	4.80	6.04	10.84
2012 TOTALS (lbs/day unmitigated)	15.97	101.25	79.32	0.04	128.16	6.02	134.18	26.79	5.53	32.32
2012 TOTALS (lbs/day mitigated)	15.97	101.25	79.32	0.04	22.87	6.02	28.89	4.80	5.53	10.33
2013 TOTALS (lbs/day unmitigated)	15.02	94.73	76.30	0.04	128.16	5.51	133.67	26.79	5.07	31.85
2013 TOTALS (lbs/day mitigated)	15.02	94.73	76.30	0.04	22.87	5.51	28.38	4.80	5.07	9.86
2014 TOTALS (lbs/day unmitigated)	14.10	88.10	73.54	0.04	128.16	4.96	133.12	26.79	4.56	31.35
2014 TOTALS (lbs/day mitigated)	14.10	88.10	73.54	0.04	22.87	4.96	27.83	4.80	4.56	9.36
2015 TOTALS (lbs/day unmitigated)	13.16	80.88	70.98	0.04	128.16	4.57	132.73	26.79	4.20	30.99
2015 TOTALS (lbs/day mitigated)	13.16	80.88	70.98	0.04	22.87	4.57	27.44	4.80	4.20	9.00
2016 TOTALS (lbs/day unmitigated)	12.34	74.24	68.76	0.04	128.16	4.12	132.28	26.79	3.79	30.57
2016 TOTALS (lbs/day mitigated)	12.34	74.24	68.76	0.04	22.87	4.12	26.99	4.80	3.79	8.59
2017 TOTALS (lbs/day unmitigated)	11.62	68.05	66.67	0.04	128.16	3.71	131.87	26.79	3.41	30.20
2017 TOTALS (lbs/day mitigated)	11.62	68.05	66.67	0.04	22.87	3.71	26.58	4.80	3.41	8.21
2018 TOTALS (lbs/day unmitigated)	10.83	62.31	64.79	0.04	128.16	3.32	131.48	26.79	3.05	29.84
2018 TOTALS (lbs/day mitigated)	10.83	62.31	64.79	0.04	22.87	3.32	26.19	4.80	3.05	7.85
2019 TOTALS (lbs/day unmitigated)	10.13	57.01	63.04	0.04	128.16	2.95	131.11	26.79	2.71	29.49
2019 TOTALS (lbs/day mitigated)	10.13	57.01	63.04	0.04	22.87	2.95	25.82	4.80	2.71	7.51

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Office.urb924

Project Name: 112-23 Construction Emissions Office Existing General Plan

2020 TOTALS (lbs/day unmitigated)	9.51	52.29	61.52	0.04	128.16	2.68	130.84	26.79	2.46	29.25
2020 TOTALS (lbs/day mitigated)	9.51	52.29	61.52	0.04	22.87	2.68	25.55	4.80	2.46	7.26
2021 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2021 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2022 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2022 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2023 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2023 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2024 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2024 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2025 TOTALS (lbs/day unmitigated)	9.36	51.73	57.90	0.04	128.16	2.67	130.82	26.79	2.45	29.23
2025 TOTALS (lbs/day mitigated)	9.36	51.73	57.90	0.04	22.87	2.67	25.53	4.80	2.45	7.24
2026 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2026 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2027 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2027 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2028 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2028 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2029 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2029 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24
2030 TOTALS (lbs/day unmitigated)	9.29	51.48	55.94	0.04	128.16	2.66	130.82	26.79	2.44	29.23
2030 TOTALS (lbs/day mitigated)	9.29	51.48	55.94	0.04	22.87	2.66	25.53	4.80	2.44	7.24

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Rec.urb924

Project Name: 112-23 Construction Emissions Recreational Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	404.51	3,150.77	3,685.61	6.39	9,212.98	134.75	9,347.73	1,927.47	123.34	2,050.81
2010 TOTALS (lbs/day mitigated)	404.51	3,150.77	3,685.61	6.39	1,655.03	134.75	1,789.78	349.07	123.34	472.41
2011 TOTALS (lbs/day unmitigated)	379.57	2,858.36	3,423.39	6.39	9,212.98	121.28	9,334.26	1,927.47	110.94	2,038.40
2011 TOTALS (lbs/day mitigated)	379.57	2,858.36	3,423.39	6.39	1,655.03	121.28	1,776.31	349.07	110.94	460.00
2012 TOTALS (lbs/day unmitigated)	355.68	2,572.74	3,174.78	6.39	9,212.98	108.63	9,321.61	1,927.47	99.29	2,026.76
2012 TOTALS (lbs/day mitigated)	355.68	2,572.74	3,174.78	6.39	1,655.03	108.63	1,763.67	349.07	99.29	448.35
2013 TOTALS (lbs/day unmitigated)	333.19	2,298.66	2,936.35	6.39	9,212.98	96.66	9,309.64	1,927.47	88.23	2,015.70
2013 TOTALS (lbs/day mitigated)	333.19	2,298.66	2,936.35	6.39	1,655.03	96.66	1,751.69	349.07	88.23	437.30
2014 TOTALS (lbs/day unmitigated)	311.23	2,040.11	2,719.70	6.39	9,212.98	86.09	9,299.07	1,927.47	78.52	2,005.98
2014 TOTALS (lbs/day mitigated)	311.23	2,040.11	2,719.70	6.39	1,655.03	86.09	1,741.13	349.07	78.52	427.58
2015 TOTALS (lbs/day unmitigated)	290.44	1,803.77	2,518.45	6.39	9,212.98	76.42	9,289.40	1,927.47	69.61	1,997.08
2015 TOTALS (lbs/day mitigated)	290.44	1,803.77	2,518.45	6.39	1,655.03	76.42	1,731.46	349.07	69.61	418.68
2016 TOTALS (lbs/day unmitigated)	273.13	1,607.21	2,345.72	6.39	9,212.98	68.61	9,281.59	1,927.47	62.41	1,989.88
2016 TOTALS (lbs/day mitigated)	273.13	1,607.21	2,345.72	6.39	1,655.03	68.61	1,723.64	349.07	62.41	411.48
2017 TOTALS (lbs/day unmitigated)	258.05	1,440.05	2,187.35	6.39	9,212.98	61.69	9,274.67	1,927.47	56.05	1,983.52
2017 TOTALS (lbs/day mitigated)	258.05	1,440.05	2,187.35	6.39	1,655.03	61.69	1,716.73	349.07	56.05	405.12
2018 TOTALS (lbs/day unmitigated)	244.21	1,297.00	2,044.54	6.39	9,212.98	55.94	9,268.92	1,927.47	50.75	1,978.21
2018 TOTALS (lbs/day mitigated)	244.21	1,297.00	2,044.54	6.39	1,655.03	55.94	1,710.97	349.07	50.75	399.81
2019 TOTALS (lbs/day unmitigated)	232.47	1,174.32	1,914.30	6.39	9,212.98	50.86	9,263.84	1,927.47	46.07	1,973.54
2019 TOTALS (lbs/day mitigated)	232.47	1,174.32	1,914.30	6.39	1,655.03	50.86	1,705.89	349.07	46.07	395.14

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Rec.urb924

Project Name: 112-23 Construction Emissions Recreational Existing General Plan

2020 TOTALS (lbs/day unmitigated)	221.50	1,069.25	1,795.21	6.39	9,212.98	46.75	9,259.73	1,927.47	42.29	1,969.75
2020 TOTALS (lbs/day mitigated)	221.50	1,069.25	1,795.21	6.39	1,655.03	46.75	1,701.78	349.07	42.29	391.35
2021 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2021 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2022 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2022 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2023 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2023 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2024 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2024 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2025 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2025 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2026 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2026 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2027 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2027 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2028 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2028 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2029 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2029 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2030 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2030 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Rec.urb924

Project Name: 112-23 Construction Emissions Recreational Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	404.51	3,150.77	3,685.61	6.39	9,212.98	134.75	9,347.73	1,927.47	123.34	2,050.81
2010 TOTALS (lbs/day mitigated)	404.51	3,150.77	3,685.61	6.39	1,655.03	134.75	1,789.78	349.07	123.34	472.41
2011 TOTALS (lbs/day unmitigated)	379.57	2,858.36	3,423.39	6.39	9,212.98	121.28	9,334.26	1,927.47	110.94	2,038.40
2011 TOTALS (lbs/day mitigated)	379.57	2,858.36	3,423.39	6.39	1,655.03	121.28	1,776.31	349.07	110.94	460.00
2012 TOTALS (lbs/day unmitigated)	355.68	2,572.74	3,174.78	6.39	9,212.98	108.63	9,321.61	1,927.47	99.29	2,026.76
2012 TOTALS (lbs/day mitigated)	355.68	2,572.74	3,174.78	6.39	1,655.03	108.63	1,763.67	349.07	99.29	448.35
2013 TOTALS (lbs/day unmitigated)	333.19	2,298.66	2,936.35	6.39	9,212.98	96.66	9,309.64	1,927.47	88.23	2,015.70
2013 TOTALS (lbs/day mitigated)	333.19	2,298.66	2,936.35	6.39	1,655.03	96.66	1,751.69	349.07	88.23	437.30
2014 TOTALS (lbs/day unmitigated)	311.23	2,040.11	2,719.70	6.39	9,212.98	86.09	9,299.07	1,927.47	78.52	2,005.98
2014 TOTALS (lbs/day mitigated)	311.23	2,040.11	2,719.70	6.39	1,655.03	86.09	1,741.13	349.07	78.52	427.58
2015 TOTALS (lbs/day unmitigated)	290.44	1,803.77	2,518.45	6.39	9,212.98	76.42	9,289.40	1,927.47	69.61	1,997.08
2015 TOTALS (lbs/day mitigated)	290.44	1,803.77	2,518.45	6.39	1,655.03	76.42	1,731.46	349.07	69.61	418.68
2016 TOTALS (lbs/day unmitigated)	273.13	1,607.21	2,345.72	6.39	9,212.98	68.61	9,281.59	1,927.47	62.41	1,989.88
2016 TOTALS (lbs/day mitigated)	273.13	1,607.21	2,345.72	6.39	1,655.03	68.61	1,723.64	349.07	62.41	411.48
2017 TOTALS (lbs/day unmitigated)	258.05	1,440.05	2,187.35	6.39	9,212.98	61.69	9,274.67	1,927.47	56.05	1,983.52
2017 TOTALS (lbs/day mitigated)	258.05	1,440.05	2,187.35	6.39	1,655.03	61.69	1,716.73	349.07	56.05	405.12
2018 TOTALS (lbs/day unmitigated)	244.21	1,297.00	2,044.54	6.39	9,212.98	55.94	9,268.92	1,927.47	50.75	1,978.21
2018 TOTALS (lbs/day mitigated)	244.21	1,297.00	2,044.54	6.39	1,655.03	55.94	1,710.97	349.07	50.75	399.81
2019 TOTALS (lbs/day unmitigated)	232.47	1,174.32	1,914.30	6.39	9,212.98	50.86	9,263.84	1,927.47	46.07	1,973.54
2019 TOTALS (lbs/day mitigated)	232.47	1,174.32	1,914.30	6.39	1,655.03	50.86	1,705.89	349.07	46.07	395.14

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Rec.urb924

Project Name: 112-23 Construction Emissions Recreational Existing General Plan

2020 TOTALS (lbs/day unmitigated)	221.50	1,069.25	1,795.21	6.39	9,212.98	46.75	9,259.73	1,927.47	42.29	1,969.75
2020 TOTALS (lbs/day mitigated)	221.50	1,069.25	1,795.21	6.39	1,655.03	46.75	1,701.78	349.07	42.29	391.35
2021 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2021 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2022 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2022 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2023 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2023 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2024 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2024 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2025 TOTALS (lbs/day unmitigated)	191.97	810.35	1,375.62	6.38	9,212.98	37.60	9,250.59	1,927.47	33.88	1,961.35
2025 TOTALS (lbs/day mitigated)	191.97	810.35	1,375.62	6.38	1,655.03	37.60	1,692.64	349.07	33.88	382.95
2026 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2026 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2027 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2027 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2028 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2028 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2029 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2029 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03
2030 TOTALS (lbs/day unmitigated)	178.35	715.16	1,158.59	6.38	9,212.98	34.42	9,247.40	1,927.47	30.96	1,958.43
2030 TOTALS (lbs/day mitigated)	178.35	715.16	1,158.59	6.38	1,655.03	34.42	1,689.45	349.07	30.96	380.03

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Res'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Residential

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	708.35	3,639.26	10,892.08	15.30	160,208.47	160.80	160,369.26	33,467.42	145.41	33,612.83
2010 TOTALS (lbs/day mitigated)	708.35	3,639.26	10,892.08	15.30	28,476.11	160.80	28,636.90	5,956.43	145.41	6,101.84
2011 TOTALS (lbs/day unmitigated)	662.88	3,304.52	10,133.49	15.30	160,208.47	147.10	160,355.57	33,467.42	132.79	33,600.21
2011 TOTALS (lbs/day mitigated)	662.88	3,304.52	10,133.49	15.30	28,476.11	147.10	28,623.21	5,956.43	132.79	6,089.22
2012 TOTALS (lbs/day unmitigated)	619.90	2,980.55	9,419.94	15.30	160,208.47	134.32	160,342.79	33,467.42	120.95	33,588.37
2012 TOTALS (lbs/day mitigated)	619.90	2,980.55	9,419.94	15.30	28,476.11	134.32	28,610.43	5,956.43	120.95	6,077.38
2013 TOTALS (lbs/day unmitigated)	580.08	2,669.61	8,742.81	15.30	160,208.47	122.26	160,330.73	33,467.42	109.66	33,577.08
2013 TOTALS (lbs/day mitigated)	580.08	2,669.61	8,742.81	15.30	28,476.11	122.26	28,598.36	5,956.43	109.66	6,066.10
2014 TOTALS (lbs/day unmitigated)	542.45	2,379.60	8,130.70	15.30	160,208.47	113.35	160,321.82	33,467.42	101.49	33,568.91
2014 TOTALS (lbs/day mitigated)	542.45	2,379.60	8,130.70	15.30	28,476.11	113.35	28,589.46	5,956.43	101.49	6,057.92
2015 TOTALS (lbs/day unmitigated)	507.47	2,113.51	7,558.28	15.30	160,208.47	103.49	160,311.96	33,467.42	92.40	33,559.82
2015 TOTALS (lbs/day mitigated)	507.47	2,113.51	7,558.28	15.30	28,476.11	103.49	28,579.59	5,956.43	92.40	6,048.83
2016 TOTALS (lbs/day unmitigated)	477.88	1,892.18	7,055.41	15.30	160,208.47	95.57	160,304.04	33,467.42	85.11	33,552.53
2016 TOTALS (lbs/day mitigated)	477.88	1,892.18	7,055.41	15.30	28,476.11	95.57	28,571.67	5,956.43	85.11	6,041.54
2017 TOTALS (lbs/day unmitigated)	451.79	1,702.16	6,580.35	15.30	160,208.47	88.52	160,296.99	33,467.42	78.62	33,546.04
2017 TOTALS (lbs/day mitigated)	451.79	1,702.16	6,580.35	15.30	28,476.11	88.52	28,564.63	5,956.43	78.62	6,035.06
2018 TOTALS (lbs/day unmitigated)	427.54	1,537.93	6,142.08	15.30	160,208.47	82.79	160,291.26	33,467.42	73.26	33,540.68
2018 TOTALS (lbs/day mitigated)	427.54	1,537.93	6,142.08	15.30	28,476.11	82.79	28,558.89	5,956.43	73.26	6,029.70
2019 TOTALS (lbs/day unmitigated)	406.77	1,395.71	5,736.57	15.30	160,208.47	77.61	160,286.08	33,467.42	68.50	33,535.92
2019 TOTALS (lbs/day mitigated)	406.77	1,395.71	5,736.57	15.30	28,476.11	77.61	28,553.72	5,956.43	68.50	6,024.94

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Res'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Residential

2020 TOTALS (lbs/day unmitigated)	386.28	1,273.63	5,356.85	15.30	160,208.47	73.43	160,281.90	33,467.42	64.65	33,532.07
2020 TOTALS (lbs/day mitigated)	386.28	1,273.63	5,356.85	15.30	28,476.11	73.43	28,549.53	5,956.43	64.65	6,021.09
2021 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2021 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2022 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2022 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2023 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2023 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2024 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2024 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2025 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2025 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2026 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2026 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2027 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2027 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2028 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2028 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2029 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2029 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2030 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2030 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Res'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Residential

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	708.35	3,639.26	10,892.08	15.30	160,208.47	160.80	160,369.26	33,467.42	145.41	33,612.83
2010 TOTALS (lbs/day mitigated)	708.35	3,639.26	10,892.08	15.30	28,476.11	160.80	28,636.90	5,956.43	145.41	6,101.84
2011 TOTALS (lbs/day unmitigated)	662.88	3,304.52	10,133.49	15.30	160,208.47	147.10	160,355.57	33,467.42	132.79	33,600.21
2011 TOTALS (lbs/day mitigated)	662.88	3,304.52	10,133.49	15.30	28,476.11	147.10	28,623.21	5,956.43	132.79	6,089.22
2012 TOTALS (lbs/day unmitigated)	619.90	2,980.55	9,419.94	15.30	160,208.47	134.32	160,342.79	33,467.42	120.95	33,588.37
2012 TOTALS (lbs/day mitigated)	619.90	2,980.55	9,419.94	15.30	28,476.11	134.32	28,610.43	5,956.43	120.95	6,077.38
2013 TOTALS (lbs/day unmitigated)	580.08	2,669.61	8,742.81	15.30	160,208.47	122.26	160,330.73	33,467.42	109.66	33,577.08
2013 TOTALS (lbs/day mitigated)	580.08	2,669.61	8,742.81	15.30	28,476.11	122.26	28,598.36	5,956.43	109.66	6,066.10
2014 TOTALS (lbs/day unmitigated)	542.45	2,379.60	8,130.70	15.30	160,208.47	113.35	160,321.82	33,467.42	101.49	33,568.91
2014 TOTALS (lbs/day mitigated)	542.45	2,379.60	8,130.70	15.30	28,476.11	113.35	28,589.46	5,956.43	101.49	6,057.92
2015 TOTALS (lbs/day unmitigated)	507.47	2,113.51	7,558.28	15.30	160,208.47	103.49	160,311.96	33,467.42	92.40	33,559.82
2015 TOTALS (lbs/day mitigated)	507.47	2,113.51	7,558.28	15.30	28,476.11	103.49	28,579.59	5,956.43	92.40	6,048.83
2016 TOTALS (lbs/day unmitigated)	477.88	1,892.18	7,055.41	15.30	160,208.47	95.57	160,304.04	33,467.42	85.11	33,552.53
2016 TOTALS (lbs/day mitigated)	477.88	1,892.18	7,055.41	15.30	28,476.11	95.57	28,571.67	5,956.43	85.11	6,041.54
2017 TOTALS (lbs/day unmitigated)	451.79	1,702.16	6,580.35	15.30	160,208.47	88.52	160,296.99	33,467.42	78.62	33,546.04
2017 TOTALS (lbs/day mitigated)	451.79	1,702.16	6,580.35	15.30	28,476.11	88.52	28,564.63	5,956.43	78.62	6,035.06
2018 TOTALS (lbs/day unmitigated)	427.54	1,537.93	6,142.08	15.30	160,208.47	82.79	160,291.26	33,467.42	73.26	33,540.68
2018 TOTALS (lbs/day mitigated)	427.54	1,537.93	6,142.08	15.30	28,476.11	82.79	28,558.89	5,956.43	73.26	6,029.70
2019 TOTALS (lbs/day unmitigated)	406.77	1,395.71	5,736.57	15.30	160,208.47	77.61	160,286.08	33,467.42	68.50	33,535.92
2019 TOTALS (lbs/day mitigated)	406.77	1,395.71	5,736.57	15.30	28,476.11	77.61	28,553.72	5,956.43	68.50	6,024.94
2020 TOTALS (lbs/day unmitigated)	386.28	1,273.63	5,356.85	15.30	160,208.47	73.43	160,281.90	33,467.42	64.65	33,532.07

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP Res'l.urb924

Project Name: 112-23 Construction Emissions Existing General Plan Residential

2020 TOTALS (lbs/day mitigated)	386.28	1,273.63	5,356.85	15.30	28,476.11	73.43	28,549.53	5,956.43	64.65	6,021.09
2021 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2021 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2022 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2022 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2023 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2023 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2024 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2024 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2025 TOTALS (lbs/day unmitigated)	323.93	951.47	3,944.03	15.28	160,208.47	64.12	160,272.59	33,467.42	56.10	33,523.52
2025 TOTALS (lbs/day mitigated)	323.93	951.47	3,944.03	15.28	28,476.11	64.12	28,540.23	5,956.43	56.10	6,012.53
2026 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2026 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2027 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2027 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2028 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2028 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2029 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2029 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54
2030 TOTALS (lbs/day unmitigated)	290.62	820.81	3,182.62	15.28	160,208.47	60.86	160,269.32	33,467.42	53.11	33,520.53
2030 TOTALS (lbs/day mitigated)	290.62	820.81	3,182.62	15.28	28,476.11	60.86	28,536.96	5,956.43	53.11	6,009.54

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP SG.urb924

Project Name: 112-23 Construction Emissions Special Generator Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	95.51	743.46	733.51	1.07	1,531.79	34.53	1,566.32	320.47	31.66	352.14
2010 TOTALS (lbs/day mitigated)	95.51	743.46	733.51	1.07	275.20	34.53	309.73	58.05	31.66	89.71
2011 TOTALS (lbs/day unmitigated)	89.61	681.42	684.95	1.07	1,531.79	31.46	1,563.25	320.47	28.84	349.31
2011 TOTALS (lbs/day mitigated)	89.61	681.42	684.95	1.07	275.20	31.46	306.66	58.05	28.84	86.89
2012 TOTALS (lbs/day unmitigated)	84.08	620.90	639.23	1.07	1,531.79	28.43	1,560.22	320.47	26.04	346.52
2012 TOTALS (lbs/day mitigated)	84.08	620.90	639.23	1.07	275.20	28.43	303.63	58.05	26.04	84.09
2013 TOTALS (lbs/day unmitigated)	79.10	563.11	595.48	1.07	1,531.79	25.62	1,557.41	320.47	23.45	343.93
2013 TOTALS (lbs/day mitigated)	79.10	563.11	595.48	1.07	275.20	25.62	300.82	58.05	23.45	81.50
2014 TOTALS (lbs/day unmitigated)	74.03	507.42	556.02	1.07	1,531.79	22.93	1,554.72	320.47	20.98	341.45
2014 TOTALS (lbs/day mitigated)	74.03	507.42	556.02	1.07	275.20	22.93	298.13	58.05	20.98	79.02
2015 TOTALS (lbs/day unmitigated)	69.10	454.31	519.23	1.07	1,531.79	20.64	1,552.43	320.47	18.87	339.34
2015 TOTALS (lbs/day mitigated)	69.10	454.31	519.23	1.07	275.20	20.64	295.84	58.05	18.87	76.92
2016 TOTALS (lbs/day unmitigated)	64.90	408.89	487.79	1.07	1,531.79	18.52	1,550.31	320.47	16.92	337.39
2016 TOTALS (lbs/day mitigated)	64.90	408.89	487.79	1.07	275.20	18.52	293.72	58.05	16.92	74.97
2017 TOTALS (lbs/day unmitigated)	61.20	369.06	458.85	1.07	1,531.79	16.67	1,548.46	320.47	15.21	335.69
2017 TOTALS (lbs/day mitigated)	61.20	369.06	458.85	1.07	275.20	16.67	291.87	58.05	15.21	73.26
2018 TOTALS (lbs/day unmitigated)	57.60	333.95	432.98	1.07	1,531.79	15.02	1,546.81	320.47	13.70	334.17
2018 TOTALS (lbs/day mitigated)	57.60	333.95	432.98	1.07	275.20	15.02	290.22	58.05	13.70	71.75
2019 TOTALS (lbs/day unmitigated)	54.63	303.25	409.31	1.07	1,531.79	13.49	1,545.28	320.47	12.29	332.77
2019 TOTALS (lbs/day mitigated)	54.63	303.25	409.31	1.07	275.20	13.49	288.70	58.05	12.29	70.34

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP SG.urb924

Project Name: 112-23 Construction Emissions Special Generator Existing General Plan

2020 TOTALS (lbs/day unmitigated)	51.72	276.39	387.89	1.07	1,531.79	12.31	1,544.10	320.47	11.21	331.68
2020 TOTALS (lbs/day mitigated)	51.72	276.39	387.89	1.07	275.20	12.31	287.52	58.05	11.21	69.26
2021 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2021 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2022 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2022 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2023 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2023 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2024 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2024 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2025 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2025 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2026 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2026 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2027 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2027 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2028 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2028 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2029 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2029 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2030 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2030 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP SG.urb924

Project Name: 112-23 Construction Emissions Special Generator Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	95.51	743.46	733.51	1.07	1,531.79	34.53	1,566.32	320.47	31.66	352.14
2010 TOTALS (lbs/day mitigated)	95.51	743.46	733.51	1.07	275.20	34.53	309.73	58.05	31.66	89.71
2011 TOTALS (lbs/day unmitigated)	89.61	681.42	684.95	1.07	1,531.79	31.46	1,563.25	320.47	28.84	349.31
2011 TOTALS (lbs/day mitigated)	89.61	681.42	684.95	1.07	275.20	31.46	306.66	58.05	28.84	86.89
2012 TOTALS (lbs/day unmitigated)	84.08	620.90	639.23	1.07	1,531.79	28.43	1,560.22	320.47	26.04	346.52
2012 TOTALS (lbs/day mitigated)	84.08	620.90	639.23	1.07	275.20	28.43	303.63	58.05	26.04	84.09
2013 TOTALS (lbs/day unmitigated)	79.10	563.11	595.48	1.07	1,531.79	25.62	1,557.41	320.47	23.45	343.93
2013 TOTALS (lbs/day mitigated)	79.10	563.11	595.48	1.07	275.20	25.62	300.82	58.05	23.45	81.50
2014 TOTALS (lbs/day unmitigated)	74.03	507.42	556.02	1.07	1,531.79	22.93	1,554.72	320.47	20.98	341.45
2014 TOTALS (lbs/day mitigated)	74.03	507.42	556.02	1.07	275.20	22.93	298.13	58.05	20.98	79.02
2015 TOTALS (lbs/day unmitigated)	69.10	454.31	519.23	1.07	1,531.79	20.64	1,552.43	320.47	18.87	339.34
2015 TOTALS (lbs/day mitigated)	69.10	454.31	519.23	1.07	275.20	20.64	295.84	58.05	18.87	76.92
2016 TOTALS (lbs/day unmitigated)	64.90	408.89	487.79	1.07	1,531.79	18.52	1,550.31	320.47	16.92	337.39
2016 TOTALS (lbs/day mitigated)	64.90	408.89	487.79	1.07	275.20	18.52	293.72	58.05	16.92	74.97
2017 TOTALS (lbs/day unmitigated)	61.20	369.06	458.85	1.07	1,531.79	16.67	1,548.46	320.47	15.21	335.69
2017 TOTALS (lbs/day mitigated)	61.20	369.06	458.85	1.07	275.20	16.67	291.87	58.05	15.21	73.26
2018 TOTALS (lbs/day unmitigated)	57.60	333.95	432.98	1.07	1,531.79	15.02	1,546.81	320.47	13.70	334.17
2018 TOTALS (lbs/day mitigated)	57.60	333.95	432.98	1.07	275.20	15.02	290.22	58.05	13.70	71.75
2019 TOTALS (lbs/day unmitigated)	54.63	303.25	409.31	1.07	1,531.79	13.49	1,545.28	320.47	12.29	332.77
2019 TOTALS (lbs/day mitigated)	54.63	303.25	409.31	1.07	275.20	13.49	288.70	58.05	12.29	70.34
2020 TOTALS (lbs/day unmitigated)	51.72	276.39	387.89	1.07	1,531.79	12.31	1,544.10	320.47	11.21	331.68
2020 TOTALS (lbs/day mitigated)	51.72	276.39	387.89	1.07	275.20	12.31	287.52	58.05	11.21	69.26

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const Ex GP SG.urb924

Project Name: 112-23 Construction Emissions Special Generator Existing General Plan

2021 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2021 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2022 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2022 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2023 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2023 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2024 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2024 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2025 TOTALS (lbs/day unmitigated)	46.78	233.29	317.23	1.07	1,531.79	10.79	1,542.58	320.47	9.81	330.28
2025 TOTALS (lbs/day mitigated)	46.78	233.29	317.23	1.07	275.20	10.79	286.00	58.05	9.81	67.86
2026 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2026 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2027 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2027 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2028 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2028 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2029 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2029 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37
2030 TOTALS (lbs/day unmitigated)	44.49	217.43	280.66	1.07	1,531.79	10.26	1,542.05	320.47	9.32	329.80
2030 TOTALS (lbs/day mitigated)	44.49	217.43	280.66	1.07	275.20	10.26	285.47	58.05	9.32	67.37

Operational Air Emissions

for Existing General Plan and Area Plan

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Comm'l.urb924

Project Name: 112-23 Existing General Plan Commercial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	134.95	141.54	125.00	0.00	0.27	0.27	169,758.28

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,308.43	14,144.25	124,040.24	131.39	21,639.57	4,209.98	12,826,643.39

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,443.38	14,285.79	124,165.24	131.39	21,639.84	4,210.25	12,996,401.67

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	10.27	141.46	118.82	0.00	0.25	0.25	169,747.04
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	0.00						
Architectural Coatings	124.19						
TOTALS (lbs/day, unmitigated)	134.95	141.54	125.00	0.00	0.27	0.27	169,758.28

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	3,038.96	4,598.01	40,322.99	42.71	7,034.59	1,368.58	4,169,683.85
Comm'l Ctr 10-30 ac	3,810.01	5,795.72	50,826.50	53.84	8,866.99	1,725.08	5,255,821.83
Comm'l Ctr <10 ac	1,840.38	2,815.40	24,690.11	26.15	4,307.34	837.99	2,553,133.54
Comm'l Shops	619.08	935.12	8,200.64	8.69	1,430.65	278.33	848,004.17
TOTALS (lbs/day, unmitigated)	9,308.43	14,144.25	124,040.24	131.39	21,639.57	4,209.98	12,826,643.39

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	8,687.99	348,040.90	4,072,078.47
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	8,115.06	438,700.16	5,132,791.76
Comm'l Ctr <10 ac		85.06	1000 sq ft	2,505.39	213,108.46	2,493,368.92
Comm'l Shops		37.06	1000 sq ft	1,909.94	70,782.38	828,153.80
					1,070,631.90	12,526,392.95

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Comm'l.urb924

Project Name: 112-23 Existing General Plan Commercial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	134.46	141.46	118.82	0.00	0.25	0.25	169,747.04

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10,813.37	17,054.81	118,458.85	109.25	21,639.57	4,209.98	11,610,363.76

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10,947.83	17,196.27	118,577.67	109.25	21,639.82	4,210.23	11,780,110.80

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	10.27	141.46	118.82	0.00	0.25	0.25	169,747.04
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	124.19						
TOTALS (lbs/day, unmitigated)	134.46	141.46	118.82	0.00	0.25	0.25	169,747.04

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	3,521.04	5,544.17	38,508.59	35.51	7,034.59	1,368.58	3,774,295.80
Comm'l Ctr 10-30 ac	4,428.98	6,988.35	48,539.48	44.77	8,866.99	1,725.08	4,757,441.33
Comm'l Ctr <10 ac	2,146.80	3,394.75	23,579.14	21.75	4,307.34	837.99	2,311,034.01
Comm'l Shops	716.55	1,127.54	7,831.64	7.22	1,430.65	278.33	767,592.62
TOTALS (lbs/day, unmitigated)	10,813.37	17,054.81	118,458.85	109.25	21,639.57	4,209.98	11,610,363.76

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	8,687.99	348,040.90	4,072,078.47
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	8,115.06	438,700.16	5,132,791.76
Comm'l Ctr <10 ac		85.06	1000 sq ft	2,505.39	213,108.46	2,493,368.92
Comm'l Shops		37.06	1000 sq ft	1,909.94	70,782.38	828,153.80
					1,070,631.90	12,526,392.95

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Institutional.urb924

Project Name: 112-23 Existing General Plan Institutional Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	67.96	98.16	93.16	0.00	0.22	0.21	117,647.30

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,277.66	2,305.39	20,363.35	21.43	3,522.38	685.49	2,091,051.71

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,345.62	2,403.55	20,456.51	21.43	3,522.60	685.70	2,208,699.01

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	7.12	98.02	82.34	0.00	0.18	0.17	117,627.64
Hearth - No Summer Emissions							
Landscape	0.86	0.14	10.82	0.00	0.04	0.04	19.66
Consumer Products	0.00						
Architectural Coatings	59.98						
TOTALS (lbs/day, unmitigated)	67.96	98.16	93.16	0.00	0.22	0.21	117,647.30

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Day-care center	24.83	32.26	283.50	0.30	49.33	9.60	29,255.75
Elementary school	898.27	832.77	7,396.28	7.74	1,271.08	247.42	755,458.07
High school	514.79	530.21	4,676.18	4.93	810.33	157.69	480,894.99
Junior college (2 yrs)	681.59	678.51	5,962.96	6.30	1,037.65	201.89	615,337.26
Library	52.52	80.19	704.76	0.75	122.64	23.86	72,726.72
Place of worship	52.61	74.45	653.38	0.69	113.89	22.16	67,517.81
Hospital	53.05	77.00	686.29	0.72	117.46	22.87	69,861.11
TOTALS (lbs/day, unmitigated)	2,277.66	2,305.39	20,363.35	21.43	3,522.38	685.49	2,091,051.71

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Day-care center		4.52	1000 sq ft	540.00	2,440.80	28,557.36
Elementary school		1.29	students	48,743.00	62,878.47	735,678.07
High school		1.71	students	23,444.00	40,089.24	469,044.11
Junior college (2 yrs)		1.54	students	33,336.00	51,337.44	600,648.02
Library		84.98	1000 sq ft	71.40	6,067.57	70,990.60
Place of worship		9.30	1000 sq ft	605.89	5,634.78	65,926.89
Hospital		16.80	1000 sq ft	345.84	5,810.11	67,978.31
					174,258.41	2,038,823.36

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Day-care center				5.0	2.5	92.5
Elementary school				20.0	10.0	70.0
High school				10.0	5.0	85.0
Junior college (2 yrs)				5.0	2.5	92.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Library				5.0	2.5	92.5
Place of worship				3.0	1.5	95.5
Hospital				25.0	12.5	62.5

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Institutional.urb924

Project Name: 112-23 Existing General Plan Institutional Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	67.10	98.02	82.34	0.00	0.18	0.17	117,627.64

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,107.08	2,780.04	19,427.22	17.83	3,522.38	685.49	1,893,087.35

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,174.18	2,878.06	19,509.56	17.83	3,522.56	685.66	2,010,714.99

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	7.12	98.02	82.34	0.00	0.18	0.17	117,627.64
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	59.98						
TOTALS (lbs/day, unmitigated)	67.10	98.02	82.34	0.00	0.18	0.17	117,627.64

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Day-care center	26.29	38.90	270.67	0.25	49.33	9.60	26,482.90
Elementary school	795.85	1,004.29	7,050.78	6.44	1,271.08	247.42	684,025.67
High school	480.40	639.36	4,462.17	4.10	810.33	157.69	435,352.05
Junior college (2 yrs)	624.63	818.15	5,692.92	5.24	1,037.65	201.89	557,015.93
Library	61.22	96.70	672.85	0.62	122.64	23.86	65,833.72
Place of worship	58.55	89.77	623.92	0.58	113.89	22.16	61,116.48
Hospital	60.14	92.87	653.91	0.60	117.46	22.87	63,260.60
TOTALS (lbs/day, unmitigated)	2,107.08	2,780.04	19,427.22	17.83	3,522.38	685.49	1,893,087.35

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Day-care center		4.52	1000 sq ft	540.00	2,440.80	28,557.36
Elementary school		1.29	students	48,743.00	62,878.47	735,678.07
High school		1.71	students	23,444.00	40,089.24	469,044.11
Junior college (2 yrs)		1.54	students	33,336.00	51,337.44	600,648.02
Library		84.98	1000 sq ft	71.40	6,067.57	70,990.60
Place of worship		9.30	1000 sq ft	605.89	5,634.78	65,926.89
Hospital		16.80	1000 sq ft	345.84	5,810.11	67,978.31
					174,258.41	2,038,823.36

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Day-care center				5.0	2.5	92.5
Elementary school				20.0	10.0	70.0
High school				10.0	5.0	85.0
Junior college (2 yrs)				5.0	2.5	92.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Library				5.0	2.5	92.5
Place of worship				3.0	1.5	95.5
Hospital				25.0	12.5	62.5

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 EX GP Res'l.urb924

Project Name: 112-23 Existing General Plan Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,332.01	2,120.42	4,943.48	0.20	14.71	14.58	2,655,006.27

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	12,369.01	16,785.22	153,134.91	156.32	25,491.48	4,967.93	15,242,339.04

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	21,701.02	18,905.64	158,078.39	156.52	25,506.19	4,982.51	17,897,345.31

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	160.23	2,074.65	882.83	0.02	3.97	3.93	2,648,484.90
Hearth - No Summer Emissions							
Landscape	733.28	45.77	4,060.65	0.18	10.74	10.65	6,521.37
Consumer Products	8,006.75						
Architectural Coatings	431.75						
TOTALS (lbs/day, unmitigated)	9,332.01	2,120.42	4,943.48	0.20	14.71	14.58	2,655,006.27

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	8,056.59	11,061.48	100,916.06	103.01	16,798.91	3,273.87	10,044,716.72
Apartments mid rise	559.32	730.21	6,661.83	6.80	1,108.96	216.12	663,087.87
Condo/townhouse general	3,528.53	4,702.46	42,901.45	43.79	7,141.55	1,391.79	4,270,211.03
Mobile home park	150.28	200.28	1,827.23	1.87	304.17	59.28	181,874.41
Retirement community	74.29	90.79	828.34	0.85	137.89	26.87	82,449.01
TOTALS (lbs/day, unmitigated)	12,369.01	16,785.22	153,134.91	156.32	25,491.48	4,967.93	15,242,339.04

Operational Settings:

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Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	28,936.00	9.57	dwelling units	86,808.00	830,752.53	9,719,804.48
Apartments mid rise	250.55	5.76	dwelling units	9,521.00	54,840.96	641,639.25
Condo/townhouse general	3,199.00	6.90	dwelling units	51,184.00	353,169.60	4,132,084.31
Mobile home park	363.33	6.90	dwelling units	2,180.00	15,042.00	175,991.40
Retirement community	367.60	3.71	dwelling units	1,838.00	6,818.98	79,782.07
					1,260,624.07	14,749,301.51

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 EX GP Res'l.urb924

Project Name: 112-23 Existing General Plan Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	32,345.27	4,089.37	66,725.95	184.71	10,214.28	9,833.16	5,349,798.83

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	13,584.80	20,246.59	145,918.32	130.22	25,491.48	4,967.93	13,810,220.89

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	45,930.07	24,335.96	212,644.27	314.93	35,705.76	14,801.09	19,160,019.72

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	160.23	2,074.65	882.83	0.02	3.97	3.93	2,648,484.90
Hearth	23,746.54	2,014.72	65,843.12	184.69	10,210.31	9,829.23	2,701,313.93
Landscaping - No Winter Emissions							
Consumer Products	8,006.75						
Architectural Coatings	431.75						
TOTALS (lbs/day, unmitigated)	32,345.27	4,089.37	66,725.95	184.71	10,214.28	9,833.16	5,349,798.83

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	8,909.88	13,342.52	96,160.32	85.82	16,798.91	3,273.87	9,100,949.41
Apartments mid rise	600.52	880.79	6,347.89	5.67	1,108.96	216.12	600,786.40
Condo/townhouse general	3,834.29	5,672.17	40,879.69	36.48	7,141.55	1,391.79	3,868,996.58
Mobile home park	163.31	241.59	1,741.12	1.55	304.17	59.28	164,786.12
Retirement community	76.80	109.52	789.30	0.70	137.89	26.87	74,702.38
TOTALS (lbs/day, unmitigated)	13,584.80	20,246.59	145,918.32	130.22	25,491.48	4,967.93	13,810,220.89

Operational Settings:

4/20/2009 6:34:14 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	28,936.00	9.57	dwelling units	86,808.00	830,752.53	9,719,804.48
Apartments mid rise	250.55	5.76	dwelling units	9,521.00	54,840.96	641,639.25
Condo/townhouse general	3,199.00	6.90	dwelling units	51,184.00	353,169.60	4,132,084.31
Mobile home park	363.33	6.90	dwelling units	2,180.00	15,042.00	175,991.40
Retirement community	367.60	3.71	dwelling units	1,838.00	6,818.98	79,782.07
					1,260,624.07	14,749,301.51

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP SG.urb924

Project Name: 112-23 OVOV Existing GP Special Generator Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	52.29	0.93	9.95	0.00	0.03	0.03	983.29

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	352.56	539.23	4,736.38	5.01	824.73	160.46	489,012.44

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	404.85	540.16	4,746.33	5.01	824.76	160.49	489,995.73

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.06	0.81	0.68	0.00	0.00	0.00	966.44
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	0.00						
Architectural Coatings	51.49						
TOTALS (lbs/day, unmitigated)	52.29	0.93	9.95	0.00	0.03	0.03	983.29

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Manufacturing	17.84	26.59	240.77	0.25	40.44	7.88	24,135.34
Wayside Honor Ranch	13.04	19.82	173.79	0.18	30.32	5.90	17,970.66
Six Flags Magic Mtn	206.96	317.07	2,780.57	2.95	485.09	94.37	287,530.61
Travel Village	22.59	34.61	303.55	0.32	52.96	10.30	31,388.76
Agua Dulce Airport	48.07	73.64	645.79	0.68	112.66	21.92	66,778.99
Landfill	44.06	67.50	591.91	0.63	103.26	20.09	61,208.08
TOTALS (lbs/day, unmitigated)	352.56	539.23	4,736.38	5.01	824.73	160.46	489,012.44

4/21/2009 1:42:17 PM

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Manufacturing		100.00	1000 sq ft	20.00	2,000.00	23,400.00
Wayside Honor Ranch		50.00	acres	30.00	1,500.00	17,550.00
Six Flags Magic Mtn		100.00	acres	240.00	24,000.00	280,800.00
Travel Village		100.00	acres	26.20	2,620.00	30,654.00
Agua Dulce Airport		100.00	acres	55.74	5,574.00	65,215.80
Landfill		100.00	acres	51.09	5,109.00	59,775.30
					40,803.00	477,395.10

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Manufacturing				48.0	24.0	28.0
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP SG.urb924

Project Name: 112-23 OVOV Existing GP Special Generator Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	51.55	0.81	0.68	0.00	0.00	0.00	966.44

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	411.35	650.19	4,522.22	4.17	824.73	160.46	442,658.63

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	462.90	651.00	4,522.90	4.17	824.73	160.46	443,625.07

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.06	0.81	0.68	0.00	0.00	0.00	966.44
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	51.49						
TOTALS (lbs/day, unmitigated)	51.55	0.81	0.68	0.00	0.00	0.00	966.44

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Manufacturing	20.63	32.08	228.90	0.21	40.44	7.88	21,863.26
Wayside Honor Ranch	15.15	23.89	165.97	0.15	30.32	5.90	16,266.60
Six Flags Magic Mtn	241.63	382.31	2,655.45	2.45	485.09	94.37	260,265.67
Travel Village	26.38	41.74	289.89	0.27	52.96	10.30	28,412.34
Agua Dulce Airport	56.12	88.79	616.73	0.57	112.66	21.92	60,446.70
Landfill	51.44	81.38	565.28	0.52	103.26	20.09	55,404.06
TOTALS (lbs/day, unmitigated)	411.35	650.19	4,522.22	4.17	824.73	160.46	442,658.63

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Manufacturing		100.00	1000 sq ft	20.00	2,000.00	23,400.00
Wayside Honor Ranch		50.00	acres	30.00	1,500.00	17,550.00
Six Flags Magic Mtn		100.00	acres	240.00	24,000.00	280,800.00
Travel Village		100.00	acres	26.20	2,620.00	30,654.00
Agua Dulce Airport		100.00	acres	55.74	5,574.00	65,215.80
Landfill		100.00	acres	51.09	5,109.00	59,775.30
					40,803.00	477,395.10

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Manufacturing				48.0	24.0	28.0
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. GP Non-Res'l.urb924

Project Name: 112-23 Existing GP Non-Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	33.46	43.16	45.42	0.00	0.11	0.11	51,662.38

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	946.34	1,393.97	12,245.11	12.93	2,131.99	414.80	1,264,166.77

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	979.80	1,437.13	12,290.53	12.93	2,132.10	414.91	1,315,829.15

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.12	43.04	36.15	0.00	0.08	0.08	51,645.53
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	0.00						
Architectural Coatings	29.60						
TOTALS (lbs/day, unmitigated)	33.46	43.16	45.42	0.00	0.11	0.11	51,662.38

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	43.76	66.08	580.76	0.61	101.06	19.66	59,930.65
High turnover (sit-down) rest.	326.25	499.90	4,393.27	4.64	764.50	148.75	453,355.79
Fast food rest. w/ drive thru	226.07	348.05	3,058.76	3.23	532.28	103.56	315,643.37
Hotel	131.91	184.48	1,621.26	1.71	282.13	54.89	167,303.36
Movie Theater	73.58	76.73	672.90	0.71	117.39	22.84	69,582.41
Car Dealership	144.77	218.73	1,918.16	2.03	334.63	65.10	198,351.19
TOTALS (lbs/day, unmitigated)	946.34	1,393.97	12,245.11	12.93	2,131.99	414.80	1,264,166.77

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	125.00	5,000.00	58,500.00
High turnover (sit-down) rest.		130.34	1000 sq ft	290.19	37,823.36	442,533.35
Fast food rest. w/ drive thru		496.12	1000 sq ft	53.08	26,334.05	308,108.38
Hotel		8.23	rooms	1,696.00	13,958.08	163,309.52
Movie Theater		1.76	1000 sq ft	3,300.00	5,808.00	67,953.60
Car Dealership		37.50	1000 sq ft	441.50	16,556.25	193,708.12
					105,479.74	1,234,112.97

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112-23 Ex. GP Non-Res'l.urb924

Project Name: 112-23 Existing GP Non-Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	32.72	43.04	36.15	0.00	0.08	0.08	51,645.53

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,079.10	1,680.85	11,691.32	10.77	2,131.99	414.80	1,144,337.67

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,111.82	1,723.89	11,727.47	10.77	2,132.07	414.88	1,195,983.20

4/21/2009 11:23:16 AM

Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.12	43.04	36.15	0.00	0.08	0.08	51,645.53
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	29.60						
TOTALS (lbs/day, unmitigated)	32.72	43.04	36.15	0.00	0.08	0.08	51,645.53

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	50.66	79.68	554.46	0.51	101.06	19.66	54,250.46
High turnover (sit-down) rest.	381.12	602.78	4,194.31	3.86	764.50	148.75	410,386.97
Fast food rest. w/ drive thru	264.87	419.68	2,920.24	2.69	532.28	103.56	285,726.86
Hotel	145.82	222.45	1,547.84	1.43	282.13	54.89	151,446.44
Movie Theater	69.04	92.52	642.62	0.59	117.39	22.84	62,984.29
Car Dealership	167.59	263.74	1,831.85	1.69	334.63	65.10	179,542.65
TOTALS (lbs/day, unmitigated)	1,079.10	1,680.85	11,691.32	10.77	2,131.99	414.80	1,144,337.67

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	125.00	5,000.00	58,500.00
High turnover (sit-down) rest.		130.34	1000 sq ft	290.19	37,823.36	442,533.35
Fast food rest. w/ drive thru		496.12	1000 sq ft	53.08	26,334.05	308,108.38
Hotel		8.23	rooms	1,696.00	13,958.08	163,309.52
Movie Theater		1.76	1000 sq ft	3,300.00	5,808.00	67,953.60
Car Dealership		37.50	1000 sq ft	441.50	16,556.25	193,708.12
					105,479.74	1,234,112.97

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Office.urb924

Project Name: 112-23 Existing General Plan Office Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	52.71	55.02	52.33	0.00	0.12	0.12	65,936.68

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	428.29	569.25	4,994.03	5.28	870.85	169.42	516,231.69

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	481.00	624.27	5,046.36	5.28	870.97	169.54	582,168.37

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.99	54.94	46.15	0.00	0.10	0.10	65,925.44
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	0.00						
Architectural Coatings	48.23						
TOTALS (lbs/day, unmitigated)	52.71	55.02	52.33	0.00	0.12	0.12	65,936.68

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	41.49	59.30	521.91	0.55	90.67	17.64	53,783.38
Regional Post Office	21.09	24.02	210.67	0.22	36.75	7.15	21,784.28
Post Office	14.98	22.59	198.12	0.21	34.56	6.72	20,486.56
Commercial Office	350.73	463.34	4,063.33	4.30	708.87	137.91	420,177.47
TOTALS (lbs/day, unmitigated)	428.29	569.25	4,994.03	5.28	870.85	169.42	516,231.69

Operational Settings:

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Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	412.29	4,485.72	52,482.87
Regional Post Office		2.38	1000 sq ft	764.00	1,818.32	21,274.34
Post Office		34.20	1000 sq ft	50.00	1,710.00	20,007.00
Commercial Office		5.00	1000 sq ft	7,014.39	35,071.95	410,341.82
					43,085.99	504,106.03

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Office.urb924

Project Name: 112-23 Existing General Plan Office Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	52.22	54.94	46.15	0.00	0.10	0.10	65,925.44

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	459.36	686.40	4,769.06	4.40	870.85	169.42	467,284.34

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	511.58	741.34	4,815.21	4.40	870.95	169.52	533,209.78

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.99	54.94	46.15	0.00	0.10	0.10	65,925.44
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	48.23						
TOTALS (lbs/day, unmitigated)	52.22	54.94	46.15	0.00	0.10	0.10	65,925.44

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	46.48	71.51	498.17	0.46	90.67	17.64	48,687.44
Regional Post Office	20.74	28.97	201.19	0.19	36.75	7.15	19,718.60
Post Office	17.32	27.24	189.20	0.17	34.56	6.72	18,543.93
Commercial Office	374.82	558.68	3,880.50	3.58	708.87	137.91	380,334.37
TOTALS (lbs/day, unmitigated)	459.36	686.40	4,769.06	4.40	870.85	169.42	467,284.34

Operational Settings:

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Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	412.29	4,485.72	52,482.87
Regional Post Office		2.38	1000 sq ft	764.00	1,818.32	21,274.34
Post Office		34.20	1000 sq ft	50.00	1,710.00	20,007.00
Commercial Office		5.00	1000 sq ft	7,014.39	35,071.95	410,341.82
					43,085.99	504,106.03

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Recreation.urb924

Project Name: 112-23 Existing General Plan Recreational

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	325.84	0.06	4.64	0.00	0.02	0.02	8.43

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,214.06	1,847.18	16,199.14	17.15	2,826.04	549.81	1,675,106.19

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,539.90	1,847.24	16,203.78	17.15	2,826.06	549.83	1,675,114.62

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth - No Summer Emissions							
Landscape	0.37	0.06	4.64	0.00	0.02	0.02	8.43
Consumer Products	0.00						
Architectural Coatings	325.47						
TOTALS (lbs/day, unmitigated)	325.84	0.06	4.64	0.00	0.02	0.02	8.43

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	1,149.58	1,762.34	15,455.13	16.37	2,696.24	524.55	1,598,170.28
Developed Park	42.00	58.65	514.32	0.54	89.73	17.46	53,184.68
Undeveloped Park	22.48	26.19	229.69	0.24	40.07	7.80	23,751.23
TOTALS (lbs/day, unmitigated)	1,214.06	1,847.18	16,199.14	17.15	2,826.04	549.81	1,675,106.19

Operational Settings:

Does not include correction for passby trips

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Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	1,233.00	133,398.27	1,560,759.77
Developed Park		7.96	acres	557.70	4,439.29	51,939.72
Undeveloped Park		2.60	acres	762.50	1,982.50	23,195.25
					139,820.06	1,635,894.74

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Ex. GP Recreation.urb924

Project Name: 112-23 Existing General Plan Recreational

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	325.47	0.00	0.00	0.00	0.00	0.00	0.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,411.47	2,227.29	15,470.23	14.26	2,826.04	549.81	1,516,265.14

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,736.94	2,227.29	15,470.23	14.26	2,826.04	549.81	1,516,265.14

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	325.47						
TOTALS (lbs/day, unmitigated)	325.47	0.00	0.00	0.00	0.00	0.00	0.00

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	1,342.72	2,124.99	14,759.70	13.61	2,696.24	524.55	1,446,624.64
Developed Park	46.37	70.72	491.18	0.45	89.73	17.46	48,141.47
Undeveloped Park	22.38	31.58	219.35	0.20	40.07	7.80	21,499.03
TOTALS (lbs/day, unmitigated)	1,411.47	2,227.29	15,470.23	14.26	2,826.04	549.81	1,516,265.14

Operational Settings:

Does not include correction for passby trips

4/21/2009 1:38:49 PM

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	1,233.00	133,398.27	1,560,759.77
Developed Park		7.96	acres	557.70	4,439.29	51,939.72
Undeveloped Park		2.60	acres	762.50	1,982.50	23,195.25
					139,820.06	1,635,894.74

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	11.7	11.7	11.7	11.7	11.7	11.7
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Constr Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	537.94	3,917.09	5,027.69	8.63	14,614.03	167.27	14,781.30	3,056.70	153.00	3,209.69	920,113.09
2011 TOTALS (lbs/day unmitigated)	505.89	3,549.41	4,669.75	8.63	14,614.03	150.54	14,764.57	3,056.70	137.58	3,194.28	920,051.10
2012 TOTALS (lbs/day unmitigated)	475.11	3,190.40	4,330.51	8.63	14,614.03	134.82	14,748.84	3,056.70	123.09	3,179.79	920,004.29
2013 TOTALS (lbs/day unmitigated)	445.99	2,845.70	4,005.47	8.63	14,614.03	119.90	14,733.93	3,056.70	109.31	3,166.00	919,984.22
2014 TOTALS (lbs/day unmitigated)	417.81	2,521.74	3,710.03	8.63	14,614.03	106.92	14,720.95	3,056.70	97.38	3,154.07	919,965.89
2015 TOTALS (lbs/day unmitigated)	391.25	2,226.45	3,435.48	8.63	14,614.03	94.91	14,708.93	3,056.70	86.31	3,143.00	919,958.05
2016 TOTALS (lbs/day unmitigated)	369.17	1,981.58	3,199.15	8.63	14,614.03	85.25	14,699.28	3,056.70	77.42	3,134.11	919,932.50

2017 TOTALS (lbs/day unmitigated)	349.92	1,774.03	2,981.79	8.63	14,614.03	76.77	14,690.79	3,056.70	69.61	3,126.31	919,923.13
2018 TOTALS (lbs/day unmitigated)	332.37	1,596.95	2,785.06	8.63	14,614.03	69.76	14,683.79	3,056.70	63.15	3,119.84	919,923.31
2019 TOTALS (lbs/day unmitigated)	317.42	1,445.38	2,605.37	8.63	14,614.03	63.60	14,677.63	3,056.70	57.48	3,114.18	919,929.75
2020 TOTALS (lbs/day unmitigated)	303.47	1,316.00	2,440.46	8.63	14,614.03	58.61	14,672.64	3,056.70	52.89	3,109.58	919,938.94
2021 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2022 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2023 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2024 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2025 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2026 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2027 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2028 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93

2029 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2030 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Constr Ex GP Ind'l.urb924

Project Name: 112-23 Construction Emissions Industrial Existing General Plan

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	537.94	3,917.09	5,027.69	8.63	14,614.03	167.27	14,781.30	3,056.70	153.00	3,209.69	920,113.09
2011 TOTALS (lbs/day unmitigated)	505.89	3,549.41	4,669.75	8.63	14,614.03	150.54	14,764.57	3,056.70	137.58	3,194.28	920,051.10
2012 TOTALS (lbs/day unmitigated)	475.11	3,190.40	4,330.51	8.63	14,614.03	134.82	14,748.84	3,056.70	123.09	3,179.79	920,004.29
2013 TOTALS (lbs/day unmitigated)	445.99	2,845.70	4,005.47	8.63	14,614.03	119.90	14,733.93	3,056.70	109.31	3,166.00	919,984.22
2014 TOTALS (lbs/day unmitigated)	417.81	2,521.74	3,710.03	8.63	14,614.03	106.92	14,720.95	3,056.70	97.38	3,154.07	919,965.89
2015 TOTALS (lbs/day unmitigated)	391.25	2,226.45	3,435.48	8.63	14,614.03	94.91	14,708.93	3,056.70	86.31	3,143.00	919,958.05
2016 TOTALS (lbs/day unmitigated)	369.17	1,981.58	3,199.15	8.63	14,614.03	85.25	14,699.28	3,056.70	77.42	3,134.11	919,932.50

2017 TOTALS (lbs/day unmitigated)	349.92	1,774.03	2,981.79	8.63	14,614.03	76.77	14,690.79	3,056.70	69.61	3,126.31	919,923.13
2018 TOTALS (lbs/day unmitigated)	332.37	1,596.95	2,785.06	8.63	14,614.03	69.76	14,683.79	3,056.70	63.15	3,119.84	919,923.31
2019 TOTALS (lbs/day unmitigated)	317.42	1,445.38	2,605.37	8.63	14,614.03	63.60	14,677.63	3,056.70	57.48	3,114.18	919,929.75
2020 TOTALS (lbs/day unmitigated)	303.47	1,316.00	2,440.46	8.63	14,614.03	58.61	14,672.64	3,056.70	52.89	3,109.58	919,938.94
2021 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2022 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2023 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2024 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2025 TOTALS (lbs/day unmitigated)	264.02	982.18	1,851.59	8.62	14,614.03	46.94	14,660.96	3,056.70	42.16	3,098.85	919,996.14
2026 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2027 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2028 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93

2029 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93
2030 TOTALS (lbs/day unmitigated)	245.58	858.78	1,545.33	8.62	14,614.03	42.86	14,656.89	3,056.70	38.42	3,095.12	920,063.93

Construction Air Emissions

for Existing General Plan and Area Plan

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Comm'l.urb924
Project Name: 112-23 OVOV Construction Emissions Commercial

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	150.79	665.81	1,173.27	1.30	6,564.35	30.77	6,595.13	1,371.72	28.05	1,399.77
2010 TOTALS (lbs/day mitigated)	150.79	665.81	1,173.27	1.30	1,169.16	30.77	1,199.93	244.99	28.05	273.03
2011 TOTALS (lbs/day unmitigated)	144.14	617.73	1,095.38	1.30	6,564.35	28.35	6,592.71	1,371.72	25.82	1,397.54
2011 TOTALS (lbs/day mitigated)	144.14	617.73	1,095.38	1.30	1,169.16	28.35	1,197.51	244.99	25.82	270.80
2012 TOTALS (lbs/day unmitigated)	138.22	571.11	1,022.66	1.30	6,564.35	26.18	6,590.54	1,371.72	23.81	1,395.53
2012 TOTALS (lbs/day mitigated)	138.22	571.11	1,022.66	1.30	1,169.16	26.18	1,195.34	244.99	23.81	268.80
2013 TOTALS (lbs/day unmitigated)	133.22	526.97	953.89	1.30	6,564.35	24.22	6,588.58	1,371.72	21.99	1,393.71
2013 TOTALS (lbs/day mitigated)	133.22	526.97	953.89	1.30	1,169.16	24.22	1,193.38	244.99	21.99	266.98
2014 TOTALS (lbs/day unmitigated)	127.94	482.50	892.48	1.30	6,564.35	22.35	6,586.71	1,371.72	20.27	1,391.99
2014 TOTALS (lbs/day mitigated)	127.94	482.50	892.48	1.30	1,169.16	22.35	1,191.51	244.99	20.27	265.26
2015 TOTALS (lbs/day unmitigated)	122.69	438.79	834.77	1.30	6,564.35	20.64	6,585.00	1,371.72	18.70	1,390.42
2015 TOTALS (lbs/day mitigated)	122.69	438.79	834.77	1.30	1,169.16	20.64	1,189.80	244.99	18.70	263.69
2016 TOTALS (lbs/day unmitigated)	118.12	400.10	784.29	1.30	6,564.35	19.04	6,583.40	1,371.72	17.23	1,388.95
2016 TOTALS (lbs/day mitigated)	118.12	400.10	784.29	1.30	1,169.16	19.04	1,188.20	244.99	17.23	262.21
2017 TOTALS (lbs/day unmitigated)	114.06	364.51	736.27	1.30	6,564.35	17.47	6,581.82	1,371.72	15.78	1,387.50
2017 TOTALS (lbs/day mitigated)	114.06	364.51	736.27	1.30	1,169.16	17.47	1,186.63	244.99	15.78	260.76
2018 TOTALS (lbs/day unmitigated)	109.91	331.97	692.67	1.30	6,564.35	16.03	6,580.38	1,371.72	14.44	1,386.16
2018 TOTALS (lbs/day mitigated)	109.91	331.97	692.67	1.30	1,169.16	16.03	1,185.19	244.99	14.44	259.43
2019 TOTALS (lbs/day unmitigated)	106.58	302.76	652.09	1.30	6,564.35	14.64	6,578.99	1,371.72	13.16	1,384.88
2019 TOTALS (lbs/day mitigated)	106.58	302.76	652.09	1.30	1,169.16	14.64	1,183.80	244.99	13.16	258.15

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Comm'l.urb924

Project Name: 112-23 OVOV Construction Emissions Commercial

2020 TOTALS (lbs/day unmitigated)	103.00	276.32	614.48	1.30	6,564.35	13.49	6,577.84	1,371.72	12.11	1,383.83
2020 TOTALS (lbs/day mitigated)	103.00	276.32	614.48	1.30	1,169.16	13.49	1,182.65	244.99	12.11	257.09
2021 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2021 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2022 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2022 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2023 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2023 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2024 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2024 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2025 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2025 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2026 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2026 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2027 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2027 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2028 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2028 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2029 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2029 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2030 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2030 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Comm'l.urb924

Project Name: 112-23 OVOV Construction Emissions Commercial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	150.79	665.81	1,173.27	1.30	6,564.35	30.77	6,595.13	1,371.72	28.05	1,399.77
2010 TOTALS (lbs/day mitigated)	150.79	665.81	1,173.27	1.30	1,169.16	30.77	1,199.93	244.99	28.05	273.03
2011 TOTALS (lbs/day unmitigated)	144.14	617.73	1,095.38	1.30	6,564.35	28.35	6,592.71	1,371.72	25.82	1,397.54
2011 TOTALS (lbs/day mitigated)	144.14	617.73	1,095.38	1.30	1,169.16	28.35	1,197.51	244.99	25.82	270.80
2012 TOTALS (lbs/day unmitigated)	138.22	571.11	1,022.66	1.30	6,564.35	26.18	6,590.54	1,371.72	23.81	1,395.53
2012 TOTALS (lbs/day mitigated)	138.22	571.11	1,022.66	1.30	1,169.16	26.18	1,195.34	244.99	23.81	268.80
2013 TOTALS (lbs/day unmitigated)	133.22	526.97	953.89	1.30	6,564.35	24.22	6,588.58	1,371.72	21.99	1,393.71
2013 TOTALS (lbs/day mitigated)	133.22	526.97	953.89	1.30	1,169.16	24.22	1,193.38	244.99	21.99	266.98
2014 TOTALS (lbs/day unmitigated)	127.94	482.50	892.48	1.30	6,564.35	22.35	6,586.71	1,371.72	20.27	1,391.99
2014 TOTALS (lbs/day mitigated)	127.94	482.50	892.48	1.30	1,169.16	22.35	1,191.51	244.99	20.27	265.26
2015 TOTALS (lbs/day unmitigated)	122.69	438.79	834.77	1.30	6,564.35	20.64	6,585.00	1,371.72	18.70	1,390.42
2015 TOTALS (lbs/day mitigated)	122.69	438.79	834.77	1.30	1,169.16	20.64	1,189.80	244.99	18.70	263.69
2016 TOTALS (lbs/day unmitigated)	118.12	400.10	784.29	1.30	6,564.35	19.04	6,583.40	1,371.72	17.23	1,388.95
2016 TOTALS (lbs/day mitigated)	118.12	400.10	784.29	1.30	1,169.16	19.04	1,188.20	244.99	17.23	262.21
2017 TOTALS (lbs/day unmitigated)	114.06	364.51	736.27	1.30	6,564.35	17.47	6,581.82	1,371.72	15.78	1,387.50
2017 TOTALS (lbs/day mitigated)	114.06	364.51	736.27	1.30	1,169.16	17.47	1,186.63	244.99	15.78	260.76
2018 TOTALS (lbs/day unmitigated)	109.91	331.97	692.67	1.30	6,564.35	16.03	6,580.38	1,371.72	14.44	1,386.16
2018 TOTALS (lbs/day mitigated)	109.91	331.97	692.67	1.30	1,169.16	16.03	1,185.19	244.99	14.44	259.43
2019 TOTALS (lbs/day unmitigated)	106.58	302.76	652.09	1.30	6,564.35	14.64	6,578.99	1,371.72	13.16	1,384.88
2019 TOTALS (lbs/day mitigated)	106.58	302.76	652.09	1.30	1,169.16	14.64	1,183.80	244.99	13.16	258.15

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Comm'l.urb924

Project Name: 112-23 OVOV Construction Emissions Commercial

2020 TOTALS (lbs/day unmitigated)	103.00	276.32	614.48	1.30	6,564.35	13.49	6,577.84	1,371.72	12.11	1,383.83
2020 TOTALS (lbs/day mitigated)	103.00	276.32	614.48	1.30	1,169.16	13.49	1,182.65	244.99	12.11	257.09
2021 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2021 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2022 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2022 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2023 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2023 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2024 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2024 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2025 TOTALS (lbs/day unmitigated)	97.55	253.02	485.59	1.30	6,564.35	12.88	6,577.23	1,371.72	11.54	1,383.26
2025 TOTALS (lbs/day mitigated)	97.55	253.02	485.59	1.30	1,169.16	12.88	1,182.04	244.99	11.54	256.53
2026 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2026 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2027 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2027 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2028 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2028 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2029 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2029 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33
2030 TOTALS (lbs/day unmitigated)	94.55	243.21	415.73	1.30	6,564.35	12.66	6,577.02	1,371.72	11.35	1,383.07
2030 TOTALS (lbs/day mitigated)	94.55	243.21	415.73	1.30	1,169.16	12.66	1,181.82	244.99	11.35	256.33

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Ind'l.urb924
Project Name: 112-23 OVOV Construction Emissions Industrial

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	461.90	3,201.21	4,139.35	6.89	13,612.73	137.07	13,749.81	2,846.64	125.27	2,971.90
2010 TOTALS (lbs/day mitigated)	461.90	3,201.21	4,139.35	6.89	2,437.37	137.07	2,574.44	512.77	125.27	638.04
2011 TOTALS (lbs/day unmitigated)	435.28	2,904.24	3,846.05	6.89	13,612.73	123.50	13,736.23	2,846.64	112.76	2,959.40
2011 TOTALS (lbs/day mitigated)	435.28	2,904.24	3,846.05	6.89	2,437.37	123.50	2,560.87	512.77	112.76	625.53
2012 TOTALS (lbs/day unmitigated)	409.81	2,614.32	3,568.21	6.89	13,612.73	110.76	13,723.49	2,846.64	101.02	2,947.66
2012 TOTALS (lbs/day mitigated)	409.81	2,614.32	3,568.21	6.89	2,437.37	110.76	2,548.13	512.77	101.02	613.79
2013 TOTALS (lbs/day unmitigated)	385.88	2,336.09	3,302.06	6.89	13,612.73	98.70	13,711.44	2,846.64	89.87	2,936.51
2013 TOTALS (lbs/day mitigated)	385.88	2,336.09	3,302.06	6.89	2,437.37	98.70	2,536.07	512.77	89.87	602.65
2014 TOTALS (lbs/day unmitigated)	362.59	2,073.83	3,060.28	6.89	13,612.73	88.14	13,700.88	2,846.64	80.16	2,926.80
2014 TOTALS (lbs/day mitigated)	362.59	2,073.83	3,060.28	6.89	2,437.37	88.14	2,525.51	512.77	80.16	592.94
2015 TOTALS (lbs/day unmitigated)	340.59	1,834.06	2,835.39	6.89	13,612.73	78.40	13,691.13	2,846.64	71.18	2,917.82
2015 TOTALS (lbs/day mitigated)	340.59	1,834.06	2,835.39	6.89	2,437.37	78.40	2,515.77	512.77	71.18	583.96
2016 TOTALS (lbs/day unmitigated)	322.23	1,634.65	2,641.59	6.89	13,612.73	70.52	13,683.26	2,846.64	63.94	2,910.57
2016 TOTALS (lbs/day mitigated)	322.23	1,634.65	2,641.59	6.89	2,437.37	70.52	2,507.89	512.77	63.94	576.71
2017 TOTALS (lbs/day unmitigated)	306.19	1,464.97	2,463.06	6.89	13,612.73	63.56	13,676.29	2,846.64	57.53	2,904.16
2017 TOTALS (lbs/day mitigated)	306.19	1,464.97	2,463.06	6.89	2,437.37	63.56	2,500.93	512.77	57.53	570.30
2018 TOTALS (lbs/day unmitigated)	291.47	1,319.69	2,301.46	6.89	13,612.73	57.77	13,670.51	2,846.64	52.18	2,898.82
2018 TOTALS (lbs/day mitigated)	291.47	1,319.69	2,301.46	6.89	2,437.37	57.77	2,495.14	512.77	52.18	564.96
2019 TOTALS (lbs/day unmitigated)	278.94	1,195.02	2,153.71	6.89	13,612.73	52.65	13,665.39	2,846.64	47.47	2,894.11

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Ind'l.urb924

Project Name: 112-23 OVOV Construction Emissions Industrial

2019 TOTALS (lbs/day mitigated)	278.94	1,195.02	2,153.71	6.89	2,437.37	52.65	2,490.02	512.77	47.47	560.25
2020 TOTALS (lbs/day unmitigated)	267.20	1,088.24	2,018.08	6.89	13,612.73	48.51	13,661.25	2,846.64	43.66	2,890.30
2020 TOTALS (lbs/day mitigated)	267.20	1,088.24	2,018.08	6.89	2,437.37	48.51	2,485.88	512.77	43.66	556.44
2021 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2021 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2022 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2022 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2023 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2023 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2024 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2024 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2025 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2025 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2026 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2026 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2027 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2027 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2028 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2028 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2029 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2029 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2030 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2030 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Ind'l.urb924

Project Name: 112-23 OVOV Construction Emissions Industrial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	461.90	3,201.21	4,139.35	6.89	13,612.73	137.07	13,749.81	2,846.64	125.27	2,971.90
2010 TOTALS (lbs/day mitigated)	461.90	3,201.21	4,139.35	6.89	2,437.37	137.07	2,574.44	512.77	125.27	638.04
2011 TOTALS (lbs/day unmitigated)	435.28	2,904.24	3,846.05	6.89	13,612.73	123.50	13,736.23	2,846.64	112.76	2,959.40
2011 TOTALS (lbs/day mitigated)	435.28	2,904.24	3,846.05	6.89	2,437.37	123.50	2,560.87	512.77	112.76	625.53
2012 TOTALS (lbs/day unmitigated)	409.81	2,614.32	3,568.21	6.89	13,612.73	110.76	13,723.49	2,846.64	101.02	2,947.66
2012 TOTALS (lbs/day mitigated)	409.81	2,614.32	3,568.21	6.89	2,437.37	110.76	2,548.13	512.77	101.02	613.79
2013 TOTALS (lbs/day unmitigated)	385.88	2,336.09	3,302.06	6.89	13,612.73	98.70	13,711.44	2,846.64	89.87	2,936.51
2013 TOTALS (lbs/day mitigated)	385.88	2,336.09	3,302.06	6.89	2,437.37	98.70	2,536.07	512.77	89.87	602.65
2014 TOTALS (lbs/day unmitigated)	362.59	2,073.83	3,060.28	6.89	13,612.73	88.14	13,700.88	2,846.64	80.16	2,926.80
2014 TOTALS (lbs/day mitigated)	362.59	2,073.83	3,060.28	6.89	2,437.37	88.14	2,525.51	512.77	80.16	592.94
2015 TOTALS (lbs/day unmitigated)	340.59	1,834.06	2,835.39	6.89	13,612.73	78.40	13,691.13	2,846.64	71.18	2,917.82
2015 TOTALS (lbs/day mitigated)	340.59	1,834.06	2,835.39	6.89	2,437.37	78.40	2,515.77	512.77	71.18	583.96
2016 TOTALS (lbs/day unmitigated)	322.23	1,634.65	2,641.59	6.89	13,612.73	70.52	13,683.26	2,846.64	63.94	2,910.57
2016 TOTALS (lbs/day mitigated)	322.23	1,634.65	2,641.59	6.89	2,437.37	70.52	2,507.89	512.77	63.94	576.71
2017 TOTALS (lbs/day unmitigated)	306.19	1,464.97	2,463.06	6.89	13,612.73	63.56	13,676.29	2,846.64	57.53	2,904.16
2017 TOTALS (lbs/day mitigated)	306.19	1,464.97	2,463.06	6.89	2,437.37	63.56	2,500.93	512.77	57.53	570.30
2018 TOTALS (lbs/day unmitigated)	291.47	1,319.69	2,301.46	6.89	13,612.73	57.77	13,670.51	2,846.64	52.18	2,898.82
2018 TOTALS (lbs/day mitigated)	291.47	1,319.69	2,301.46	6.89	2,437.37	57.77	2,495.14	512.77	52.18	564.96
2019 TOTALS (lbs/day unmitigated)	278.94	1,195.02	2,153.71	6.89	13,612.73	52.65	13,665.39	2,846.64	47.47	2,894.11
2019 TOTALS (lbs/day mitigated)	278.94	1,195.02	2,153.71	6.89	2,437.37	52.65	2,490.02	512.77	47.47	560.25

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Ind'l.urb924

Project Name: 112-23 OVOV Construction Emissions Industrial

2020 TOTALS (lbs/day unmitigated)	267.20	1,088.24	2,018.08	6.89	13,612.73	48.51	13,661.25	2,846.64	43.66	2,890.30
2020 TOTALS (lbs/day mitigated)	267.20	1,088.24	2,018.08	6.89	2,437.37	48.51	2,485.88	512.77	43.66	556.44
2021 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2021 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2022 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2022 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2023 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2023 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2024 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2024 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2025 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82
2025 TOTALS (lbs/day mitigated)	234.93	823.42	1,535.53	6.88	2,437.37	39.29	2,476.66	512.77	35.19	547.96
2026 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2026 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2027 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2027 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2028 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2028 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2029 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2029 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01
2030 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87
2030 TOTALS (lbs/day mitigated)	219.70	725.29	1,283.90	6.88	2,437.37	36.07	2,473.44	512.77	32.24	545.01

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Insti'l.urb924

Project Name: 112-23 OVOV Construction Emissions Institutional

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	70.26	372.40	475.91	0.44	2,183.07	19.10	2,202.17	456.19	17.48	473.67
2010 TOTALS (lbs/day mitigated)	70.26	372.40	475.91	0.44	388.84	19.10	407.94	81.48	17.48	98.97
2011 TOTALS (lbs/day unmitigated)	66.78	347.17	446.86	0.44	2,183.07	17.73	2,200.80	456.19	16.22	472.41
2011 TOTALS (lbs/day mitigated)	66.78	347.17	446.86	0.44	388.84	17.73	406.57	81.48	16.22	97.70
2012 TOTALS (lbs/day unmitigated)	63.65	322.71	419.92	0.44	2,183.07	16.30	2,199.37	456.19	14.90	471.09
2012 TOTALS (lbs/day mitigated)	63.65	322.71	419.92	0.44	388.84	16.30	405.14	81.48	14.90	96.38
2013 TOTALS (lbs/day unmitigated)	61.03	299.62	394.45	0.44	2,183.07	15.02	2,198.09	456.19	13.72	469.91
2013 TOTALS (lbs/day mitigated)	61.03	299.62	394.45	0.44	388.84	15.02	403.86	81.48	13.72	95.20
2014 TOTALS (lbs/day unmitigated)	58.23	276.23	371.82	0.44	2,183.07	13.70	2,196.77	456.19	12.50	468.69
2014 TOTALS (lbs/day mitigated)	58.23	276.23	371.82	0.44	388.84	13.70	402.54	81.48	12.50	93.98
2015 TOTALS (lbs/day unmitigated)	55.41	252.15	350.49	0.44	2,183.07	12.62	2,195.69	456.19	11.52	467.70
2015 TOTALS (lbs/day mitigated)	55.41	252.15	350.49	0.44	388.84	12.62	401.46	81.48	11.52	93.00
2016 TOTALS (lbs/day unmitigated)	52.93	230.49	331.95	0.44	2,183.07	11.47	2,194.54	456.19	10.45	466.64
2016 TOTALS (lbs/day mitigated)	52.93	230.49	331.95	0.44	388.84	11.47	400.31	81.48	10.45	91.93
2017 TOTALS (lbs/day unmitigated)	50.71	210.39	314.31	0.44	2,183.07	10.42	2,193.49	456.19	9.49	465.68
2017 TOTALS (lbs/day mitigated)	50.71	210.39	314.31	0.44	388.84	10.42	399.26	81.48	9.49	90.97
2018 TOTALS (lbs/day unmitigated)	48.40	191.79	298.42	0.44	2,183.07	9.44	2,192.51	456.19	8.58	464.77
2018 TOTALS (lbs/day mitigated)	48.40	191.79	298.42	0.44	388.84	9.44	398.28	81.48	8.58	90.06
2019 TOTALS (lbs/day unmitigated)	46.53	175.00	283.61	0.44	2,183.07	8.47	2,191.54	456.19	7.69	463.88
2019 TOTALS (lbs/day mitigated)	46.53	175.00	283.61	0.44	388.84	8.47	397.31	81.48	7.69	89.17

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Insti'l.urb924

Project Name: 112-23 OVOV Construction Emissions Institutional

2020 TOTALS (lbs/day unmitigated)	44.57	159.81	270.07	0.44	2,183.07	7.74	2,190.81	456.19	7.02	463.21
2020 TOTALS (lbs/day mitigated)	44.57	159.81	270.07	0.44	388.84	7.74	396.58	81.48	7.02	88.50
2021 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2021 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2022 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2022 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2023 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2023 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2024 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2024 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2025 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2025 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2026 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2026 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2027 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2027 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2028 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2028 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2029 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2029 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2030 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2030 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Insti'l.urb924
Project Name: 112-23 OVOV Construction Emissions Institutional

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	70.26	372.40	475.91	0.44	2,183.07	19.10	2,202.17	456.19	17.48	473.67
2010 TOTALS (lbs/day mitigated)	70.26	372.40	475.91	0.44	388.84	19.10	407.94	81.48	17.48	98.97
2011 TOTALS (lbs/day unmitigated)	66.78	347.17	446.86	0.44	2,183.07	17.73	2,200.80	456.19	16.22	472.41
2011 TOTALS (lbs/day mitigated)	66.78	347.17	446.86	0.44	388.84	17.73	406.57	81.48	16.22	97.70
2012 TOTALS (lbs/day unmitigated)	63.65	322.71	419.92	0.44	2,183.07	16.30	2,199.37	456.19	14.90	471.09
2012 TOTALS (lbs/day mitigated)	63.65	322.71	419.92	0.44	388.84	16.30	405.14	81.48	14.90	96.38
2013 TOTALS (lbs/day unmitigated)	61.03	299.62	394.45	0.44	2,183.07	15.02	2,198.09	456.19	13.72	469.91
2013 TOTALS (lbs/day mitigated)	61.03	299.62	394.45	0.44	388.84	15.02	403.86	81.48	13.72	95.20
2014 TOTALS (lbs/day unmitigated)	58.23	276.23	371.82	0.44	2,183.07	13.70	2,196.77	456.19	12.50	468.69
2014 TOTALS (lbs/day mitigated)	58.23	276.23	371.82	0.44	388.84	13.70	402.54	81.48	12.50	93.98
2015 TOTALS (lbs/day unmitigated)	55.41	252.15	350.49	0.44	2,183.07	12.62	2,195.69	456.19	11.52	467.70
2015 TOTALS (lbs/day mitigated)	55.41	252.15	350.49	0.44	388.84	12.62	401.46	81.48	11.52	93.00
2016 TOTALS (lbs/day unmitigated)	52.93	230.49	331.95	0.44	2,183.07	11.47	2,194.54	456.19	10.45	466.64
2016 TOTALS (lbs/day mitigated)	52.93	230.49	331.95	0.44	388.84	11.47	400.31	81.48	10.45	91.93
2017 TOTALS (lbs/day unmitigated)	50.71	210.39	314.31	0.44	2,183.07	10.42	2,193.49	456.19	9.49	465.68
2017 TOTALS (lbs/day mitigated)	50.71	210.39	314.31	0.44	388.84	10.42	399.26	81.48	9.49	90.97
2018 TOTALS (lbs/day unmitigated)	48.40	191.79	298.42	0.44	2,183.07	9.44	2,192.51	456.19	8.58	464.77
2018 TOTALS (lbs/day mitigated)	48.40	191.79	298.42	0.44	388.84	9.44	398.28	81.48	8.58	90.06
2019 TOTALS (lbs/day unmitigated)	46.53	175.00	283.61	0.44	2,183.07	8.47	2,191.54	456.19	7.69	463.88
2019 TOTALS (lbs/day mitigated)	46.53	175.00	283.61	0.44	388.84	8.47	397.31	81.48	7.69	89.17

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Insti'l.urb924

Project Name: 112-23 OVOV Construction Emissions Institutional

2020 TOTALS (lbs/day unmitigated)	44.57	159.81	270.07	0.44	2,183.07	7.74	2,190.81	456.19	7.02	463.21
2020 TOTALS (lbs/day mitigated)	44.57	159.81	270.07	0.44	388.84	7.74	396.58	81.48	7.02	88.50
2021 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2021 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2022 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2022 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2023 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2023 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2024 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2024 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2025 TOTALS (lbs/day unmitigated)	42.74	152.03	226.62	0.44	2,183.07	7.54	2,190.61	456.19	6.83	463.02
2025 TOTALS (lbs/day mitigated)	42.74	152.03	226.62	0.44	388.84	7.54	396.38	81.48	6.83	88.32
2026 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2026 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2027 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2027 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2028 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2028 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2029 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2029 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25
2030 TOTALS (lbs/day unmitigated)	41.73	148.75	203.06	0.44	2,183.07	7.47	2,190.54	456.19	6.77	462.96
2030 TOTALS (lbs/day mitigated)	41.73	148.75	203.06	0.44	388.84	7.47	396.31	81.48	6.77	88.25

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Non-Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Non Residential

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	35.31	213.40	202.11	0.13	625.76	12.27	638.03	130.77	11.27	142.03
2010 TOTALS (lbs/day mitigated)	35.31	213.40	202.11	0.13	111.47	12.27	123.75	23.36	11.27	34.63
2011 TOTALS (lbs/day unmitigated)	33.41	199.54	192.18	0.13	625.76	11.57	637.33	130.77	10.62	141.38
2011 TOTALS (lbs/day mitigated)	33.41	199.54	192.18	0.13	111.47	11.57	123.04	23.36	10.62	33.98
2012 TOTALS (lbs/day unmitigated)	31.59	186.28	183.18	0.13	625.76	10.56	636.32	130.77	9.69	140.46
2012 TOTALS (lbs/day mitigated)	31.59	186.28	183.18	0.13	111.47	10.56	122.04	23.36	9.69	33.05
2013 TOTALS (lbs/day unmitigated)	29.99	173.72	174.66	0.13	625.76	9.70	635.46	130.77	8.90	139.66
2013 TOTALS (lbs/day mitigated)	29.99	173.72	174.66	0.13	111.47	9.70	121.18	23.36	8.90	32.26
2014 TOTALS (lbs/day unmitigated)	28.37	161.16	166.92	0.13	625.76	8.72	634.48	130.77	8.00	138.76
2014 TOTALS (lbs/day mitigated)	28.37	161.16	166.92	0.13	111.47	8.72	120.20	23.36	8.00	31.36
2015 TOTALS (lbs/day unmitigated)	26.68	147.30	159.66	0.13	625.76	8.03	633.79	130.77	7.36	138.13
2015 TOTALS (lbs/day mitigated)	26.68	147.30	159.66	0.13	111.47	8.03	119.51	23.36	7.36	30.72
2016 TOTALS (lbs/day unmitigated)	25.23	134.68	153.31	0.13	625.76	7.23	632.99	130.77	6.62	137.39
2016 TOTALS (lbs/day mitigated)	25.23	134.68	153.31	0.13	111.47	7.23	118.70	23.36	6.62	29.98
2017 TOTALS (lbs/day unmitigated)	23.99	122.88	147.34	0.13	625.76	6.53	632.28	130.77	5.97	136.74
2017 TOTALS (lbs/day mitigated)	23.99	122.88	147.34	0.13	111.47	6.53	118.00	23.36	5.97	29.34
2018 TOTALS (lbs/day unmitigated)	22.60	111.96	141.89	0.13	625.76	5.85	631.61	130.77	5.36	136.12
2018 TOTALS (lbs/day mitigated)	22.60	111.96	141.89	0.13	111.47	5.85	117.33	23.36	5.36	28.72
2019 TOTALS (lbs/day unmitigated)	21.37	102.04	136.86	0.13	625.76	5.20	630.95	130.77	4.75	135.51
2019 TOTALS (lbs/day mitigated)	21.37	102.04	136.86	0.13	111.47	5.20	116.67	23.36	4.75	28.11

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Non-Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Non Residential

2020 TOTALS (lbs/day unmitigated)	20.28	93.17	132.35	0.13	625.76	4.77	630.52	130.77	4.35	135.12
2020 TOTALS (lbs/day mitigated)	20.28	93.17	132.35	0.13	111.47	4.77	116.24	23.36	4.35	27.72
2021 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2021 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2022 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2022 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2023 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2023 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2024 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2024 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2025 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2025 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2026 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2026 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2027 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2027 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2028 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2028 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2029 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2029 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2030 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2030 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Non-Res'l.urb924
Project Name: 112-23 OVOV Construction Emissions Non Residential

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	35.31	213.40	202.11	0.13	625.76	12.27	638.03	130.77	11.27	142.03
2010 TOTALS (lbs/day mitigated)	35.31	213.40	202.11	0.13	111.47	12.27	123.75	23.36	11.27	34.63
2011 TOTALS (lbs/day unmitigated)	33.41	199.54	192.18	0.13	625.76	11.57	637.33	130.77	10.62	141.38
2011 TOTALS (lbs/day mitigated)	33.41	199.54	192.18	0.13	111.47	11.57	123.04	23.36	10.62	33.98
2012 TOTALS (lbs/day unmitigated)	31.59	186.28	183.18	0.13	625.76	10.56	636.32	130.77	9.69	140.46
2012 TOTALS (lbs/day mitigated)	31.59	186.28	183.18	0.13	111.47	10.56	122.04	23.36	9.69	33.05
2013 TOTALS (lbs/day unmitigated)	29.99	173.72	174.66	0.13	625.76	9.70	635.46	130.77	8.90	139.66
2013 TOTALS (lbs/day mitigated)	29.99	173.72	174.66	0.13	111.47	9.70	121.18	23.36	8.90	32.26
2014 TOTALS (lbs/day unmitigated)	28.37	161.16	166.92	0.13	625.76	8.72	634.48	130.77	8.00	138.76
2014 TOTALS (lbs/day mitigated)	28.37	161.16	166.92	0.13	111.47	8.72	120.20	23.36	8.00	31.36
2015 TOTALS (lbs/day unmitigated)	26.68	147.30	159.66	0.13	625.76	8.03	633.79	130.77	7.36	138.13
2015 TOTALS (lbs/day mitigated)	26.68	147.30	159.66	0.13	111.47	8.03	119.51	23.36	7.36	30.72
2016 TOTALS (lbs/day unmitigated)	25.23	134.68	153.31	0.13	625.76	7.23	632.99	130.77	6.62	137.39
2016 TOTALS (lbs/day mitigated)	25.23	134.68	153.31	0.13	111.47	7.23	118.70	23.36	6.62	29.98
2017 TOTALS (lbs/day unmitigated)	23.99	122.88	147.34	0.13	625.76	6.53	632.28	130.77	5.97	136.74
2017 TOTALS (lbs/day mitigated)	23.99	122.88	147.34	0.13	111.47	6.53	118.00	23.36	5.97	29.34
2018 TOTALS (lbs/day unmitigated)	22.60	111.96	141.89	0.13	625.76	5.85	631.61	130.77	5.36	136.12
2018 TOTALS (lbs/day mitigated)	22.60	111.96	141.89	0.13	111.47	5.85	117.33	23.36	5.36	28.72
2019 TOTALS (lbs/day unmitigated)	21.37	102.04	136.86	0.13	625.76	5.20	630.95	130.77	4.75	135.51

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Non-Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Non Residential

2019 TOTALS (lbs/day mitigated)	21.37	102.04	136.86	0.13	111.47	5.20	116.67	23.36	4.75	28.11
2020 TOTALS (lbs/day unmitigated)	20.28	93.17	132.35	0.13	625.76	4.77	630.52	130.77	4.35	135.12
2020 TOTALS (lbs/day mitigated)	20.28	93.17	132.35	0.13	111.47	4.77	116.24	23.36	4.35	27.72
2021 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2021 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2022 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2022 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2023 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2023 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2024 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2024 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2025 TOTALS (lbs/day unmitigated)	19.73	90.91	119.33	0.13	625.76	4.71	630.46	130.77	4.30	135.07
2025 TOTALS (lbs/day mitigated)	19.73	90.91	119.33	0.13	111.47	4.71	116.18	23.36	4.30	27.66
2026 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2026 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2027 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2027 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2028 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2028 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2029 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2029 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64
2030 TOTALS (lbs/day unmitigated)	19.43	89.95	112.28	0.13	625.76	4.69	630.44	130.77	4.28	135.05
2030 TOTALS (lbs/day mitigated)	19.43	89.95	112.28	0.13	111.47	4.69	116.16	23.36	4.28	27.64

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Office.urb924
Project Name: 112-23 OVOV Construction Emissions Office

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	103.51	515.22	745.24	0.75	3,760.00	24.96	3,784.96	785.71	22.81	808.52
2010 TOTALS (lbs/day mitigated)	103.51	515.22	745.24	0.75	669.70	24.96	694.66	140.33	22.81	163.14
2011 TOTALS (lbs/day unmitigated)	98.66	479.46	697.77	0.75	3,760.00	23.11	3,783.11	785.71	21.11	806.82
2011 TOTALS (lbs/day mitigated)	98.66	479.46	697.77	0.75	669.70	23.11	692.81	140.33	21.11	161.44
2012 TOTALS (lbs/day unmitigated)	94.34	444.84	653.62	0.75	3,760.00	21.29	3,781.29	785.71	19.43	805.14
2012 TOTALS (lbs/day mitigated)	94.34	444.84	653.62	0.75	669.70	21.29	690.99	140.33	19.43	159.76
2013 TOTALS (lbs/day unmitigated)	90.68	412.13	611.90	0.75	3,760.00	19.66	3,779.66	785.71	17.92	803.63
2013 TOTALS (lbs/day mitigated)	90.68	412.13	611.90	0.75	669.70	19.66	689.36	140.33	17.92	158.25
2014 TOTALS (lbs/day unmitigated)	86.80	378.92	574.70	0.75	3,760.00	18.01	3,778.01	785.71	16.40	802.11
2014 TOTALS (lbs/day mitigated)	86.80	378.92	574.70	0.75	669.70	18.01	687.71	140.33	16.40	156.73
2015 TOTALS (lbs/day unmitigated)	82.89	345.42	539.70	0.75	3,760.00	16.62	3,776.62	785.71	15.12	800.83
2015 TOTALS (lbs/day mitigated)	82.89	345.42	539.70	0.75	669.70	16.62	686.32	140.33	15.12	155.45
2016 TOTALS (lbs/day unmitigated)	79.48	315.47	509.16	0.75	3,760.00	15.24	3,775.24	785.71	13.85	799.56
2016 TOTALS (lbs/day mitigated)	79.48	315.47	509.16	0.75	669.70	15.24	684.94	140.33	13.85	154.18
2017 TOTALS (lbs/day unmitigated)	76.48	287.70	480.10	0.75	3,760.00	13.90	3,773.90	785.71	12.62	798.33
2017 TOTALS (lbs/day mitigated)	76.48	287.70	480.10	0.75	669.70	13.90	683.60	140.33	12.62	152.95
2018 TOTALS (lbs/day unmitigated)	73.31	262.17	453.83	0.75	3,760.00	12.66	3,772.66	785.71	11.47	797.19
2018 TOTALS (lbs/day mitigated)	73.31	262.17	453.83	0.75	669.70	12.66	682.36	140.33	11.47	151.81
2019 TOTALS (lbs/day unmitigated)	70.74	239.11	429.37	0.75	3,760.00	11.46	3,771.46	785.71	10.37	796.08
2019 TOTALS (lbs/day mitigated)	70.74	239.11	429.37	0.75	669.70	11.46	681.16	140.33	10.37	150.70

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Office.urb924

Project Name: 112-23 OVOV Construction Emissions Office

2020 TOTALS (lbs/day unmitigated)	68.08	218.23	406.85	0.75	3,760.00	10.52	3,770.52	785.71	9.50	795.21
2020 TOTALS (lbs/day mitigated)	68.08	218.23	406.85	0.75	669.70	10.52	680.22	140.33	9.50	149.83
2021 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2021 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2022 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2022 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2023 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2023 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2024 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2024 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2025 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2025 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2026 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2026 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2027 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2027 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2028 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2028 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2029 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2029 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2030 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2030 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Office.urb924
Project Name: 112-23 OVOV Construction Emissions Office

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	103.51	515.22	745.24	0.75	3,760.00	24.96	3,784.96	785.71	22.81	808.52
2010 TOTALS (lbs/day mitigated)	103.51	515.22	745.24	0.75	669.70	24.96	694.66	140.33	22.81	163.14
2011 TOTALS (lbs/day unmitigated)	98.66	479.46	697.77	0.75	3,760.00	23.11	3,783.11	785.71	21.11	806.82
2011 TOTALS (lbs/day mitigated)	98.66	479.46	697.77	0.75	669.70	23.11	692.81	140.33	21.11	161.44
2012 TOTALS (lbs/day unmitigated)	94.34	444.84	653.62	0.75	3,760.00	21.29	3,781.29	785.71	19.43	805.14
2012 TOTALS (lbs/day mitigated)	94.34	444.84	653.62	0.75	669.70	21.29	690.99	140.33	19.43	159.76
2013 TOTALS (lbs/day unmitigated)	90.68	412.13	611.90	0.75	3,760.00	19.66	3,779.66	785.71	17.92	803.63
2013 TOTALS (lbs/day mitigated)	90.68	412.13	611.90	0.75	669.70	19.66	689.36	140.33	17.92	158.25
2014 TOTALS (lbs/day unmitigated)	86.80	378.92	574.70	0.75	3,760.00	18.01	3,778.01	785.71	16.40	802.11
2014 TOTALS (lbs/day mitigated)	86.80	378.92	574.70	0.75	669.70	18.01	687.71	140.33	16.40	156.73
2015 TOTALS (lbs/day unmitigated)	82.89	345.42	539.70	0.75	3,760.00	16.62	3,776.62	785.71	15.12	800.83
2015 TOTALS (lbs/day mitigated)	82.89	345.42	539.70	0.75	669.70	16.62	686.32	140.33	15.12	155.45
2016 TOTALS (lbs/day unmitigated)	79.48	315.47	509.16	0.75	3,760.00	15.24	3,775.24	785.71	13.85	799.56
2016 TOTALS (lbs/day mitigated)	79.48	315.47	509.16	0.75	669.70	15.24	684.94	140.33	13.85	154.18
2017 TOTALS (lbs/day unmitigated)	76.48	287.70	480.10	0.75	3,760.00	13.90	3,773.90	785.71	12.62	798.33
2017 TOTALS (lbs/day mitigated)	76.48	287.70	480.10	0.75	669.70	13.90	683.60	140.33	12.62	152.95
2018 TOTALS (lbs/day unmitigated)	73.31	262.17	453.83	0.75	3,760.00	12.66	3,772.66	785.71	11.47	797.19
2018 TOTALS (lbs/day mitigated)	73.31	262.17	453.83	0.75	669.70	12.66	682.36	140.33	11.47	151.81
2019 TOTALS (lbs/day unmitigated)	70.74	239.11	429.37	0.75	3,760.00	11.46	3,771.46	785.71	10.37	796.08
2019 TOTALS (lbs/day mitigated)	70.74	239.11	429.37	0.75	669.70	11.46	681.16	140.33	10.37	150.70

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Office.urb924

Project Name: 112-23 OVOV Construction Emissions Office

2020 TOTALS (lbs/day unmitigated)	68.08	218.23	406.85	0.75	3,760.00	10.52	3,770.52	785.71	9.50	795.21
2020 TOTALS (lbs/day mitigated)	68.08	218.23	406.85	0.75	669.70	10.52	680.22	140.33	9.50	149.83
2021 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2021 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2022 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2022 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2023 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2023 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2024 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2024 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2025 TOTALS (lbs/day unmitigated)	64.94	204.86	332.52	0.75	3,760.00	10.17	3,770.17	785.71	9.18	794.89
2025 TOTALS (lbs/day mitigated)	64.94	204.86	332.52	0.75	669.70	10.17	679.87	140.33	9.18	149.51
2026 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2026 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2027 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2027 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2028 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2028 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2029 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2029 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40
2030 TOTALS (lbs/day unmitigated)	63.21	199.22	292.22	0.75	3,760.00	10.04	3,770.05	785.71	9.07	794.78
2030 TOTALS (lbs/day mitigated)	63.21	199.22	292.22	0.75	669.70	10.04	679.74	140.33	9.07	149.40

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Recreation.urb924
Project Name: 112-23 OVOV Construction Emissions Recreation

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	578.17	4,306.12	5,252.23	9.14	15,098.87	183.25	15,282.12	3,158.14	167.55	3,325.70
2010 TOTALS (lbs/day mitigated)	578.17	4,306.12	5,252.23	9.14	2,708.05	183.25	2,891.29	570.45	167.55	738.00
2011 TOTALS (lbs/day unmitigated)	543.31	3,899.90	4,877.28	9.14	15,098.87	164.73	15,263.60	3,158.14	150.49	3,308.64
2011 TOTALS (lbs/day mitigated)	543.31	3,899.90	4,877.28	9.14	2,708.05	164.73	2,872.78	570.45	150.49	720.94
2012 TOTALS (lbs/day unmitigated)	509.74	3,503.07	4,521.43	9.14	15,098.87	147.31	15,246.18	3,158.14	134.44	3,292.58
2012 TOTALS (lbs/day mitigated)	509.74	3,503.07	4,521.43	9.14	2,708.05	147.31	2,855.36	570.45	134.44	704.88
2013 TOTALS (lbs/day unmitigated)	477.89	3,121.99	4,180.00	9.14	15,098.87	130.78	15,229.65	3,158.14	119.17	3,277.31
2013 TOTALS (lbs/day mitigated)	477.89	3,121.99	4,180.00	9.14	2,708.05	130.78	2,838.83	570.45	119.17	689.61
2014 TOTALS (lbs/day unmitigated)	447.10	2,764.10	3,869.26	9.14	15,098.87	116.33	15,215.20	3,158.14	105.88	3,264.02
2014 TOTALS (lbs/day mitigated)	447.10	2,764.10	3,869.26	9.14	2,708.05	116.33	2,824.37	570.45	105.88	676.32
2015 TOTALS (lbs/day unmitigated)	418.10	2,438.31	3,580.61	9.14	15,098.87	103.03	15,201.90	3,158.14	93.62	3,251.77
2015 TOTALS (lbs/day mitigated)	418.10	2,438.31	3,580.61	9.14	2,708.05	103.03	2,811.08	570.45	93.62	664.07
2016 TOTALS (lbs/day unmitigated)	394.01	2,168.46	3,332.51	9.14	15,098.87	92.36	15,191.23	3,158.14	83.80	3,241.94
2016 TOTALS (lbs/day mitigated)	394.01	2,168.46	3,332.51	9.14	2,708.05	92.36	2,800.41	570.45	83.80	654.24
2017 TOTALS (lbs/day unmitigated)	372.99	1,940.18	3,104.99	9.14	15,098.87	83.02	15,181.89	3,158.14	75.21	3,233.35
2017 TOTALS (lbs/day mitigated)	372.99	1,940.18	3,104.99	9.14	2,708.05	83.02	2,791.07	570.45	75.21	645.65
2018 TOTALS (lbs/day unmitigated)	353.92	1,745.76	2,899.36	9.14	15,098.87	75.33	15,174.20	3,158.14	68.11	3,226.25
2018 TOTALS (lbs/day mitigated)	353.92	1,745.76	2,899.36	9.14	2,708.05	75.33	2,783.38	570.45	68.11	638.55
2019 TOTALS (lbs/day unmitigated)	337.63	1,579.58	2,711.81	9.14	15,098.87	68.58	15,167.45	3,158.14	61.90	3,220.04
2019 TOTALS (lbs/day mitigated)	337.63	1,579.58	2,711.81	9.14	2,708.05	68.58	2,776.63	570.45	61.90	632.34

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Recreation.urb924

Project Name: 112-23 OVOV Construction Emissions Recreation

2020 TOTALS (lbs/day unmitigated)	322.54	1,437.93	2,540.01	9.14	15,098.87	63.10	15,161.97	3,158.14	56.86	3,215.00
2020 TOTALS (lbs/day mitigated)	322.54	1,437.93	2,540.01	9.14	2,708.05	63.10	2,771.15	570.45	56.86	627.30
2021 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2021 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2022 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2022 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2023 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2023 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2024 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2024 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2025 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2025 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2026 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2026 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2027 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2027 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2028 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2028 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2029 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2029 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2030 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2030 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Recreation.urb924
Project Name: 112-23 OVOV Construction Emissions Recreation

Project Location: South Coast AQMD
On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006
Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:
CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	578.17	4,306.12	5,252.23	9.14	15,098.87	183.25	15,282.12	3,158.14	167.55	3,325.70
2010 TOTALS (lbs/day mitigated)	578.17	4,306.12	5,252.23	9.14	2,708.05	183.25	2,891.29	570.45	167.55	738.00
2011 TOTALS (lbs/day unmitigated)	543.31	3,899.90	4,877.28	9.14	15,098.87	164.73	15,263.60	3,158.14	150.49	3,308.64
2011 TOTALS (lbs/day mitigated)	543.31	3,899.90	4,877.28	9.14	2,708.05	164.73	2,872.78	570.45	150.49	720.94
2012 TOTALS (lbs/day unmitigated)	509.74	3,503.07	4,521.43	9.14	15,098.87	147.31	15,246.18	3,158.14	134.44	3,292.58
2012 TOTALS (lbs/day mitigated)	509.74	3,503.07	4,521.43	9.14	2,708.05	147.31	2,855.36	570.45	134.44	704.88
2013 TOTALS (lbs/day unmitigated)	477.89	3,121.99	4,180.00	9.14	15,098.87	130.78	15,229.65	3,158.14	119.17	3,277.31
2013 TOTALS (lbs/day mitigated)	477.89	3,121.99	4,180.00	9.14	2,708.05	130.78	2,838.83	570.45	119.17	689.61
2014 TOTALS (lbs/day unmitigated)	447.10	2,764.10	3,869.26	9.14	15,098.87	116.33	15,215.20	3,158.14	105.88	3,264.02
2014 TOTALS (lbs/day mitigated)	447.10	2,764.10	3,869.26	9.14	2,708.05	116.33	2,824.37	570.45	105.88	676.32
2015 TOTALS (lbs/day unmitigated)	418.10	2,438.31	3,580.61	9.14	15,098.87	103.03	15,201.90	3,158.14	93.62	3,251.77
2015 TOTALS (lbs/day mitigated)	418.10	2,438.31	3,580.61	9.14	2,708.05	103.03	2,811.08	570.45	93.62	664.07
2016 TOTALS (lbs/day unmitigated)	394.01	2,168.46	3,332.51	9.14	15,098.87	92.36	15,191.23	3,158.14	83.80	3,241.94
2016 TOTALS (lbs/day mitigated)	394.01	2,168.46	3,332.51	9.14	2,708.05	92.36	2,800.41	570.45	83.80	654.24
2017 TOTALS (lbs/day unmitigated)	372.99	1,940.18	3,104.99	9.14	15,098.87	83.02	15,181.89	3,158.14	75.21	3,233.35
2017 TOTALS (lbs/day mitigated)	372.99	1,940.18	3,104.99	9.14	2,708.05	83.02	2,791.07	570.45	75.21	645.65
2018 TOTALS (lbs/day unmitigated)	353.92	1,745.76	2,899.36	9.14	15,098.87	75.33	15,174.20	3,158.14	68.11	3,226.25
2018 TOTALS (lbs/day mitigated)	353.92	1,745.76	2,899.36	9.14	2,708.05	75.33	2,783.38	570.45	68.11	638.55
2019 TOTALS (lbs/day unmitigated)	337.63	1,579.58	2,711.81	9.14	15,098.87	68.58	15,167.45	3,158.14	61.90	3,220.04
2019 TOTALS (lbs/day mitigated)	337.63	1,579.58	2,711.81	9.14	2,708.05	68.58	2,776.63	570.45	61.90	632.34

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Recreation.urb924

Project Name: 112-23 OVOV Construction Emissions Recreation

2020 TOTALS (lbs/day unmitigated)	322.54	1,437.93	2,540.01	9.14	15,098.87	63.10	15,161.97	3,158.14	56.86	3,215.00
2020 TOTALS (lbs/day mitigated)	322.54	1,437.93	2,540.01	9.14	2,708.05	63.10	2,771.15	570.45	56.86	627.30
2021 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2021 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2022 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2022 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2023 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2023 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2024 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2024 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2025 TOTALS (lbs/day unmitigated)	279.27	1,067.06	1,927.77	9.12	15,098.87	50.04	15,148.91	3,158.14	44.85	3,203.00
2025 TOTALS (lbs/day mitigated)	279.27	1,067.06	1,927.77	9.12	2,708.05	50.04	2,758.09	570.45	44.85	615.30
2026 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2026 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2027 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2027 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2028 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2028 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2029 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2029 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12
2030 TOTALS (lbs/day unmitigated)	259.17	930.49	1,610.45	9.12	15,098.87	45.48	15,144.35	3,158.14	40.68	3,198.82
2030 TOTALS (lbs/day mitigated)	259.17	930.49	1,610.45	9.12	2,708.05	45.48	2,753.53	570.45	40.68	611.12

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Residential

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	620.83	3,122.56	9,047.85	12.46	134,100.91	137.81	134,238.72	28,013.30	124.44	28,137.73
2010 TOTALS (lbs/day mitigated)	620.83	3,122.56	9,047.85	12.46	23,834.17	137.81	23,971.98	4,985.19	124.44	5,109.63
2011 TOTALS (lbs/day unmitigated)	581.65	2,837.84	8,418.92	12.46	134,100.91	126.04	134,226.95	28,013.30	113.59	28,126.88
2011 TOTALS (lbs/day mitigated)	581.65	2,837.84	8,418.92	12.46	23,834.17	126.04	23,960.21	4,985.19	113.59	5,098.78
2012 TOTALS (lbs/day unmitigated)	544.65	2,562.10	7,827.07	12.46	134,100.91	115.07	134,215.98	28,013.30	103.41	28,116.71
2012 TOTALS (lbs/day mitigated)	544.65	2,562.10	7,827.07	12.46	23,834.17	115.07	23,949.24	4,985.19	103.41	5,088.61
2013 TOTALS (lbs/day unmitigated)	510.47	2,297.58	7,265.07	12.46	134,100.91	104.74	134,205.64	28,013.30	93.74	28,107.04
2013 TOTALS (lbs/day mitigated)	510.47	2,297.58	7,265.07	12.46	23,834.17	104.74	23,938.90	4,985.19	93.74	5,078.93
2014 TOTALS (lbs/day unmitigated)	478.04	2,050.08	6,756.78	12.46	134,100.91	96.92	134,197.82	28,013.30	86.56	28,099.86
2014 TOTALS (lbs/day mitigated)	478.04	2,050.08	6,756.78	12.46	23,834.17	96.92	23,931.08	4,985.19	86.56	5,071.75
2015 TOTALS (lbs/day unmitigated)	447.82	1,822.51	6,281.20	12.46	134,100.91	88.44	134,189.34	28,013.30	78.75	28,092.04
2015 TOTALS (lbs/day mitigated)	447.82	1,822.51	6,281.20	12.46	23,834.17	88.44	23,922.61	4,985.19	78.75	5,063.94
2016 TOTALS (lbs/day unmitigated)	422.21	1,632.76	5,863.25	12.46	134,100.91	81.60	134,182.51	28,013.30	72.45	28,085.75
2016 TOTALS (lbs/day mitigated)	422.21	1,632.76	5,863.25	12.46	23,834.17	81.60	23,915.77	4,985.19	72.45	5,057.64
2017 TOTALS (lbs/day unmitigated)	399.57	1,469.45	5,468.48	12.46	134,100.91	75.48	134,176.38	28,013.30	66.82	28,080.11
2017 TOTALS (lbs/day mitigated)	399.57	1,469.45	5,468.48	12.46	23,834.17	75.48	23,909.64	4,985.19	66.82	5,052.01
2018 TOTALS (lbs/day unmitigated)	378.48	1,328.04	5,104.41	12.46	134,100.91	70.48	134,171.38	28,013.30	62.13	28,075.43
2018 TOTALS (lbs/day mitigated)	378.48	1,328.04	5,104.41	12.46	23,834.17	70.48	23,904.64	4,985.19	62.13	5,047.33
2019 TOTALS (lbs/day unmitigated)	360.41	1,205.41	4,767.52	12.46	134,100.91	65.94	134,166.84	28,013.30	57.96	28,071.26
2019 TOTALS (lbs/day mitigated)	360.41	1,205.41	4,767.52	12.46	23,834.17	65.94	23,900.10	4,985.19	57.96	5,043.15

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Residential

2020 TOTALS (lbs/day unmitigated)	342.62	1,099.89	4,452.19	12.46	134,100.91	62.27	134,163.18	28,013.30	54.59	28,067.88
2020 TOTALS (lbs/day mitigated)	342.62	1,099.89	4,452.19	12.46	23,834.17	62.27	23,896.44	4,985.19	54.59	5,039.78
2021 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2021 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2022 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2022 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2023 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2023 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2024 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2024 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2025 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2025 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2026 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2026 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2027 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2027 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2028 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2028 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2029 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2029 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2030 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2030 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Residential

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	620.83	3,122.56	9,047.85	12.46	134,100.91	137.81	134,238.72	28,013.30	124.44	28,137.73
2010 TOTALS (lbs/day mitigated)	620.83	3,122.56	9,047.85	12.46	23,834.17	137.81	23,971.98	4,985.19	124.44	5,109.63
2011 TOTALS (lbs/day unmitigated)	581.65	2,837.84	8,418.92	12.46	134,100.91	126.04	134,226.95	28,013.30	113.59	28,126.88
2011 TOTALS (lbs/day mitigated)	581.65	2,837.84	8,418.92	12.46	23,834.17	126.04	23,960.21	4,985.19	113.59	5,098.78
2012 TOTALS (lbs/day unmitigated)	544.65	2,562.10	7,827.07	12.46	134,100.91	115.07	134,215.98	28,013.30	103.41	28,116.71
2012 TOTALS (lbs/day mitigated)	544.65	2,562.10	7,827.07	12.46	23,834.17	115.07	23,949.24	4,985.19	103.41	5,088.61
2013 TOTALS (lbs/day unmitigated)	510.47	2,297.58	7,265.07	12.46	134,100.91	104.74	134,205.64	28,013.30	93.74	28,107.04
2013 TOTALS (lbs/day mitigated)	510.47	2,297.58	7,265.07	12.46	23,834.17	104.74	23,938.90	4,985.19	93.74	5,078.93
2014 TOTALS (lbs/day unmitigated)	478.04	2,050.08	6,756.78	12.46	134,100.91	96.92	134,197.82	28,013.30	86.56	28,099.86
2014 TOTALS (lbs/day mitigated)	478.04	2,050.08	6,756.78	12.46	23,834.17	96.92	23,931.08	4,985.19	86.56	5,071.75
2015 TOTALS (lbs/day unmitigated)	447.82	1,822.51	6,281.20	12.46	134,100.91	88.44	134,189.34	28,013.30	78.75	28,092.04
2015 TOTALS (lbs/day mitigated)	447.82	1,822.51	6,281.20	12.46	23,834.17	88.44	23,922.61	4,985.19	78.75	5,063.94
2016 TOTALS (lbs/day unmitigated)	422.21	1,632.76	5,863.25	12.46	134,100.91	81.60	134,182.51	28,013.30	72.45	28,085.75
2016 TOTALS (lbs/day mitigated)	422.21	1,632.76	5,863.25	12.46	23,834.17	81.60	23,915.77	4,985.19	72.45	5,057.64
2017 TOTALS (lbs/day unmitigated)	399.57	1,469.45	5,468.48	12.46	134,100.91	75.48	134,176.38	28,013.30	66.82	28,080.11
2017 TOTALS (lbs/day mitigated)	399.57	1,469.45	5,468.48	12.46	23,834.17	75.48	23,909.64	4,985.19	66.82	5,052.01
2018 TOTALS (lbs/day unmitigated)	378.48	1,328.04	5,104.41	12.46	134,100.91	70.48	134,171.38	28,013.30	62.13	28,075.43
2018 TOTALS (lbs/day mitigated)	378.48	1,328.04	5,104.41	12.46	23,834.17	70.48	23,904.64	4,985.19	62.13	5,047.33
2019 TOTALS (lbs/day unmitigated)	360.41	1,205.41	4,767.52	12.46	134,100.91	65.94	134,166.84	28,013.30	57.96	28,071.26
2019 TOTALS (lbs/day mitigated)	360.41	1,205.41	4,767.52	12.46	23,834.17	65.94	23,900.10	4,985.19	57.96	5,043.15

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV Res'l.urb924

Project Name: 112-23 OVOV Construction Emissions Residential

2020 TOTALS (lbs/day unmitigated)	342.62	1,099.89	4,452.19	12.46	134,100.91	62.27	134,163.18	28,013.30	54.59	28,067.88
2020 TOTALS (lbs/day mitigated)	342.62	1,099.89	4,452.19	12.46	23,834.17	62.27	23,896.44	4,985.19	54.59	5,039.78
2021 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2021 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2022 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2022 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2023 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2023 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2024 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2024 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2025 TOTALS (lbs/day unmitigated)	289.24	830.43	3,281.61	12.44	134,100.91	54.45	134,155.36	28,013.30	47.40	28,060.70
2025 TOTALS (lbs/day mitigated)	289.24	830.43	3,281.61	12.44	23,834.17	54.45	23,888.62	4,985.19	47.40	5,032.59
2026 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2026 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2027 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2027 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2028 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2028 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2029 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2029 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08
2030 TOTALS (lbs/day unmitigated)	260.69	721.34	2,650.50	12.44	134,100.91	51.70	134,152.61	28,013.30	44.89	28,058.19
2030 TOTALS (lbs/day mitigated)	260.69	721.34	2,650.50	12.44	23,834.17	51.70	23,885.87	4,985.19	44.89	5,030.08

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV SG.urb924

Project Name: 112-23 OVOV Construction Emissions Special Generator

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	74.35	561.29	533.60	0.72	1,173.20	26.89	1,200.09	245.40	24.66	270.05
2010 TOTALS (lbs/day mitigated)	74.35	561.29	533.60	0.72	210.45	26.89	237.34	44.34	24.66	68.99
2011 TOTALS (lbs/day unmitigated)	69.84	515.88	499.55	0.72	1,173.20	24.63	1,197.83	245.40	22.57	267.97
2011 TOTALS (lbs/day mitigated)	69.84	515.88	499.55	0.72	210.45	24.63	235.08	44.34	22.57	66.91
2012 TOTALS (lbs/day unmitigated)	65.60	471.67	467.60	0.72	1,173.20	22.29	1,195.50	245.40	20.42	265.82
2012 TOTALS (lbs/day mitigated)	65.60	471.67	467.60	0.72	210.45	22.29	232.74	44.34	20.42	64.76
2013 TOTALS (lbs/day unmitigated)	61.80	429.48	437.04	0.72	1,173.20	20.15	1,193.35	245.40	18.44	263.84
2013 TOTALS (lbs/day mitigated)	61.80	429.48	437.04	0.72	210.45	20.15	230.59	44.34	18.44	62.78
2014 TOTALS (lbs/day unmitigated)	57.92	388.64	409.44	0.72	1,173.20	18.03	1,191.24	245.40	16.50	261.90
2014 TOTALS (lbs/day mitigated)	57.92	388.64	409.44	0.72	210.45	18.03	228.48	44.34	16.50	60.84
2015 TOTALS (lbs/day unmitigated)	54.12	349.04	383.70	0.72	1,173.20	16.29	1,189.50	245.40	14.90	260.29
2015 TOTALS (lbs/day mitigated)	54.12	349.04	383.70	0.72	210.45	16.29	226.74	44.34	14.90	59.23
2016 TOTALS (lbs/day unmitigated)	50.87	314.90	361.68	0.72	1,173.20	14.62	1,187.83	245.40	13.36	258.76
2016 TOTALS (lbs/day mitigated)	50.87	314.90	361.68	0.72	210.45	14.62	225.07	44.34	13.36	57.70
2017 TOTALS (lbs/day unmitigated)	48.01	284.70	341.38	0.72	1,173.20	13.16	1,186.36	245.40	12.01	257.41
2017 TOTALS (lbs/day mitigated)	48.01	284.70	341.38	0.72	210.45	13.16	223.61	44.34	12.01	56.35
2018 TOTALS (lbs/day unmitigated)	45.18	257.90	323.25	0.72	1,173.20	11.85	1,185.05	245.40	10.80	256.20
2018 TOTALS (lbs/day mitigated)	45.18	257.90	323.25	0.72	210.45	11.85	222.29	44.34	10.80	55.14
2019 TOTALS (lbs/day unmitigated)	42.81	234.32	306.64	0.72	1,173.20	10.61	1,183.82	245.40	9.67	255.07
2019 TOTALS (lbs/day mitigated)	42.81	234.32	306.64	0.72	210.45	10.61	221.06	44.34	9.67	54.00

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Combined Summer Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV SG.urb924

Project Name: 112-23 OVOV Construction Emissions Special Generator

2020 TOTALS (lbs/day unmitigated)	40.52	213.63	291.65	0.72	1,173.20	9.69	1,182.89	245.40	8.82	254.21
2020 TOTALS (lbs/day mitigated)	40.52	213.63	291.65	0.72	210.45	9.69	220.13	44.34	8.82	53.15
2021 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2021 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2022 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2022 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2023 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2023 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2024 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2024 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2025 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2025 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2026 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2026 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2027 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2027 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2028 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2028 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2029 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2029 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2030 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2030 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89

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Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV SG.urb924

Project Name: 112-23 OVOV Construction Emissions Special Generator

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5
2010 TOTALS (lbs/day unmitigated)	74.35	561.29	533.60	0.72	1,173.20	26.89	1,200.09	245.40	24.66	270.05
2010 TOTALS (lbs/day mitigated)	74.35	561.29	533.60	0.72	210.45	26.89	237.34	44.34	24.66	68.99
2011 TOTALS (lbs/day unmitigated)	69.84	515.88	499.55	0.72	1,173.20	24.63	1,197.83	245.40	22.57	267.97
2011 TOTALS (lbs/day mitigated)	69.84	515.88	499.55	0.72	210.45	24.63	235.08	44.34	22.57	66.91
2012 TOTALS (lbs/day unmitigated)	65.60	471.67	467.60	0.72	1,173.20	22.29	1,195.50	245.40	20.42	265.82
2012 TOTALS (lbs/day mitigated)	65.60	471.67	467.60	0.72	210.45	22.29	232.74	44.34	20.42	64.76
2013 TOTALS (lbs/day unmitigated)	61.80	429.48	437.04	0.72	1,173.20	20.15	1,193.35	245.40	18.44	263.84
2013 TOTALS (lbs/day mitigated)	61.80	429.48	437.04	0.72	210.45	20.15	230.59	44.34	18.44	62.78
2014 TOTALS (lbs/day unmitigated)	57.92	388.64	409.44	0.72	1,173.20	18.03	1,191.24	245.40	16.50	261.90
2014 TOTALS (lbs/day mitigated)	57.92	388.64	409.44	0.72	210.45	18.03	228.48	44.34	16.50	60.84
2015 TOTALS (lbs/day unmitigated)	54.12	349.04	383.70	0.72	1,173.20	16.29	1,189.50	245.40	14.90	260.29
2015 TOTALS (lbs/day mitigated)	54.12	349.04	383.70	0.72	210.45	16.29	226.74	44.34	14.90	59.23
2016 TOTALS (lbs/day unmitigated)	50.87	314.90	361.68	0.72	1,173.20	14.62	1,187.83	245.40	13.36	258.76
2016 TOTALS (lbs/day mitigated)	50.87	314.90	361.68	0.72	210.45	14.62	225.07	44.34	13.36	57.70
2017 TOTALS (lbs/day unmitigated)	48.01	284.70	341.38	0.72	1,173.20	13.16	1,186.36	245.40	12.01	257.41
2017 TOTALS (lbs/day mitigated)	48.01	284.70	341.38	0.72	210.45	13.16	223.61	44.34	12.01	56.35
2018 TOTALS (lbs/day unmitigated)	45.18	257.90	323.25	0.72	1,173.20	11.85	1,185.05	245.40	10.80	256.20
2018 TOTALS (lbs/day mitigated)	45.18	257.90	323.25	0.72	210.45	11.85	222.29	44.34	10.80	55.14
2019 TOTALS (lbs/day unmitigated)	42.81	234.32	306.64	0.72	1,173.20	10.61	1,183.82	245.40	9.67	255.07
2019 TOTALS (lbs/day mitigated)	42.81	234.32	306.64	0.72	210.45	10.61	221.06	44.34	9.67	54.00
2020 TOTALS (lbs/day unmitigated)	40.52	213.63	291.65	0.72	1,173.20	9.69	1,182.89	245.40	8.82	254.21
2020 TOTALS (lbs/day mitigated)	40.52	213.63	291.65	0.72	210.45	9.69	220.13	44.34	8.82	53.15

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: Z:\Alan Sako\112.23 OVOV\112-23 URBEMIS FILES\112.23 Const OVOV SG.urb924

Project Name: 112-23 OVOV Construction Emissions Special Generator

2021 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2021 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2022 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2022 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2023 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2023 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2024 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2024 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2025 TOTALS (lbs/day unmitigated)	37.13	184.77	243.22	0.72	1,173.20	8.67	1,181.88	245.40	7.88	253.28
2025 TOTALS (lbs/day mitigated)	37.13	184.77	243.22	0.72	210.45	8.67	219.12	44.34	7.88	52.22
2026 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2026 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2027 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2027 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2028 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2028 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2029 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2029 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89
2030 TOTALS (lbs/day unmitigated)	35.55	174.13	218.09	0.72	1,173.20	8.32	1,181.52	245.40	7.56	252.96
2030 TOTALS (lbs/day mitigated)	35.55	174.13	218.09	0.72	210.45	8.32	218.76	44.34	7.56	51.89

Operational Air Emissions

for Proposed General Plan and Area Plan

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Comm'l.urb924

Project Name: 112-23 OVOV Commercial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	147.70	154.95	136.27	0.00	0.30	0.30	185,858.61

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,040.49	13,525.00	118,669.43	124.32	20,448.00	3,979.99	12,139,727.56

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,188.19	13,679.95	118,805.70	124.32	20,448.30	3,980.29	12,325,586.17

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	11.24	154.87	130.09	0.00	0.28	0.28	185,847.37
Hearth - No Summer Emissions							
Landscape	0.49	0.08	6.18	0.00	0.02	0.02	11.24
Consumer Products	0.00						
Architectural Coatings	135.97						
TOTALS (lbs/day, unmitigated)	147.70	154.95	136.27	0.00	0.30	0.30	185,858.61

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	3,050.50	4,542.81	39,859.00	41.76	6,868.13	1,336.81	4,077,523.29
Comm'l Ctr 10-30 ac	3,757.32	5,629.11	49,390.22	51.74	8,510.46	1,656.47	5,052,555.00
Comm'l Ctr <10 ac	1,621.17	2,444.14	21,445.08	22.47	3,695.21	719.24	2,193,803.36
Comm'l Shops	611.50	908.94	7,975.13	8.35	1,374.20	267.47	815,845.91
TOTALS (lbs/day, unmitigated)	9,040.49	13,525.00	118,669.43	124.32	20,448.00	3,979.99	12,139,727.56

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	9,728.62	389,728.54	3,975,230.99
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	8,933.07	482,921.79	4,925,802.20
Comm'l Ctr <10 ac		85.06	1000 sq ft	2,465.12	209,683.11	2,138,767.69
Comm'l Shops		37.06	1000 sq ft	2,104.11	77,978.32	795,378.88
					1,160,311.76	11,835,179.76

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Comm'l.urb924

Project Name: 112-23 OVOV Commercial Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	147.21	154.87	130.09	0.00	0.28	0.28	185,847.37

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10,265.87	16,298.82	113,954.82	103.42	20,448.00	3,979.99	10,990,562.91

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	10,413.08	16,453.69	114,084.91	103.42	20,448.28	3,980.27	11,176,410.28

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	11.24	154.87	130.09	0.00	0.28	0.28	185,847.37
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	135.97						
TOTALS (lbs/day, unmitigated)	147.21	154.87	130.09	0.00	0.28	0.28	185,847.37

Area Source Changes to Defaults

Percentage of residences with wood stoves changed from 10% to 0%

Percentage of residences with wood fireplaces changed from 5% to 0%

Percentage of residences with natural gas fireplaces changed from 85% to 0%

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Comm'l Ctr >30 ac	3,454.40	5,474.49	38,275.44	34.74	6,868.13	1,336.81	3,691,538.88
Comm'l Ctr 10-30 ac	4,270.26	6,783.57	47,428.00	43.04	8,510.46	1,656.47	4,574,272.64
Comm'l Ctr <10 ac	1,849.53	2,945.40	20,593.09	18.69	3,695.21	719.24	1,986,134.67
Comm'l Shops	691.68	1,095.36	7,658.29	6.95	1,374.20	267.47	738,616.72
TOTALS (lbs/day, unmitigated)	10,265.87	16,298.82	113,954.82	103.42	20,448.00	3,979.99	10,990,562.91

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Comm'l Ctr >30 ac		40.06	1000 sq ft	9,728.62	389,728.54	3,975,230.99
Comm'l Ctr 10-30 ac		54.06	1000 sq ft	8,933.07	482,921.79	4,925,802.20
Comm'l Ctr <10 ac		85.06	1000 sq ft	2,465.12	209,683.11	2,138,767.69
Comm'l Shops		37.06	1000 sq ft	2,104.11	77,978.32	795,378.88
					1,160,311.76	11,835,179.76

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Comm'l Ctr >30 ac				2.0	1.0	97.0
Comm'l Ctr 10-30 ac				2.0	1.0	97.0
Comm'l Ctr <10 ac				2.0	1.0	97.0
Comm'l Shops				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Institutional.urb924

Project Name: 112-23 OVOV Institutional Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	70.80	102.30	96.64	0.00	0.22	0.22	122,617.22

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,243.68	2,208.83	19,541.79	20.30	3,334.32	649.23	1,983,078.59

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,314.48	2,311.13	19,638.43	20.30	3,334.54	649.45	2,105,695.81

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	7.42	102.16	85.82	0.00	0.18	0.18	122,597.56
Hearth - No Summer Emissions							
Landscape	0.86	0.14	10.82	0.00	0.04	0.04	19.66
Consumer Products	0.00						
Architectural Coatings	62.52						
TOTALS (lbs/day, unmitigated)	70.80	102.30	96.64	0.00	0.22	0.22	122,617.22

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Day-care center	22.62	28.46	250.35	0.26	43.02	8.37	25,550.68
Elementary school	956.05	875.73	7,794.75	8.06	1,320.47	257.18	786,375.63
High school	389.01	386.49	3,412.86	3.55	583.62	113.63	346,967.06
Junior college (2 yrs)	687.11	647.65	5,696.22	5.95	978.72	190.52	581,354.24
Library	60.20	90.58	796.67	0.83	136.88	26.65	81,308.00
Place of worship	78.22	108.15	949.64	0.99	163.48	31.82	97,071.43
Hospital	50.47	71.77	641.30	0.66	108.13	21.06	64,451.55
TOTALS (lbs/day, unmitigated)	2,243.68	2,208.83	19,541.79	20.30	3,334.32	649.23	1,983,078.59

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Day-care center		4.52	1000 sq ft	540.00	2,440.80	24,896.16
Elementary school		1.45	students	51,667.00	74,917.15	764,154.94
High school		1.79	students	18,500.00	33,115.00	337,772.99
Junior college (2 yrs)		1.54	students	36,062.00	55,535.48	566,461.87
Library		84.98	1000 sq ft	91.40	7,767.17	79,225.16
Place of worship		9.30	1000 sq ft	997.46	9,276.38	94,619.06
Hospital		16.80	1000 sq ft	365.16	6,134.69	62,573.81
					189,186.67	1,929,703.99

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.3	10.3	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Day-care center				5.0	2.5	92.5
Elementary school				20.0	10.0	70.0
High school				10.0	5.0	85.0
Junior college (2 yrs)				5.0	2.5	92.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Library				5.0	2.5	92.5
Place of worship				3.0	1.5	95.5
Hospital				25.0	12.5	62.5

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Institutional.urb924

Project Name: 112-23 OVOV Institutional Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	69.94	102.16	85.82	0.00	0.18	0.18	122,597.56

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,024.54	2,662.11	18,742.43	16.91	3,334.32	649.23	1,795,709.44

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,094.48	2,764.27	18,828.25	16.91	3,334.50	649.41	1,918,307.00

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	7.42	102.16	85.82	0.00	0.18	0.18	122,597.56
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	62.52						
TOTALS (lbs/day, unmitigated)	69.94	102.16	85.82	0.00	0.18	0.18	122,597.56

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Day-care center	23.23	34.30	240.32	0.22	43.02	8.37	23,133.33
Elementary school	833.46	1,055.53	7,469.25	6.71	1,320.47	257.18	712,178.21
High school	352.51	465.79	3,274.17	2.96	583.62	113.63	314,170.20
Junior college (2 yrs)	606.11	780.49	5,467.96	4.95	978.72	190.52	526,352.29
Library	68.64	109.16	764.75	0.69	136.88	26.65	73,615.44
Place of worship	84.77	130.33	911.81	0.83	163.48	31.82	87,884.17
Hospital	55.82	86.51	614.17	0.55	108.13	21.06	58,375.80
TOTALS (lbs/day, unmitigated)	2,024.54	2,662.11	18,742.43	16.91	3,334.32	649.23	1,795,709.44

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Day-care center		4.52	1000 sq ft	540.00	2,440.80	24,896.16
Elementary school		1.45	students	51,667.00	74,917.15	764,154.94
High school		1.79	students	18,500.00	33,115.00	337,772.99
Junior college (2 yrs)		1.54	students	36,062.00	55,535.48	566,461.87
Library		84.98	1000 sq ft	91.40	7,767.17	79,225.16
Place of worship		9.30	1000 sq ft	997.46	9,276.38	94,619.06
Hospital		16.80	1000 sq ft	365.16	6,134.69	62,573.81
					189,186.67	1,929,703.99

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.3	10.3	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Day-care center				5.0	2.5	92.5
Elementary school				20.0	10.0	70.0
High school				10.0	5.0	85.0
Junior college (2 yrs)				5.0	2.5	92.5

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Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Library				5.0	2.5	92.5
Place of worship				3.0	1.5	95.5
Hospital				25.0	12.5	62.5

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Res'l.urb924

Project Name: 112-23 OVOV Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	9,121.97	2,046.86	4,597.69	0.19	13.74	13.62	2,565,140.88

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	11,558.30	15,333.31	140,672.65	141.35	22,989.35	4,483.48	13,785,528.12

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	20,680.27	17,380.17	145,270.34	141.54	23,003.09	4,497.10	16,350,669.00

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	154.83	2,004.65	853.04	0.02	3.84	3.80	2,559,126.91
Hearth - No Summer Emissions							
Landscape	676.16	42.21	3,744.65	0.17	9.90	9.82	6,013.97
Consumer Products	7,876.92						
Architectural Coatings	414.06						
TOTALS (lbs/day, unmitigated)	9,121.97	2,046.86	4,597.69	0.19	13.74	13.62	2,565,140.88

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	6,768.73	9,078.35	83,287.64	83.69	13,611.23	2,654.52	8,161,957.00
Apartments mid rise	942.41	1,219.70	11,189.92	11.24	1,828.71	356.64	1,096,580.99
Condo/townhouse general	3,598.06	4,731.94	43,412.36	43.62	7,094.64	1,383.63	4,254,290.83
Mobile home park	161.93	200.70	1,841.27	1.85	300.91	58.68	180,438.98
Retirement community	87.17	102.62	941.46	0.95	153.86	30.01	92,260.32
TOTALS (lbs/day, unmitigated)	11,558.30	15,333.31	140,672.65	141.35	22,989.35	4,483.48	13,785,528.12

Operational Settings:

4/21/2009 1:18:35 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	25,991.67	9.90	dwelling units	77,975.00	771,952.47	7,873,915.05
Apartments mid rise	395.55	6.90	dwelling units	15,031.00	103,713.90	1,057,881.77
Condo/townhouse general	3,143.50	8.00	dwelling units	50,296.00	402,368.00	4,104,153.52
Mobile home park	570.00	4.99	dwelling units	3,420.00	17,065.80	174,071.15
Retirement community	470.40	3.71	dwelling units	2,352.00	8,725.92	89,004.38
					1,303,826.09	13,299,025.87

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Res'l.urb924

Project Name: 112-23 OVOV Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	31,806.54	3,973.53	65,622.94	181.63	10,047.53	9,672.60	5,199,821.47

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	12,391.54	18,485.68	134,708.09	117.85	22,989.35	4,483.48	12,494,227.90

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	44,198.08	22,459.21	200,331.03	299.48	33,036.88	14,156.08	17,694,049.37

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	154.83	2,004.65	853.04	0.02	3.84	3.80	2,559,126.91
Hearth	23,360.73	1,968.88	64,769.90	181.61	10,043.69	9,668.80	2,640,694.56
Landscaping - No Winter Emissions							
Consumer Products	7,876.92						
Architectural Coatings	414.06						
TOTALS (lbs/day, unmitigated)	31,806.54	3,973.53	65,622.94	181.63	10,047.53	9,672.60	5,199,821.47

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Single family housing	7,303.11	10,944.76	79,756.22	69.78	13,611.23	2,654.52	7,397,420.68
Apartments mid rise	996.03	1,470.46	10,715.46	9.37	1,828.71	356.64	993,863.47
Condo/townhouse general	3,838.08	5,704.78	41,571.67	36.37	7,094.64	1,383.63	3,855,788.38
Mobile home park	166.98	241.96	1,763.20	1.54	300.91	58.68	163,537.14
Retirement community	87.34	123.72	901.54	0.79	153.86	30.01	83,618.23
TOTALS (lbs/day, unmitigated)	12,391.54	18,485.68	134,708.09	117.85	22,989.35	4,483.48	12,494,227.90

Operational Settings:

4/21/2009 1:18:59 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Single family housing	25,991.67	9.90	dwelling units	77,975.00	771,952.47	7,873,915.05
Apartments mid rise	395.55	6.90	dwelling units	15,031.00	103,713.90	1,057,881.77
Condo/townhouse general	3,143.50	8.00	dwelling units	50,296.00	402,368.00	4,104,153.52
Mobile home park	570.00	4.99	dwelling units	3,420.00	17,065.80	174,071.15
Retirement community	470.40	3.71	dwelling units	2,352.00	8,725.92	89,004.38
					1,303,826.09	13,299,025.87

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			

% of Trips - Commercial (by land use)

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV SG.urb924

Project Name: 112-23 OVOV Special Generator Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	46.96	0.81	0.68	0.00	0.00	0.00	966.44

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	322.22	513.04	3,590.85	3.26	643.48	125.25	345,965.96

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	369.18	513.85	3,591.53	3.26	643.48	125.25	346,932.40

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.06	0.81	0.68	0.00	0.00	0.00	966.44
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	46.90						
TOTALS (lbs/day, unmitigated)	46.96	0.81	0.68	0.00	0.00	0.00	966.44

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Manufacturing	11.63	18.18	130.99	0.12	22.64	4.41	12,274.15
Wayside Honor Ranch	13.27	21.07	147.32	0.13	26.43	5.15	14,208.12
Six Flags Magic Mtn	211.56	337.13	2,357.05	2.14	422.95	82.32	227,329.86
Travel Village	23.09	36.80	257.31	0.23	46.17	8.99	24,816.84
Agua Dulce Airport	45.04	71.77	501.76	0.46	90.04	17.52	48,392.84
Landfill	17.63	28.09	196.42	0.18	35.25	6.86	18,944.15
TOTALS (lbs/day, unmitigated)	322.22	513.04	3,590.85	3.26	643.48	125.25	345,965.96

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Manufacturing		100.00	1000 sq ft	12.84	1,284.00	13,096.80
Wayside Honor Ranch		50.00	acres	30.00	1,500.00	15,300.00
Six Flags Magic Mtn		100.00	acres	240.00	24,000.00	244,800.00
Travel Village		100.00	acres	26.20	2,620.00	26,724.00
Agua Dulce Airport		100.00	acres	51.09	5,109.00	52,111.80
Landfill		100.00	acres	20.00	2,000.00	20,400.00
					36,513.00	372,432.60

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Manufacturing				48.0	24.0	28.0
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV SG.urb924

Project Name: 112-23 OVOV Special Generator Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	46.96	0.81	0.68	0.00	0.00	0.00	966.44

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	322.22	513.04	3,590.85	3.26	643.48	125.25	345,965.96

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	369.18	513.85	3,591.53	3.26	643.48	125.25	346,932.40

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.06	0.81	0.68	0.00	0.00	0.00	966.44
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	46.90						
TOTALS (lbs/day, unmitigated)	46.96	0.81	0.68	0.00	0.00	0.00	966.44

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Manufacturing	11.63	18.18	130.99	0.12	22.64	4.41	12,274.15
Wayside Honor Ranch	13.27	21.07	147.32	0.13	26.43	5.15	14,208.12
Six Flags Magic Mtn	211.56	337.13	2,357.05	2.14	422.95	82.32	227,329.86
Travel Village	23.09	36.80	257.31	0.23	46.17	8.99	24,816.84
Agua Dulce Airport	45.04	71.77	501.76	0.46	90.04	17.52	48,392.84
Landfill	17.63	28.09	196.42	0.18	35.25	6.86	18,944.15
TOTALS (lbs/day, unmitigated)	322.22	513.04	3,590.85	3.26	643.48	125.25	345,965.96

4/21/2009 1:43:43 PM

Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Manufacturing		100.00	1000 sq ft	12.84	1,284.00	13,096.80
Wayside Honor Ranch		50.00	acres	30.00	1,500.00	15,300.00
Six Flags Magic Mtn		100.00	acres	240.00	24,000.00	244,800.00
Travel Village		100.00	acres	26.20	2,620.00	26,724.00
Agua Dulce Airport		100.00	acres	51.09	5,109.00	52,111.80
Landfill		100.00	acres	20.00	2,000.00	20,400.00
					36,513.00	372,432.60

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Manufacturing				48.0	24.0	28.0
Wayside Honor Ranch				2.0	1.0	97.0
Six Flags Magic Mtn				2.0	1.0	97.0
Travel Village				2.0	1.0	97.0
Agua Dulce Airport				2.0	1.0	97.0
Landfill				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Non-Res'l.urb924

Project Name: 112-23 OVOV Non-Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	39.00	52.63	53.38	0.00	0.12	0.12	63,024.87

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	988.43	1,425.51	12,531.36	13.11	2,154.44	419.38	1,279,587.15

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,027.43	1,478.14	12,584.74	13.11	2,154.56	419.50	1,342,612.02

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.81	52.51	44.11	0.00	0.09	0.09	63,008.02
Hearth - No Summer Emissions							
Landscape	0.74	0.12	9.27	0.00	0.03	0.03	16.85
Consumer Products	0.00						
Architectural Coatings	34.45						
TOTALS (lbs/day, unmitigated)	39.00	52.63	53.38	0.00	0.12	0.12	63,024.87

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	43.31	64.37	566.18	0.59	97.28	18.94	57,784.24
High turnover (sit-down) rest.	291.57	440.38	3,873.22	4.05	665.49	129.55	395,299.72
Fast food rest. w/ drive thru	245.46	372.71	3,278.11	3.43	563.24	109.64	334,562.89
Hotel	177.74	242.53	2,133.15	2.23	366.52	71.35	217,708.49
Movie Theater	74.54	73.85	648.01	0.68	111.66	21.73	66,290.21
Car Dealership	155.81	231.67	2,032.69	2.13	350.25	68.17	207,941.60
TOTALS (lbs/day, unmitigated)	988.43	1,425.51	12,531.36	13.11	2,154.44	419.38	1,279,587.15

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	138.00	5,520.00	56,304.00
High turnover (sit-down) rest.		130.34	1000 sq ft	289.72	37,762.10	385,173.45
Fast food rest. w/ drive thru		496.12	1000 sq ft	64.42	31,960.05	325,992.50
Hotel		8.23	rooms	2,527.00	20,797.21	212,131.53
Movie Theater		1.76	1000 sq ft	3,600.00	6,336.00	64,627.20
Car Dealership		37.50	1000 sq ft	530.00	19,875.00	202,725.00
					122,250.36	1,246,953.68

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Non-Res'l.urb924

Project Name: 112-23 OVOV Non-Residential Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	38.26	52.51	44.11	0.00	0.09	0.09	63,008.02

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,098.45	1,717.92	12,030.11	10.89	2,154.44	419.38	1,158,511.24

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	1,136.71	1,770.43	12,074.22	10.89	2,154.53	419.47	1,221,519.26

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	3.81	52.51	44.11	0.00	0.09	0.09	63,008.02
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	34.45						
TOTALS (lbs/day, unmitigated)	38.26	52.51	44.11	0.00	0.09	0.09	63,008.02

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Racquetball/health	49.02	77.58	543.49	0.49	97.28	18.94	52,317.27
High turnover (sit-down) rest.	333.18	530.71	3,718.01	3.37	665.49	129.55	357,900.39
Fast food rest. w/ drive thru	281.40	449.17	3,146.75	2.85	563.24	109.64	302,909.88
Hotel	191.21	292.28	2,047.67	1.85	366.52	71.35	197,111.08
Movie Theater	67.37	89.00	622.26	0.56	111.66	21.73	60,015.08
Car Dealership	176.27	279.18	1,951.93	1.77	350.25	68.17	188,257.54
TOTALS (lbs/day, unmitigated)	1,098.45	1,717.92	12,030.11	10.89	2,154.44	419.38	1,158,511.24

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Operational Settings:

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Racquetball/health		40.00	1000 sq ft	138.00	5,520.00	56,304.00
High turnover (sit-down) rest.		130.34	1000 sq ft	289.72	37,762.10	385,173.45
Fast food rest. w/ drive thru		496.12	1000 sq ft	64.42	31,960.05	325,992.50
Hotel		8.23	rooms	2,527.00	20,797.21	212,131.53
Movie Theater		1.76	1000 sq ft	3,600.00	6,336.00	64,627.20
Car Dealership		37.50	1000 sq ft	530.00	19,875.00	202,725.00
					122,250.36	1,246,953.68

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Racquetball/health				5.0	2.5	92.5
High turnover (sit-down) rest.				5.0	2.5	92.5
Fast food rest. w/ drive thru				5.0	2.5	92.5
Hotel				5.0	2.5	92.5
Movie Theater				2.0	1.0	97.0
Car Dealership				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Office.urb924

Project Name: 112-23 OVOV Office Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	66.16	69.06	65.66	0.00	0.15	0.15	82,769.64

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	514.16	669.17	5,874.67	6.14	1,011.61	196.91	600,645.65

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	580.32	738.23	5,940.33	6.14	1,011.76	197.06	683,415.29

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.01	68.96	57.93	0.00	0.12	0.12	82,755.60
Hearth - No Summer Emissions							
Landscape	0.61	0.10	7.73	0.00	0.03	0.03	14.04
Consumer Products	0.00						
Architectural Coatings	60.54						
TOTALS (lbs/day, unmitigated)	66.16	69.06	65.66	0.00	0.15	0.15	82,769.64

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	66.33	92.72	816.83	0.85	140.08	27.27	83,236.23
Regional Post Office	19.85	21.64	189.86	0.20	32.72	6.37	19,422.53
Post Office	13.44	19.93	174.89	0.18	30.14	5.87	17,890.82
Commercial Office	385.85	494.46	4,338.40	4.54	747.55	145.50	443,812.22
High-Rise Office	28.69	40.42	354.69	0.37	61.12	11.90	36,283.85
TOTALS (lbs/day, unmitigated)	514.16	669.17	5,874.67	6.14	1,011.61	196.91	600,645.65

Operational Settings:

4/21/2009 2:53:59 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	730.56	7,948.49	81,074.63
Regional Post Office		2.38	1000 sq ft	780.00	1,856.40	18,935.28
Post Office		34.20	1000 sq ft	50.00	1,710.00	17,442.00
Commercial Office		5.00	1000 sq ft	8,483.89	42,419.45	432,678.36
High-Rise Office		11.56	1000 sq ft	300.00	3,468.00	35,373.60
					57,402.34	585,503.87

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0
High-Rise Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Office.urb924

Project Name: 112-23 OVOV Office Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	65.55	68.96	57.93	0.00	0.12	0.12	82,755.60

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	538.03	806.42	5,640.80	5.12	1,011.61	196.91	543,794.79

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	603.58	875.38	5,698.73	5.12	1,011.73	197.03	626,550.39

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	5.01	68.96	57.93	0.00	0.12	0.12	82,755.60
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	60.54						
TOTALS (lbs/day, unmitigated)	65.55	68.96	57.93	0.00	0.12	0.12	82,755.60

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Medical office building	72.40	111.75	783.91	0.71	140.08	27.27	75,364.10
Regional Post Office	18.84	26.08	182.32	0.17	32.72	6.37	17,583.97
Post Office	15.18	24.02	167.94	0.15	30.14	5.87	16,197.25
Commercial Office	400.18	595.86	4,166.04	3.78	747.55	145.50	401,800.30
High-Rise Office	31.43	48.71	340.59	0.31	61.12	11.90	32,849.17
TOTALS (lbs/day, unmitigated)	538.03	806.42	5,640.80	5.12	1,011.61	196.91	543,794.79

Operational Settings:

4/21/2009 2:54:21 PM

Does not include correction for passby trips

Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Medical office building		10.88	1000 sq ft	730.56	7,948.49	81,074.63
Regional Post Office		2.38	1000 sq ft	780.00	1,856.40	18,935.28
Post Office		34.20	1000 sq ft	50.00	1,710.00	17,442.00
Commercial Office		5.00	1000 sq ft	8,483.89	42,419.45	432,678.36
High-Rise Office		11.56	1000 sq ft	300.00	3,468.00	35,373.60
					57,402.34	585,503.87

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0

4/21/2009 2:54:21 PM

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Medical office building				7.0	3.5	89.5
Regional Post Office				2.0	1.0	97.0
Post Office				2.0	1.0	97.0
Commercial Office				2.0	1.0	97.0
High-Rise Office				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Recreation.urb924

Project Name: 112-23 OVOV Recreation Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	416.98	0.06	4.64	0.00	0.02	0.02	8.43

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	2,963.22	4,481.14	39,317.93	41.19	6,774.90	1,318.67	4,022,173.48

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	3,380.20	4,481.20	39,322.57	41.19	6,774.92	1,318.69	4,022,181.91

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth - No Summer Emissions							
Landscape	0.37	0.06	4.64	0.00	0.02	0.02	8.43
Consumer Products	0.00						
Architectural Coatings	416.61						
TOTALS (lbs/day, unmitigated)	416.98	0.06	4.64	0.00	0.02	0.02	8.43

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Summer Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	1,116.56	1,687.35	14,804.96	15.51	2,551.05	496.54	1,514,528.64
Developed Park	70.85	96.51	846.83	0.89	145.92	28.40	86,629.17
Undeveloped Park	1,775.81	2,697.28	23,666.14	24.79	4,077.93	793.73	2,421,015.67
TOTALS (lbs/day, unmitigated)	2,963.22	4,481.14	39,317.93	41.19	6,774.90	1,318.67	4,022,173.48

Operational Settings:

Does not include correction for passby trips

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Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 80 Season: Summer

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	1,338.00	144,758.22	1,476,533.85
Developed Park		7.96	acres	1,040.20	8,279.99	84,455.91
Undeveloped Park		260.00	acres	890.00	231,400.00	2,360,279.96
					384,438.21	3,921,269.72

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 OVOV Recreation.urb924

Project Name: 112-23 OVOV Recreation Emissions

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

AREA SOURCE EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	416.61	0.00	0.00	0.00	0.00	0.00	0.00

OPERATIONAL (VEHICLE) EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	3,386.90	5,400.18	37,755.88	34.26	6,774.90	1,318.67	3,641,428.55

SUM OF AREA SOURCE AND OPERATIONAL EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
TOTALS (lbs/day, unmitigated)	3,803.51	5,400.18	37,755.88	34.26	6,774.90	1,318.67	3,641,428.55

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Area Source Unmitigated Detail Report:

AREA SOURCE EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOx	CO	SO2	PM10	PM2.5	CO2
Natural Gas	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Hearth	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Landscaping - No Winter Emissions							
Consumer Products	0.00						
Architectural Coatings	416.61						
TOTALS (lbs/day, unmitigated)	416.61	0.00	0.00	0.00	0.00	0.00	0.00

Area Source Changes to Defaults

The number of persons per household for consumer product use changed from 3 persons to 3.09 persons

Operational Unmitigated Detail Report:

OPERATIONAL EMISSION ESTIMATES Winter Pounds Per Day, Unmitigated

Source	ROG	NOX	CO	SO2	PM10	PM25	CO2
Golf Course	1,275.67	2,033.41	14,216.78	12.90	2,551.05	496.54	1,371,161.10
Developed Park	76.11	116.31	813.18	0.74	145.92	28.40	78,428.72
Undeveloped Park	2,035.12	3,250.46	22,725.92	20.62	4,077.93	793.73	2,191,838.73
TOTALS (lbs/day, unmitigated)	3,386.90	5,400.18	37,755.88	34.26	6,774.90	1,318.67	3,641,428.55

Operational Settings:

Does not include correction for passby trips

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Does not include double counting adjustment for internal trips

Analysis Year: 2010 Temperature (F): 60 Season: Winter

Emfac: Version : Emfac2007 V2.3 Nov 1 2006

Summary of Land Uses

Land Use Type	Acreage	Trip Rate	Unit Type	No. Units	Total Trips	Total VMT
Golf Course		108.19	acres	1,338.00	144,758.22	1,476,533.85
Developed Park		7.96	acres	1,040.20	8,279.99	84,455.91
Undeveloped Park		260.00	acres	890.00	231,400.00	2,360,279.96
					384,438.21	3,921,269.72

Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Light Auto	51.7	1.2	98.6	0.2
Light Truck < 3750 lbs	7.3	2.7	94.6	2.7
Light Truck 3751-5750 lbs	22.9	0.4	99.6	0.0
Med Truck 5751-8500 lbs	10.6	0.9	99.1	0.0
Lite-Heavy Truck 8501-10,000 lbs	1.6	0.0	81.2	18.8
Lite-Heavy Truck 10,001-14,000 lbs	0.5	0.0	60.0	40.0
Med-Heavy Truck 14,001-33,000 lbs	0.9	0.0	22.2	77.8
Heavy-Heavy Truck 33,001-60,000 lbs	0.5	0.0	0.0	100.0
Other Bus	0.1	0.0	0.0	100.0
Urban Bus	0.1	0.0	0.0	100.0
Motorcycle	2.8	67.9	32.1	0.0
School Bus	0.1	0.0	0.0	100.0

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Vehicle Fleet Mix

Vehicle Type	Percent Type	Non-Catalyst	Catalyst	Diesel
Motor Home	0.9	0.0	88.9	11.1

Travel Conditions

	Residential			Commercial		
	Home-Work	Home-Shop	Home-Other	Commute	Non-Work	Customer
Urban Trip Length (miles)	10.2	10.2	10.2	10.2	10.2	10.2
Rural Trip Length (miles)	17.6	12.1	14.9	15.4	9.6	12.6
Trip speeds (mph)	30.0	30.0	30.0	30.0	30.0	30.0
% of Trips - Residential	32.9	18.0	49.1			
% of Trips - Commercial (by land use)						
Golf Course				2.0	1.0	97.0
Developed Park				2.0	1.0	97.0
Undeveloped Park				2.0	1.0	97.0

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Urbemis 2007 Version 9.2.4

Combined Summer Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Constr OVOV Ind'l.urb924

Project Name: 112-23 OVOV Construction Emissions Industrial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	461.90	3,201.21	4,139.35	6.89	13,612.73	137.07	13,749.81	2,846.64	125.27	2,971.90	742,758.88
2011 TOTALS (lbs/day unmitigated)	435.28	2,904.24	3,846.05	6.89	13,612.73	123.50	13,736.23	2,846.64	112.76	2,959.40	742,704.54
2012 TOTALS (lbs/day unmitigated)	409.81	2,614.32	3,568.21	6.89	13,612.73	110.76	13,723.49	2,846.64	101.02	2,947.66	742,662.83
2013 TOTALS (lbs/day unmitigated)	385.88	2,336.09	3,302.06	6.89	13,612.73	98.70	13,711.44	2,846.64	89.87	2,936.51	742,642.91
2014 TOTALS (lbs/day unmitigated)	362.59	2,073.83	3,060.28	6.89	13,612.73	88.14	13,700.88	2,846.64	80.16	2,926.80	742,624.91
2015 TOTALS (lbs/day unmitigated)	340.59	1,834.06	2,835.39	6.89	13,612.73	78.40	13,691.13	2,846.64	71.18	2,917.82	742,615.60
2016 TOTALS (lbs/day unmitigated)	322.23	1,634.65	2,641.59	6.89	13,612.73	70.52	13,683.26	2,846.64	63.94	2,910.57	742,592.48

2017 TOTALS (lbs/day unmitigated)	306.19	1,464.97	2,463.06	6.89	13,612.73	63.56	13,676.29	2,846.64	57.53	2,904.16	742,582.58
2018 TOTALS (lbs/day unmitigated)	291.47	1,319.69	2,301.46	6.89	13,612.73	57.77	13,670.51	2,846.64	52.18	2,898.82	742,580.59
2019 TOTALS (lbs/day unmitigated)	278.94	1,195.02	2,153.71	6.89	13,612.73	52.65	13,665.39	2,846.64	47.47	2,894.11	742,583.83
2020 TOTALS (lbs/day unmitigated)	267.20	1,088.24	2,018.08	6.89	13,612.73	48.51	13,661.25	2,846.64	43.66	2,890.30	742,589.44
2021 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2022 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2023 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2024 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2025 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2026 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2027 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2028 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20

2029 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2030 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20

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Urbemis 2007 Version 9.2.4

Combined Winter Emissions Reports (Pounds/Day)

File Name: C:\Documents and Settings\rmamaghani\Application Data\Urbemis\Version9a\Projects\112.23 Constr OVOV Ind'l.urb924

Project Name: 112-23 OVOV Construction Emissions Industrial

Project Location: South Coast AQMD

On-Road Vehicle Emissions Based on: Version : Emfac2007 V2.3 Nov 1 2006

Off-Road Vehicle Emissions Based on: OFFROAD2007

Summary Report:

CONSTRUCTION EMISSION ESTIMATES

	ROG	NOx	CO	SO2	PM10 Dust	PM10 Exhaust	PM10	PM2.5 Dust	PM2.5 Exhaust	PM2.5	CO2
2010 TOTALS (lbs/day unmitigated)	461.90	3,201.21	4,139.35	6.89	13,612.73	137.07	13,749.81	2,846.64	125.27	2,971.90	742,758.88
2011 TOTALS (lbs/day unmitigated)	435.28	2,904.24	3,846.05	6.89	13,612.73	123.50	13,736.23	2,846.64	112.76	2,959.40	742,704.54
2012 TOTALS (lbs/day unmitigated)	409.81	2,614.32	3,568.21	6.89	13,612.73	110.76	13,723.49	2,846.64	101.02	2,947.66	742,662.83
2013 TOTALS (lbs/day unmitigated)	385.88	2,336.09	3,302.06	6.89	13,612.73	98.70	13,711.44	2,846.64	89.87	2,936.51	742,642.91
2014 TOTALS (lbs/day unmitigated)	362.59	2,073.83	3,060.28	6.89	13,612.73	88.14	13,700.88	2,846.64	80.16	2,926.80	742,624.91
2015 TOTALS (lbs/day unmitigated)	340.59	1,834.06	2,835.39	6.89	13,612.73	78.40	13,691.13	2,846.64	71.18	2,917.82	742,615.60
2016 TOTALS (lbs/day unmitigated)	322.23	1,634.65	2,641.59	6.89	13,612.73	70.52	13,683.26	2,846.64	63.94	2,910.57	742,592.48

2017 TOTALS (lbs/day unmitigated)	306.19	1,464.97	2,463.06	6.89	13,612.73	63.56	13,676.29	2,846.64	57.53	2,904.16	742,582.58
2018 TOTALS (lbs/day unmitigated)	291.47	1,319.69	2,301.46	6.89	13,612.73	57.77	13,670.51	2,846.64	52.18	2,898.82	742,580.59
2019 TOTALS (lbs/day unmitigated)	278.94	1,195.02	2,153.71	6.89	13,612.73	52.65	13,665.39	2,846.64	47.47	2,894.11	742,583.83
2020 TOTALS (lbs/day unmitigated)	267.20	1,088.24	2,018.08	6.89	13,612.73	48.51	13,661.25	2,846.64	43.66	2,890.30	742,589.44
2021 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
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2023 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2024 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2025 TOTALS (lbs/day unmitigated)	234.93	823.42	1,535.53	6.88	13,612.73	39.29	13,652.02	2,846.64	35.19	2,881.82	742,628.85
2026 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2027 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2028 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20

2029 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20
2030 TOTALS (lbs/day unmitigated)	219.70	725.29	1,283.90	6.88	13,612.73	36.07	13,648.80	2,846.64	32.24	2,878.87	742,679.20

CALINE4 CO Emissions

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 1: The Old Road & Rye Canyon
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	The Old Road	AT GRADE	4	5	5
East-West Roadway:	Rye Canyon	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

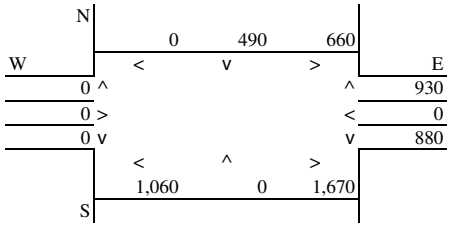
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

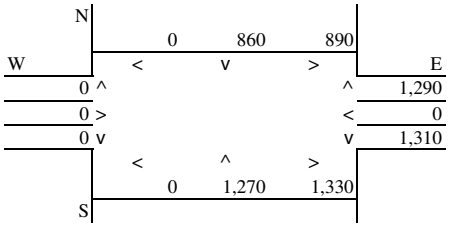
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	4,100	N-S Road	4,770

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 8: McBean Parkway & Magic Mountain Parkway
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	McBean Parkway	AT GRADE	4	5	5
East-West Roadway:	Magic Mountain Parkway	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak

	N				
		720	1,980	520	
W	<		v	>	E
470	^			^	350
1,660	>			<	690
140	v			v	70
		<	^	>	
		250	1,320	40	
	S				

P.M. Peak

	N				
		110	2,130	300	
W	<		v	>	E
420	^			^	640
1,830	>			<	1,420
410	v			v	220
		<	^	>	
		360	2,460	280	
	S				

Representative Traffic Volumes (Vehicles per Hour)

N-S Road	5,360	N-S Road	6,060

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 10: Orchard Village & McBean Parkway
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Orchard Village	AT GRADE	4	5	5
East-West Roadway:	McBean Parkway	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

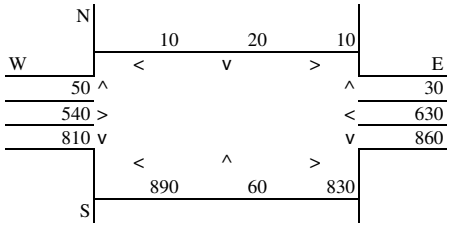
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

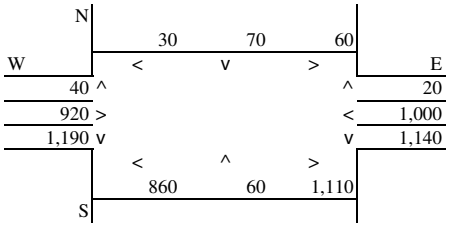
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	3,470	N-S Road	4,430

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 15: Bouquet Canyon Road & Soledad Canyon Road
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Bouquet Canyon Road	AT GRADE	4	5	5
East-West Roadway:	Soledad Canyon Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak

	N			
	1,370	1,860	390	
W	<	v	>	E
360	^		^	250
1,010	>		<	930
120	v		v	140
	<	^	>	
	20	620	190	
	S			

P.M. Peak

	N			
	890	1,390	420	
W	<	v	>	E
1,350	^		^	760
1,180	>		<	1,050
110	v		v	360
	<	^	>	
	100	1,750	490	
	S			

Representative Traffic Volumes (Vehicles per Hour)

N-S Road	4,850	N-S Road	6,560

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 3: The Old Road & Valencia Boulevard
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	The Old Road	AT GRADE	4	5	5
East-West Roadway:	Valencia Boulevard	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

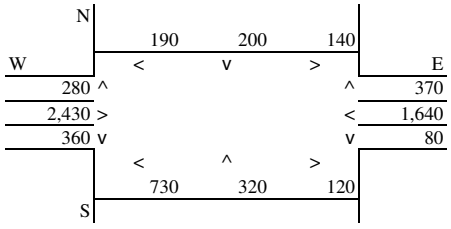
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

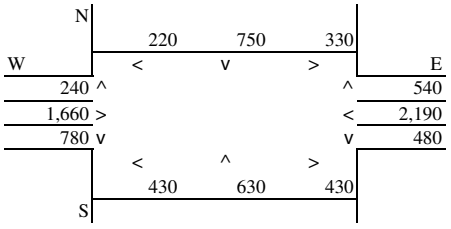
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,810	N-S Road	3,500

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 4: The Old Road & McBean Parkway
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	The Old Road	AT GRADE	4	5	5
East-West Roadway:	McBean Parkway	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

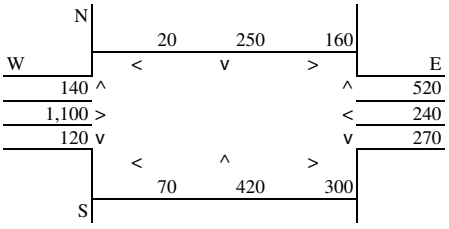
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

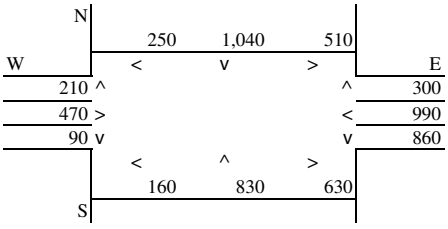
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,510	N-S Road	3,610

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 5: The Old Road & Pico Canyon Road
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	The Old Road	AT GRADE	4	5	5
East-West Roadway:	Pico Canyon Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

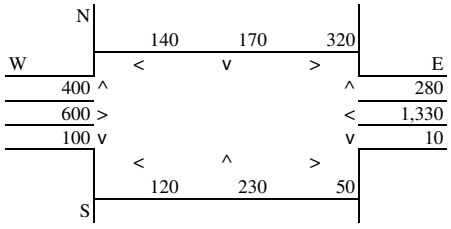
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

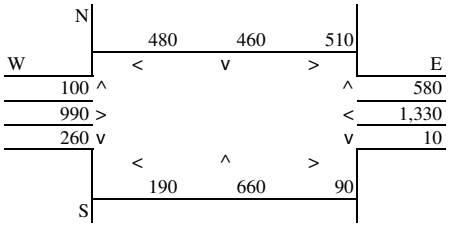
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,540	N-S Road	2,790

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 11: Orchard Village & Wiley Canyon Road
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Orchard Village	AT GRADE	4	5	5
East-West Roadway:	Wiley Canyon Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

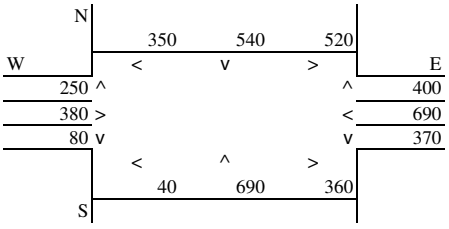
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

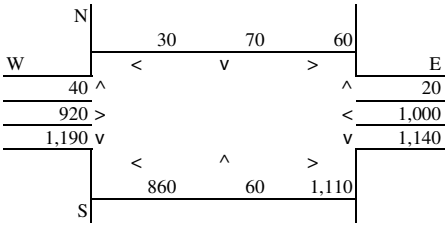
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	2,750	N-S Road	4,430

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 12: Valencia Boulevard & Magic Mountain Parkway
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Valencia Boulevard	AT GRADE	4	5	5
East-West Roadway:	Magic Mountain Parkway	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

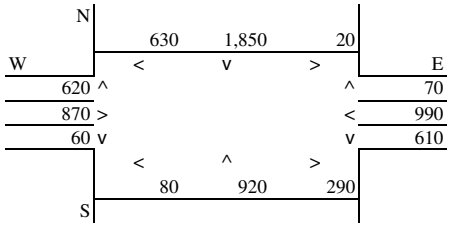
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

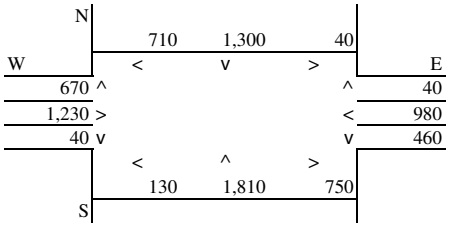
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	4,110	N-S Road	4,570

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 14: Bouquet Canyon Road & Newhall Ranch Road
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Bouquet Canyon Road	AT GRADE	4	5	5
East-West Roadway:	Newhall Ranch Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak

	N				
		790	2,190	100	
W	<	v	>	E	
240	^		^	80	
870	>		<	1,350	
800	v		v	660	
		<	^	>	
		500	530	320	
	S				

P.M. Peak

	N				
		420	1,470	70	
W	<	v	>	E	
660	^		^	100	
1,990	>		<	970	
1,060	v		v	160	
		<	^	>	
		880	2,480	650	
	S				

Representative Traffic Volumes (Vehicles per Hour)

N-S Road	5,000	N-S Road	6,700

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 17: Sierra Highway & Newhall Ranch Road
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Sierra Highway	AT GRADE	4	5	5
East-West Roadway:	Newhall Ranch Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

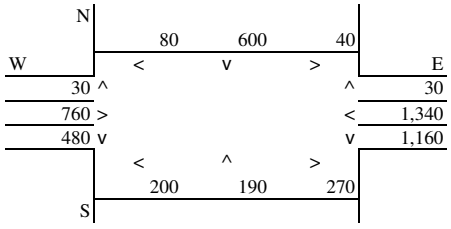
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

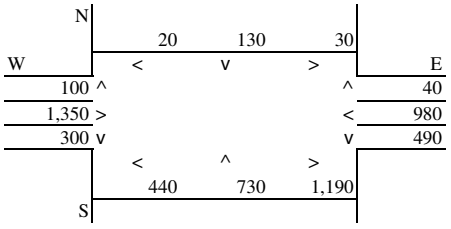
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	2,900	N-S Road	3,280

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 18: Whites Cyn Rd & Soledad Cyn Rd.
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Whites Canyon Road	AT GRADE	4	5	5
East-West Roadway:	Soledad Canyon Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

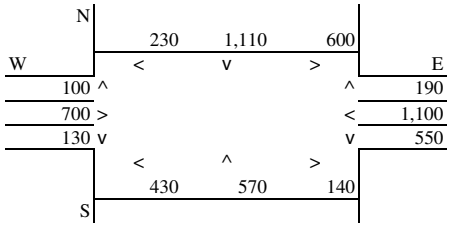
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

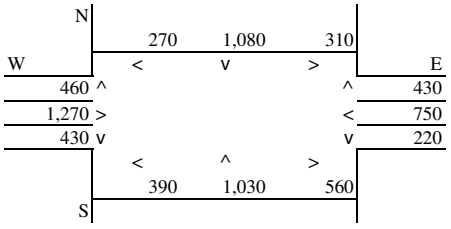
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	2,930	N-S Road	3,710

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 21: Pico Canyon Rd & Valencia Blvd
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Valencia Boulevard	AT GRADE	4	5	5
East-West Roadway:	Pico Canyon Road	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

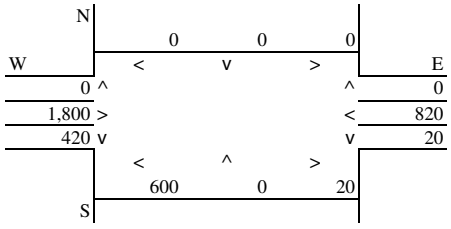
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

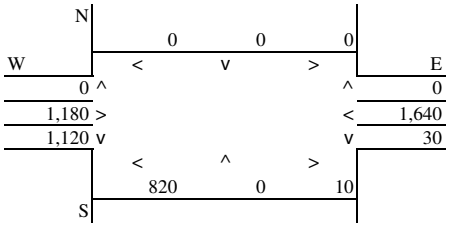
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	1,060	N-S Road	1,980

BAY AREA AQMD SIMPLIFIED CALINE4 ANALYSIS; UPDATED WITH EMFAC2007

Project Title:	One Valley One Vision Area Plan/General Plan Update
Intersection:	Intersection 23: Golden Valley & Via Princessa
Analysis Condition:	OVOV Area Plan/General Plan Buildout
Nearest Air Monitoring Station measuring CO:	Santa Clarita/Placerita Monitoring Station
Background 1-hour CO Concentration (ppm):	2.0
Background 8-hour CO Concentration (ppm):	1.6
Persistence Factor:	0.7
Analysis Year:	2030

		Roadway Type	No. of Lanes	Approach/Departure Speed A.M.	Approach/Departure Speed P.M.
North-South Roadway:	Golden Valley	AT GRADE	4	5	5
East-West Roadway:	Via Princessa	AT GRADE	4	5	5

EMFAC2007 COMPOSITE EMISSION FACTORS FOR CO

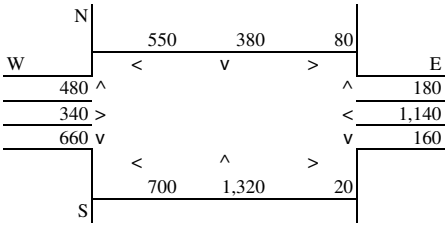
Air Basin: South Coast Air Basin County: Los Angeles

Assumes lowest mean wintertime temperature of 47 degrees F and 30% humidity.

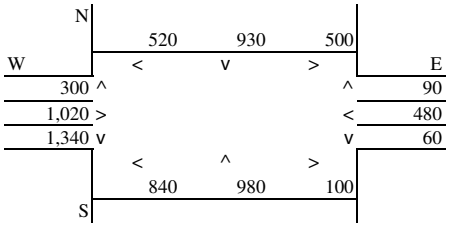
	Average Speed (miles per hour)									
Year	5	8	11	14	17	20	23	26	29	32
2007	10.404	9.093	8.058	7.231	6.563	6.024	5.588	5.23	4.936	4.7
2008	9.453	8.28	7.351	6.607	6.005	5.518	5.124	4.799	4.532	4.316
2009	8.51	7.471	6.646	5.984	5.448	5.012	4.66	4.367	4.126	3.929
2010	7.609	6.699	5.976	5.392	4.918	4.532	4.219	3.958	3.741	3.564
2011	6.831	6.032	5.393	4.877	4.456	4.113	3.833	3.599	3.404	3.243
2012	6.141	5.437	4.874	4.416	4.042	3.737	3.487	3.277	3.101	2.955
2013	5.528	4.909	4.411	4.005	3.673	3.4	3.177	2.988	2.83	2.697
2014	4.98	4.435	3.995	3.635	3.339	3.097	2.897	2.728	2.584	2.464
2015	4.502	4.021	3.63	3.311	3.047	2.829	2.65	2.497	2.368	2.258
2020	2.909	2.632	2.402	2.21	2.05	1.917	1.805	1.708	1.624	1.552
2025	2.144	1.95	1.789	1.653	1.539	1.444	1.364	1.294	1.233	1.181
2030	1.756	1.601	1.472	1.363	1.271	1.195	1.131	1.075	1.027	0.985

PEAK HOUR TURNING VOLUMES

A.M. Peak



P.M. Peak



Representative Traffic Volumes (Vehicles per Hour)

N-S Road	3,240	N-S Road	4,250

APPENDIX 3.4

Greenhouse Gas Emission Calculations

Greenhouse Gas Emissions Calculations

for Existing Conditions

Existing Conditions - OVOV Planning Area
Indirect GHG Emissions from Electrical Demand

Land Use	Units	Electrical Demand Factor[1] (kW-hr/unit/yr)	Annual Demand Factor (10^6 kW-hr/yr)	CO_2E Emission Factor[2] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Residential	72,638 Unit	5,656.50	410.88	399	**164,005.60**
FoodStore	1,341,840 Sq.Ft.	53.30	71.52	399	**28,547.95**
Restaurant	212,030 Sq.Ft.	47.45	10.06	399	**4,015.88**
Hospital	149,900 Sq.Ft.	21.70	3.25	399	**1,298.40**
Retail	2,576,562 Sq.Ft.	13.55	34.91	399	**13,935.64**
Movie Theater (3)	82,500 Sq.Ft.	13.55	1.12	399	**446.21**
College/University	459,475 Sq.Ft.	11.55	5.31	399	**2,118.32**
High School	262,500 Sq.Ft.	10.50	2.76	399	**1,100.18**
Elementary School	747,550 Sq.Ft.	5.90	4.41	399	**1,760.51**
Daycare	11,500 Sq.Ft.	5.90	0.07	399	**27.08**
Office	2,704,040 Sq.Ft.	12.95	35.02	399	**13,977.51**
Hotel/Motel	390,000 Sq.Ft.	9.95	3.88	399	**1,548.94**
Warehouse	0 Sq.Ft.	4.35	-	399	**-**
Miscellaneous	19,195,560 Sq.Ft.	10.50	201.55	399	**80,452.05**
				Projected GHG Emissions from Electrical Demand	**313,234.28**

Sources:
1. South Coast Air Quality Management District, *CEQA Air Quality Handbook*, (1993) Table A9-11-A.

2. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MT	Metric ton
yr	Year

Impact Sciences, Inc.
Prepared by R. Mamaghani
12 March 2009

JN 112-23

Existing Conditions - OVOV Planning Area
GHG Emissions from Solid Waste Generation

Land Use	Size	Unit	Rate (Tons/yr)	Solid Waste Generation (Tons/yr)	CO_2E Emission Factor[2] (MT CO_2E/MT waste)	Annual CO_2E Emissions (MT CO_2E/yr)
Single Family Detached	46,071	du	1.0200	46,992.42	0.11	**4,689.39**
Multi-Family or Attached	24,387	du	0.5850	14,266.40	0.11	**1,423.65**
Mobile Home	2,180	du	0.5850	1,275.30	0.11	**127.26**
General Retail	7,811,260	sq. ft.	0.0012	9,373.51	0.11	**935.39**
Eating/Drnkng Establ.	212,030	sq. ft.	0.0054	1,144.96	0.11	**114.26**
Food & Drug Stores	1,341,840	sq. ft.	0.0036	4,830.62	0.11	**482.05**
Auto Dlr/Service Sta.	399,500	sq. ft.	0.0026	1,018.73	0.11	**101.66**
Hotel & Motel	390,000	sq. ft.	0.0027	1,033.50	0.11	**103.13**
Warehouse	0	sq. ft.	0.0006	0.00	0.11	**-**
Medical Offices	133,730	sq. ft.	0.0014	180.54	0.11	**18.02**
Hospitals	149,900	sq. ft.	0.0028	412.23	0.11	**41.14**
Business Park	16,441,130	sq. ft.	0.0007	11,508.79	0.11	**1,148.47**
Office	2,162,420	sq. ft.	0.0007	1,513.69	0.11	**151.05**
Library 3	53,730	sq. ft.	0.0007	37.61	0.11	**3.75**
Education & Schools	1,021,550	sq. ft.	0.0007	664.01	0.11	**66.26**
College	459,475	sq. ft.	0.0007	298.66	0.11	**29.80**
Trans., Comm., Utilities	903,440	sq. ft.	0.0040	3,568.59	0.11	**356.11**
Special Generator 4	0	sq. ft.	0.0040	0.00	0.11	**-**
Golf Course/Park	872	acres	0.1000	87.19	0.11	**8.70**
Manufacturing	1,850,990	sq. ft.	0.0025	4,627.48	0.11	**461.78**
Church 3	487,890	sq. ft.	0.0007	341.52	0.11	**34.08**
				Projected GHG Emissions From Solid Waste Disposal		**10,295.94**

du = dwelling unit; sq.ft. - square feet; tpy = tons per year; lbs. = pounds

Sources:

1. Ventura County Solid Waste Management Department's Guidelines for Preparation of Environmental Assessments for Solid Waste Impacts. Assumes 50% diversion.

2. US Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Greenhouse Gas Emission Factors for Management of Selected Materials in Municipal Solid Waste (EPA-530-R-98-013)*, (1998). The factor is based on mixed municipal solid waste as disposed in landfills without landfill gas recovery.

Where:

CO_2E	Carbon dioxide equivalent
MT	Metric ton
yr	Year

3. Assumes same generation rate as for office.

4. Conservatively assumes same generation rate as utilities.

Existing Conditions - OVOV Planning Area
GHG Emission from Potable Water Treatment and Conveyance

Land Use	Action	Net Potable Water Needs Estimate[1] (MG/yr)	Electrical Demand Factor[2,3] (kW-hr/MG)	Annual Electrical Demand (10^6 kW-hr/year)	CO_2E Emission Factor[4] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	Supply & Conveyance	32,780.61	9,727	318.857	290	92,468.53
Net Project	Treatment	32,780.61	111	3.639	290	1,055.21
Net Project	Distribution	32,780.61	1,272	41.697	290	12,092.11
					Projected GHG Emissions From Water Demand	**105,615.85**

Sources:

1. Section 3.13, Water Services
2. California Energy Commission, *California's Water-Energy Relationship, Final Staff Report (CEC-700-2005-011-SF)*, (2005) 26.
3. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*, (2006) 22. Prepared by Navigant Consulting, Inc.
4. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MG	Million gallons
MT	Metric ton
N_2O	Nitrous oxide
yr	Year

Existing Conditions, OVOV Planning Area
GHG Emission from Wastewater Collection and Treatment

Wasterwater Treatment Electrical Demand GHG Emissions

Land Use	Net Wastewater Generation Rate[1] (MG/yr)	Electrical Demand Factor[2] (kW-hr/MG)	Annual Demand Factor (10^b kW-hr/yr)	CO_2E Emision Factor[3] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	19,668.37	1,911	37.59	399	**15,002.93**

Sources:
1. Section 3.13, Water Service. Assumes that 60% of water demand would be wastewater.
2. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*. Prepared
3. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006),

Wastewater Treatment Process GHG Emissions[1]

Project	Maximum Population	Pounds BOD5 per Capita per Day[2] (lbs BOD5/capita/day)	Pounds CH_4 per Pound BOD5[3] (lbs CH_4/BOD5)	Fraction Anaerobically Digested[4]	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	252,000	0.13	0.22	0.15	**3,758.68**

Sources:
1. US Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I, Chapter 4.3.5*, (1998). Data is not available to determine CO_2
2. The US EPA recommends a default value of 0.13 lb BOD5/capita/day.
3. The US EPA recommends a default value of 0.22 lb CH_4/BOD5.
4. The US EPA recommends a default value of 15% for the fraction anaerobically digested for domestic wastewater.

Where:

BOD5	Biological oxygen demand using a standard 5 day test	18,761.61
CH_4	Methane	
CO_2	Carbon dioxide	
CO_2E	Carbon dioxide equivalent	
GWP	Global warming potential	
kW-hr	Kilowatt-hour	
lbs	Pounds	
MG	Million gallons	
MT	Metric ton	
N_2O	Nitrous oxide	
yr	Year	

Greenhouse Gas Emissions Calculations

for Existing General Plan and Area Plan

Existing General Plan
Indirect GHG Emissions from Electrical Demand

Land Use	Units	Electrical Demand Factor[1] (kW-hr/unit/yr)	Annual Demand Factor (10^6 kW-hr/yr)	CO_2E Emission Factor[2] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Residential	151,916 Unit	5,656.50	859.31	399	**343,003.32**
FoodStore	3,182,757 Sq.Ft.	53.30	169.64	399	**67,713.88**
Restaurant	343,270 Sq.Ft.	47.45	16.29	399	**6,501.58**
Hospital	345,840 Sq.Ft.	21.70	7.50	399	**2,995.59**
Retail	3,923,329 Sq.Ft.	13.55	53.16	399	**21,219.79**
Movie Theater (3)	82,500 Sq.Ft.	13.55	1.12	399	**446.21**
College/University	833,400 Sq.Ft.	11.55	9.63	399	**3,842.22**
High School	586,100 Sq.Ft.	10.50	6.15	399	**2,456.45**
Elementary School	1,218,575 Sq.Ft.	5.90	7.19	399	**2,869.80**
Daycare	13,500 Sq.Ft.	5.90	0.08	399	**31.79**
Office	8,917,970 Sq.Ft.	12.95	115.49	399	**46,098.07**
Hotel/Motel	678,400 Sq.Ft.	9.95	6.75	399	**2,694.36**
Warehouse	0 Sq.Ft.	4.35	-	399	**-**
Miscellaneous	50,950,550 Sq.Ft.	10.50	534.98	399	**213,542.93**
				Projected GHG Emissions from Electrical Demand	**713,415.99**

Sources:
1. South Coast Air Quality Management District, *CEQA Air Quality Handbook*, (1993) Table A9-11-A.

2. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MT	Metric ton
yr	Year

Impact Sciences, Inc.
Prepared by R. Mamaghani
12 March 2009

JN 112-23

Existing General Plan
GHG Emissions from Solid Waste Generation

Land Use	Size	Unit	Rate (Tons/yr)	Solid Waste Generation (Tons/yr)	CO_2E Emission Factor[2] (MT CO_2E/MT waste)	Annual CO_2E Emissions (MT CO_2E/yr)
Single Family Detached	86,808	du	1.0200	88,544.16	0.11	**8,835.85**
Multi-Family or Attached	62,543	du	0.5850	36,587.66	0.11	**3,651.09**
Mobile Home	2,565	du	0.5850	1,500.53	0.11	**149.74**
General Retail	18,243,123	sq. ft.	0.0012	21,891.75	0.11	**2,184.59**
Eating/Drnkng Establ.	343,270	sq. ft.	0.0054	1,853.66	0.11	**184.98**
Food & Drug Stores	3,182,757	sq. ft.	0.0036	11,457.93	0.11	**1,143.39**
Auto Dlr/Service Sta.	441,500	sq. ft.	0.0026	1,125.83	0.11	**112.35**
Hotel & Motel	678,400	sq. ft.	0.0027	1,797.76	0.11	**179.40**
Warehouse	0	sq. ft.	0.0006	0.00	0.11	**-**
Medical Offices	412,290	sq. ft.	0.0014	556.59	0.11	**55.54**
Hospitals	345,840	sq. ft.	0.0028	951.06	0.11	**94.91**
Business Park	45,656,650	sq. ft.	0.0007	31,959.66	0.11	**3,189.27**
Office	8,240,680	sq. ft.	0.0007	5,768.48	0.11	**575.64**
Library 3	71,400	sq. ft.	0.0007	49.98	0.11	**4.99**
Education & Schools	1,818,175	sq. ft.	0.0007	1,181.81	0.11	**117.93**
College	833,400	sq. ft.	0.0007	541.71	0.11	**54.06**
Trans., Comm., Utilities	1,250,240	sq. ft.	0.0040	4,938.45	0.11	**492.81**
Special Generator 4	0	sq. ft.	0.0040	0.00	0.11	**-**
Golf Course/Park	1,791	acres	0.1000	179.07	0.11	**17.87**
Manufacturing	4,043,660	sq. ft.	0.0025	10,109.15	0.11	**1,008.80**
Church 3	605,890	sq. ft.	0.0007	424.12	0.11	**42.32**
				Projected GHG Emissions From Solid Waste Disposal		**22,095.51**

du = dwelling unit; sq.ft. - square feet; tpy = tons per year; lbs. = pounds

Sources:

1. Ventura County Solid Waste Management Department's Guidelines for Preparation of Environmental Assessments for Solid Waste Impacts. Assumes 50% diversion.

2. US Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Greenhouse Gas Emission Factors for Management of Selected Materials in Municipal Solid Waste (EPA-530-R-98-013)*, (1998). The factor is based on mixed municipal solid waste as disposed in landfills without landfill gas recovery.

Where:

CO_2E	Carbon dioxide equivalent
MT	Metric ton
yr	Year

3. Assumes same generation rate as for office.

4. Conservatively assumes same generation rate as utilities.

OVOV
GHG Emissions from Solid Waste Generation

Land Use	Size	Unit	Rate (Tons/yr)	Solid Waste Generation (Tons/yr)	CO_2E Emission Factor[2] (MT CO_2E/MT waste)	Annual CO_2E Emissions (MT CO_2E/yr)
Single Family Detached	77,975	du	1.0200	79,534.50	0.11	**7,936.78**
Multi-Family or Attached	67,679	du	0.5850	39,592.22	0.11	**3,950.92**
Mobile Home	3,420	du	0.5850	2,000.70	0.11	**199.65**
General Retail	19,974,282	sq. ft.	0.0012	23,969.14	0.11	**2,391.89**
Eating/Drnkng Establ.	354,140	sq. ft.	0.0054	1,912.36	0.11	**190.83**
Food & Drug Stores	3,484,638	sq. ft.	0.0036	12,544.70	0.11	**1,251.84**
Auto Dlr/Service Sta.	530,000	sq. ft.	0.0026	1,351.50	0.11	**134.87**
Hotel & Motel	1,010,800	sq. ft.	0.0027	2,678.62	0.11	**267.30**
Warehouse	0	sq. ft.	0.0006	0.00	0.11	**-**
Medical Offices	730,560	sq. ft.	0.0014	986.26	0.11	**98.42**
Hospitals	365,160	sq. ft.	0.0028	1,004.19	0.11	**100.21**
Business Park	44,484,350	sq. ft.	0.0007	31,139.05	0.11	**3,107.38**
Office	10,344,450	sq. ft.	0.0007	7,241.12	0.11	**722.59**
Library 3	91,400	sq. ft.	0.0007	63.98	0.11	**6.38**
Education & Schools	1,767,675	sq. ft.	0.0007	1,148.99	0.11	**114.66**
College	901,550	sq. ft.	0.0007	586.01	0.11	**58.48**
Trans., Comm., Utilities	1,032,440	sq. ft.	0.0040	4,078.14	0.11	**406.96**
Special Generator 4	0	sq. ft.	0.0040	0.00	0.11	**-**
Golf Course/Park	2,378	acres	0.1000	237.82	0.11	**23.73**
Manufacturing	3,268,690	sq. ft.	0.0025	8,171.73	0.11	**815.46**
Church 3	997,460	sq. ft.	0.0007	698.22	0.11	**69.68**
				Projected GHG Emissions From Solid Waste Disposal		**21,848.02**

du = dwelling unit; sq.ft. - square feet; tpy = tons per year; lbs. = pounds

Sources:

1. Ventura County Solid Waste Management Department's Guidelines for Preparation of Environmental Assessments for Solid Waste Impacts. Assumes 50% diversion.

2. US Environmental Protection Agency, Office of Solid Waste and Emergency Response, *Greenhouse Gas Emission Factors for Management of Selected Materials in Municipal Solid Waste (EPA-530-R-98-013)*, (1998). The factor is based on mixed municipal solid waste as disposed in landfills without landfill gas recovery.

Where:

CO_2E	Carbon dioxide equivalent
MT	Metric ton
yr	Year

3. Assumes same generation rate as for office.

4. Conservatively assumes same generation rate as utilities.

Existing General Plan
GHG Emission from Potable Water Treatment and Conveyance

Land Use	Action	Net Potable Water Needs Estimate[1] (MG/yr)	Electrical Demand Factor[2,3] (kW-hr/MG)	Annual Electrical Demand (10^6 kW-hr/year)	CO_2E Emission Factor[4] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	Supply & Conveyance	44,934.85	9,727	437.081	290	126,753.58
Net Project	Treatment	44,934.85	111	4.988	290	1,446.45
Net Project	Distribution	44,934.85	1,272	57.157	290	16,575.57
					Projected GHG Emissions From Water Demand	**144,775.60**

Sources:

1. Section 3.13, Water Services
2. California Energy Commission, *California's Water-Energy Relationship, Final Staff Report (CEC-700-2005-011-SF)*, (2005) 26.
3. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*, (2006) 22. Prepared by Navigant Consulting, Inc.
4. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MG	Million gallons
MT	Metric ton
N_2O	Nitrous oxide
yr	Year

Existing General Plan
GHG Emission from Wastewater Collection and Treatment

Wasterwater Treatment Electrical Demand GHG Emissions

Land Use	Net Wastewater Generation Rate[1] (MG/yr)	Electrical Demand Factor[2] (kW-hr/MG)	Annual Demand Factor (10^6 kW-hr/yr)	CO_2E Emision Factor[3] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	26,960.91	1,911	51.52	399	**20,565.64**

Sources:
1. Section 3.13, Water Service. Assumes that 60% of water demand would be wastewater.
2. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*. Prepared
3. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006),

Wastewater Treatment Process GHG Emissions[1]

Project	Maximum Population	Pounds BOD5 per Capita per Day[2] (lbs BOD5/capita/day)	Pounds CH_4 per Pound BOD5[3] (lbs CH_4/BOD5)	Fraction Anaerobically Digested[4]	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	448,310	0.13	0.22	0.15	**6,686.73**

Sources:
1. US Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I, Chapter 4.3.5*, (1998). Data is not available to determine CO_2
2. The US EPA recommends a default value of 0.13 lb BOD5/capita/day.
3. The US EPA recommends a default value of 0.22 lb CH_4/BOD5.
4. The US EPA recommends a default value of 15% for the fraction anaerobically digested for domestic wastewater.

Where:

BOD5	Biological oxygen demand using a standard 5 day test
CH_4	Methane
CO_2	Carbon dioxide
CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MG	Million gallons
MT	Metric ton
N_2O	Nitrous oxide
yr	Year

27,252.37

Greenhouse Gas Emissions Calculations

for Proposed General Plan and Area Plan

OVOV
Indirect GHG Emissions from Electrical Demand

Land Use	Units	Electrical Demand Factor[1] (kW-hr/unit/yr)	Annual Demand Factor (10^6 kW-hr/yr)	CO_2E Emission Factor[2] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Residential	149,074 Unit	5,656.50	843.24	399	**336,586.51**
FoodStore	3,484,638 Sq.Ft.	53.30	185.73	399	**74,136.47**
Restaurant	354,140 Sq.Ft.	47.45	16.80	399	**6,707.46**
Hospital	365,160 Sq.Ft.	21.70	7.92	399	**3,162.93**
Retail	4,905,463 Sq.Ft.	13.55	66.47	399	**26,531.77**
Movie Theater (3)	90,000 Sq.Ft.	13.55	1.22	399	**486.78**
College/University	901,550 Sq.Ft.	11.55	10.41	399	**4,156.41**
High School	462,500 Sq.Ft.	10.50	4.86	399	**1,938.42**
Elementary School	1,291,675 Sq.Ft.	5.90	7.62	399	**3,041.95**
Daycare	13,500 Sq.Ft.	5.90	0.08	399	**31.79**
Office	11,133,310 Sq.Ft.	12.95	144.18	399	**57,549.44**
Hotel/Motel	1,010,800 Sq.Ft.	9.95	10.06	399	**4,014.54**
Warehouse	0 Sq.Ft.	4.35	-	399	**-**
Miscellaneous	48,785,480 Sq.Ft.	10.50	512.25	399	**204,468.73**
				Projected GHG Emissions from Electrical Demand	**722,813.21**

Sources:
1. South Coast Air Quality Management District, *CEQA Air Quality Handbook*, (1993) Table A9-11-A.

2. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MT	Metric ton
yr	Year

Impact Sciences, Inc.
Prepared by R. Mamaghani
12 March 2009

JN 112-23

OVOV
GHG Emission from Potable Water Treatment and Conveyance

Land Use	Action	Net Potable Water Needs Estimate[1] (MG/yr)	Electrical Demand Factor[2,3] (kW-hr/MG)	Annual Electrical Demand (10^6 kW-hr/year)	CO_2E Emission Factor[4] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	Supply & Conveyance	44,934.85	9,727	437.081	290	126,753.58
Net Project	Treatment	44,934.85	111	4.988	290	1,446.45
Net Project	Distribution	44,934.85	1,272	57.157	290	16,575.57
					Projected GHG Emissions From Water Demand	**144,775.60**

Sources:

1. Section 3.13, Water Services
2. California Energy Commission, *California's Water-Energy Relationship, Final Staff Report (CEC-700-2005-011-SF)*, (2005) 26.
3. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*, (2006) 22. Prepared by Navigant Consulting, Inc.
4. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006), http://www.climateregistry.org/CARROT/public/Reports.aspx.

Where:

CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MG	Million gallons
MT	Metric ton
N_2O	Nitrous oxide
yr	Year

OVOV

GHG Emission from Wastewater Collection and Treatment

Wasterwater Treatment Electrical Demand GHG Emissions

Land Use	Net Wastewater Generation Rate[1] (MG/yr)	Electrical Demand Factor[2] (kW-hr/MG)	Annual Demand Factor (10^b kW-hr/yr)	CO_2E Emision Factor[3] (MT $CO_2E/10^6$ kW-hr)	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	26,960.91	1,911	51.52	399	**20,565.64**

Sources:

1. Section 3.13, Water Service. Assumes that 60% of water demand would be wastewater.
2. California Energy Commission, *Refining Estimates of Water-Related Energy Use in California, PIER Final Project Report (CEC-500-2006-118)*. Prepared
3. California Climate Action Registry, "Reporting Online Tool, Public Annual Entity Emissions," *Southern California Edison, PUP Report*, (2006),

Wastewater Treatment Process GHG Emissions[1]

Project	Maximum Population	Pounds BOD5 per Capita per Day[2] (lbs BOD5/capita/day)	Pounds CH_4 per Pound BOD5[3] (lbs CH_4/BOD5)	Fraction Anaerobically Digested[4]	Annual CO_2E Emissions (MT CO_2E/yr)
Net Project	439,923	0.13	0.22	0.15	**6,561.63**

Sources:

1. US Environmental Protection Agency, *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I, Chapter 4.3.5*, (1998). Data is not available to determine CO_2
2. The US EPA recommends a default value of 0.13 lb BOD5/capita/day.
3. The US EPA recommends a default value of 0.22 lb CH_4/BOD5.
4. The US EPA recommends a default value of 15% for the fraction anaerobically digested for domestic wastewater.

Where:

BOD5	Biological oxygen demand using a standard 5 day test
CH_4	Methane
CO_2	Carbon dioxide
CO_2E	Carbon dioxide equivalent
GWP	Global warming potential
kW-hr	Kilowatt-hour
lbs	Pounds
MG	Million gallons
MT	Metric ton
N_2O	Nitrous oxide
yr	Year

27,127.28

APPENDIX 3.9

Soil Types and Characteristics of the County's Planning Area

SOIL TYPES AND CHARACTERISTICS OF THE COUNTY'S PLANNING AREA

The following is a short description of each of the soils that are found within the County's Planning Area. Additionally, **Table 1, Soil Characteristics of the County's Planning Area,** further describes the types of soils and their characteristic types within the County's Planning Area.

Agua Dulce stony loam, 30 to 50 percent slopes (AgF)

This soil is located in mountainous areas in the southern part of Agua Dulce Canyon. Permeability is moderately slow in this soil. Available water-holding capacity is 3 to 4 inches. Fertility is moderate, runoff is rapid, and the erosion hazard is high. Roots can penetrate to a depth between 36 and 60 inches. Thin lenses of sandstone conglomerate generally limit the depth to which plant roots can penetrate. Agua Dulce stony loam, 30 to 50 percent slopes, is used for range, wildlife habitat, and watershed. Capability unit VIIe-1 (19) dryland; range site 2. There are approximately 6,118 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Amargosa rocky coarse sandy loam, 9 to 55 percent slopes, eroded (AmF2)

This soil is located on hilly uplands. In most places about 25 to 40 percent of the original surface soil has been removed through moderate sheet and rill erosion. Rock outcrops cover 2 to 20 percent of the surface, and many areas are cut by shallow gullies. Permeability is moderately rapid in this soil. Available water-holding capacity is 1 to 1.5 inches. Fertility is very low, runoff is medium to rapid, and the hazard of water erosion is moderate to high. In most places roots can penetrate to a depth of about 14 to 20 inches. Amargosa rocky coarse sandy loam, 9 to 55 percent slopes, eroded, is used as range and for recreation, wildlife, and water supply purposes. Capability Class VIIe-1 (19) dryland; range site 4. There are approximately 4,271 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Anaverde loam, 15 to 30 percent slopes (AnE)

Some of this soil is located on Pelona Ridge, and others are located along the upper reaches of Cottonwood Creek, west and south of White Oak Lodge. Permeability is moderate in this soil. Available water-holding capacity is 5.5 to 9 inches, depending on soil depth. Fertility is high, runoff is medium, and the erosion hazard is moderate. This Anaverde soil is used for range, wildlife, and recreation. Capability Class VIe-1 (20) dryland; range site 2. There are approximately 2 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Anaverde rocky loam, 30 to 50 percent slopes (ApF)

Some of this soil is located along the upper reaches of Cottonwood Creek and others are on Pelona Ridge. Slopes are dominantly 35 to 45 percent, and outcrops of bedrock cover from 5 to 10 percent of the areas. Runoff is rapid, and the erosion hazard is high. This Anaverde soil is used for range, wildlife, habitat, and watershed. Capability Class VIIe-1 (20) dryland; range site 2. There are approximately 10 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Castaic silty clay loam, 2 to 9 percent slopes (CkC)

This soil is located on toe slopes. Some areas are along Davenport Road and others are near the communities of Vincent and Acton. Fertility is low in this soil. Available water holding capacity is 5 to 7.5 inches. Roots extend to a depth of 30 to 44 inches. Runoff is slow to medium, and the erosion hazard is slight to moderate. This soil is used only for limited grazing. Dryland farming has not been successful. A few areas are used as homesites. Capability Class IIIe-1 (19) irrigated. There are approximately 130 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Castaic silty clay loam, 9 to 15 percent slopes (CkD)

On this soil, runoff is medium, and the erosion hazard is moderate. This soil is used for range and as homesites. Capability Class IIIe-1 irrigated. There are approximately 196 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Castaic-Balcom silty clay loams, 9 to 15 percent slopes (CmD)

This complex is on toe slopes in Romero Canyon. Runoff is medium, and the erosion hazard is moderate. In most places, slopes range from 12 to 14 percent. Included with these soils are a few areas less than 10 acres in size where sheet and rill erosion is moderate. Also included are small areas of Saugus loam and Millsholm rocky loam. This complex is used primarily for Dryland small grains and pasture and for range. Capability unit IIIe-1 irrigated. There are approximately 172 acres of this soil located within the Los Angeles County portion of the OVOV Planning Area.

Castaic-Balcom silty clay loams, 15 to 30 percent slopes (CmE)

The soils in this complex are less sloping and less eroded than Castaic-Balcom silty clay loams, 30 to 50 percent slopes, eroded (CmF2), but otherwise they are similar. Slopes are commonly about 25 percent. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. Landslips are common. Included with this soil some areas 10 to 20 acres in size where sheet and rill erosion are moderate. Also included are small areas of Saugus loam, Gazos clay loam, and Millsholm rocky loam. This complex is

used for range as wildlife habitat. Capability unit IVe-1 irrigated. There are approximately 2,642 acres of this soil located within the Los Angeles County portion of the OVOV Planning Area.

Castaic-Balcom silty clay loams, 30 to 50 percent slopes (CmF)

These soils are slightly eroded, and their surface layer is 10 to 12 inches thick. Included with these soils areas 10 to 20 acres in size where rill and sheet erosion are moderate. Also included are small areas of Saugus loam. Areas of this complex are used for range, wildlife habitat, and watershed. Capability unit VIe-1 dryland. There are approximately 9,160 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Castaic-Balcom silty clay loams, 30 to 50 percent slopes, eroded (CmF2)

This complex is in the area near Castaic Junction. It is 60 percent Castaic silty clay loam and 40 percent Balcom silty clay loam. Permeability is moderately slow in these soils. Available water-holding capacity is 5 to 7 inches. Fertility is moderate, runoff is rapid, and the hazard of erosion is high. Plant roots generally penetrate to a depth of about 26 to 36 inches, but can reach a depth of 40 inches in some places. The Balcom soil, not the Castaic soil, contains lime at a depth of 10 to 20 inches. Included with these soils are small areas of Gazos clay loam, of Saugus loam, and of Gaviota sandy loam. Also included are narrow areas of soils that have a reddish-brown surface layer. Castaic-Balcom silty clay loams, 30 to 50 percent eroded, are used chiefly for range. They also are used for watershed purposes and for wildlife habitat and recreation. Capability unit VIe-1 dryland. There are approximately 11,897 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Castaic-Balcom silty clay loams, 50 to 65 percent slopes, eroded (CmG2)

This soil is located on mountainous uplands northwest of Castaic Junction, adjacent to the boundaries of Los Angeles and Ventura Counties. Moderate sheet and rill erosion have occurred in nearly all places where this soil is located. Runoff is very rapid, and the hazard of further erosion is very high. This soil is used mainly for wildlife habitat and watershed purposes, but some areas are grazed. Capability Class VIIe-1 dryland. There are approximately 2,669 acres of this soil located within the Los Angeles County portion of the OVOV Planning Area.

Castaic and Saugus soils, 30 to 65 percent slopes, severely eroded (CnG3)

This undifferentiated group of soils is 35 percent Castaic silty clay loam and 30 percent Saugus loam. Included in mapping this unit are exposed areas of soft shale and conglomerate that make up as much as 10 percent of the unit and areas of Balcom silty clay loam that make up as much as 25 percent. Areas of this unit are cut by many intermittent, very deep drainage channels that have narrow v-shaped valleys and between them sharp, tortuous divides. Soil slipping is common, and geological erosion is active. During heavy rainstorms much silt is washed away from these soils. Because of repeated burning of brush, the vegetation on these soils now consists mainly of thick stands of chamise. The Castaic soil in this unit is steeper and more eroded than the Castaic soil in Cataic-Balcom silty clay loams, 30 to 50 percent slopes, eroded (CmF2), but otherwise is similar. Also, depth to soft shale generally is less, about 20 to 30 inches. The Saugus soil is steeper and more eroded than Saugus loam, 30 to 50 percent slopes, eroded (ScF2), but otherwise it is similar. In addition, depth to weakly consolidated sediment is 24 to 44 inches. Slopes are dominantly 45 to 65 percent. Available water-holding capacity is 4 to 6 inches in the Castaic soil, and 4 to 7 inches in the Saugus soil. In both soils, fertility is very low, runoff is very rapid, and the hazard of further erosion is very high. Most of this unit is inaccessible to man and livestock because the brush is dense, the soils are steep or very steep, and the valleys are narrow and v-shaped. These soils are used for watershed and for wildlife habitat. Capability unit VIIIe-1 dryland. There are approximately 8,136 acres of this soil within the Los Angeles County portion of the OVOV Planning Area.

Chino loam (Co)

This soil is nearly level and generally is located in the Leona Valley, but many areas are located along the Tehachapi Range. Permeability is moderately slow. Available water-holding capacity is 10 to 12 inches. Present fertility is moderate, but when the soil is reclaimed, fertility is high. Runoff is very slow, and the soil is likely to be ponded in places in spring. The hazard of erosion is none to slight. Roots can penetrate to a depth of 60 inches or more, depending on the height of the fluctuating water table. Chino loam is wet and is in meadow. It is used only as pasture. Capability Class IIw-2 irrigated. There are approximately 57 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Cortina sandy loam, 0 to 2 percent slopes (CyA)

This soil occupies narrow alluvial fans in side canyons along tributaries of the Santa Clara River. The surface layer lacks cobblestones, but the soil otherwise is similar to Cortina cobbly sandy loam, 2 to 9 percent slopes (CzC). Thickness of the surface layer ranges from 12 to 16 inches. In most places, slopes range from about 3 to 5 percent and are quite long. A few stones and pebbles are in the soil, but they do not interfere with tillage. Runoff is slow, and the hazard of erosion is moderate. Included with this soil in

mapping are small areas of Cortina cobbly sandy loam, Metz loamy sand, and Sorrento loam. Also included are small areas that have a surface layer of loam, which are mainly the result of land leveling and smoothing. In the past, loamy soil material from adjacent uplands was moved onto the areas to square fields and eliminate point rows. This Cortina soil is used for range and for dryland small grains. It is also used for irrigated alfalfa, small grains, and pasture. Capability unit IVs-0. There are approximately 888 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Cortina sandy loam, 2 to 9 percent slopes (CyC)

This soil occupies narrow alluvial fans in side canyons along tributaries of the Santa Clara River. The surface layer lacks cobblestones, but the soil is otherwise similar to Cortina cobbly sandy loam, 2 to 9 percent slopes (CzC). Thickness of the surface layer ranges from 12 to 16 inches. In most places, slopes range from about 3 to 5 percent and are quite long. A few stones and pebbles are in the soil, but they do not interfere with tillage. Runoff is slow, and the hazard of erosion is moderate. Included with this soil are small areas of Cortina cobbly sandy loam, Metz loamy sand, and Sorrento loam. Also included are small areas that have a surface layer of loam, which are mainly the result of land leveling and smoothing. In the past, loamy soil material from adjacent uplands was moved onto the areas to square fields and eliminate point rows. This Cortina soil is used for range and for dryland small grains. It is also used for irrigated alfalfa, small grains, and pasture. Capability unit IVs-0. There are approximately 646 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Cortina cobbly sandy loam, 2 to 9 percent slopes (CzC)

This soil is on narrow alluvial fans along Castaic Creek, in Agua Dulce Canyon, and in Mint Canyon. Permeability is rapid in this Cortina soil. Available water-holding capacity is 2 to 3 inches. Runoff is slow, and the hazard of erosion is slight. Fertility is low. Roots can penetrate to a depth of 60 inches or more. Included with this soil type are small areas of Cortina sandy loam and Metz sandy loam. This Cortina soil is used for range, as wildlife habitat, and for watershed purposes. The areas are likely to be flooded for a short period after a heavy rain. Capability unit VIIs-7 dryland. There are approximately 562 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Gaviota rocky sandy loam, 15 to 30 percent slopes, eroded (GaE2)

This soil is well drained. Permeability is moderately rapid. Available water-holding capacity is 1 to 2 inches. Runoff is medium, and the hazard of erosion is moderate. Fertility is low. Roots can penetrate to a depth of 14 to 20 inches. This soil is used for range, wildlife habitat, and watershed. Capability Class

VIIe-1 dryland. There are approximately 29 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Gaviota rocky sandy loam, 30 to 50 percent slopes, eroded (GaF2)

This soil is on mountains. Some areas located south of Castaic Junction are fairly large. Smaller areas are south of Solemint and northeast of Quail Lake. Slopes commonly are 45 percent. In most places sheet and rill erosion is moderate, and a few areas are cut by deep gullies. Outcrops of rock cover from about 5 to 10 percent of the total area. The dominant vegetation is chamise brush and an understory of annual grasses. Runoff is rapid on this soil, and the hazard of erosion is high. Drainage is somewhat excessive. Included with this soil in mapping are small areas of Millsholm rocky loam and Saugus loam. Also included are about 500 acres of a very rocky Gaviota soil near Vasquez Rocks. This Gaviota soil is used for range, wildlife, and watershed. Capability unit VIIe-1 dryland. There are approximately 6,128 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Gazos clay loam, 30 to 50 percent slopes (GbF)

Permeability of this soil is moderately slow. Available water-holding capacity is 3 to 6 inches. Runoff is rapid, and the hazard from erosion is high. Fertility is moderate. This soil is used mainly for grazing. Capability Class VIe-1 dryland. There are approximately 512 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Godde rocky loam, 30 to 50 percent slopes (GdF)

This soil occupies mountainous areas on Pelona Ridge and in other areas of the Leona Valley. In places, outcrops of rock occupy 5 to 10 percent of the area covered by this soil. Permeability of this soil is moderate. Available water-holding capacity is 2 to 3 inches. Fertility is low. Runoff is rapid, and the hazard of erosion is high. This soil is used for range, as wildlife habitat, and for recreation and watershed purposes. Capability Class VIIe-1 dryland. There are approximately 1,970 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Greenfield sandy loam, 0 to 2 percent slopes (GsA)

This soil is on long, smooth, broad alluvial fans near Fairmont. In places, the surface layer is coarse sandy loam. Runoff is very slow, and the hazard of erosion is slight. This soil is used for irrigated crops, dryland small grains, and pasture and range. Capability Class I-1 irrigated and IVec-1 dryland. There are approximately 24 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Greenfield sandy loam, 2 to 9 percent slopes (GsC)

This soil is on alluvial fans near Fairmont. Permeability is moderately rapid in this soil. Available water-holding capacity is 7.5 to 9 inches. Fertility is moderate. Roots can penetrate to a depth of 60 inches or more. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is used for irrigated crops, dryland small grains, and pasture and range. Capability Class IIe-1 irrigated and IVec-1 dryland. There are approximately 459 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Greenfield sandy loam, 9 to 15 percent slopes, eroded (GsD2)

This soil occupies narrow fans and terraces near Fairmont. Slopes commonly range from 10 to 14 percent. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. This soil is used for dryland small grains, dryland pasture, and range. Capability Class IIIe-1 irrigated and IVec-1 dryland. There are approximately 277 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Hanford coarse sandy loam, 2 to 9 percent slopes (HbC)

In most places, this soil ranges from 2 to 5 percent slopes. Runoff is slow to medium, and the hazard of erosion is slight to moderate. This soil is used for irrigated crops, dryland small grains, and range. Capability Class IIe-1 irrigated and IVec-1 dryland. There are approximately 723 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Hanford coarse sandy loam, 9 to 15 percent slopes (HbD)

This soil occupies alluvial fans in narrow side canyons along Portal Ridge. Sheet and rill erosion are slight. Runoff is medium, and the hazard of water erosion is moderate. The hazard of soil blowing is slight to moderate. This soil is used for dryland small grains, dryland pasture, and range. Capability Class IIIe-1 irrigated and IVec-1 dryland. There are approximately 50 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Hanford sandy loam, 0 to 2 percent slopes (HcA)

This soil occurs throughout the area near Fairmont. It is dominantly sandy loam and fine sandy loam throughout, but otherwise it is similar to Hanford coarse sandy loam, 0 to 2 percent slopes (HbC). Runoff is slow on this soil, and the hazard of erosion is slight. Available water-holding capacity is 6 to 7.5 inches. Fertility is moderate. Roots can penetrate to a depth of 60 inches or more. Included with this soil in mapping are small areas of Hanford coarse sandy loam and of Greenfield sandy loam. This Hanford soil

is used for irrigated crops, pasture, and range. Capability unit IIs-4 irrigated and IVec-1 dryland. There are approximately 1,227 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Hanford sandy loam, 2 to 9 percent slopes (HcC)

This soil is on alluvial fans near Fairmont. It is dominantly sandy loam and fine sandy loam throughout, but it is otherwise similar to Hanford coarse sandy loam, 0 to 2 percent slopes, though with more pronounced slopes. In most places slopes range from 2 to 6 percent. Runoff is slow to medium on this soil, and the hazard of erosion is slight to moderate. Available water-holding capacity is 6 to 7.5 inches. Fertility is moderate. Included with this soil are small areas of Greenfield coarse sandy loam and of Hanford coarse sandy loam. Also included are small areas where rill and sheet erosion are moderate. Other included small areas are on fans where slopes range from 10 to 12 percent. This Hanford soil is used for purposed similar to those of Hanford coarse sandy loam, 0 to 2 percent slopes. Capability unit IIe-1 irrigated and IVec-1 dryland. There are approximately 3,960 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Hanford sandy loam, calcareous variant, 2 to 9 percent slopes (HeC)

Slopes for this soil are dominantly about 2 to 4 percent. Permeability is moderately rapid in this soil. Available water holding capacity is 7.5 to 9.9 inches. Fertility is moderate. Runoff is slow, and the hazard of erosion is slight. This soil is used for dryland small grains and range. Capability Class IIe-1 irrigated and IVec-1 dryland. There are approximately 46 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Las Posas loam, 9 to 30 percent slopes (LaE)

This soil occupies toe slopes and foothills west of Agua Dulce. Slopes are fairly long and smooth. Runoff is medium to rapid on this soil. The hazard of erosion is moderate to high. Available water-holding capacity is 4 to 7 inches. This soil is used for range in spring. Capability Class IVe-1 irrigated. There are approximately 348 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Las Posas-Toomes rocky loams, 30 to 50 percent slopes (LdF)

Some areas of this soil are on steep mountains, and other areas are on moderately steep foothills. The soils are most prevalent near Acton, Agua Dulce, and Vincent. Permeability is moderately slow. Runoff is rapid, and the hazard of erosion is high. Available water-holding capacity is 4 to 7 inches. Fertility is low.

This soil is used for range and as wildlife habitat. Capability Class VIIe-1 dryland. There are approximately 3,403 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Metz loamy sand, 0 to 2 percent slopes (MfA)

This soil is on alluvial fans near Castaic Junction. Permeability of this soil is rapid. Available water-holding capacity is 4 to 5 inches. Fertility is low. Runoff is very slow, and the hazard of water erosion is slight to moderate. Roots can penetrate to a depth of 60 inches or more. Included with this soil in mapping are small areas of Sorrento sandy loam and of Yolo sandy loam. Also included are a few small areas of Metz soils in lower-lying areas that are subject to occasional flooding. This Metz soil is used for irrigated crops, dryland farming, and wildlife habitat. Capability unit IIIs-4 irrigated. There are approximately 302 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Metz loamy sand, 2 to 9 percent slopes (MfC)

This soil is on alluvial fans along the Santa Clara River and its major tributaries. In most places slopes range from 2 to 5 percent. Runoff is slow, and the hazard of erosion is slight. Included with this soil in mapping are some areas at the head of narrow canyons that have slopes of 12 to 14 percent. Also included are small areas of Cortina sandy loam, Cortina cobbly sandy loam, and Yolo loam. In many places in Sand Canyon, the soil has been mixed, leveled, and shaped by earthmoving equipment. In these places much of the soil has been roughly bench terraced. This Metz soil is used for purposed similar to those of Metz loamy sand, 0 to 2 percent slopes (MfA). Capability unit IIIs-4 irrigated. There are approximately 828 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Metz loam, 0 to 2 percent slopes (MgA)

This soil is on flood plains north of Saugus. The surface layer is loam about 8 to 16 inches thick, but otherwise this soil is similar to Metz loamy sand, 0 to 2 percent slopes (MfA). In many places, reaction is mildly alkaline. Runoff is very slow on this soil, and the hazard of erosion is slight to none. Available water-holding capacity is 5 to 6 inches. Fertility is moderate. Included with this soil in mapping are small areas of Metz loamy sand. This Metz soil is used mainly for alfalfa and for row crops. Capability unit IIs-4 irrigated. There are approximately 31 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Metz loam, 2 to 5 percent sloes (MgB)

The surface layer of this soil is loam that is about 8 to 10 inches thick. Slopes range from 2 to 3 percent in most places. Sheet and rill erosion are minor. Runoff is slow on this soil, and the hazard of erosion is slight. Fertility is moderate. Included with this soil in mapping are small areas of Metz loamy sand. This Metz soil is used for irrigated alfalfa and small grains. Capability unit IIs-4 irrigated. There are approximately 271 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Millsholm rocky loam, 15 to 30 percent slopes, eroded (MhE2)

Slopes of this soil range from about 20 to 24 percent in most places. Sheet and rill erosion are moderate in most of the area. Runoff is medium to rapid, and the hazard of further erosion is moderate to high. This soil is used for range, wildlife, and recreation. Capability Class VIIe-1 dryland. There are approximately 816 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Millsholm rocky loam, 30 to 50 percent slopes, eroded (MhF2)

This soil is moderately permeable. Available water-holding capacity is 2 to 3 inches. Fertility is low. Runoff is rapid, and the hazard of erosion is high. This soil is used for range, wildlife, and watershed purposes. Capability Class VIIe-1 dryland. There are approximately 6,591 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Mocho sandy loam, 0 to 2 percent slopes (MoA)

This soil is near Castaic Junction. The surface layer is brown sandy loam that generally is massive and slightly hard. It is 10 to 12 inches thick. The hazard of erosion is slight on this soil, and runoff is very slow. Available water-holding capacity is 7.5 to 9.5 inches. Included with this soil are small areas of Metz loamy sand, Sorrento loam, and Yolo loam. This Mocho soil is used for purposed similar to those of Mocho loam, 0 to 2 percent slopes (MpA). Capability unit I-1 irrigated. There are approximately 37 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Mocho loam, 0 to 2 percent slopes (MpA)

This soil is on alluvial fans south of Castaic Junction. This soil is moderately permeable. Available water-holding capacity is 8 to 10 inches. Fertility is high. Runoff is very slow, and the hazard of erosion is none to slight. Roots can penetrate to a depth of 60 inches or more. Included with this soil are small areas of Metz loamy sand, Sorrento loam, and Yolo loam. This soil is used for dryland and irrigated crops.

Capability unit I-1 irrigated. There are approximately 304 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Mocho sandy loam, 2 to 9 percent slopes (MpC)

This soil occupies fairly narrow alluvial fans near Castaic Junction. In most places slopes range from 2 to 5 percent. In places at the heads of fans, a few pebbles or cobblestones are on the surface. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Included with this soil are small areas of Metz loamy sand, Sorrento loam, and Yolo loam. Also included are areas 5 to 10 acres in size where sheet and rill erosion are moderate. This Mocho soil is used about the same as Mocho loam, 0 to 2 percent slopes (MpA). Capability unit IIe-1 irrigated. There are approximately 603 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Oak Glen sandy loam, 2 to 9 percent slopes (ObC)

This soil is typically found on long, smooth alluvial fans. Permeability is moderately rapid in this soil. Available water-holding capacity is 6 to 7.5 inches. Fertility is high. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots penetrate to a depth of 60 inches or more. This soil is used for dryland small grains and range. Capability Classification is IIIe-1 dryland. There are approximately 5 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Oak Glen gravelly sandy loam, 2 to 9 percent slopes (OcC)

Except that this soil is gravelly throughout, it is similar to Oak Glen sandy loam, 2 to 9 percent slopes (ObC). The gravel consists of rounded granitic material that is about 2 inches or less in diameter, which makes up from 15 to about 35 percent, by volume, of the mass. Because of the gravel, available water-holding capacity is less than in Oak Glen sandy loam, 2 to 9 percent slopes, and tillage is more difficult. Runoff is slow to medium on this soil, and the hazard of erosion is slight to moderate. Available water-holding capacity is about 4 to 6 inches. Included with this soil are small areas of Oak Glen sandy loam. Also included are areas of unnamed soil in which the content of gravel ranges from 35 to 65 percent, by volume. This unnamed soil occupies up to 15 or 20 percent of each soil area. A few areas of a soil that has slopes of 12 to 14 percent are also included. This Oak Glen soil is used for range and as wildlife habitat. Capability unit IIIe-1 dryland. There are approximately 54 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Oak Glen loam, 0 to 2 percent slopes (OdA)

Most areas of this soil are in Oso Canyon. The surface layer is dark-gray light loam about 46 inches thick. The substratum is pale brown and ranges from heavy sandy loam to heavy coarse sandy loam and light loam. It is less than 18 percent clay. This soil is moderately permeable. Available water-holding capacity is high, but the growing season is shorter than in other areas of Oak Glen soils. Runoff is very slow, and the hazard of erosion is none to slight. Roots can penetrate to a depth of 60 inches or more. Included with this soil are small areas of Oak Glen sandy loam. Here cattle have trampled the surface, and the soil is hard and massive when dry. This Oak Glen soil is used for range and as wildlife habitat. Capability unit IIIc-1 dryland. There are approximately 4 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, 2 to 9 percent slopes (OgC)

This soil is on terraces near Saugus. This soil has moderately slow permeability. Available water-holding capacity is 9 to 11 inches. Fertility is low. Tilth is poor. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots can penetrate to a depth of about 60 inches. Included with this soil in mapping are small areas of Ojai loam, 9 to 15 percent slopes (OgD). Also included are small areas of Zamora loam. This Ojai soil is used for irrigated alfalfa, row crops, and range. It also is increasingly being used as site for homes and industries. Some areas on terraces northwest of Solemint and south of the Saugus-Ventura Road near the power substation have been shaped and altered by earthmoving equipment. These areas now have houses on them or are used as golf courses. Capability unit IIIe-1 irrigated. There are approximately 451 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, 9 to 15 percent slopes (OgD)

This soil is on foothills. Most areas are strongly sloping, but some areas are rolling. Slopes range from 10 to 15 percent in most places. Runoff is medium, and the hazard of erosion is moderate. Included with this soil in mapping are small areas where sheet and rill erosion are moderate. Also included are a few deep gullies. Other included small areas consist of Ojai loam, 15 to 30 percent slopes (OgE). This Ojai soil is used mostly for range, but some areas are used for dryland small grains. The areas also provide habitat for wildlife. Capability unit IVe-1 irrigated. There are approximately 181 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, 15 to 30 percent slopes (OgE)

This soil is on foothills near Solemint. Slopes range from 20 to 26 percent in most places. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Included with this soil in mapping are some areas 10 to 20 acres in size where sheet and rill erosions are moderate. Also included are a few deep loam, thin surface variant, 30 to 50 percent slopes, and Ojai loam, 30 to 50 percent slopes, eroded (OgF2). This Ojai soil is used for range, wildlife habitat, and watershed. The slopes severely limit suitability for cultivation. Capability unit VIe-1 dryland. There are approximately 157 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, 30 to 50 percent slopes (OgF)

This soil is on foothills near Castaic, Saugus, and Solemint. Slopes generally range from 35 to 45 percent. Runoff is rapid, and the hazard of erosion is high. Included with this soil are small areas of Ojai loam, 15 to 30 percent slopes (OgE). Also included are about 280 acres at the head of Plum Canyon that consist of Ojai soils and have a surface layer of clay loam. Small areas cut by sheet and rill erosion are also included. This Ojai soil is used for range, wildlife habitat, and watershed. Capability unit VIIe-1 dryland. There are approximately 2,516 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, 30 to 50 percent slopes, eroded (OgF2)

Much of the original surface layer of this soil has been removed through sheet and rill erosion. The present surface layer is 16 to 18 inches thick in most places. Slopes commonly are about 40 percent. The areas are cut by a few deep gullies and by many shallow gullies. Runoff is rapid, and the hazard of further erosion is high. This Ojai soil is suitable for range, wildlife, habitat, and watershed purposes. Capability unit VIIe-1 dryland. There are approximately 18 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai loam, thin surface variant, 30 to 50 percent slopes (OhF)

This is the only variant from this type of normal Ojai soil series. It is found on terraces. Permeability is moderately slow in this soil. Runoff is rapid, and the hazard of erosion is high. Available water-holding capacity is 8 to 10 inches. Fertility is low. Included with this soil in mapping are some small areas of Agua Dulce stony loam. Ojai loam, thin surface variant, 30 to 50 percent slopes, is used only for range. Capability unit VIIe-1 dryland. There are approximately 1,791 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ojai-Zamora loams, 15 to 30 percent slopes (OzE)

This soil is under grasses and oaks on short, hilly side slopes near Saugus. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is used for range. Capability Class is VIe-1 dryland. There are approximately 314 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona coarse sandy loam, 2 to 5 percent slopes (RcB)

This type of soil is found on long, broad, smooth terraces. Soil blowing is a slight to moderate hazard. Runoff is slow, and the hazard of water erosion is slight. This soil is used for dryland crops and range, dryland and irrigated orchards, and wildlife habitat. Capability Class is IIIe-1 irrigated and IVec-1 dryland. There are approximately 168 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona coarse sandy loam, 5 to 9 percent slopes (RcC)

This type of soil is found on terraces. Permeability is moderately slow in this soil. Available water-holding capacity is 8 to 10 inches. Fertility is moderate, runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots can penetrate to a depth of 60 inches. This soil is used for dryland crops and range, dryland and irrigated orchards, and wildlife habitat. Capability Class is IIIe-1 irrigated and IVec-1 dryland. There are approximately 461 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona coarse sandy loam, 9 to 15 percent slopes (RcD)

This soil is found on terraces. In many places, the topography is rolling. Soil blowing is a slight to moderate hazard. Runoff is medium, and the hazard of water erosion is moderate. This soil is used for dryland small grains and range. Because rainfall is unreliable, growth of dryland crops is poor. Capability Class is IVe-1 irrigated and IVec-1 dryland. There are approximately 611 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona sandy loam, 9 to 30 percent slopes, eroded (RdE2)

This soil is formed in old granitic alluvium laid down in a series of fairly narrow fingerlike rides that face northeast. Runoff is medium to rapid on this soil, and the hazard of erosion is moderate to high. This soil is used for range, wildlife habitat, and watershed. Capability Class is VIe-1 dryland. There are approximately 197 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona gravelly sandy loam, 9 to 30 percent slopes (ReE)

The available water-holding capacity of this soil is 5.5 to 7.5 inches. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is used only for range and wildlife habitat. Capability Class is VIe-1 dryland. There are approximately 258 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona loam, 2 to 5 percent slopes (RfB)

Runoff for this soil is slow, and the hazard of erosion is slight. This soil is used for dryland small grains. Capability Class is IIe-1 irrigated and IVec-1 dryland. There are approximately 99 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Ramona loam, 5 to 9 percent slopes (RfC)

Runoff for this soil is slow to medium, and the hazard of erosion is slight to moderate. This soil is used for dryland crops and range, dryland and irrigated orchards, and wildlife habitat. Capability Class IIIe-1 irrigated and IVec-1 dryland. There are approximately 41 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Riverwash (Rg)

Riverwash consists of sandy material in the beds of intermittent streams. Narrow stringers of gravelly sand occupy many of the areas. During each flood, fresh deposits of alluvium are laid down and removed as a result of stream-bank erosion. The hazard of soil blowing is slight to moderate. Little or no vegetation is on the areas. This land type has no value for farming. The areas are used for wildlife and watershed purposes. Capability unit VIIIw-4 dryland. There are approximately 1,308 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Sandy Alluvial Land (Sa)

Sandy alluvial land (Sa) is mostly on flood plains along the Santa Clara River and its larger tributaries. It consists of unconsolidated alluvium that generally is stratified and ranges in texture from sand to loamy sand. The soil material has been recently deposited by streams. Flooding is frequent and, during each flood, resorting of the soil material occurs. The plant cover is willows and cottonwoods that have an understory of annual grasses and forbs. Soil blowing is a moderate hazard. This land type is used for grazing, wildlife habitat, and watershed purposes. Frequent flooding severely limits use for cultivated crops. Protection from flooding is needed. Capability unit VIIw-4. There are approximately 2,127 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Saugus loam, 15 to 30 percent slopes (ScE)

In most places this soil has slopes that range from 20 to 24 percent. Runoff is medium, and the hazard of erosion is moderate. Included with this slope are small areas on toe slopes that have slopes of 5 to 15 percent. Also included are areas 5 to 10 acres in size where sheet and rill erosion are moderate. Other included small areas consist of Balcom silty clay loams and of Saugus loam, 30 to 50 percent slopes (ScF). Thus, Saugus soil is used mainly for range. Some areas are used for homesites and subdivisions, though much grading is required. Capability unit VIe-1. There are approximately 652 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Saugus loam, 30 to 50 percent slopes (ScF)

In most places, the slope of this soil is about 45 percent, though on north slopes the slope may be as steep as 55 percent. Runoff is rapid, and the hazard of erosion is high. Included with this soil in mapping are small areas of Castaic-Balcom silty clay loams, 30 to 50 percent slopes (CmF), and of Castaic and Saugus soils, 30 to 65 percent slopes, severely eroded (CnG3). Also included are small areas cut by sheet and gully erosion. This Saugus soil is used mainly for range. Many areas, however, have been reshaped and graded by earthmoving equipment for use as homesites and subdivisions. Capability unit VIIe-1 dryland. There are approximately 3,080 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Saugus loam, 30 to 50 percent slopes, eroded (ScF2)

This soil is on uplands in Romero Canyon and in other places near Castaic Junction. Permeability is moderate in this soil. Available water-holding capacity is 5 to 7.5 inches. Fertility is low, runoff is rapid, and the hazard of erosion is high. Included with this soil in mapping are small areas of Castaic-Balcom silty clay loams and of Castaic and Saugus soils. Also included are small areas of Gaviota rocky sandy loam and of Rough broken land. This Saugus soil is used for range, wildlife habitat, and watershed. Capability unit VIIe-1 dryland. There are approximately 22,781 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Sorrento loam, 0 to 2 percent slopes (SsA)

This soil is on alluvial fans along the Santa Clara River and its major tributaries. Runoff is very slow, and the hazard of erosion is slight. Included with this soil in mapping are small areas that have a surface layer of sandy loam. Also included are small areas of Metz loamy sand, Mocho loam, and Yolo loam. This Sorrento soil is used for many kinds of irrigated crops. Capability unit I-1 irrigated. There are

approximately 181 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Sorrento loam, 2 to 5 percent slopes (SsB)

This soil is on long, smooth alluvial fans along drainage ways of the Santa Clara River, near Castaic Junction. Permeability of this soil is moderate. Available water-holding capacity is 8.5 to 10 inches. Fertility is high. Runoff is slow, and the hazard of erosion is slight. Roots can penetrate to a depth of 60 inches or more. Included with this soil in mapping are small areas of Metz loamy sand, Mocho loam, and Yolo loam. Also included are small areas that have a surface of sandy loam. This Sorrento soil is used for such irrigated crops as alfalfa, green onions, carrots, walnuts, and pasture. Capability unit IIe-1. There are approximately 802 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Temescal-Rock land complex, 30 to 50 percent slopes (TrF)

The permeability of this soil is moderate. Available water-holding capacity is 2 to 3 inches. Fertility is low, runoff is rapid, and the hazard of erosion is high. In most places roots can penetrate to a depth of 14 to 20 inches. This soil is used for range, wildlife, and watershed. Capability unit for the Temescal part is VIIe-1 dryland, and for the Rock land, VIIIs-1 dryland. There are approximately 140 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Terrace Escarpments (TsF)

Terrace escarpments is a type of land that consists of short, moderately steep to steep faces or breaks that separate the terraces from the lower-lying alluvial fans. The surface layer is generally coarse sandy loam. Slopes generally are about 35 percent, but they range from 15 to 45 percent. Annual grasses and forbs make up the vegetation. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Included with this land type are small areas where rill and gully erosion are severe. Also included are a few large, deep gullies that are actively eroding. Terrace escarpments are used for grazing. The areas are used mainly to provide cover for wildlife. Capability Class is VIIe-1 dryland. There are approximately 1,829 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Vernalis loam, 2 to 5 percent slopes (VbB)

This soil is more sloping, but it otherwise is similar to Vernalis clay loam, 0 to 2 percent slopes (VcA). The dominant slope ranges from 2 to 4 percent. Runoff is slow on this soil, and the hazard of erosion is slight. Available water-holding capacity is 9 to 10 inches. This soil is used for irrigated crops and dryland crops.

It is also used for range. Capability Class is I-1 irrigated and IVec-1 dryland. There are approximately 77 acres of this soil within the County of Los Angeles portion of the OVOV Planning Area.

Vernalis clay loam, 0 to 2 percent slopes (VcA)

Runoff is very slow in this soil, and the hazard of erosion is none to slight. Available water-holding capacity is 9.5 to 10.5 inches. This soil is used for sugar beets, irrigated small grains, dryland small grains, and range. Capability Class is I-1 irrigated and IVec-1 dryland. There are approximately 15 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Vista coarse sandy loam, 15 to 30 percent slopes (VsE)

This soil is located on hilly uplands. Slopes commonly range from 18 to 26 percent. Runoff is medium to rapid, and the hazard of erosion is moderate to high. This soil is used for range, wildlife habitat, and watershed. Capability Class VIe-1 dryland. There are approximately 214 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Vista coarse sandy loam, 30 to 50 percent slopes (VsF)

This soil is located in the uplands on Pelona Ridge. The permeability of this soil is moderately rapid. Available water-holding capacity is 2.5 to 3.5 inches. Fertility is low. Runoff is rapid, and the hazard of erosion is high. In most places, roots can penetrate to a depth of about 28 to 38 inches. This soil is used for range, wildlife habitat, and watershed. Capability Class is VIIe-1 dryland. There are approximately 1,456 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Vista coarse sandy loam, 30 to 50 percent slopes, eroded (VsF2)

Much of the original surface layer of this soil has been removed through sheet and rill erosion. Many areas are cut by shallow gullies, and a few areas are cut by deep gullies. The present surface layer is 8 to 12 inches thick. Slopes range from 35 to 45 percent in most places, but they are as steep as 55 percent in a few places. Runoff is rapid, and the hazard of further erosion is high. Included with this soil are small areas that have a surface layer of sandy loam. Also included are small, slightly eroded areas. Other included small areas consist of Amargosa rocky coarse sandy loam. This Vista soil is used for range, wildlife habitat, and watershed. Capability Class is VIIe-1 dryland. There are approximately 402 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Water (W)

These are areas that are covered by water. These areas include lakes, rivers, streams, ponds, wetland areas, etc. These areas have no use in agricultural activity. There are approximately 2,159 acres of this type of land located within the County of Los Angeles portion of the OVOV Planning Area.

Wyman gravelly loam, 2 to 9 percent slopes (WgC)

This soil is located on terraces near Acton and Vincent. Permeability of this soil is moderate. Available water holding capacity is 8.5 to 9.5 inches. Fertility is moderate. The gravel in the soil does not significantly interfere with tillage, but it reduces the available water-holding capacity somewhat. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots can penetrate to a depth of 60 inches or more. This soil is used for dryland small grains and range. It is also used for wildlife habitat. Capability Class is IIe-1 irrigated and IVec-1 dryland. There are approximately 1,283 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Wyman gravelly loam, 9 to 15 percent slopes (WgD)

This soil is located on alluvial fans and terraces. Slopes range from 10 to 14 percent in most places. Runoff is medium, and the hazard of erosion is moderate. This soil is used for dryland small grain and range. It is also used for wildlife habitat. Capability Class is IIIe-1 irrigated and IVec-1 dryland. There are approximately 157 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Wyman cobbly loam, 5 to 9 percent slopes (WoC)

Runoff is slow to medium on this soil, and the hazard of erosion is slight to moderate. Available water holding capacity is 5.5 to 7 inches. Fertility is low. This soil is used for range in spring and for wildlife habitat year round. Capability Class VIe-7 dryland. There are approximately 252 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Yolo loam, 0 to 2 percent slopes (YoA)

This soil occurs on alluvial fans near Newhall and Saugus. Permeability is moderate in this soil. Available water-holding capacity is 8.5 to 10.5 inches. Fertility is high. Runoff is very low, and the hazard of erosion is none to slight. Roots can penetrate to a depth of 60 inches or more. Included with this soil are small areas of Metz loamy sand and of Sorrento loam. Also included are small areas that have a surface layer of sandy loam. This Yolo soil is used for irrigated crops. Capability unit I-1 irrigated. There are

approximately 645 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Yolo loam, 2 to 9 percent slopes (YoC)

This soil occurs on fairly narrow alluvial fans near Newhall and Saugus. Slopes range from 2 to 6 percent in most places. Runoff is slight to moderate, and the hazard of erosion is slow to medium. Included with this soil are areas at the upper edge of the alluvial fans that have slopes as steep as 10 to 12 percent, by volume, and fine gravel throughout. Also included are small areas that have a surface layer of sandy loam or that have a few pebbles and stones on the surface. Other included small areas consist of Metz loamy sand and of Sorrento loam. This Yolo soil is used mainly for irrigated crops and for range, but use for homesites is rapidly increasing. Capability unit IIe-1 irrigated. There are approximately 2,195 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Zamora Loam, 2 to 9 percent slopes (ZaC)

This soil is on long, smooth, convex terraces near Castaic Junction. Permeability of this soil is moderately slow. Available water-holding capacity is 10 to 11 inches. Fertility is moderate. Runoff is slow to medium, and the hazard of erosion is slight to moderate. Roots can penetrate to a depth of 60 inches of more. Included with this soil mapping are small areas that have a surface layer of sandy loam or clay loam. Also included are about 75 acres where slopes are 0 to 2 percent. This Zamora soil is used for dryland grains and range. It also is used for wildlife habitat. Capability unit IIe-1 irrigated. There are approximately 592 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Zamora loam, 9 to 15 percent slopes (ZaD)

This soil is located on strongly sloping to nearly rolling terraces. In most places, slopes range from 10 to 14 percent. Runoff is medium, and the hazard of erosion is moderate. This soil is used for range. It is also used as pump sites for oil fields, which occupy a large part of this soil. Capability Class is IIIe-1 irrigated. There are approximately 94 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

Zamora clay loam, 2 to 9 percent slopes (ZcC)

In most places where this soil is located, slopes range from 5 to 7 percent. Runoff is slow to medium on this soil, and the hazard of erosion is slight to moderate. Available water-holding capacity is 10.5 to 11.5 inches. Fertility is moderate. This soil is used primarily for range. It also is used as pump sites for oil

fields, which occupy much of the acreage. Capability Class is IIe-1 irrigated. There are approximately 8 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

129 – Saugus loam, 30 to 50 percent slopes

The Saugus component makes up 85 percent of this soil. Slopes are 30 to 50 percent. This component occurs on mountains. The parent material consists of soft residuum weathered sandstone and shale. Depth to a root restrictive layer, bedrock, paralithic, is 40 to 60 inches. The natural drainage class is well drained. Water movement is moderately high. Available water to depth of 60 inches is low. Nonirrigated land capability classification is VIe. There are approximately 285 acres of this soils located within the County of Los Angeles portion of the OVOV Planning Area.

143 – Xerorthents – Urban Land – Saugus Complex, 15 to 30 percent slopes

The Xerorthents component makes up 45 percent of this soil complex. Slopes are usually 15 to 30 percent, and this soil is found on hills. The parent material consists of human-altered residuum. Depth to a root restrictive layer, bedrock, lithic, is 10 to 60 inches. Well drained. Available water depth of 60 inches is very low. Nonirrigated land capability classification is VIII.

The Saugus component makes up 15 percent of this soil. Slopes are 15 to 30 percent. The parent material consists of residuum weathered sandstone and shale. Depth to a root restrictive layer is 40 to 60 inches. Well drained. Water movement is moderately high. Available water to a depth of 60 inches is low. Land Capability Class IVe nonirrigated and IVe irrigated. There are approximately 61 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

19 – Trigo family – Calcixerollic Xerochrepts-Vista family complex, 30 to 70 percent slopes

The Trigo family component makes up to 35 percent of this soil complex. Slopes are 30 to 70 percent. This component occurs on mountains. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer is 3 to 19 inches. Drainage is excessive. Available water to a depth of 60 inches is very low. Capability class VIIe nonirrigated.

The Calcixerollic Xerochrepts component of this soil makes up 30 percent. Slopes are 30 to 70 percent. This complex is found on mountains. The parent material consists of residuum weathered sandstone and shale. Depth to a restrictive layer is 15 to 42 inches. Water movement is relatively high. Available water to a depth of 60 inches is moderate. Capability class VIIe nonirrigated.

The Vista family component makes up 20 percent of unit. Slopes are 30 to 70 percent. Found on mountains. The parent material consist of residuum weathered sandstone and shale. Depth to a root restrictive layer is 60 inches. Well drained. Water movement is high. Available water to a depth of 60 inches is moderate. Capability unit VIIe nonirrigated. There are approximately 200 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

54 – Caperton-Trigo, granitic substratum – Lodo families complex, 50 to 85 percent slopes

The Caperton family component makes up 45 percent of this soil complex. This component occurs on mountains. The parent material consists of residuum weathered from gneiss. Depth to a root restrictive layer is 4 to 20 inches. Well drained. Water movement is relatively high. Available water to a depth of 60 inches is very low. Capability class is VIIe nonirrigated.

The Trigo family, granitic substratum component makes up 25 percent. Slopes are 50 to 85 percent. Found on mountains. Parent material consists of residuum weathered from granodiorite. Depth to a root restrictive layer is 3 to 19 inches. Natural drainage is excessively drained. Water movement is high. Available water to a depth of 60 inches is very low. Capability unit VIIe nonirrigated.

The Lodo family component makes up 15 percent of this soil complex. Slopes are 50 to 85 percent. Found on mountains. Parent material consists of residuum weathered from schist. Depth to a root restrictive layer is 6 to 19 inches. Excessively drained. Water movement is moderately high. Available water to a depth of 60 inches is very low. Capability unit VIIe non-irrigated. There are approximately 220 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

1 – Exchequer family, 30 to 60 percent slopes

This soil is located on mountains. Slopes are 30 to 60 percent. The parent material consists of residuum weathered from granite. Depth to a root restrictive layer, bedrock, lithic, is 5 to 18 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded or ponded. There is no zone of water saturation within a depth of 72 inches. Capability Classification VIIe nonirrigated. There are approximately 20 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

102 – Badland

This type of soil is not used for agricultural activities. There are approximately 46 acres of this type located within the County of Los Angeles portion of the OVOV Planning Area.

115 – Friant fine sandy loam, 50 to 75 percent slopes

This soil is located on mountains and has slopes of 50 to 75 percent. The parent material consists of residuum weathered from slate. Depth to a root restrictive layer, bedrock, lithic, is 6 to 20 inches. The natural drainage class is somewhat excessively drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-well potential is low. This soil is not flooded. There is no zone of water saturation within a depth of 72 inches. Land Capability Class VIIe nonirrigated. There are approximately 58 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

117 – Gaviota sandy loam, 30 to 50 percent slopes

This soil is found on mountains and slopes are 30 to 50 percent. The parent material consists of residuum weathered from sandstone. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. This soil is not flooded or ponded. There is no zone of water saturation within a depth of 72 inches. Land Capability Class VIIe nonirrigated. There are approximately 9 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

122 – Millsholm loam, 30 to 50 percent slopes

This soil is located on hills and have slopes between 30 to 50 percent. The parent material consists of residuum weathered from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic, is 10 to 20 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. The soil is not flooded nor is it ponded. There is no zone of water saturation within a depth of 72 inches. Land Capability Class VIIe nonirrigated. There are approximately 126 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

125 – Rock outcrop-Friant complex, 50 to 75 percent

The rock outcrop portion of this soil is not used in any agricultural activities. It is composed mostly of rocky, boulder areas along steep hilly, mountainous areas. The Friant portion of this soil is usually found on slopes that are 50 to 75 percent. The parent material consists of residuum weathered from metamorphic and sedimentary rock. Depth to a root restrictive layer is 6 to 20 inches. The natural drainage class is somewhat excessively drained. Available water to a depth of 60 inches is very low. Shrink-swell potential is low. The soil is not flooded or ponded. There is no zone of water saturation within a depth of 72 inches. Nonirrigated land Capability Class is VIIe. There are approximately 24 acres of this soil located within the County of Los Angeles portion of the OVOV Planning Area.

128 – Saugus loam, 15 to 30 percent slopes

This soil is found on mountains in areas with slopes of 15 to 30 percent. The parent material consists of soft residuum weather from sandstone and shale. Depth to a root restrictive layer, bedrock, lithic is 40 to 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded or ponded.

Table 1
On-Site Soil Characteristics

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Soil Survey of the Antelope Valley Area, California[1]								
Agua Dulce stony loam, 30 to 50 percent slopes	Ojai-Agua Dulce Association/Agua Dulce Series	rapid	high	30 to 50	range, wildlife habitat, and watershed	VIIe-1	moderately slow	moderate
Amargosa rocky coarse sandy loam, 9 to 55 percent slopes	Vista-Amargosa Association/Amargosa Series	medium to rapid	moderate to high	9 to 55	range, recreation, wildlife, and water supply purposes	VIIe-1	moderately rapid	very low
Anaverde loam, 15 to 30 percent slopes	Anaverde-Godde Association/Anaverde Series	medium	moderate	15 to 30	range, wildlife, and recreation.	VIe-1	moderate/ 5.5 to 9 inches	high
Anaverde rocky loam, 30 to 50 percent slopes	Anaverde-Godde Association/Anaverde Series	rapid	high	35 to 45	range, wildlife habitat, watershed	VIIe-1	NA	NA
Castaic silty clay loam, 2 to 9 percent slopes	Saugus-Castaic-Balcom Association/Castaic Series	slow to medium	slight to moderate	2 to 9	limited grazing, homesites	IIIe-1 irrigated	NA/ 5 to 7.5 inches	NA
Castaic silty clay loam, 9 to 15 percent slopes	Saugus-Castaic-Balcom Association/Castaic Series	medium	moderate	9 to 15	range and homesites	IIIe-1	NA	NA
Castaic-Balcom silty clay loams, 9 to 15 percent slopes	Saugus-Castaic-Balcom Association/Castaic Series	medium	moderate	12 to 14	dryland small grains/pasture/range	IIIe-1 irrigated	NA	NA
Castaic-Balcom silty clay loams, 15 to 30 percent slopes	Saugus-Castaic-Balcom Association/Castaic Series	medium to rapid	moderate to high	25	range as wildlife habitat	IVe-1 irrigated	NA	NA

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Castaic-Balcom silty clay loams, 30 to 50 percent slopes	Saugus-Castaic-Balcom Association/Castaic Series	NA	moderate	NA	range/wildlife habitat/watershed	VIe-1 dryland	NA	NA
Castaic-Balcom silty clay loams, 30 to 50 percent slopes, eroded	Saugus-Castaic-Balcom Association/Castaic Series	rapid	high	30 to 50	range/watershed/ wildlife habitat/ recreation	VIe-1 dryland	Slow/5 to 7 inches	moderate
Castaic-Balcom silty clay loams, 50 to 65 percent slopes, eroded	Saugus-Castaic-Balcom Association/Castaic Series	very rapid	very high	50 to 65	wildlife habitat, watershed purposes, and graze land	VIIe-1	NA	NA
Castaic and Saugus soils, 30 to 65 percent slopes, severely eroded	Saugus-Castaic-Balcom Association/Castaic Series	rapid	very high	45 to 65	watershed/wildlife habitat	VIIIe-1 dryland	NA / 4 to 6 inches (Castaic soil) and 4 to 7 inches (Saugus soil)	low
Chino loam	Hanford-Ramona-Greenfield Association/Chino Series	very slow	none to slight	NA	wet and in meadow, used for pasture	IIw-2 irrigated	moderately slow/ 10 to 12 inches	moderate, but high when reclaimed
Cortina sandy loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Cortina Series	slow	moderate	3 to 5	dryland small grains/irrigated alfalfa/pasture	IVs-0	NA	NA
Cortina sandy loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Cortina Series	slow	moderate	3 to 5	dryland small grains/irrigated alfalfa/pasture	IVs-0	NA	NA
Cortina cobbly sandy loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Cortina Series	slow	slight	2 to 9	range, wildlife habitat, and watershed purposes	VIIs-7	rapid/2 to 3 inches	low
Gaviota rocky sandy loam, 15 to 30 percent slopes, eroded	Gaviota-Millsholm Association/Gaviota Series	medium	moderate	15 to 30	range, wildlife habitat, and watershed	VIIe-1	moderately rapid/ 1 to 2 inches	low

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Gaviota rocky sandy loam, 30 to 50 percent slopes, eroded	Gaviota-Millsholm Association/Gaviota Series	rapid	high	45	range, wildlife, and watershed	VIIe-1 dryland	NA	NA
Gazos clay loam, 30 to 50 percent slopes	Gaviota-Millsholm Association/Gazos Series	rapid	high	30 to 50	grazing	VIe-1	moderately slow/ 3 to 6 inches	moderate
Godde rocky loam, 30 to 50 percent slopes	Anaverde-Godde Association/Godde Series	rapid	high	30 to 50	range, wildlife habitat, recreation, watershed purposes	VIIe-1	moderate/ 2 to 3 inches	low
Greenfield sandy loam, 0 to 2 percent slopes	Hanford-Ramona-Greenfield Association/Greenfield Series	slow	slight	0 to 2	irrigated crops, dryland small grains, pasture, and range	IIe-1 irrigated	NA	NA
Greenfield sandy loam, 2 to 9 percent slopes	Hanford-Ramona Greenfield Association/Greenfield Series	slow to medium	slight to moderate	2 to 9	irrigated crops, dryland small grains, pasture, and range	IIe-1 irrigated	moderately rapid/7.5 to 9 inches	moderate
Greenfield sandy loam, 9 to 15 percent slopes, eroded	Hanford-Ramona-Greenfield Association/Greenfield Series	medium to rapid	moderate to high	10 to 14	dryland small grains, dryland pasture, range	IIIe-1 irrigated	NA	NA
Hanford coarse sandy loam, 9 to 15 percent slopes	Hanford-Ramona-Greenfield Association/Hanford Series	medium	moderate	9 to 15	dryland small grains, dryland pasture, range	IIIe-1 irrigated	NA	NA
Hanford sandy loam, 0 to 2 percent slopes	Hanford-Ramona-Greenfield Association/Hanford Series	slow	slight	0 to 2	irrigated crops/pasture/range	IIs-4 irrigated/ IVec-1 dryland	NA / 6 to 7.5 inches	moderate

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Hanford sandy loam, 2 to 9 percent slopes	Hanford-Ramona-Greenfield Association/Hanford Series	slow to medium	slight to moderate	2 to 6	irrigated crops/pasture/range	IIe-1 irrigated/IVec-1 dryland	NA / 6 to 7.5 inches	moderate
Hanford sandy loam, calcareous variant, 2 to 9 percent slopes	Hanford-Ramona-Greenfield Association/Hanford Series	slow	slight	2 to 9	dryland small grains and range	IIe-1 irrigated	moderately rapid/ 7.5 to 9.9 inches	moderate
Las Posas loam, 9 to 30 percent slopes	Las Posas-Toomes-Temescal Association/Las Posas Series	medium to rapid	moderate to high	9 to 30	range in spring	IVe-1	NA/4 to 7 inches	NA
Las Posas-Toomes rocky loams, 30 to 50 percent slopes	Las Posas-Toomes-Temescal Association/Las Posas Series	rapid	high	30 to 50	range and wildlife habitat	VIIe-1	moderately slow/ 4 to 7 inches	low
Metz loamy sand, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Metz Series	slow	slight to moderate	0 to 2	irrigated crops/dryland farming/wildlife habitat	IIIs-4 irrigated	rapid/ 4 to 5 inches	low
Metz loamy sand, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Metz Series	slow	slight	2 to 5	irrigated crops	IIIs-4 irrigated	NA / NA	NA
Metz loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Metz Series	slow	slight to none	0 to 2	alfalfa/row crops	IIs-4 irrigated	NA / 5 to 6 inches	moderate
Metz loam, 2 to 5 percent slopes	Yolo-Metz-Cortina Association/Metz Series	slow	slight	2 to 3	irrigated alfalfa/small grains	IIs-4 irrigated	NA / NA	moderate
Millsholm rocky loam, 15 to 30 percent slopes, eroded	Gaviota-Millsholm Association/Millsholm Series	medium to rapid	moderate to high	20 to 24	range, wildlife, and recreation.	VIIe-1	NA	NA
Millsholm rocky loam, 30 to 50 percent slopes, eroded	Gaviota-Millsholm Association/Millsholm Series	rapid	high	30 to 50	range, wildlife, and watershed	VIIe-1	moderate/ 2 to 3 inches	NA

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Mocho sandy loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Mocho Series	slow	slight	0 to 2	dryland/irrigated crops	I-1 irrigated	NA/ 7.5 to 9.5 inches	NA
Mocho loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Mocho Series	slow	none to slight	0 to 2	dryland/irrigated crops	I-1 irrigated	moderate/ 8 to 10 inches	high
Mocho loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Mocho Series	slow to medium	slight to moderate	2 to 5	dryland/irrigated crops	IIe-1 irrigated	NA / NA	NA
Oak Glen sandy loam, 2 to 9 percent slopes	Oak Glen-Gorman Association/Oak Glen Series	slow to medium	slight to moderate	2 to 9	dryland small grains, and range	IIIe-1	moderately rapid/ 6 to 7.5 inches	high
Oak Glen gravelly sandy loam, 2 to 9 percent slopes	Oak Glen-Gorman Association/Oak glen Series	slow to medium	slight to moderate	2 to 9	range/wildlife habitat	IIIe-1 dryland	NA/ 4 to 6 inches	NA
Oak Glen loam, 0 to 2 percent slopes	Oak Glen-Gorman Association/Oak Glen Series	very slow	none to slight	0 to 2	range/wildlife habitat	IIIc-1 dryland	moderate/ high	NA
Ojai loam, 2 to 9 percent slope	Ojai-Agua Dulce Association/Ojai Series	slow to medium	slight to moderate	2 to 9	irrigated alfalfa/row crops/ range/home sites/industry sites	IIIe-1 irrigated	moderate/ 9 to 11 inches	low
Ojai loam, 9 to 15 percent slopes	Ojai-Agua Dulce Association/Ojai Series	medium	moderate	10 to 15	range/dryland small grains/wildlife habitat	IVe-1 irrigated	NA / NA	NA
Ojai loam, 15 to 30 percent slopes	Ojai-Agua Dulce Association/Ojai Series	medium to rapid	moderate to high	20 to 26	range/wildlife habitat/watershed/severely limit suitability for cultivation	VIe-1 dryland	NA / NA	NA
Ojai loam, 30 to 50 percent slopes	Ojai-Agua Dulce Association/Ojai Series	rapid	high	35 to 45	range/wildlife habitat/watershed	VIIe-1 dryland	NA / NA	NA

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Ojai loam, 30 to 50 percent slopes, eroded	Ojai-Agua Dulce Association/Ojai Series	rapid	high	40	range/wildlife habitat/watershed	VIIe-1 dryland	NA / NA	NA
Ojai loam, thin surface variant, 30 to 50 percent slopes	Ojai-Agua Dulce Association/Ojai Series	rapid	high	30 to 50	range	VIIe-1 dryland	moderate/ 8 to 10 inches	low
Ojai-Zamora loams, 15 to 30 percent slopes	Ojai-Agua Dulce Association/Ojai Series	medium to rapid	moderate	15 to 30	range	VIe-1	NA	NA
Ramona coarse sandy loam, 2 to 5 percent slopes	Hanford-Ramona-Greenfield Association/Ramona Series	slow	slight	2 to 5	dryland crops, dryland and irrigated orchards, and wildlife habitat	IIe-1 irrigated	NA	NA
Ramona coarse sandy loam, 5 to 9 percent	Hanford-Ramona-Greenfield Association/Ramona Series	slow to medium	slight to moderate	5 to 9	dryland crops, dryland and irrigated orchards, and wildlife habitat	IIIe-1 irrigated	moderately slow/ 8 to 10 inches	moderate
Ramona coarse sandy loam, 9 to 15 percent	Hanford-Ramona-Greenfield Association/Ramona Series	medium	moderate	9 to 15	small grains and range	IVe-1	NA	NA
Ramona sandy loam, 9 to 30 percent slopes, eroded	Hanford-Ramona-Greenfield Association/Ramona Series	medium to rapid	moderate to high	25	range, wildlife habitat, and watershed	VIe-1	NA	NA
Ramona gravelly sandy loam, 9 to 30 percent slopes	Hanford-Ramona-Greenfield Association/Ramona Series	medium to rapid	moderate to high	9 to 30	range and wildlife habitat	VIe-1	NA/ 5.5 to 7.5 inches	NA
Ramona loam, 2 to 5 percent slopes	Hanford-Ramona-Greenfield Association/Ramona Series	slow	slight	2 to 5	dryland small grains	IIe-1 irrigated	NA	NA

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Ramona loam, 5 to 9 percent slopes	Hanford-Ramona-Greenfield Association/Ramona Series	slow to medium	slight to moderate	5 to 9	dryland crops, range, dryland and irrigated orchards, and wildlife habitat	IIIe-1 irrigated	NA	NA
Riverwash	N/A	NA	moderate	NA	wildlife habitat/watershed/no value for farming	VIIIw-4 dryland	NA / NA	NA
Sandy alluvial land	N/A	NA	moderate	NA	grazing/wildlife habitat/watershed/limited use for cultivated crops	VIIw-4	NA / NA	NA
Saugus loam, 15 to 30 percent slopes	Saugus-Castaic-Balcom Association/Saugus Series	medium	moderate	20 to 24	range/homesites and subdivisions	VIe-1	NA / NA	NA
Saugus loam, 30 to 50 percent slopes	Saugus-Castaic-Balcom Association/Saugus Series	rapid	high	45 to 55	range/homesites and subdivisions	VIIe-1 dryland	NA / NA	NA
Saugus loam, 30 to 50 percent slopes, eroded	Saugus-Castaic-Balcom Association/Saugus Series	rapid	high	30 to 50	range/wildlife habitat/watershed	VIIe-1 dryland	moderate/ 5 to 7.5 inches	low
Sorrento loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Sorrento Series	slow	slight	0 to 2	many kinds of irrigated crops	I-1 irrigated	NA / NA	NA
Sorrento loam, 2 to 5 percent slopes	Yolo-Metz-Cortina Association/Sorrento Series	slow	slight	2 to 5	irrigated crops such as alfalfa/green onions/carrots/walnuts/ pasture	IIe-1	moderate/ 8.5 to 10 inches	high
Temescal-Rock land complex, 30 to 50 percent slopes	Las Posas-Toomes-Temescal Association/Temescal Series	rapid	high	30 to 50	range, wildlife and watershed	Temescal part: VIIe-1 Rock Land: VIIIs-1	moderate/ 2 to 3 inches	low

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Terrace Escarpments	N/A	medium to rapid	moderate to high	35	incidentally for grazing. Cover for wildlife	VIIe-1	NA	NA
Vernalis loam, 2 to 5 percent slopes	Hanford-Ramona-Greenfield Association/Vernalis Series	slow	slight	2 to 5	irrigated crops, dryland crops, range	IIe-1 irrigated	NA/ .5 to 9.5 inches	NA
Vernalis clay loam, 0 to 2 percent slopes	Hanford-Ramona-Greenfield Association/Vernalis Series	very slow	none to slight	0 to 2	sugar beets, irrigated small grains, dryland small grains, and range	I-1 irrigated	NA/ 9.5 to 10.5 inches	NA
Vista coarse sandy loam, 15 to 30 percent slopes	Vista-Amargosa Association/Vista Series	medium to rapid	moderate to high	15 to 30	range, wildlife habitat, and watershed	VIe-1	NA	NA
Vista coarse sandy loam, 30 to 50 percent slopes	Vista-Amargosa Association/Vista Series	rapid	high	30 to 50	range, wildlife habitat, watershed	VIIe-1	moderately rapid/ 2.5 to 3.5 inches	low
Vista coarse sandy loam, 30 to 50 percent slopes, eroded	Vista-Amargosa Association/Vista Series	rapid	high	35 to 45	range/wildlife habitat/watershed	VIIe-1 dryland	NA / NA	NA
Wyman gravelly loam, 2 to 9 percent slopes	Las Posas-Toomes-Temescal Association/Wyman Series	slow to medium	slight to moderate	2 to 9	dryland small grains and range, and wildlife habitat	IIe-1 irrigated	moderate/ 8.5 to 9.5 inches	moderate
Wyman gravelly loam, 9 to 15 percent slopes	Las Posas-Toomes-Temescal Association/Wyman Series	medium	moderate	9 to 15	dryland small grain, range, and wildlife habitat	IIIe-1 irrigated	NA	NA
Wyman cobbly loam, 5 to 9 percent slopes	Las Posas-Toomes-Temescal Association/Wyman Series	slow to medium	slight to moderate	5 to 9	range in spring, and wildlife habitat	VIe-7	NA/5.5 to 7 inches	NA

Soil	Association and Series	Runoff	Erosion Hazard	Slope (percent)	Soil Use	Capability Classification	Permeability/ Water-Holding Capacity	Fertility
Yolo loam, 0 to 2 percent slopes	Yolo-Metz-Cortina Association/Yolo Series	very low	none to slight	0 to 2	irrigated crops	I-1 irrigated	moderate/ 8.5 to 10.5 inches	high
Yolo loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Yolo Series	slight to moderate	slow to medium	2 to 6	irrigated crops/range/homesites	IIe-1 irrigated	NA / NA	NA
Zamora loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Zamora Series	slow to medium	slight to moderate	2 to 9	dryland grains/range/wildlife habitat	IIe-1 irrigated	moderate/ 10 to 11 inches	moderate
Zamora loam, 9 to 15 percent slopes	Yolo-Metz-Cortina Association/Zamora Series	medium	moderate	9 to 15	range and pump-sites for oil fields	IIIe-1	NA	NA
Zamora clay loam, 2 to 9 percent slopes	Yolo-Metz-Cortina Association/Zamora Series	slow to medium	slight to moderate	5 to 7	range and pump-sites for oil fields	IIe-1 irrigated	NA/10.5 to 11.5 inches	NA

Soil	Depth to a Restrictive Layer, Bedrock or Lithic (inches)	Water Movement	Drainage	Available Water Depth of 60 inches	Capability Class	Parent Material	Slopes (Percent)
Soil Survey of Los Angeles County, California, West San Fernando Valley Area[2]							
102 – Badland[4]	NA	NA	NA	NA	NA	NA	NA
115 – Friant fine sandy loam, 50 to 75 percent slopes	6 to 20	high	somewhat excessively drained	very low	VIIe	residuum weathered from slate	50 to 75
117 – Gaviota sandy loam, 30 to 50 percent slopes	10 to 20	high	well drained	very low	VIIe	residuum weathered from sandstone	30 to 50
122 – Millsholm loam, 30 to 50 percent slopes	10 to 20	moderately high	well drained	very low	VIIe	residuum weathered from sandstone and shale	30 to 50

Soil	Depth to a Restrictive Layer, Bedrock or Lithic (inches)	Water Movement	Drainage	Available Water Depth of 60 inches	Capability Class	Parent Material	Slopes (Percent)
125 – Rock-outcrop[4]-Friant complex, 50 to 75 percent slopes	Rock: NA Friant: 6 to 20	Rock: NA Friant: NA	Rock: NA Friant: excessively drained	Rock: NA Friant: very low	Rock: NA Friant: VIIe	Rock: NA Friant: residuum weathered from metamorphic and sedimentary rock	Rock: NA Friant: 50 to 75
Soil Survey of Los Angeles County, California, West San Fernando Valley Area[2] (continued)							
128 – Saugus loam, 15 to 30 percent slopes	40 to 60	moderately high	well drained	low	IVe	soft residuum weathered from sandstone and shale	30 to 50
129 – Saugus loam, 30 to 50 percent slopes	40 to 60	NA	well drained	low	VIe non-irrigated	soft residuum, weathered sandstone, shale	30 to 50
143 – Xerorthents-Urban land-Saugus complex, 15 to 30 percent slopes	10 to 60 (Xerorthents) 40 to 60 (Saugus)	moderately high (Saugus)	well drained (Xerorthents and Saugus)	very low (Xerorthents) low (Saugus)	VIII non-irrigated (Xerorthents), IVe non-irrigated and IVe irrigated (Saugus)	human-altered residuum (Xerorthents), residuum weathered sandstone and shale (Saugus)	15 to 30

Soil	Depth to a Restrictive Layer, Bedrock or Lithic (inches)	Water Movement	Drainage	Available Water Depth of 60 inches	Capability Class	Parent Material	Slopes (Percent)
Soil Survey of the Angeles National Forest Area, California[3]							
1-Exchequer family, 30 to 60 percent slopes	5 to 18	moderately high	excessively drained	very low	VIIe	residuum weathered granite	30 to 60
19 – Trigo family-Calcixerollic Xerochrepts-Vista family complex, 30 to 70 percent slopes	3 to 19 (Trigo) 15 to 42 (Calcixerollic Xerochrepts), 60 (Vista)	relatively high (Calcixerollic Xerochrepts), high (Vista)	Excessive (Trigo Family), well drained (Vista)	very low (Trigo), moderate (Calcixerollic Xerochrepts), moderate (Vista)	VIIe non-irrigated (Trigo), VIIe non-irrigated (Calcixerollic Xerochrepts), VIIe (Vista)	residuum weathered sandstone and shale (all three components)	30 to 70
Soil Survey of the Angeles National Forest Area, California[3] (continued)							
54 – Caperton-Trigo, granitic substratum-Lodo families complex, 50 to 85 percent slopes	4 to 20 (Caperton), 3 to 19 (Trigo), 6 to 19 (Lodo)	moderately high (Caperton), high (Trigo), moderately high (Lodo)	well drained (Caperton), excessively drained (Trigo), excessively drained (Lodo)	very low (Caperton), very low (Trigo), very low (Lodo)	VIIe non-irrigated (Caperton), VIIe non-irrigated (Trigo), VIIe non-irrigated (Lodo)	residuum weathered from gneiss (Caperton), residuum weathered from granodiorite (Trigo), residuum weathered from schist (Lodo)	50 to 85

[1] *United States Department of Agriculture Soil Conservation Service In Cooperation with University of California Agricultural Experiment Station, Soil Survey Antelope Valley Area, California, January 1970.*

[2] *United States Department of Agriculture Soil Conservation Service In Cooperation with University of California Agricultural Experiment Station, Soil Survey Los Angeles County, California, West San Fernando Valley Area.*

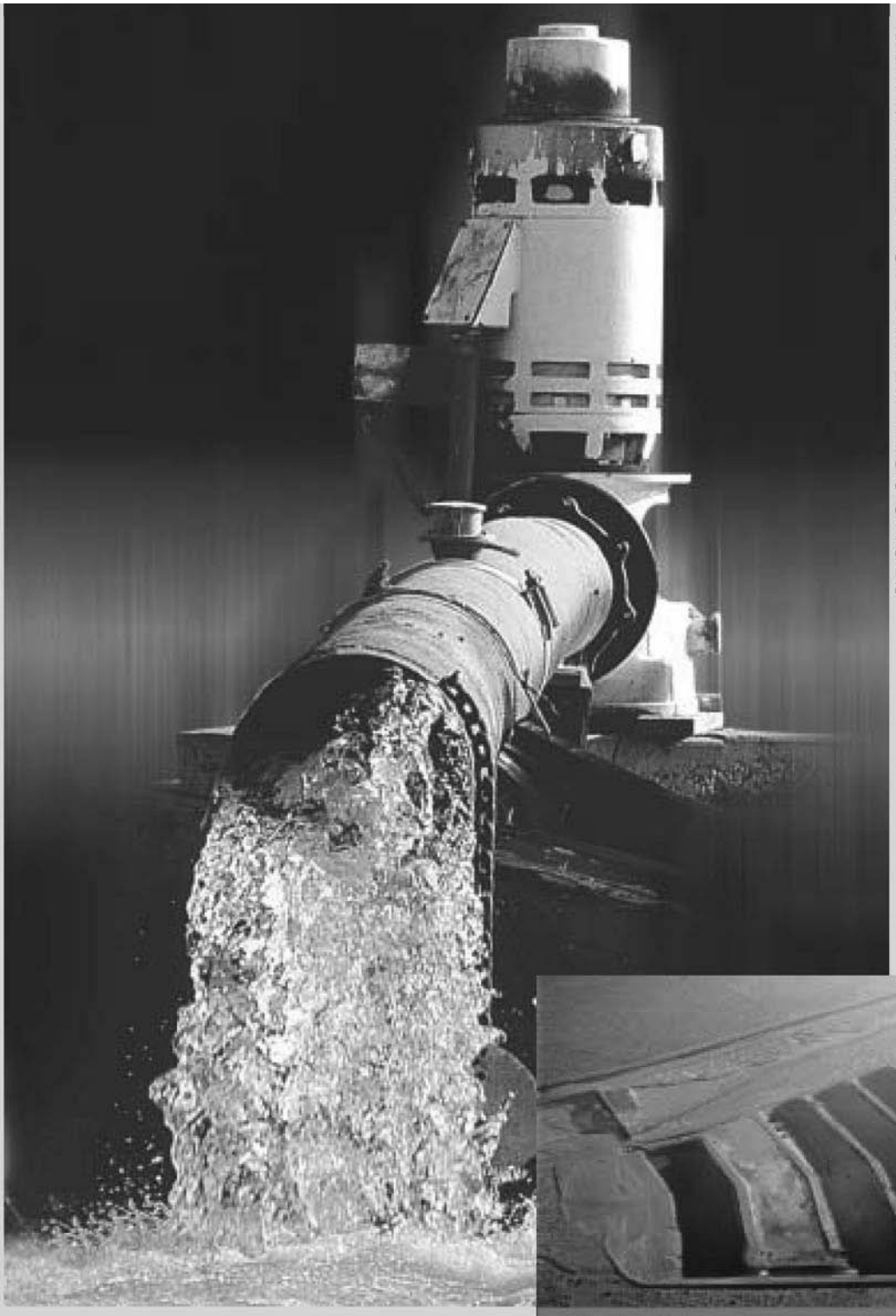
[3] *United States Department of Agriculture Soil Conservation Service In Cooperation with University of California Agricultural Experiment Station, Soil Survey Angeles National Forest Area, California.*

[4] *Generated brief soil descriptions are created for major soil components. The Badland and Rock outcrop is a miscellaneous area.*

APPENDIX 3.13

Water Service Information

DEPARTMENT OF WATER RESOURCES



BULLETIN 118 - UPDATE 2003

CALIFORNIA'S GROUNDWATER

Cover photograph:
A typical agricultural well with the water discharge pipe and the electric motor that drives the pump.

Inset photograph:
Groundwater recharge ponds in the Upper Coachella Valley near the Whitewater River that use local and imported water. Recharge ponds are also called spreading basins or recharge basins.

State of California
The Resources Agency
Department of Water Resources

CALIFORNIA'S
GROUNDWATER

BULLETIN 118 *Update 2003*

October 2003

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If you need this publication in an alternate form, contact the Department's Office of Water Education at 1-800-272-8869.

Foreword

Groundwater is one of California's greatest natural resources. In an average year, groundwater meets about 30 percent of California's urban and agricultural water demands. In drought years, this percentage increases to more than 40 percent. In 1995, an estimated 13 million Californians, nearly 43 percent of the State's population, were served by groundwater. The demand on groundwater will increase significantly as California's population grows to a projected 46 million by the year 2020. In many basins, our ability to optimally use groundwater is affected by overdraft and water quality impacts, or limited by a lack of data, management, and coordination between agencies.

Over the last few years, California voters and the Legislature have provided significant funding to local agencies for conjunctive use projects, groundwater recharge facilities, groundwater monitoring, and groundwater basin management activities under Proposition 13 and the Local Groundwater Management Assistance Act of 2000. Most recently, the 2002 passage of Proposition 50 will result in additional resources to continue recent progress toward sustaining our groundwater resources through local agency efforts. We are beginning to see significant benefits from these investments.

The State Legislature recognizes the need for groundwater data in making sound local management decisions. In 1999, the Legislature approved funding and directed the Department of Water Resources (DWR) to update the inventory of groundwater basins contained in Bulletin 118 (1975), *California's Ground Water* and Bulletin 118-80 (1980), *Ground Water Basins in California.* In 2001, the Legislature passed AB 599, requiring the State Water Resources Control Board to establish a comprehensive monitoring program to assess groundwater quality in each groundwater basin in the State and to increase coordination among agencies that collect groundwater contamination information. In 2002, the Legislature passed SB 1938, which contains new requirements for local agency groundwater management plans to be eligible for public funds for groundwater projects.

Effective management of groundwater basins is essential because groundwater will play a key role in meeting California's water needs. DWR is committed to assisting local agencies statewide in developing and implementing effective, locally planned and controlled groundwater management programs. DWR is also committed to federal and State interagency efforts and to partnerships with local agencies to coordinate and expand data monitoring activities that will provide necessary information for more effective groundwater management. Coordinated data collection at all levels of government and local planning and management will help to ensure that groundwater continues to serve the needs of Californians.

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California Department of Pesticide Regulation
California Department of Toxic Substances Control
California Department of Health Services
California State Water Resources Control Board
California Regional Water Quality Control Boards
United States Geological Survey
United States Bureau of Reclamation

We also wish to thank numerous reviewers who provided valuable comments on the April 2003 public review draft of this bulletin.

Acronyms and abbreviations

AB Assembly Bill
BMO Basin management objective
CAS California Aquifer Susceptibility
CVP Central Valley Project
DBCP Dibromochloropropane
DCE Dichloroethylene
DHS California Department of Health Services
DPR California Department of Pesticide Regulation
DTSC California Department of Toxic Substances Control
DWR California Department of Water Resources
DWSAP Drinking Water Source Assessment Program
EDB Ethylene dibromide
EC Electrical conductivity
EMWD Eastern Municipal Water District
EWMP Efficient water management
EPA U.S. Environmental Protection Agency
ESA Federal Endangered Species Act
ET Evapotranspiration
ETAW Evapotranspiration of applied water
EWA Environmental Water Account
GAMA Groundwater Ambient Monitoring and Assessment
GIS Geographic information system
GMA Groundwater Management Agency
gpm Gallons per minute
GRID Groundwater Resources Information Database
GRIST Groundwater Resources Information Sharing Team
H & S Health and Safety Code
HR Hydrologic region
ISI Integrated Storage Investigations
ITF Interagency Task Force
JPA Joint powers agreement
maf Million acre-feet
MCL Maximum contaminant level
mg/L Milligrams per liter
MOU Memorandum of understanding
MTBE Methyl tertiary-butyl ether
OCWD Orange County Water District
PAC Public Advisory Committee
PCE Tetrachloroethylene
PCA Possible contaminating activity
PPIC Public Policy Institute of California
ROD Record of Decision
RWQCB Regional Water Quality Control Board
SB Senate Bill
SGA Sacramento Groundwater Authority
SVOC Semi-volatile organic compound
SVWD Scotts Valley Water District
SWRCB State Water Resources Control Board

taf Thousand acre-feet
TCE Trichloroethylene
TDS Total dissolved solids
UWMP Urban water management plan
USACE U.S. Army Corps of Engineers
USBR U.S. Bureau of Reclamation
USC United States Code
USGS U.S. Geological Survey
VOC Volatile organic compound
WQCP Water Quality Control Plan

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Findings

Major Findings

1. **Groundwater provides about 30% of the State's water supply in an average year, yet in many basins the amount of groundwater extracted annually is not accurately known.**
   - In some regions, groundwater provides 60% or more of the supply during dry years.
   - Many small- to moderate-sized towns and cities are entirely dependent on groundwater for drinking water supplies.
   - 40% to 50% of Californians rely on groundwater for part of their water supply.
   - In many basins, groundwater use is indirectly estimated by assuming crop evapotranspiration demands and surveying the acreage of each crop type.

2. **Opportunities for local agencies to manage their groundwater resources have increased significantly since the passage of Assembly Bill 3030 in 1992. (Water Code § 10750 et seq.). In the past several years more agencies have developed management programs to facilitate conjunctive use, determine the extent of the resource, and protect water quality.**
   - The act provides the authority for many local agencies to manage groundwater.
   - The act has resulted in more than 200 local agencies adopting groundwater management plans to date.
   - The act encourages regional cooperation in basins and allows private water purveyors to participate in groundwater management through memoranda of understanding with public agencies.
   - Many local agencies are recognizing their responsibility and authority to better manage groundwater resources.

3. **Agencies in some areas have not yet developed groundwater management plans.**
   - Concerns about cooperative management, governance, and potential liabilities have kept some agencies from developing management plans.
   - Development of management programs to maintain a sustainable groundwater supply for local use has not been accomplished throughout the State.

4. **A comprehensive assessment of overdraft in the State's groundwater basins has not been conducted since Bulletin 118-80, but it is estimated that overdraft is between 1 million and 2 million acre-feet annually.**
   - Historical overdraft in many basins is evident in hydrographs that show a steady decline in groundwater levels for a number of years.
   - Other basins may be subject to overdraft in the future if current water management practices are continued.
   - Overdraft can result in increased water production costs, land subsidence, water quality impairment, and environmental degradation.
   - Few basins have detailed water budgets by which to estimate overdraft.
   - While the most extensively developed basins tend to have information, many basins have insufficient data for effective management or the data have not been evaluated.
   - The extent and impacts of overdraft must be fully evaluated to determine whether groundwater will provide a sustainable water supply.
   - Modern computer hardware and software enable rapid manipulation of data to determine basin conditions such as groundwater storage changes or groundwater extraction, but a lack of essential data limits the ability to make such calculations.
   - Adequate statewide land use data for making groundwater extraction estimates are not available in electronic format.

5. **Surface water and groundwater are connected and can be effectively managed as integrated resources.**
   - Groundwater originates as surface water.
   - Groundwater extraction can affect flow in streams.
   - Changes in surface water flow can affect groundwater levels.
   - Legal systems for surface water and groundwater rights can make coordinated management complex.

6. **Groundwater quality and groundwater quantity are interdependent and are increasingly being considered in an integrated manner.**
   - Groundwater quantity and groundwater quality are inseparable.
   - Groundwater in some aquifers may not be usable because of contamination with chemicals, either from natural or human sources.
   - Unmanaged groundwater extraction may cause migration of poor quality water.
   - Monitoring and evaluating groundwater quality provides managers with the necessary data to make sound decisions regarding storage of water in the groundwater basin.
   - State agencies conduct several legislatively mandated programs to monitor different aspects of groundwater quality.
   - California Department of Water Resources (DWR) monitors general groundwater quality in many basins throughout the State for regional evaluation.

7. **Land use decisions affecting recharge areas can reduce the amount of groundwater in storage and degrade the quality of that groundwater.**
   - In many basins, little is known about the location of recharge areas and their effectiveness.
   - Protection and preservation of recharge areas are seldom considered in land use decisions.
   - If recharge areas are altered by paving, channel lining, or other land use changes, available groundwater will be reduced.
   - Potentially contaminating activities can degrade the quality of groundwater and require wellhead treatment or aquifer remediation before use.
   - There is no coordinated effort to inform the public that recharge areas should be protected against contamination and preserved so that they function effectively.

Additional Important Findings

8. **Funding to assist local groundwater management has recently been available in unprecedented amounts.**
   - Proposition 13 (Water Code, § 79000 et seq.) authorized $230 million in loans and grants for local groundwater programs and projects, almost all of which has been allocated.
   - The Local Groundwater Management Assistance Act of 2000 (Water Code, § 10795) has resulted in more than $15 million in grants to local agencies in fiscal years 2001, 2002, and 2003.
   - Proposition 50 (Water Code, § 79500 et seq) will provide funding for many aspects of water management, including groundwater management and groundwater recharge projects.
   - Funding for the California Bay-Delta program has provided technical and facilitation assistance to numerous local groundwater planning efforts.

9. **Local governments are increasingly involved in groundwater management.**
   - Twenty-four of the 27 existing county groundwater management ordinances have been adopted since 1990.
   - Most ordinances require the proponents of groundwater export to demonstrate that a proposed project will not cause subsidence, degrade groundwater quality, or deplete the water supply before the county will issue an export permit.
   - While the ordinances generally require a permit for export of groundwater, most do not require a comprehensive groundwater management plan designed to ensure a sustainable water resource for local use.
   - Some local governments are coordinating closely with local water agencies that have adopted groundwater management plans.
   - Many local governments are monitoring and conducting studies in an effort to better understand groundwater resources.

10. **Despite the increased groundwater management opportunities and activities, the extent of local efforts is not well known.**
   - There is no general requirement that groundwater management plans be submitted to DWR, so the number of adopted plans and status of groundwater management throughout the State are not currently known.
   - There are no requirements for evaluating the effectiveness of adopted plans, other than during grant proposal review.
   - No agency is responsible for tracking implementation of adopted plans.
   - Unlike urban water management plans, groundwater management plans are not required to be submitted to DWR, making the information unavailable for preparing the California Water Plan.

11. **Despite the fact that several agencies often overlie each groundwater basin, there are few mechanisms in place to support and encourage agencies to manage the basin cooperatively.**
   - Some local agencies have recognized the benefits of initiating basinwide and regional planning for groundwater management and have recorded many successes.
   - Regional cooperation and coordination depends on the ability of local agencies to fund such efforts.
   - There is no specific State or federal program to fund and support coordination efforts that would benefit all water users in a region and statewide.

12. **The State Legislature has recognized the need to consider water supplies as part of the local land use planning process.**
   - Three bills—Senate Bill 221[1], SB 610[2], and AB 901[3]—were enacted in 2001 to improve the assessment of water supplies. The new laws require the verification of sufficient water supply as a condition for approving certain developments and compel urban water suppliers to provide more information on the reliability of groundwater as an element of supply.
   - The Government Code does not specifically require local governments to include a water resources element in their general plans.

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[1] Business and Professions Code Section 11010, Government Code Sections 65867.5, 66455.3, and 66473.7.
[2] Public Resources Code Section 21151.9, Water Code Sections 10631, 10656, 10657, 10910-10912, 10915.
[3] Water Code Sections 10610.2, 10631, 10634.

13. **The need to monitor groundwater quality and contamination of groundwater continues to grow.**
    - As opportunities for developing additional surface water supplies become more limited, subsequent growth will increasingly rely on groundwater.
    - Human activities are likely the cause of more than half the exceedances of maximum contaminant levels in public water supply wells.
    - New contaminants are being regulated and standards are becoming more stringent for others, requiring increased monitoring and better management of water quality.

14. **Monitoring networks for groundwater levels and groundwater quality have not been evaluated in all basins to ensure that the data accurately represent conditions in the aquifer(s).**
    - Groundwater levels are monitored in about 10,000 active wells including those basins where most of the groundwater is used.
    - Groundwater levels are not monitored in approximately 200 basins, where population is sparse and groundwater use is generally low.
    - Groundwater quality monitoring networks are most dense near population centers and may not be representative of the basin as a whole.
    - Many of the wells being monitored are not ideally constructed to provide water level or water quality information that is representative of a specific aquifer.
    - Many wells are too deep to monitor changes in the unconfined (water table) portion of basins.

15. **The coordination of groundwater data collection and evaluation by local, State, and federal agencies is improving.**
    - The State Water Resources Control Board (SWRCB) recently formed the Groundwater Resources Information Sharing Team (GRIST) consisting of several State and federal agencies with groundwater-related programs.
    - DWR established a website in 1996 that has provided water-level data and hydrographs for more than 35,000 active and inactive wells monitored by DWR and cooperating agencies.
    - DWR collects and maintains water level data in part through partnerships with local agency cooperators.
    - DWR staff collaborated with many local, State, and federal agencies in developing this update of Bulletin 118.
    - SWRCB recently formed an interagency task force to develop a comprehensive groundwater quality monitoring program for assessing every groundwater basin in the State as required by the Groundwater Quality Monitoring Act of 2001 (AB 599; Water Code, § 10780 et seq.).
    - Water purveyors have concerns about balancing public access to data with water supply security.

16. **Boundaries of groundwater basins have been determined using the best available geologic and hydrologic information. These boundaries are important in determining the availability of local water supplies.**
    - Basin boundaries were derived primarily by identifying alluvial sediments on geologic maps using the best available information, but are subject to change when new information becomes available.
    - The Water Code requires the use of basin boundaries defined in Bulletin 118 in groundwater management plans and urban water management plans.
    - The location of basin boundaries will become more critical as the demand for water continues to increase.
    - Subbasin boundaries may be delineated for management convenience rather than based on hydrogeologic conditions.

17. **Little is known about the stream-aquifer interaction in many groundwater basins.**
    - Groundwater and surface water are closely linked in the hydrologic cycle.
    - The relationship between streamflow and extraction of groundwater is not fully understood in most basins and is generally not monitored.
    - Groundwater extraction in many basins may affect streamflow.
    - Interaction of groundwater flow and surface water may affect environmental resources in the hyporheic zone.
    - An understanding of stream-aquifer interaction will be essential to evaluating water transfers in many areas of the State.

18. **Although many new wells are built in fractured rock areas, insufficient hydrogeologic information is available to ensure the reliability of groundwater supplies.**
    - Population is increasing rapidly in foothill and mountain areas in which groundwater occurs in fractured rock.
    - The cumulative effect of groundwater development may reduce the yield of individual wells, lower the flow of mountain streams, and impact local habitat.
    - Characterization of groundwater resources in fractured rock areas can be very expensive and complex.
    - Many groundwater users in these areas have no other water supply alternatives.
    - Recent dry years have seen many wells go dry in fractured rock areas throughout the State.
    - Groundwater management in these areas is beginning, but there is insufficient data to support quantitative conclusions about the long-term sustainable yield.

19. **When new wells are built, drillers are required to file a Well Completion Report with DWR. That report contains a lithologic log, the usability of which varies considerably from driller to driller.**
    - The Well Completion Reports are confidential and not available to the public, as stipulated by the Water Code, unless the owner's permission is obtained.
    - The usefulness of the information in Well Completion Reports varies but is not fully realized.
    - Public access to Well Completion Reports would increase understanding of groundwater conditions and issues.
    - There is no provision in the Water Code that requires submission of geophysical logs, which would provide an accurate log of the geologic materials within the aquifer.
    - Geophysical logs would provide a greatly improved database for characterization of aquifers.

Recommendations

Major Recommendations

1. **Local or regional agencies should develop groundwater management plans if groundwater constitutes part of their water supply. Management objectives should be developed to maintain a sustainable long-term supply for multiple beneficial uses. Management should integrate water quantity and quality, groundwater and surface water, and recharge area protection.**
   - Groundwater management in California is a local agency responsibility.
   - In basins where there is more than one management agency, those agencies should coordinate their management objectives and program activities.
   - A water budget should be completed that includes recharge, extraction and change in storage in the aquifer(s).
   - Changes in groundwater quality should be monitored and evaluated.
   - Stakeholders should be identified and included in development of groundwater management plans.

2. **The State of California should continue programs to provide technical and financial assistance to local agencies to develop monitoring programs, management plans, and groundwater storage projects to more efficiently use groundwater resources and provide a sustainable supply for multiple beneficial uses. DWR should:**
   - Post information about projects that have successfully obtained funding through various grant and loan programs.
   - Provide additional technical assistance to local agencies in the preparation of grant and loan applications.
   - Continue outreach efforts to inform the public and water managers of grant and loan opportunities.
   - Participate, when requested, in local efforts to develop and implement groundwater management plans.
   - Continue to assess, develop, and modify its groundwater programs to provide the greatest benefit to local agencies.
   - Develop grant criteria to ensure funding supports local benefits as well as Statewide priorities, such as development of the California Water Plan and meeting Bay-Delta objectives.

3. **DWR should continue to work with local agencies to more accurately define historical overdraft and to more accurately predict future water shortages that could result in overdraft.**
   - A water budget should be developed for each basin.
   - The annual change in storage should be determined for each basin.
   - The amount of annual recharge and discharge, including pumping, should be determined.
   - Changes in groundwater quality that make groundwater unusable or could allow additional groundwater to be used should be included in any evaluation of overdraft.

4. **Groundwater management agencies should work with land use agencies to inform them of the potential impacts various land use decisions may have on groundwater, and to identify, prioritize, and protect recharge areas.**
   - Local planners should consider recharge areas when making land use decisions that could reduce recharge or pose a risk to groundwater quality.
   - Recharge areas should be identified and protected from land uses that limit recharge rates, such as paving or lining of channels.

- Both local water agencies and local governments should pursue education and outreach to inform the public of the location and importance of recharge areas.
- DWR should inform local agencies of the availability of grant funding and technical assistance that could support these efforts.

5. **DWR should publish a report by December 31, 2004 that identifies those groundwater basins or subbasins that are being managed by local or regional agencies and those that are not, and should identify how local agencies are using groundwater resources and protecting groundwater quality.**
   - Such information will be necessary to confirm whether agencies are meeting the requirements of SB 1938 (Water Code Section 10753.7).
   - Collection and summary of existing groundwater management plans will provide a better understanding of the distribution and coordination of groundwater management programs throughout the State.
   - Successful strategies employed by specific local agencies should be highlighted to assist others in groundwater management efforts.
   - Similarly, the impact of groundwater management ordinances throughout the State should be evaluated to provide a better understanding of the effect of ordinances on groundwater management.

6. **Water managers should include an evaluation of water quality in a groundwater management plan, recognizing that water quantity and water quality are inseparable.**
   - Local water managers should obtain groundwater quality data from federal, state, and local agencies that have collected such data in their basin.
   - Local agencies should evaluate long-term trends in groundwater quality.
   - Local agencies should work closely with the SWRCB and DWR in evaluating their groundwater basins.
   - Local agencies should establish management objectives and monitoring programs that will maintain a sustainable supply of good quality groundwater.

7. **Water transfers that involve groundwater (or surface water that will be replaced with groundwater) should be consistent with groundwater management in the source area that will assure the long term sustainability of the groundwater resource.**

8. **Continue to support coordinated management of groundwater and surface water supplies and integrated management of groundwater quality and groundwater quantity.**
   - Future bond funding should be provided for conjunctive use facilities to improve water supply reliability.
   - Funding for feasibility and pilot studies, in addition to construction of projects will help maximize the potential for conjunctive use.
   - DWR should continue and expand its efforts to form partnerships with local agencies to investigate and develop locally controlled conjunctive use programs.

9. **Local, State, and federal agencies should improve data collection and analysis to better estimate groundwater basin conditions used in Statewide and local water supply reliability planning. DWR should:**
   - Assist local agencies in the implementation of SB 221, SB 610, and AB 901 to help determine water supply reliability during the local land use planning process.
   - Provide and continue to update information on groundwater basins, including basin boundaries, groundwater levels, monitoring data, aquifer yield, and other aquifer characteristics.

- Identify areas of rapid development that are heavily reliant on groundwater and prioritize monitoring activities in these areas to identify potential impacts on these basins.
- Evaluate the existing network of wells monitored for groundwater elevations, eliminate wells of questionable value from the network, and add wells where data are needed.
- Work cooperatively with local groundwater managers to evaluate the groundwater basins of the State with respect to overdraft and its potential impacts, beginning with the most heavily used basins.
- Expand DWR and local agency monitoring programs to provide a better understanding of the interaction between groundwater and surface water.
- Work with SWRCB to investigate temporal trends in water quality to identify areas of water quality degradation that should receive additional attention.
- Estimate groundwater extraction using a land use based method for over 200 basins with little or no groundwater budget information.
- Integrate groundwater budgets into the California Water Plan Update process.

10. **Increase coordination and sharing of groundwater data among local, State, and federal agencies and improve data dissemination to the public. DWR should:**
    - Use the established website to continually update new groundwater basin data collected after the publication of California's Groundwater (Bulletin 118-Update 2003).
    - Publish a summary update of Bulletin 118 every five years coincident with the California Water Plan (Bulletin 160).
    - Publish, in cooperation with SWRCB, a biennial groundwater report that addresses current groundwater quantity and quality conditions.
    - Coordinate the collection and storage of its groundwater quality monitoring data with programs of SWRCB and other agencies to ensure maximum coverage statewide and reduce duplication of effort.
    - Make groundwater basin information more compatible with other Geographic Information System-based resource data to improve local integrated resources planning efforts.
    - Compile data collected by projects funded under grant and loan programs and make data available to the public on the DWR website.
    - Encourage local agency cooperators to submit data to the DWR database.
    - Maximize the accuracy and usefulness of data and develop guidelines for quality assurance and quality control, consistency, and format compatibility.
    - Expand accessibility of groundwater data by the public after considering appropriate security measures.
    - State, federal and local agencies should expand accessibility of groundwater data by the public after considering appropriate security measures.
    - Local agencies should submit copies of adopted groundwater management plans to DWR.

Additional Important Recommendations

11. **Local water agencies and local governments should be encouraged to develop cooperative working relationships at basinwide or regional levels to effectively manage groundwater. DWR should:**
    - Provide technical and financial assistance to local agencies in the development of basinwide groundwater management plans.
    - Provide a preference in grant funding for groundwater projects for agencies that are part of a regional or basinwide planning effort.
    - Provide Proposition 50 funding preferences for projects that are part of an integrated regional water management plan.

12. **Groundwater basin boundaries identified in Bulletin 118 should be updated as new information becomes available and the basin becomes better defined. DWR should:**
    - Identify basin boundaries that are based on limited data.
    - List the kind of information that is necessary to better define basin boundaries.
    - Develop a systematic procedure to obtain and evaluate stakeholder input on groundwater basin boundaries.

13. **Improve the understanding of groundwater resources in fractured rock areas of the State.**
    - DWR, in cooperation with local and federal agencies, should conduct studies to determine the amount of groundwater that is available in fractured rock areas, including water quality assessment, identification of recharge areas and amounts, and a water budget when feasible.
    - Local agencies and local governments should conduct studies in their areas to quantify the local demands on groundwater and project future demands.
    - The Legislature should consider expanding the groundwater management authority in the Water Code to include areas outside of alluvial groundwater basins
    - DWR should include information on the most significant fractured rock groundwater sources in future updates of Bulletin 118.

14. **Develop a program to obtain geophysical logs in areas where additional data are needed.**
    - DWR should encourage submission of geophysical logs, when they are conducted, as a part of the Well Completion Report.
    - The geophysical logs would be available for use by public agencies to better understand the aquifer, but would be confidential as stipulated by the Water Code.
    - DWR should seek funding to work with agencies and property owners to obtain geophysical logs of new wells in areas where additional data are needed.
    - Geophysical logs would be used to better characterize the aquifers within each groundwater basin.

15. **Educate the public on the significance of groundwater resources and on methods of groundwater management.**
    - DWR should continue to educate the public on statewide groundwater issues and assist local agencies in their public education efforts.
    - Local agencies should expand their outreach efforts during development of groundwater management plans under AB 3030 and other authority.
    - DWR should develop educational materials to explain how they quantify groundwater throughout the State, as well as the utility and limitations of the information.
    - DWR should continue its efforts to educate individual well owners and small water systems that are entirely dependent on groundwater.

Introduction

Introduction

Groundwater is one of California's greatest natural resources. In an average water supply year, groundwater meets about 30 percent of California's urban and agricultural demand. In drought years, this percentage increases to 40 percent or even higher (DWR 1998). Some cities, such as Fresno, Davis, and Lodi, rely solely on groundwater for their drinking water supply. In 1995, an estimated 13 million Californians (nearly 43 percent of the State's population) used groundwater for at least a portion of their public supply needs (Solley and others 1998). With a projected population of nearly 46 million by the year 2020, California's demand on groundwater will increase significantly. In many basins, our ability to optimally use groundwater is affected by overdraft and water quality, or limited by a lack of data, lack of management, and coordination between agencies.

In the last few years, California has provided substantial funds to local agencies for groundwater management. For example, the nearly $2 billion Water Bond 2000 (Proposition 13) approved by California voters in March 2000 specifically authorizes funds for two groundwater programs: $200 million for grants for feasibility studies, project design, and the construction of conjunctive use facilities; and $30 million for loans for local agency acquisition and construction of groundwater recharge facilities and grants for feasibility studies for recharge projects. Additionally, the Local Groundwater Management Assistance Act of 2000 (AB 303) resulted in $15 million in fiscal years 2001, 2002, and 2003 for groundwater studies and data collection intended to improve basin and subbasin groundwater management. These projects focus on improving groundwater monitoring, coordinating groundwater basin management, and conducting groundwater studies.

The State Legislature has increasingly recognized the importance of groundwater and the need for monitoring in making sound groundwater management decisions. Significant legislation was passed in 2000, 2001 and 2002. AB 303 authorizes grants to help local agencies develop better groundwater management strategies. AB 599 (2001) requires, for the first time, that the State Water Resources Control Board (SWRCB), in cooperation with other agencies, develop a comprehensive monitoring program capable of assessing groundwater quality in every basin in the State with the intent of maintaining a safe groundwater supply. SB 610 (2001) and SB 901 (2001) together require urban water suppliers, in their urban water management plans, to determine the adequacy of current and future supplies to meet demands. Detailed groundwater information is required for those suppliers that use groundwater. SB 221 (2001) prohibits approval of certain developments without verification of an available water supply. These bills are significant with respect to groundwater because much of California's new development will rely on groundwater for its supply.

Finally, SB 1938 (2002) was enacted to provide incentives to local agencies for improved groundwater management. The legislation modified the Water Code to require that specific elements be included in a groundwater management plan for an agency to be eligible for certain State funding administered by the Department of Water Resources for groundwater projects. AB 303 is exempt from that requirement.

History of Bulletin 118

DWR has long recognized the need for collection, summary, and evaluation of groundwater data as tools in planning optimal use of the groundwater resource. An example of this is DWR's Bulletin 118 series. Bulletin 118 presents the results of groundwater basin evaluations in California. The Bulletin 118 series was preceded by Water Quality Investigations Report No. 3, *Ground Water Basins in California* (referred to in this bulletin as Report No. 3), published in 1952 by the Department of Public Works, Division of Water Resources (the predecessor of DWR). The purpose of Report No. 3 was to create a base index map of the "more important ground water basins" for carrying out DWR's mandate in Section 229 of the Water Code. Section 229 directed Public Works to:

> …investigate conditions of the quality of all waters within the State, including saline waters, coastal and inland, as related to all sources of pollution of whatever nature and shall report thereon to the Legislature and to the appropriate regional water pollution control board annually, and may recommend any steps which might be taken to improve or protect the quality of such waters.

Report No. 3 identified 223 alluvium-filled valleys that were believed to be basins with usable groundwater in storage. A statewide numbering system was created in cooperation with the State Water Pollution Control Board (now the State Water Resources Control Board) based on the boundaries of the nine Regional Water Quality Control Boards. In 1992, Water Code Section 229 was amended, resulting in the elimination of the annual reporting requirements.

In 1975, DWR published Bulletin 118, *California's Ground Water*, (referred to in this report as Bulletin 118-75). Bulletin 118-75 summarized available information from DWR, U.S. Geological Survey, and other agencies for individual groundwater basins to "help those who must make decisions affecting the protection, additional use, and management of the State's ground water resources."

Bulletin 118-75 contains a summary of technical information for 248 of the 461 identified groundwater basins, subbasins, and what were referred to as "areas of potential ground water storage" in California as well as maps showing their location and extent. The Bulletin 118-75 basin boundaries were based on geologic and hydrogeologic conditions except where basins were defined by a court decision.

In 1978, Section 12924 was added to the California Water Code:

> The Department shall, in conjunction with other public agencies, conduct an investigation of the State's groundwater basins. The Department shall identify the State's groundwater basins on the basis of geologic and hydrogeologic conditions and consideration of political boundary lines whenever practical. The Department shall also investigate existing general patterns of groundwater pumping and groundwater recharge within such basins to the extent necessary to identify basins which are subject to critical conditions of overdraft.

DWR published the report in 1980 as *Ground Water Basins in California: A Report to the Legislature in Response to Water Code Section 12924* (referred to in this report as Bulletin 118-80). The bulletin included 36 groundwater basins with boundaries different from Bulletin 118-75. The changed boundaries resulted by combining several basins based on geologic or political considerations and by dividing the San Joaquin Valley groundwater basin into many smaller subbasins based primarily on political boundaries. These changes resulted in the identification of 447 groundwater basins, subbasins, and areas of potential groundwater storage. Bulletin 118-80 also identified 11 basins as subject to critical conditions of overdraft.

Box A Which Bulletin 118 Do You Mean?

Mention of an update to Bulletin 118 causes some confusion about which Bulletin 118 the California Department of Water Resources (DWR) has updated. In addition to the statewide Bulletin 118 series (Bulletin 118-75, Bulletin 118-80, and Bulletin 118-03), DWR released several other publications in the 118 series that evaluate groundwater basins in specific areas of the State. Region-specific Bulletin 118 reports are listed below.

- Bulletin 118-1. Evaluation of Ground Water Resources: South San Francisco Bay
  Appendix A. Geology, 1967
  Volume 1. Fremont Study Area, 1968
  Volume 2. Additional Fremont Study Area, 1973
  Volume 3. Northern Santa Clara County, 1975
  Volume 4. South Santa Clara County, 1981
- Bulletin 118-2. Evaluation of Ground Water Resources: Livermore and Sunol Valleys, 1974
  Appendix A. Geology, 1966
- Bulletin 118-3. Evaluation of Ground Water Resources: Sacramento County, 1974
- Bulletin 118-4. Evaluation of Ground Water Resources: Sonoma County
  Volume 1. Geologic and Hydrologic Data, 1975
  Volume 2. Santa Rosa Plain, 1982
  Volume 3. Petaluma Valley, 1982
  Volume 4. Sonoma Valley, 1982
  Volume 5. Alexander Valley and Healdsburg Area, 1983
- Bulletin 118-5. Bulletin planned but never completed.
- Bulletin 118-6. Evaluation of Ground Water Resources: Sacramento Valley, 1978

The Need for Bulletin 118 Update 2003

Despite California's heavy reliance on groundwater, basic information for many of the groundwater basins is lacking. Particular essential data necessary to provide for both the protection and optimal use of this resource is not available. To this end, the California Legislature mandated in the Budget Act of 1999 that DWR prepare:

> ...the statewide update of the inventory of groundwater basins contained in Bulletin 118-80, which includes, but is not limited to, the following: the review and summary of boundaries and hydrographic features, hydrogeologic units, yield data, water budgets, well production characteristics, and water quality and active monitoring data; development of a water budget for each groundwater basin; development of a format and procedures for publication of water budgets on the Internet; development of the model groundwater management ordinance; and development of guidelines for evaluating local groundwater management plans.

The information on groundwater basins presented in Bulletin 118 Update 2003 is mostly limited to the acquisition and compilation of existing data previously developed by federal, State, and local water agencies. While this bulletin is a good starting reference for basic data on a groundwater basin, more recent data and more information about the basin may be available in recent studies conducted by local water management agencies. Those agencies should be contacted to obtain the most recent data.

Report Organization

Bulletin 118 Update 2003 includes this report and supplemental material consisting of individual descriptions and a Geographic Information System-compatible map of each of the delineated groundwater basins in California. The basin descriptions will be updated as new information becomes available, and can be viewed or downloaded at http://www.waterplan.water.ca.gov/groundwater/118index.htm (Appendix A). Basin descriptions will not be published in hard copy.

This report is organized into the following topics:

- Groundwater is one of California's most important natural resources, and our reliance on it has continued to grow (Chapter 1).
- Groundwater has a complex legal and institutional framework in California that has shaped the groundwater management system in place today (Chapter 2).
- Groundwater management occurs primarily at the local water agency level, but may also be instituted at the local government level. At the request of the Legislature, DWR has developed some recommendations for a model groundwater management ordinance and components for inclusion in a groundwater management plan (Chapter 3).
- Groundwater has had a flurry of activity in the Legislature and at the ballot box in recent years that will affect the way groundwater is managed in California (Chapter 4).
- Groundwater programs with a variety of objectives exist in many State and federal agencies (Chapter 5).
- Groundwater concepts and definitions should be made available to a wide audience (Chapter 6).
- Groundwater basins with a wide range of characteristics and concerns exist in each of California's 10 hydrologic regions (Chapter 7).

Chapter 1
Groundwater – California's Hidden Resource

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Groundwater – California's Hidden Resource

In 1975, *California's Ground Water – Bulletin 118* described groundwater as "California's hidden resource." Today, those words ring as true as ever. Because groundwater cannot be directly observed, except under a relatively few conditions such as at a spring or a wellhead, most Californians do not give much thought to the value that California's vast groundwater supply has added to the State. It is unlikely that California could have achieved its present status as the largest food and agricultural economy in the nation and fifth largest overall economy in the world without groundwater resources. Consider that about 43 percent of all Californians obtain drinking water from groundwater. California is not only the single largest user of groundwater in the nation, but the estimated 14.5 million acre-feet (maf) of groundwater extracted in California in 1995 represents nearly 20 percent of all groundwater extracted in the entire United States (Solley and others 1998).

California's Hydrology

California's climate is dominated by the Pacific storm track. Numerous mountain ranges cause orographic lifting of clouds, producing precipitation mostly on the western slopes and leaving a rain shadow on most eastern slopes (Figure 1 and Figure 2). These storms also leave tremendous accumulations of snow in the Sierra Nevada during the winter months. While the average annual precipitation in California is about 23 inches (DWR 1998), the range of annual rainfall varies greatly from more than 140 inches in the northwestern part of the State to less than 4 inches in the southeastern part of the State.

Snowmelt and rain falling in the mountains flow into creeks, streams, and rivers. The average annual runoff in California is approximately 71 maf (DWR 1998). As these flows make their way into the valleys, much of the water percolates into the ground. The vast majority of California's groundwater that is accessible in significant amounts is stored in alluvial groundwater basins. These alluvial basins, which are the subject of this report, cover nearly 40 percent of the geographic area of the State (Figure 3).

This bulletin focuses on groundwater resources, but in reality groundwater and surface water are inextricably linked in the hydrologic cycle. As an example, groundwater may be recharged by spring runoff in streams, but later in the year the base flow of a stream may be provided by groundwater. So, although the land surface is a convenient division for categorizing water resources, it is a somewhat arbitrary one. It is essential that water managers recognize and account for the relationship between groundwater and surface water in their planning and operations.

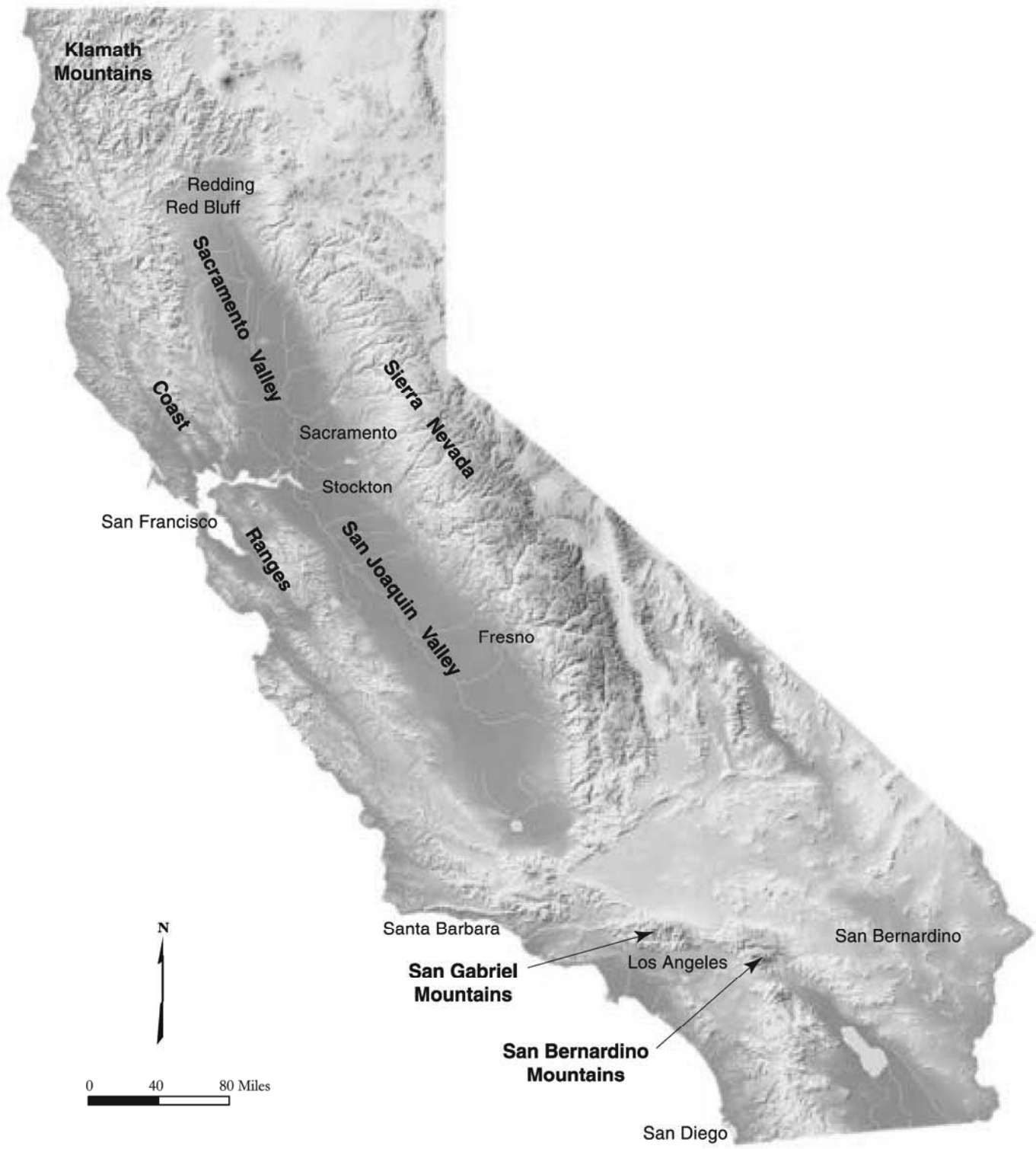

Figure 1 Shaded relief map of California

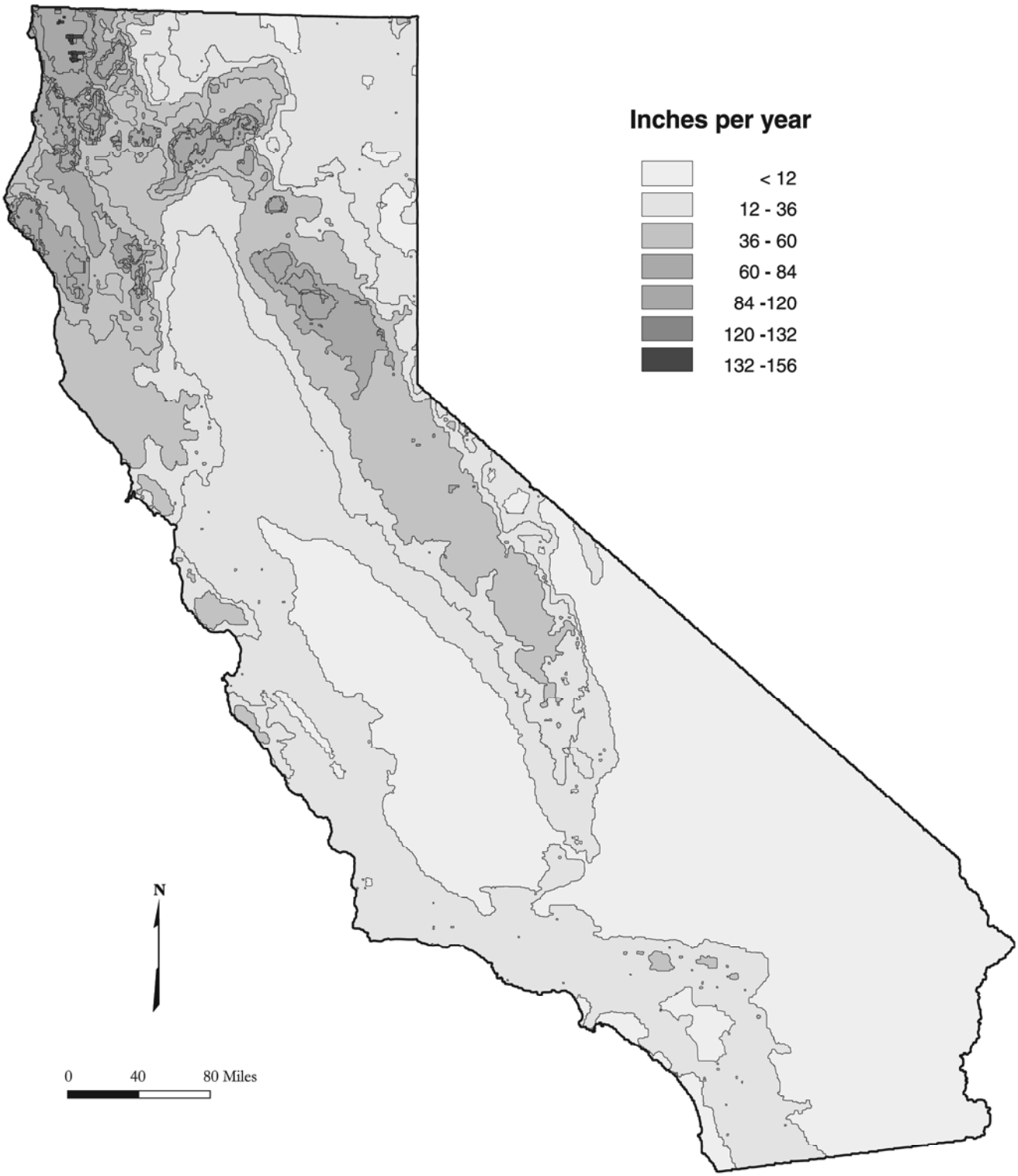

Figure 2 Mean annual precipitation in California, 1961 to 1990

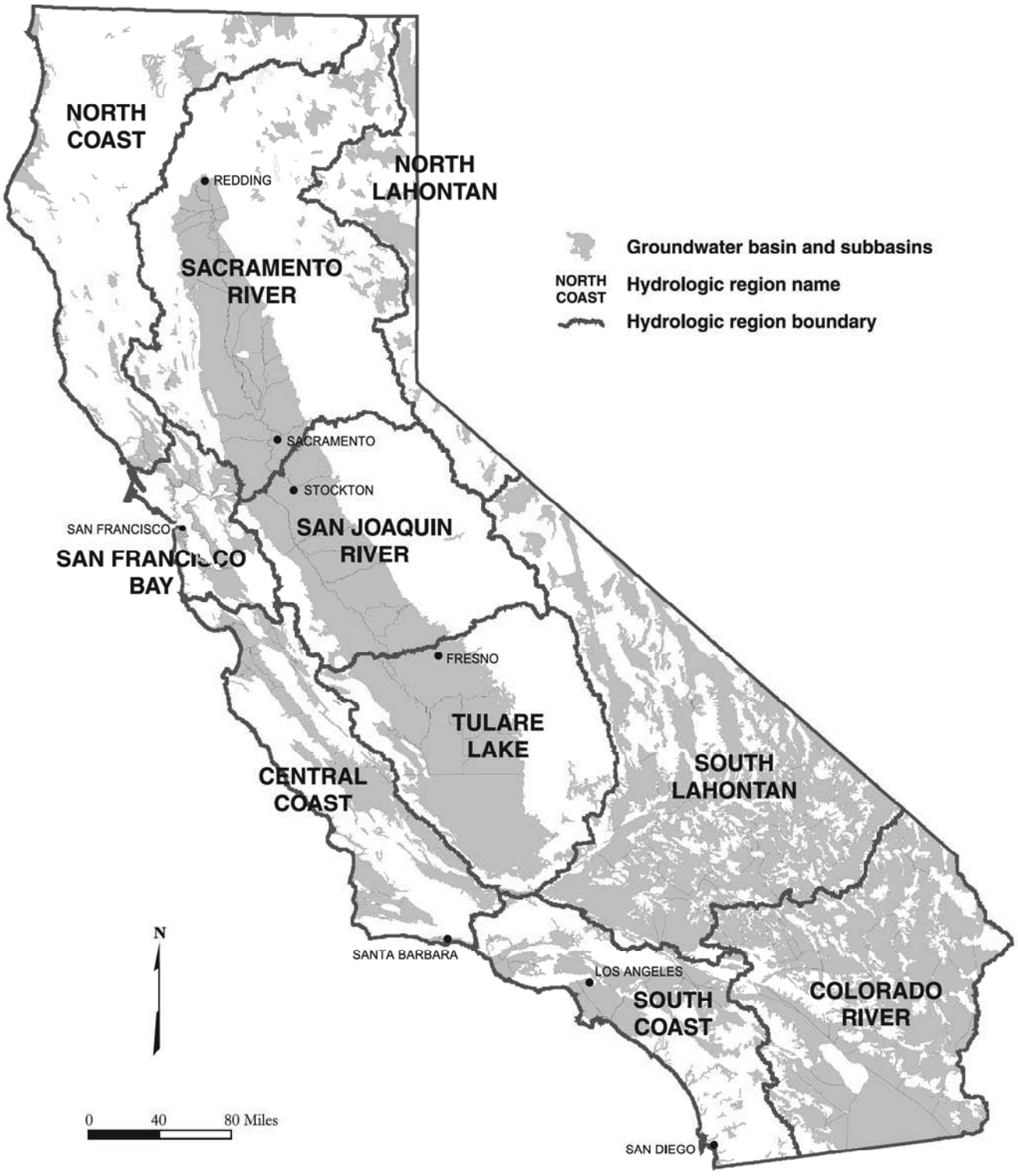

Figure 3 Groundwater basins, subbasins and hydrologic regions

California's Water Supply System

The economic success achieved in California could not have been foreseen a century ago. California's natural hydrologic system appeared too limited to support significant growth in population, industry, and agriculture. The limitations revolved around not only the relative aridity of the State, but the geographic, seasonal, and climatic variability that influence California's water supply. Approximately 70 percent of the State's average annual runoff occurs north of Sacramento, while about 75 percent of the State's urban and agricultural water needs are to the south. Most of the State's precipitation falls between October and April with half of it occurring December through February in average years. Yet, the peak demand for this water occurs in the summer months. Climatic variability includes dramatic deviations from average supply conditions by way of either droughts or flooding. In the 20th century alone, California experienced multiyear droughts in 1912–1913, 1918–1920, 1922–1924, 1929–1934, 1947–1950, 1959–1961, 1976–1977, and 1987–1992 (DWR 1998).

California has dealt with the limitations resulting from its natural hydrology and achieved its improbable growth by developing an intricate system of reservoirs, canals, and pipelines under federal, State and local projects (Figure 4). However, a significant portion of California's water supply needs is also met by groundwater. Typically, groundwater supplies about 30 percent of California's urban and agricultural uses. In dry years, groundwater use increases to about 40 percent statewide and 60% or more in some regions.

The importance of groundwater to the State's development may have been underestimated at the beginning of the 20th century. At that time, groundwater was seen largely as just a convenient resource that allowed for settlement in nearly any part of the State, given groundwater's widespread occurrence. Significant artesian flow from confined aquifers in the Central Valley allowed the early development of agriculture. When the Water Commission Act defined the allocation of surface water rights in 1914, it did not address allocation of the groundwater resource. In the 1920s, the development of the deep-well turbine pump and the increased availability of electricity led to a tremendous expansion of agriculture, which used these high-volume pumps and increased forever the significance of groundwater as a component of water supply in California.

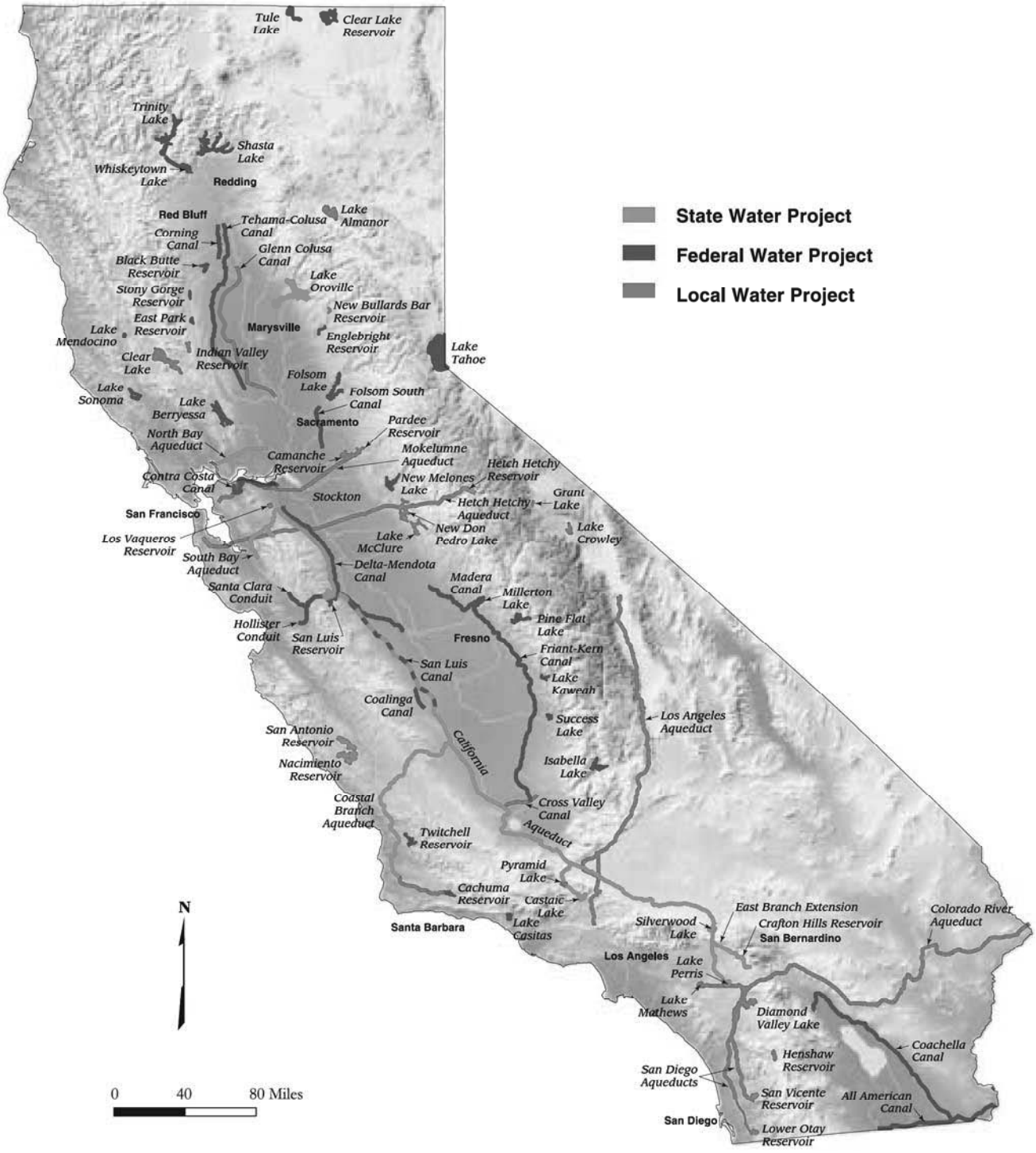

Figure 4 Water projects in California

Box B Will Climate Change Affect California's Groundwater?

California's water storage and delivery system can be thought of as including three reservoir systems—the snowpack of the Sierra Nevada, an extensive system of dams, lakes, and conveyance systems for surface water, and finally the aquifers that store groundwater. Precipitation in the form of snow is stored in the Sierra in winter and early spring and under ideal conditions melts in a manner that allows dams to capture the water for use during California's dry season. When snow melts faster, the dams act as flood control structures to prevent high runoff from flooding lowland areas. Water storage and delivery infrastructure—dams and canals—has been designed largely around the historical snowpack, while aquifers have played a less formal and less recognized role.

What will be the effect of climate change on California's water storage system? How will groundwater basins and aquifers be affected?

The latest report of the Intergovernmental Panel on Climate Change (2001) reaffirms that climate is changing in ways that cannot be accounted for by natural variability and that "global warming" is occurring. Studies by the National Water Assessment Team for the U.S. Global Change Research Program's National Assessment of the Potential Consequences of Climate Variability and Change identify potential changes that could affect water resources systems. For California, these include higher snow levels leading to more precipitation in the form of rain, earlier runoff, a rise in sea level, and possibly larger floods. In addition to affecting the balance between storage and flood control of our reservoirs, such changes in hydrology would affect wildlands, resulting in faunal and floral displacement and resulting in changes in vegetative water consumption. These changes would also affect patterns of both irrigated and dryland farming.

A warmer, wetter winter would increase the amount of runoff available for groundwater recharge; however, this additional runoff in the winter would be occurring at a time when some basins, particularly in Northern California, are either being recharged at their maximum capacity or are already full. Conversely, reductions in spring runoff and higher evapotranspiration because of warmer temperatures could reduce the amount of water available for recharge and surface storage.

The extent to which climate will change and the impact of that change are both unknown. A reduced snowpack, coupled with increased seasonal rainfall and earlier snowmelt may require a change in the operating procedures for existing dams and conveyance facilities. Furthermore, these changes may require more active development of successful conjunctive management programs in which the aquifers are more effectively used as storage facilities. Water managers might want to evaluate their systems to better understand the existing snowpack-surface water-groundwater relationship, and identify opportunities that may exist to optimize groundwater and other storage capability under a new hydrologic regime that may result from climate change. If more water was stored in aquifers or in new or reoperated surface storage, the additional water could be used to meet water demands when the surface water supply was not adequate because of reduced snowmelt.

Recent Groundwater Development Trends

While development of California's surface water storage system has slowed significantly, groundwater development continues at a strong pace. A review of well completion reports submitted to the California Department of Water Resources (DWR) provides data on the number and type of water wells drilled in California since 1987. For the 14-year period, DWR received 127,616 well completion reports for water supply wells that were newly constructed, reconditioned, or deepened—an average of 9,115 annually[1]. Of these, 82 percent were drilled for individual domestic uses; 14 percent for irrigation; and about 4 percent for a combined group of municipal and industrial uses (Figure 5). Although domestic wells predominate, individual domestic use makes up a small proportion of total groundwater use in the State.

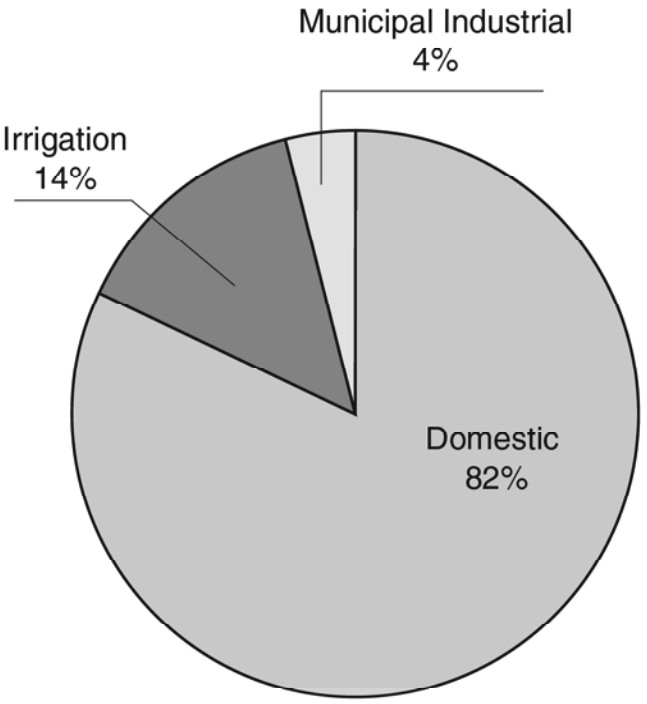

Figure 5 Well completion reports filed with DWR from 1987 through 2000

The most evident influence on the number of wells constructed is hydrologic conditions. The number of wells constructed and modified increases dramatically with drought conditions (Figure 6). The number of wells constructed and modified annually from 1987 through 1992 is more than double the annual totals for 1995 through 2000. Each year from 1987 through 1992 was classified as either dry or critically dry; water years 1995 through 2000 were either above normal or wet, based on measured unimpaired runoff in the Sacramento and San Joaquin valleys. In addition to providing an indication of the growth of groundwater development, well completion reports are a valuable source of information on groundwater basin conditions.

[1] DWR also received an average of 4,225 well completion reports for monitoring, which were not included above because they do not extract groundwater for supply purposes.

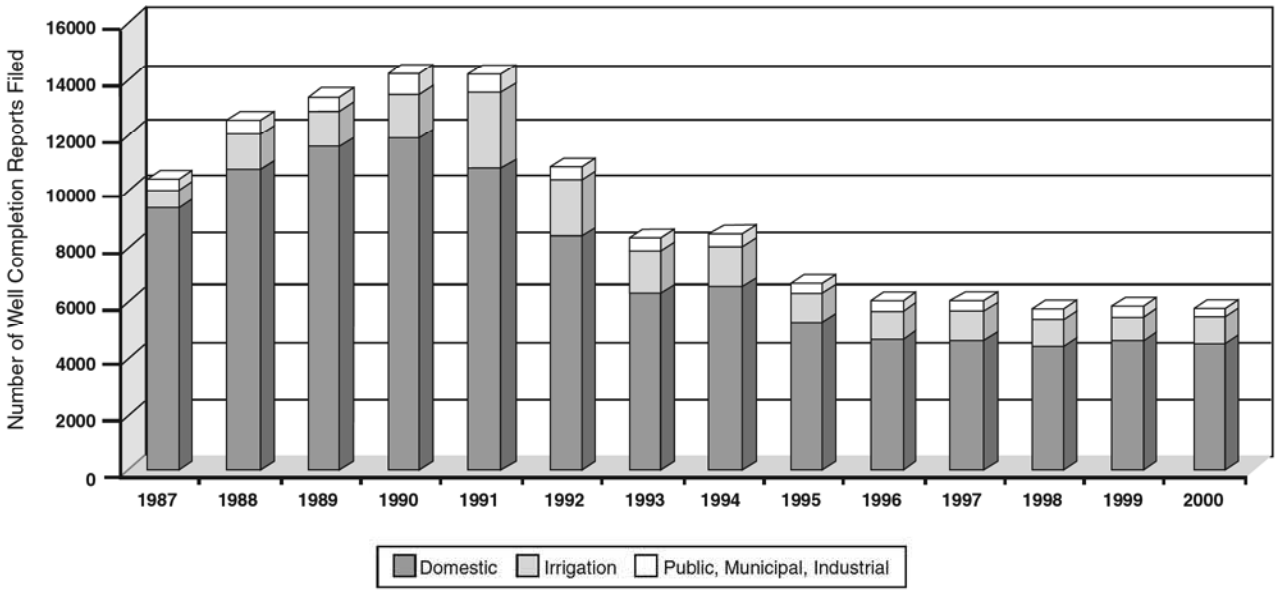

Figure 6 Well completion reports filed annually from 1987 through 2000

The Need for Groundwater Monitoring and Evaluation

Some 34 million people called California their home in the year 2000, and a population of nearly 46 million is expected by 2020. The increased population and associated commercial, industrial, and institutional growth will bring a substantially greater need for water. This need will be met in part by improved water use efficiency, opportunities to reoperate or expand California's surface water system, and increased desalination and recycling of water sources not currently considered usable. This need will also be met by storing and extracting additional groundwater. However, the sustainability of the groundwater resource, both in terms of what is currently used and future increased demand, cannot be achieved without effective groundwater management. In turn, effective groundwater management cannot be achieved without a program of groundwater data collection and evaluation.

Perhaps surprising to many, California does not have a comprehensive monitoring network for evaluating the health of its groundwater resource, including quantity and quality of groundwater. The reasons for this are many with the greatest one being that information on groundwater levels and groundwater quality is primarily obtained by drilling underground, which is relatively expensive. Given that delineated groundwater basins cover about 40 percent of the State's vast area, the cost of a dedicated monitoring network would be prohibitive. The other important reason for the lack of a comprehensive network is that, as will be discussed later in this report, groundwater is a locally controlled resource. State and federal agencies become involved only when a groundwater issue is directly related to the mission of a particular agency or if a local agency requests assistance. For these and other reasons, California lacks a cohesive, dedicated monitoring network.

Box C What about Overdraft?

Overdraft is the condition of a groundwater basin in which the amount of water withdrawn by pumping over the long term exceeds the amount of water that recharges the basin. Overdraft is characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. Overdraft can lead to increased extraction costs, land subsidence, water quality degradation, and environmental impacts.

The California Water Plan Update, Bulletin 160-98 (DWR 1998) estimated that groundwater overdraft in California in 1995 was nearly 1.5 million acre-feet annually, with most of the overdraft occurring in the Tulare Lake, San Joaquin River, and Central Coast hydrologic regions. The regional and statewide estimates of overdraft are currently being revised for the 2003 update of Bulletin 160. While these estimates are useful from a regional and statewide planning perspective, the basin water budgets calculated for this update of Bulletin 118 clearly indicate that information is insufficient in many basins to quantify overdraft that has occurred, project future impacts on groundwater in storage, and effectively manage groundwater. Further technical discussion of overdraft is provided in Chapter 6 of this bulletin.

When DWR and other agencies involved in groundwater began to collect data in the first half of the 20th century, it quickly became evident that there were insufficient funds to install an adequate number of monitoring wells to accurately determine changes in the condition of groundwater basins. Consequently, to create a serviceable monitoring network, the agencies asked owners of irrigation or domestic wells for permission to measure water levels and to a lesser extent to monitor water quality. These have been called "wells of opportunity." In many areas, this approach has led to a network of wells that provide adequate information to gain a general understanding of conditions in the subsurface and to track changes through time. In some areas, groundwater studies were conducted and often included the construction of a monitoring well network. These studies have gradually contributed to a more detailed understanding of some of California's groundwater basins, particularly the most heavily developed basins.

Given the combination of monitoring wells of opportunity and dedicated monitoring wells, it might be assumed that an adequate monitoring network in California will eventually accumulate. However, several factors contribute to reducing the effectiveness of the monitoring network for data collection and evaluation: (1) The funding for data programs in many agencies, which was generally insufficient in the first place, has been reduced significantly. (2) When private properties change ownership, some new owners rescind permission for agency personnel to enter the property and measure the well. (3) The appropriateness of using these private wells is questionable because they are often screened over long intervals encompassing multiple aquifers in the subsurface, and in some cases construction details for the well are unknown. (4) Some wells with long-term records actually reach the end of their usefulness because the casing collapses or something falls into the well, making it unusable. In some cases, groundwater levels may drop below the well depth. (5) As water quality or water quantity conditions change, the monitoring networks may no longer be adequate to provide necessary data to manage groundwater.

The importance of long-term monitoring networks cannot be overstated. Sound groundwater management decisions require observation of trends in groundwater levels and groundwater quality. Only through these long-term evaluations can the question of sustainability of groundwater be answered. For example, this report contains a summary of groundwater contamination in public water supply wells throughout the State collected from 1994 through 2000. While this provides a "snapshot" of the suitability of the groundwater currently developed for public supply needs, it does not address sustainability of groundwater for public uses. Sustainability can only be determined by observing groundwater quality over time. If conditions worsen, local managers will need to take steps to prevent further harm to groundwater quality. Long-term groundwater records require adequate funding and staff to develop groundwater monitoring networks and to collect, summarize, and evaluate the data.

Chapter 2
Groundwater Management in California

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Groundwater Management in California

Groundwater management, as defined in this report, is the planned and coordinated monitoring, operation, and administration of a groundwater basin or portion of a groundwater basin with the goal of long-term sustainability of the resource. Throughout the history of water management in California, local agencies have practiced an informal type of groundwater management. For example, since the early 20th century, when excess surface water was available, some agencies intentionally recharged groundwater to augment their total water supply. In 1947, the amount of groundwater used was estimated at 9 million to 10 million acre-feet. By the beginning of the 21st century, the amount of groundwater used had increased to an estimated 15 million acre-feet. Better monitoring would provide more accurate information. This increased demand on California's groundwater resources, when coupled with estimates of population growth, has resulted in a need for more intensive groundwater management.

In 1914, California created a system of appropriating surface water rights through a permitting process (Stats 1913, ch. 586), but groundwater use has never been regulated by the State. Though the regulation of groundwater has been considered on several occasions, the California Legislature has repeatedly held that groundwater management should remain a local responsibility (Sax 2002). Although they are treated differently legally, groundwater and surface water are closely interconnected in the hydrologic cycle. Use of one resource will often affect the other, so that effective groundwater management must consider surface water supplies and uses.

Figure 7 depicts the general process by which groundwater management needs are addressed under existing law. Groundwater management needs are identified at the local water agency level and may be directly resolved at the local level. If groundwater management needs cannot be directly resolved at the local agency level, additional actions such as enactment of ordinances by local governments, passage of laws by the Legislature, or decisions by the courts may be necessary to resolve the issues. Upon implementation, local agencies evaluate program success and identify additional management needs. The State's role is to provide technical and financial assistance to local agencies for their groundwater management efforts, such as through the Local Groundwater Assistance grant program (see Chapter 4, AB 303).

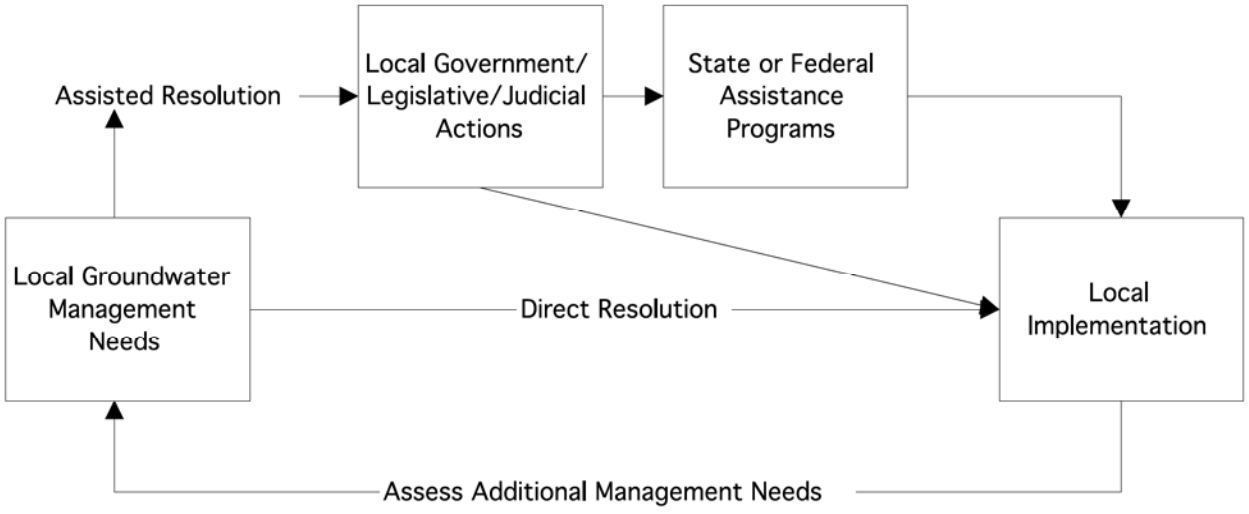

Figure 7 Process of addressing groundwater management needs in California

How Groundwater is Managed in California

There are three basic methods available for managing groundwater resources in California: (1) management by local agencies under authority granted in the California Water Code or other applicable State statutes, (2) local government groundwater ordinances or joint powers agreements, and (3) court adjudications. Table 1 shows how often each of these methods has been used, and each method is discussed briefly below. No law requires that any of these forms of management be applied in a basin. Management is often instituted after local agencies or landowners recognize a specific groundwater problem. The level of groundwater management in any basin or subbasin is often dependent on water availability and demand.

Table 1 Groundwater management methods

Method	Frequency of use[a]
Local water agencies	Undetermined number of agencies with authority to manage some aspect of groundwater under general powers associated with a particular type of district. Thirteen agencies with specially legislated authority to limit or regulate extraction. Seven agencies with adopted plans under authority from Water Code Section 10750 et seq.[b] (AB 255 of 1991). More than 200 agencies with adopted plans under authority from Water Code Section 10750 et seq. (AB 3030 of 1992).
Local groundwater management ordinances	Currently adopted in 27 counties.
Court adjudication	Currently decided in 19 groundwater basins, mostly in Southern California. Three more basins are in court.

a. The numbers for some methods are unknown because reporting to the California Department of Water Resources is not required.
b. Section 10750 *et seq*. was amended in 1992.

Groundwater Management through Authority Granted to Local Water Agencies

More than 20 types of local agencies are authorized by statute to provide water for various beneficial uses. Many of these agencies also have statutory authority to institute some form of groundwater management. For example, a Water Replenishment District (Water Code, § 60000 et seq.) is authorized to establish groundwater replenishment programs and collect fees for that service. A Water Conservation District (Water Code, § 75500 et seq.) can levy groundwater extraction fees. Table 2 lists these and other types of local agencies that deliver water and may have authority to institute some form of groundwater management. Most of these agencies are identified in the Water Code, but their specific authority related to groundwater management varies. The Water Code does not require that the agencies report their activities to the California Department of Water Resources (DWR).

Table 2 Local agencies with authority to deliver water for beneficial uses, which may have authority to institute groundwater management

Local agency	Authority	Number of agencies[a]
Community Services District	Gov. Code § 61000 et seq.	313
County Sanitation District	Health and Safety Code § 4700 et seq.	91
County Service Area	Gov. Code § 25210.1 et seq.	897
County Water Authority	Water Code App. 45.	30
County Water District	Water Code § 30000 et seq.	174
County Waterworks District	Water Code § 55000 et seq.	34
Flood Control and Water Conservation District	Water Code App. 38.	39
Irrigation District	Water Code § 20500 et seq.	97
Metropolitan Water District	Water Code App 109.	1
Municipal Utility District	Pub. Util. Code § 11501 et seq.	5
Municipal Water District	Water Code § 71000 et seq.	40
Public Utility District	Pub. Util. Code § 15501 et seq.	54
Reclamation District	Water Code § 50000 et seq.	152
Recreation and Park District	Pub. Resources Code § 5780 et seq.	110
Resort Improvement District	Pub. Resources Code § 13000 et seq.	-
Resource Conservation District	Pub. Resources Code § 9001 et seq.	99
Water Conservation District	Water Code App. 34; Wat. Code § 74000 et seq.	13
Water District	Water Code § 34000 et seq.	141
Water Replenishment District	Water Code § 60000 et seq.	1
Water Storage District	Water Code § 39000 et seq.	8

a. From State Controller's Office Special Districts Annual Report, 49th Edition.

Greater authority to manage groundwater has been granted to a small number of local agencies or districts created through special acts of the Legislature. For example, the Sierra Valley Groundwater Basin Act of 1980 (Water Code, App. 119) created the first two groundwater management districts in California. Currently, 13 local agencies have specific groundwater management authority as a result of being special act districts. The specific authority of each agency varies, but they can generally be grouped into two categories. Most of the agencies formed since 1980 have the authority to limit export and even control some in-basin extraction upon evidence of overdraft or the threat of overdraft. These agencies can also generally levy fees for groundwater management activities and for water supply replenishment. Agencies formed prior to 1980 do not have authority to limit extraction from a basin. However, the groundwater users in these areas are generally required to report extractions to the agency, and the agency can levy fees for groundwater management or water supply replenishment. Some of these agencies have effectively used a tiered fee

structure to discourage excessive groundwater extraction in the basin. Table 3 lists the names of special act districts with legislative authority to manage groundwater.

Table 3 Special act districts with groundwater management authority in California

District or agency	Water Code citation[a]	Year agency established in Code[b]
Desert Water Agency	App. 100	1961
Fox Canyon Groundwater Management Agency	App. 121.	1982
Honey Lake Groundwater Management District	App. 129.	1989
Long Valley Groundwater Management District	App. 119.	1980
Mendocino City Community Services District	Section 10700 et seq.	1987
Mono County Tri-Valley Groundwater Management District	App. 128.	1989
Monterey Peninsula Water Management District	App. 118.	1977
Ojai Groundwater Management Agency	App. 131.	1991
Orange County Water District	App. 40.	1933
Pajaro Valley Water Management Agency	App. 124.	1984
Santa Clara Valley Water District	App. 60.	1951
Sierra Valley Groundwater Management District	App. 119.	1980
Willow Creek Groundwater Management Agency	App. 135.	1993

a. From West's Annotated California Codes (1999 update)
b. This represents the year the agency was established in the Water Code. Specific authorities, such as those for groundwater management activities, may have been granted through later amendments.

In 1991, AB 255 (Stats. 1991, Ch. 903) was enacted authorizing local agencies overlying basins subject to critical conditions of overdraft, as defined in DWR's Bulletin 118-80, to establish programs for groundwater management within their service areas. Water Code section 10750 et seq. provided these agencies with the powers of a water replenishment district to raise revenue for facilities to manage the basin for the purposes of extraction, recharge, conveyance, and water quality. Seven local agencies adopted plans under this authority.

The provisions of AB 255 were repealed in 1992 with the passage of AB 3030 (Stats. 1992, Ch. 947). This legislation was significant in that it greatly increased the number of local agencies authorized to develop a groundwater management plan and set forth a common framework for management by local agencies throughout California. AB 3030, which is codified in Water Code section 10750 et seq., provides a systematic procedure to develop a groundwater management plan by local agencies overlying the groundwater basins defined by Bulletin 118-75 (DWR 1975) and updates. Upon adoption of a plan, these agencies could possess the same authority as a water replenishment district to "fix and collect fees and assessments for groundwater management" (Water Code, § 10754). However, the authority to fix and collect these fees and assessments is contingent on receiving a majority of votes in favor of the proposal in a local election (Water Code, § 10754.3). More than 200 agencies have adopted an AB 3030 groundwater management plan. None of these agencies is known to have exercised the authority of a Water Replenishment District.

Water Code section 10755.2 expands groundwater management opportunities by encouraging coordinated plans and by authorizing public agencies to enter into a joint powers agreement or memorandum of understanding with public or private entities that provide water service. At least 20 coordinated plans have been prepared to date involving nearly 120 agencies, including cities and private water companies.

Local Groundwater Ordinances

A second general method of managing groundwater in California is through ordinances adopted by local governments such as cities or counties. Twenty-seven counties have adopted groundwater ordinances, and others are being considered (Figure 8). The authority of counties to regulate groundwater has been challenged, but in 1995 the California Supreme Court declined to review an appeal of a lower court decision *Baldwin v. County of Tehama* (1994) that holds that State law does not occupy the field of groundwater management and does not prevent cities and counties from adopting ordinances to manage groundwater under their police powers. However, the precise nature and extent of the police power of cities and counties to regulate groundwater is uncertain.

The Public Policy Institute of California recently performed a study of California's water transfer market, which included a detailed investigation of the nature of groundwater ordinances by counties in California. The report found that 22 counties had adopted ordinances requiring a permit to export groundwater. In all but three cases, restricting out-of-county uses appears to be the only purpose (Hanak 2003). One ordinance, adopted recently in Glenn County (Box D, "Basin Management Objectives for Groundwater Management"), takes a comprehensive approach by establishing management objectives for the county's groundwater basins. Several other counties in Northern California are considering adopting similar management objective based ordinances.

Ordinances are mostly a recent trend in groundwater management, with 24 of the 27 ordinances enacted since 1990. Local ordinances passed during the 1990s have significantly increased the potential role of local governments in groundwater management. The intent of most ordinances has been to hold project proponents accountable for impacts that may occur as a result of proposed export projects. Because adoption of most of these ordinances is recent, their effect on local and regional groundwater management planning efforts is not yet fully known. However, it is likely that future groundwater development will take place within the constraints of local groundwater management ordinances. Table 4 lists counties with groundwater management ordinances and their key elements.

Figure 8 Counties with groundwater ordinances

Box D Basin Management Objectives for Groundwater Management

Most county groundwater management ordinances require that an export proponent prove the project will not deplete groundwater, cause groundwater quality degradation, or result in land subsidence. Although these factors could be part of any groundwater management plan, these ordinances do not require that a groundwater management plan be developed and implemented.

The only ordinance requiring development and adoption of objectives to be accomplished by management of the basin was adopted by the Glenn County Board of Supervisors in 2000. The action came after a citizens committee spent five years working with stakeholders. The process of developing a groundwater management ordinance for Glenn County began in 1995 when local landowners and county residents became concerned about plans to export groundwater or substitute groundwater for exported surface water. Control of exports was the focus of early ordinance discussions.

After long discussions and technical advice from groundwater specialists, the committee realized that goals and objectives must be identified for effective management of groundwater in the county. What did the county want to accomplish by managing groundwater within the county? What did groundwater management really mean?

The concept of establishing basin management objectives emerged (BMOs). BMOs would establish threshold values for groundwater levels, groundwater quality, and land surface subsidence. When a threshold level is reached, the rules and regulations require that groundwater extraction be adjusted or stopped to prevent exceeding the threshold.

The Glenn County Board of Supervisors has adopted BMOs, which were developed by an advisory committee, for groundwater levels throughout the county. While currently there are 17 BMOs representing the 17 management areas in the county, the goal is to begin managing the entire county in a manner that benefits each of the local agencies and their landowners, as well as landowners outside of an agency boundary. The committee is now developing BMOs for groundwater quality and land surface subsidence.

There is no single set of management objectives that will be successful in all areas. Groundwater management must be adapted to an area's political, institutional, legal, and technical constraints and opportunities. Groundwater management must be tailored to each basin or subbasin's conditions and needs. Even within a single basin, the management objectives may change as more is learned about managing the resource within that basin. Flexibility is the key, but that flexibility must operate within a framework that ensures public participation, monitoring, evaluation, feedback on management alternatives, rules and regulations, and enforcement.

Table 4 Counties with ordinances addressing groundwater management

County	Year enacted	Key elements (refer to ordinances for exemptions and other details)
Butte	1996	Export permit required (extraction & substitute pumping), Water Commission and Technical Advisory Committee, groundwater planning reports (county-wide monitoring program)
Calaveras	2002	Export permit required (extraction & substitute pumping)
Colusa	1998	Export permit required (extraction & substitute pumping)
Fresno	2000	Export permit required (extraction & substitute pumping)
Glenn	1990 rev. 2000	Water Advisory Committee and Technical Advisory Committee, basin management objectives and monitoring network, export permit required (1990)
Imperial	1996	Commission established to manage groundwater, including controlling exports (permit required), overdraft, artificial recharge, and development projects
Inyo	1998	Regulates (1) water transfers pursuant to Water Code Section 1810, (2) sales of water to the City of Los Angeles from within Inyo Co., (3) transfer or transport of water from basins within Inyo County to another basin with the County, and (4) transfers of water from basins within Inyo Co. to any area outside the County.
Kern	1998	Conditional use permit for export to areas both outside county and within watershed area of underlying aquifer in county. Only applies to southeastern drainage of Sierra Nevada and Tehachapi mountains.
Lake	1999	Export permit required (extraction & substitute pumping)
Lassen	1999	Export permit required (extraction & substitute pumping)
Madera	1999	Permit required for export, groundwater banking, and import for groundwater banking purposes to areas outside local water agencies
Mendocino	1995	Mining of groundwater regulated for new developments in Town of Mendocino
Modoc	2000	Export permit required for transfers out of basin
Mono	1988	Permit required for transfers out of basin
Monterey	1993	Water Resources Agency strictly regulates extraction facilities in zones with groundwater problems
Napa	1996	Permits for local groundwater extractions; exemptions for single parcels and agricultural use
Sacramento	1952 rev. 1985	Water Agency established to manage and protect groundwater management zones; replenishment charges
San Benito	1995	Mining groundwater (overdraft) for export prohibited; permit required for off-parcel use, injecting imported water; influence of well pumping restrictions
San Bernardino	2002	Permit required for any new groundwater well within the desert region of the county
San Diego	1991	Provides for mapping of groundwater impacted basins (defined); projects within impacted basins require groundwater investigations
San Joaquin	1996	Export permit required (extraction & substitute pumping)
Shasta	1997	Export permit required (extraction & substitute pumping)
Sierra	1998	Export permit required or for off-parcel use
Siskiyou	1998	Permit required for transfers out of basin
Tehama	1992	Mining groundwater (overdraft) for export prohibited; permit required for off-parcel use; influence of well pumping restrictions
Tuolumne	2001	Export permit required (extraction & substitute pumping)
Yolo	1996	Export permit required (extraction & substitute pumping)

Adjudicated Groundwater Basins

A third general form of groundwater management in California is court adjudication. In some California groundwater basins, as the demand for groundwater exceeded supply, landowners and other parties turned to the courts to determine how much groundwater can rightfully be extracted by each user. The courts study available data to arrive at a distribution of the groundwater that is available each year, usually based on the California law of overlying use and appropriation. This court-directed process can be lengthy and costly. As noted in Table 5, the longest adjudication took 24 years. Many of these cases have been resolved with a court-approved negotiated settlement, called a stipulated judgment. Unlike overlying and non-overlying rights to groundwater, such decisions guarantee to each party a proportionate share of the groundwater that is available each year. The intense technical focus on the groundwater supply and restrictions on groundwater extraction for all parties make adjudications one of the strongest forms of groundwater management in California.

There are 19 court adjudications for groundwater basins in California, mostly in Southern California (see Table 5). Eighteen of the adjudications were undertaken in State Superior Court and one in federal court. For each adjudicated groundwater basin, the court usually appoints a watermaster to oversee the court judgment. In 15 of these adjudications, the court judgment limits the amount of groundwater that can be extracted by all parties based on a court-determined safe yield of the basin. The basin boundaries are also defined by the court. The Santa Margarita Basin was adjudicated in federal court. That decision requires water users to report the amount of surface water and groundwater they use, but groundwater extraction is not restricted.

Most basin adjudications have resulted in either a reduction or no increase in the amount of groundwater extracted. As a result, agencies often import surface water to meet increased demand. The original court decisions provided watermasters with the authority to regulate extraction of the quantity of groundwater; however, they omitted authority to regulate extraction to protect water quality or to prevent the spread of contaminants in the groundwater. Because water quantity and water quality are inseparable, watermasters are recognizing that they must also manage groundwater quality.

Box E Adjudication of Groundwater Rights in the Raymond Basin

The first basin-wide adjudication of groundwater rights in California was in the Raymond Basin in Los Angeles County in 1949 (*Pasadena v. Alhambra*). The first water well in Raymond Basin was drilled in 1881; 20 years later, the number of operating wells grew to about 140. Because of this pumping, the City of Pasadena began spreading water in 1914 to replenish the groundwater, and during the next 10 years the city spread more than 20,000 acre-feet.

Pumping during 1930 through 1937 caused water levels to fall 30 to 50 feet in wells in Pasadena. After attempting to negotiate a reduction of pumping on a cooperative basis, the City of Pasadena, on September 23, 1937, filed a complaint in Superior Court against the City of Alhambra and 29 other pumpers to quiet title to the water rights within Raymond Basin. The court ruled that the city must amend its complaint, making defendants of all entities pumping more than 100 acre-feet per year, and that it was not a simple quiet title suit but, a general adjudication of the water rights in the basin.

In February 1939, a court used the reference procedure under the State Water Code to direct the State Division of Water Resources, Department of Public Works (predecessor to the Department of Water Resources) as referee to review all physical facts pertaining to the basin, determine the safe yield, and ascertain whether there was a surplus or an overdraft. The study took 2-1/2 years to complete and cost more than $53,000, which was paid by the parties. The resulting Report of Referee submitted to the court in July 1943 found that the annual safe yield of the basin was 21,900 acre-feet but that the actual pumping and claimed rights were 29,400 acre-feet per year.

Most parties agreed to appoint a committee of seven attorneys and engineers to work out a stipulated agreement. In 1944, the court designated the Division of Water Resources to serve as watermaster for the stipulated agreement, which all but one of the parties supported. On December 23, 1944, the judge signed the judgment that adopted the stipulation.

The stipulation provided that (1) the water was taken by each party openly, notoriously, and under a claim of right, which was asserted to be, and was adverse to each and all other parties; (2) the safe yield would be divided proportionally among the parties; and (3) each party's right to a specified proportion of the safe yield would be declared and protected. It also established an arrangement for the exchange of pumping rights among parties.

Based on the stipulation, the court adopted a program of proportionate reductions. In so doing, the court developed the doctrine of mutual prescription, whereby the rights were essentially based on the highest continual amount of pumping during the five years following the beginning of the overdraft, and under conditions of overdraft, all of the overlying and appropriative water users had acquired prescriptive rights against each other, that is, mutual prescription.*

In 1945, one party appealed the judgment, and in 1947, the District Court of Appeals reversed and remanded *Pasadena v. Alhambra.* However, on June 3, 1949, the State Supreme Court overturned the appellate court's decision and affirmed the original judgment. In 1950, the court granted a motion by the City of Pasadena that there be a review of the determination of safe yield, and in 1955, the safe yield and the total decreed rights were increased to 30,622 acre-feet per year. In 1984, watermaster responsibilities were assigned to the Raymond Basin Management Board.

*In City of Los Angeles v. City of San Fernando (1975) the California Supreme Court rejected the doctrine of mutual prescription and held that a groundwater basin should be adjudicated based on the correlative rights of overlying users and prior appropriation among non-overlying users. For further discussion, see Appendix B.

Table 5 List of adjudicated basins

Court name	Relationship to DWR Bulletin 118 basin name; county	Basin No.	Filed in court	Final decision	Watermaster and/or website
1—Scott River Stream System	Scott River Valley; Siskiyou	1-5	1970	1980	Two local irrigation districts
2—Santa Paula Basin	Subbasin of Santa Clara River; Ventura	4-4	1991	1996	Three-person technical advisory committee from United Water CD, City of Ventura, and Santa Paula Basin Pumpers Association; www.unitedwater.org
3—Central Basin	Northeast part of Coastal Plain of Los Angeles County Basin; Los Angeles	4-11	1962	1965	DWR—Southern District; wwwdpla.water.ca.gov/sd/watermaster/watermaster.html
4—West Coast Basin	Southwest part of Coastal Plain of Los Angeles County Basin; Los Angeles	4-11	1946	1961	DWR—Southern District; wwwdpla.water.ca.gov/sd/watermaster/watermaster.html
5—Upper Los Angeles River Area	San Fernando Valley Basin (entire watershed); Los Angeles	4-12	1955	1979	Superior Court appointee
6—Raymond Basin	Northwest part of San Gabriel Valley Basin; Los Angeles	4-13	1937	1944	Raymond Basin Management Board
7—Main San Gabriel Basin	San Gabriel Valley Basin, excluding Raymond Basin; Los Angeles	4-13	1968	1973	Water purveyors and water districts elect a nine-member board; www.watermaster.org/
Puente Narrows, *Addendum to Main San Gabriel Basin decision*			1972	1972	Two consulting engineers
8—Puente	San Gabriel Valley Basin, excluding Raymond Basin; Los Angeles	4-13	1985	1985	Three consultants
9—Cummings Basin	Cummings Valley Basin; Kern	5-2	1966	1972	Tehachapi-Cummings County Water District; www.tccwd.com/gwm.htm
10—Tehachapi Basin	Tehachapi Valley West Basin and Tehachapi Valley East Basin; Kern	5-28 6-45	1966	1973	Tehachapi-Cummings County Water District; www.tccwd.com/gwm.htm
11—Brite Basin	Brite Valley; Kern	5-80	1966	1970	Tehachapi-Cummings County Water District; www.tccwd.com/gwm.htm

Table 5 List of adjudicated basins (continued)

Court name	Relationship to DWR Bulletin 118 basin name; county	Basin No.	Filed in court	Final decision	Watermaster and/or website
12—Mojave Basin Area Adjuducation	Lower, Middle & Upper Mojave River Valley Basins; El Mirage & Lucerne valleys; San Bernardino	6-40, 6-41, 6-42	1990	1996	Mojave Water Agency; www.mojavewater.org/mwa700.htm
13—Warren Valley Basin	Part of Warren Valley Basin; San Bernardino	7-12	1976	1977	Hi-Desert Water District; www.mojavewater.org
14—Chino Basin	Northwest part of Upper Santa Ana Valley Basin; San Bernardino and Riverside	8-2	1978	1978	Nine people, recommended by producers and appointed by the court; www.cbwm.org/
15—Cucamonga Basin	North central part of Upper Santa Ana Valley Basin; San Bernardino	8-2	1975	1978	Not yet appointed, operated as part of Chino Basin
16—San Bernardino Basin Area	Northeast part of Upper Santa Ana Basin; San Bernardino and Riverside	8-2	1963	1969	One representative each from Western Municipal Water District of Riverside County & San Bernardino Valley Municipal Water District
17—Six Basins	Six subbasins in northwest upper Santa Ana Valley; Upper & Lower Claremont Heights, Canyon, Pomona, Live Oak & Ganesha; Los Angeles. Small portions of Upper Claremont Heights and Canyon are in San Bernardino County	4-14, 8-2	1998	1998	Nine-member board representing all parties to the judgment
18—Santa Margarita River watershed	The Santa Margarita River watershed, including 3 groundwater basins: Santa Margarita Valley, Temecula Valley and Cahuilla Valley Basins; San Diego and Riverside.	9-4, 9-5, 9-6	1951	1966	U.S. District Court appointee
19—Goleta	Goleta Central Basin; judgment includes North Basin; Santa Barbara	3-16	1973	1989	No watermaster appointed; the court retains jurisdiction

How Successful Have Groundwater Management Efforts Been?

This chapter describes the opportunities for local agencies to manage their groundwater resources. Many have questioned whether these opportunities have led to an overall successful system of groundwater management throughout California. How successful groundwater management has been throughout the State is a difficult question and cannot be answered at present. While there are many examples of local agency successes (see Box F, "Managing through a Joint Powers Agreement," Box G, "Managing a Basin through Integrated Water Management," and Box H, "Managing Groundwater Using both Physical and Institutional Solutions"), there are neither mandates to prepare groundwater management plans nor reporting requirements when plans are implemented, so a comprehensive assessment of local planning efforts is not possible. Additionally, many plans have been adopted only recently, during a period of several consecutive wet years, so many of the plan components are either untested or not implemented.

At a minimum, successful groundwater management should be defined as maintaining and maximizing long-term reliability of the groundwater resource, focused on preventing significant depletion of groundwater in storage over the long term and preventing significant degradation of groundwater quality. A review of some of the groundwater management plans prepared under AB 3030 reveals that some plans are simply brief recitations about continuing the agency's existing programs. Not all agencies that enacted groundwater management plans under AB 3030 are actively implementing the plan.

Despite this apparent lack of implementation of groundwater management plans prepared under AB 3030, the bill has certainly increased interest in more effective groundwater management. With more than 200 agencies participating in plans and more than 120 of those involved in coordinated plans with other agencies, AB 3030 has resulted in a heightened awareness of groundwater management. Additionally, annual reports published by a few water agencies indicate that they are indeed moving toward better coordination throughout the basin and more effective management of all water supplies. Given the history of groundwater management in California, these seemingly small steps toward better management may actually represent giant strides forward.

More recently, financial incentives have played a large role in driving groundwater management activities. For example, under grant and loan programs resulting from Proposition 13 of 2000 (see description in Chapter 4), local agencies submitted applications proposing a total increase in annual water yield of more than 300,000 acre-feet through groundwater storage projects. Additional projects and programs would be developed with sufficient funding for feasibility and pilot studies. Unfortunately, not enough funding exists for all of the proposed projects, and many other legal and institutional barriers remain (see Box I, "Impediments to Conjunctive Management Programs in California"). It is clear, however, that further incentives would help agencies move ahead more aggressively in their groundwater management planning efforts.

Additional progress in groundwater management is reflected by passage of amendments to the Water Code (§§ 10753.4 and 10795.4 as amended, §§ 10753.7, 10753.8, and 10753.9 as amended and renumbered, and §§ 10753.1 and 10753.7 as added) through SB 1938 of 2002. The amendments require that groundwater management plans include specific components for agencies to be eligible for some public funds for groundwater projects. The provisions of SB 1938 (2001) are fully described in Chapters 3 and 4.

This evaluation of groundwater management success has not really considered ordinances and adjudications. Adjudications have been successful at maintaining the groundwater basin conditions, often restricting pumping for all basin users. In some cases, adjudication provides the necessary framework for more proactive management as well. Ordinances have successfully restricted exports from basins, but have not

Box F Managing through a Joint Powers Agreement

In 1993, representatives from business, environmental, public, and water purveyor interests formed the Sacramento Area Water Forum to develop a plan to protect the region's water resources from the effects of prolonged drought as the demand for water continues to grow. The Water Forum was founded on two co-equal objectives: (1) to provide a reliable and safe water supply for the region's economic health and planned development to the year 2030 and (2) to preserve the fishery, wildlife, recreational and aesthetic values of the lower American River.

After a six-year consensus-based process of education, analysis and negotiation, the participants signed a Water Forum agreement to meet these objectives. The agreement provides a framework for avoiding future water shortages, environmental degradation, groundwater contamination, threats to groundwater reliability, and limits to economic prosperity.

The Sacramento Groundwater Authority (SGA) was formed to fulfill a key Water Forum goal of protecting and managing the north-area groundwater basin. The SGA is a joint powers authority formed for the purpose of collectively managing the region's groundwater resources. This authority permits SGA to make contractual arrangements required to implement a conjunctive use program, and also provides potential partners with the legal and political certainty for entering into long-term agreements.

SGA's regional banking and exchange program is designed to provide long-term supply benefits for local needs, but also will have the potential to provide broader statewide benefits consistent with American River environmental needs. Water stored in Folsom Lake would be conjunctively used with groundwater in order to reduce surface water diversions in dry years and to achieve in-lieu recharge of the basin in wet years. The conjunctive use program participants include 16 water providers in northern Sacramento and southern Placer counties that serve water to more than half a million people.

Two of three implementation phases of the program are complete. In the first phase, program participants identified long-term water supply needs and conducted an inventory of existing infrastructure that could be used to implement the program. In the second phase, SGA completed two pilot banking and exchange projects, demonstrating the technical, legal, and institutional viability of a regional conjunctive use program. In the first pilot study, water agencies worked with the U.S. Bureau of Reclamation and the Sacramento Area Flood Control Agency to bank 2,100 acre-feet of groundwater, providing additional flood storage capacity in Folsom Lake. In the second pilot study, Citrus Heights and Fair Oaks water districts and the city of Sacramento extracted and used 7,143 acre-feet of groundwater, forgoing a portion of their rights to surface water, making this water available to the Environmental Water Account. The third phase of the SGA program is to further solidify the institutional framework and construct facilities to implement a full-scale regional conjunctive use program. These facilities, that will result in an average annual yield of 21,400 acre-feet, are currently under construction, funded in part by a $21.6 million grant under Proposition 13 of 2000.

Box G Managing a Basin through Integrated Water Management

Orange County Water District (OCWD) was established in 1933 by an uncodified Act (Water Code App. 40) to manage Orange County's groundwater basin and protect the Santa Ana River rights of water users of north-central Orange County. The district manages the groundwater basin, which provides as much as 75 percent of the water supply for its service area. The district strives for a groundwater-based water supply with enough reserves to provide a water supply through drought conditions. An integrated set of water management practices helps achieve this, including the use of recharge, alternative sources, and conservation.

Recharge

The Santa Ana River provides the main natural recharge source for the county's groundwater basin. Increased groundwater use and lower-than-average rainfall during the late 1980s and early 1990s forced the district to rely on an aggressive program to enhance recharge of the groundwater basin. Programs used today to optimize water use and availability include:

- Construction of levees in the river channel to increase infiltration.
- Construction of artificial recharge basins within the forebay.
- Development of an underwater basin cleaning vehicle that removes a clogging layer at the bottom of the recharge basin and extends the time between draining the basin for cleaning by a bulldozer.
- Use of storm water captured behind Prado Dam that would otherwise flow to the ocean.
- Use of imported water from the State Water Project and Colorado River.
- Injection of treated recycled water to form a seawater intrusion barrier.

Alternative Water Use and Conservation

OCWD has successfully used nontraditional sources of water to help satisfy the growing need for water in Orange County. Projects that have added to the effective supply of groundwater are:

- Use of treated recycled water for irrigation and industrial use.
- In-lieu use to reduce groundwater pumping.
- Change to low-flow toilets and showerheads.
- Participation of 70 percent of Orange County hotels and motels in water conservation programs.
- Change to more efficient computerized irrigation.

Since 1975, Water Factory 21 has provided recycled water that meets all primary and secondary drinking water standards set by the California Department of Health Services. OCWD has proposed a larger, more efficient membrane purification project called the Groundwater Replenishment System (GWRS), which is scheduled to begin operating at 70,000 acre-feet per year in 2007. By 2020 the system will annually supply 121,000 acre-feet of high quality water for recharge, for injection into the seawater intrusion barrier, and for direct industrial uses.

This facility will use a lower cost microfiltration and reverse osmosis treatment process that produces water of near distilled quality, which will help reverse the trend of rising total dissolved solids (TDS) in groundwater caused by the recharge of higher TDS-content Santa Ana River and Colorado River waters. The facility will use about half the energy required to import an equivalent amount of water to Orange County from Northern California. The GWRS will be funded, in part, by a $30 million grant under Proposition 13 of 2000.

Source: Orange County Water District

Box H Managing Groundwater using both Physical and Institutional Solutions

Four agencies share responsibility for groundwater management in Ventura County. Coordination and cooperation between these agencies focus on regular meetings, attendance at each other's board meetings, joint projects, watershed committees, and ongoing personal contacts to discuss water-related issues. The agencies and their areas of responsibility are:

- United Water Conservation District – physical solutions, monitoring, modeling, reporting, administering management plans and adjudication;
- Fox Canyon Groundwater Management Agency – pumping allocations, credits and penalties, abandoned well destruction, data for irrigation efficiency;
- County of Ventura – well permits, well construction regulations, tracking abandoned wells; and
- Calleguas Municipal Water District – groundwater storage of imported water.

In Ventura County 75% to 80% of the extracted groundwater is for agriculture; the remainder is for municipal and industrial use. Seawater intrusion into the aquifers was recognized in the 1940s and was the driving force behind a number of groundwater management projects and policies in the county's groundwater basins. As groundwater issues became more complicated at the end of the 20th century, these groundwater management projects and policies were useful in solving a number of problems.

Physical Solutions

Physical solutions substitute supplemental surface water for groundwater pumping near coastal areas, increase basin recharge, and increase the reliability of imported water. Projects include:

- Winter flood-flow storage for dry season release
- Wells and pipelines to move pumping for drinking water away from the coast
- Diversion structures to supply surface water to spreading grounds and irrigation
- Pipelines to convey surface water to coastal areas
- Las Posas Basin Aquifer Storage and Recovery project

Institutional Solutions

Institutional solutions focus on developing and implementing effective groundwater management programs, reducing pumping demands, tracking groundwater levels and water quality, managing groundwater pumping patterns, and destroying abandoned wells to prevent cross-contamination of aquifers. Solutions include:

- Creation of Fox Canyon Groundwater Management Agency (GMA), which represents each major pumping constituency
- Use of irrigation efficiency (agriculture), water conservation, and alternative sources of water (urban) to reduce pumping by 25%
- Manage outside the GMA area through an AB 3030 plan and a court adjudication
- Limit new permits for wells in specific aquifers to avoid seawater intrusion
- Creation of a program to destroy abandoned wells
- Creation of a database of historical groundwater levels and quality information collected since the 1920s
- Development of a regional groundwater flow model and a regional master plan for groundwater projects
- Creation of an irrigation weather station to assist in irrigation efficiency

Implementation of these physical and institutional management tools has resulted in the reversal of seawater intrusion in key coastal monitoring wells. These same tools are being used to mitigate saline intrusion (not seawater) in two inland basins and to reduce seasonal nitrate problems in the recharge area. Work is being expanded to help reduce loading of agricultural pesticides and nutrients. Without close coordination and cooperation of the county's water-related agencies, municipalities, and landowners, it would have been very difficult to implement most of these solutions. Although such coordination takes time, the investment has paid off in solutions that help provide a sustainable water supply for all water users in Ventura County.

Source: United Water Conservation District

necessarily improved groundwater management. The primary intent of most ordinances is to ensure that proponents of projects are held accountable for potential impacts of the proposed export projects. As studies lead to a better understanding of local water resources, development of pilot export and transfer projects, with appropriate monitoring, may lead to greater certainty in managing groundwater resources. Areas managed under adjudications and ordinances will continue to develop more active management approaches. Population growth and its accompanying increased demand on the resources is a certainty. Most geographic areas in California are not immune to this growth, so strategies for more than just maintaining existing groundwater supply through extraction or export restrictions need to be implemented.

Box I Impediments to Conjunctive Management Programs in California

In 1998 the National Water Research Institute, in cooperation with the Association of Ground Water Agencies and the Metropolitan Water District of Southern California, conducted a workshop to determine the biggest impediments to implementing a cost-effective conjunctive water management program in California.

Since that time, some steps have been taken to overcome those impediments, but several important barriers remain. Workshop participants identified the 10 most significant obstacles:

1) Inability of local and regional water management governance entities to build trust, resolve differences (internally and externally), and share control.
2) Inability to match benefits and funding burdens in ways that are acceptable to all parties, including third parties.
3) Lack of sufficient federal, State, and regional financial incentives to encourage groundwater conjunctive use to meet statewide water needs.
4) Legal constraints that impede conjunctive use, regarding storage rights, basin judgments, area of origin, water rights, and indemnification.
5) Lack of statewide leadership in the planning and development of conjunctive use programs as part of comprehensive water resources plans, which recognize local, regional, and other stakeholders' interests.
6) Inability to address quality difference in "put" versus "take"; standards for injection, export, and reclaimed water; and unforeseeable future groundwater degradation.
7) Risk that water stored cannot be extracted when needed because of infrastructure, water quality or water level, politics, and institutional or contractual provisions.
8) Lack of assurances to prevent third-party impacts and assurances to increase willingness of local citizens to participate.
9) Lack of creativity in developing lasting "win-win" conjunctive use projects, agreements, and programs.
10) Supplemental suppliers and basin managers have different roles and expectations in relation to conjunctive use.

[**Editor's note**: The California Department of Water Resources' Conjunctive Water Management program has taken significant steps to overcome several of these impediments, using a combination of California Bay-Delta Authority, DWR, Proposition 13, and AB 303 funds to promote locally planned and controlled conjunctive use programs.]

Future Groundwater Management in California

Trying to predict what will happen with groundwater management in California is difficult given that actions by all of the involved groups—landowners, local governments, local, State, and federal agencies, and the courts—will continue to shape groundwater management in the future. However, the increasing population and its demands on California's water supply will accelerate the rate at which groundwater management issues become critical and require resolution. Some general conclusions are:

- Groundwater management will continue to be a local responsibility with increasing emphasis on how actions in one part of a basin impact groundwater resources throughout the basin. Regional cooperation and coordination of groundwater management activities will increase.

- As the State's population continues to grow, the increased reliance on groundwater will keep the topic of groundwater management at the forefront of legislative interest.

- Coordinated management of groundwater and surface water resources, through further development of conjunctive water management programs and projects, will become increasingly important.

- The increased reliance on groundwater in the future will necessitate a more direct link between land use planning, watershed management, floodplain management, and groundwater management plans.

- Current trends indicate that financial incentives in the form of loans and grants are increasing groundwater management planning and implementation at the local level. These successes will only continue at the current pace with increased funding to local agencies.

- Management of groundwater will increasingly include consideration of groundwater quality and groundwater quantity.

- Groundwater will be an important element in the trend toward an integrated water management approach that considers the full range of demand management and supply alternatives.

- Understanding of the relationship of groundwater and surface water and the role of groundwater in the environment will continue to grow.

Box J Managing Groundwater Quantity and Quality

When people hear the words "groundwater monitoring"' they may think either of measuring groundwater levels or of analyzing for groundwater quality. In reality, monitoring and management of groundwater quantity and groundwater quality are inseparable components of a management plan.

Although the primary focus of the California Department of Water Resources (DWR) is on groundwater quantity and the measures taken by local agencies to manage supply, management must also consider groundwater quality. Natural or anthropogenic contamination and pumping patterns that are not managed to protect groundwater quality may limit the quantity of groundwater that is available for use in a basin.

Several State programs provide useful data as well as regulatory direction on groundwater quality that managers can use in managing their groundwater supply. One program is the Drinking Water Source Assessment and Protection Program prepared by the California Department of Health Services in response to 1996 amendments to the federal Safe Drinking Water Act. The DWSAP requires water purveyors to assess sources of drinking water, develop zones indicating time of travel of groundwater, and identify potentially contaminating activities around supply wells. The goal is to ensure that the quality of drinking water sources is maintained and protected. Other useful water quality data for groundwater managers is collected by the agencies within the California Environmental Protection Agency, including the State Water Resources Control Board, Department of Pesticide Regulation and the Department of Toxic Substances Control, which are discussed in more detail in Chapter 5. Each of these agencies has a specific statutory responsibility to collect groundwater quality information and protect water quality.

Protection of Recharge Areas

Groundwater recharge areas, and the human activities that can render them unusable, are an example of the need to coordinate land use activities to protect both groundwater quality and quantity. Protection of recharge areas, whether natural or man-made, is necessary if the quantity and quality of groundwater in the aquifer are to be maintained. Existing and potential recharge areas must be protected so that they remain functional, that is they continue to provide recharge to the aquifer and they are not contaminated with chemical or microbial constituents. Land-use practices should be implemented so that neither the quantity nor quality of groundwater is reduced. A lack of protection of recharge areas could decrease the availability of usable groundwater and require the substitution of a more expensive water supply.

Many potentially contaminating activities have routinely been practiced in recharge areas, leading to the presence of contaminants in groundwater. In many areas, groundwater obtained from aquifers now requires remediation. Recent studies in some areas show that recharge areas are contaminated, but down-gradient wells are not, indicating that it is only a matter of time before contaminants in wells reach concentrations that require treatment of the groundwater.

In addition to quality impacts, urban development, consisting of pavement and buildings on former agricultural land, lining of flood control channels, and other land use changes have reduced the capacity of recharge areas to replenish groundwater, effectively reducing the safe yield of some basins.

Box J Managing Groundwater Quantity and Quality (continued)

To ensure that recharge areas continue to replenish high quality groundwater, water managers and land use planners should work together to:

- Identify recharge areas so the public and local zoning agencies are aware of the areas that need protection from paving and from contamination;
- Include recharge areas in zoning categories that eliminate the possibility of contaminants entering the subsurface;
- Standardize guidelines for pre-treatment of the recharge water, including recycled water;
- Build monitoring wells to collect data on changes in groundwater quality that may be caused by recharge; and
- Consider the functions of recharge areas in land use and development decisions.

Chapter 3
Groundwater Management Planning and Implementation

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Groundwater Management Planning and Implementation

The 1990s were a very important decade in the history of groundwater management in California. In 1992, the State Legislature provided an opportunity for more formal groundwater management with the passage of AB 3030 (Water Code § 10750 et seq.). More than 200 agencies have adopted an AB 3030 groundwater management plan. Additionally, 24 of the 27 counties with ordinances related to groundwater management adopted those laws during the 1990s. Plans prepared under AB 3030 certainly brought unprecedented numbers of water agencies into the groundwater management arena, and counties are now heavily involved in groundwater management, primarily through ordinances. However, many plans prepared under AB 3030 have had little or no implementation, and many counties focus primarily on limiting exports rather than on a comprehensive management program. As a result, the California Budget Act of 1999 (Stats. 1999, ch. 50), which authorized this update to Bulletin 118, directed the California Department of Water Resources (DWR) to complete several tasks, including developing criteria for evaluating groundwater management plans and developing a model groundwater management ordinance. This chapter presents the results of these directives. The intent is to provide a framework that will assist local agencies in proactively planning and implementing effective groundwater management programs.

Criteria for Evaluating Groundwater Management Plans—Required and Recommended Components

In 2002, the Legislature passed SB 1938 (Stats 2002, ch 603), which amended Water Code section 10750 et seq to require that groundwater management plans adopted by local agencies include certain components to be eligible for public funds administered by DWR for construction of groundwater projects; the statute applies to funds authorized or appropriated after September 1, 2002. In addition to the required components, DWR worked with representatives from local water agencies to develop a list of additional recommended components that are common to effective groundwater management.

Both the "required" and the "recommended" components are tools that local agencies can use either to institute a groundwater management plan for the first time or to update existing groundwater management plans. These components are discussed below and listed in Appendix C, which can be used as a checklist by local agencies to assess whether their groundwater management plans are addressing these issues.

Required Components of Local Groundwater Management Plans

As of January 1, 2003, amendments to Water Code Section 10750 et seq., resulting from the passage of SB 1938, require new groundwater management plans prepared under section 10750, commonly referred to as AB 3030 plans, to include the first component listed below.

Groundwater management plans prepared under any statutory authority must include components 2 through 7 to be eligible for the award of public funds administered by DWR for the construction of groundwater projects or groundwater quality projects. These requirements apply to funds authorized or appropriated after September 1, 2002. Funds appropriated under Water Code section 10795 et seq. (AB 303 – Local Groundwater Assistance Fund) are specifically excluded.

1) Documentation that a written statement was provided to the public "describing the manner in which interested parties may participate in developing the groundwater management plan" (Water Code, § 10753.4 (b)).

2) Basin management objectives (BMOs) for the groundwater basin that is subject to the plan (Water Code, § 10753.7 (a)(1)).
3) Components relating to the monitoring and management of groundwater levels, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping (Water Code, § 10753.7 (a)(1)).
4) A plan by the managing entity to "involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin" (Water Code, § 10753.7 (a)(2)). A local agency includes "any local public agency that provides water service to all or a portion of its service area" (Water Code, § 10752 (g)).
5) Adoption of monitoring protocols (Water Code, § 10753.7 (a)(4)) for the components in Water Code section 10753.7 (a)(1). Monitoring protocols are not defined in the Water Code, but the section is interpreted to mean developing a monitoring program capable of tracking changes in conditions for the purpose of meeting BMOs.
6) A map showing the area of the groundwater basin as defined by DWR Bulletin 118 with the area of the local agency subject to the plan as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan (Water Code, § 10753.7 (a)(3)).
7) For local agencies not overlying groundwater basins, plans shall be prepared including the above listed components and using geologic and hydrologic principles appropriate to those areas (Water Code, § 10753.7 (a)(5)).

Recommended Components of Groundwater Management Plans

Although the seven components listed above are required only under certain conditions, they should always be considered for inclusion in any groundwater management planning process. In addition to the required components of a groundwater management plan resulting from the passage of SB 1938, it is recommended that the components listed below be included in any groundwater management plan adopted and implemented by a local managing entity. These additional components were developed in accord with the Budget Act of 1999 and with the assistance of stakeholder groups. The components should be considered and developed for specific application within the basin, subbasin, or agency service area covered by the plan. Additional components will likely be needed in specific areas. The level of detail for each component will vary from agency to agency. None of the suggested data reporting in the components should be construed to require disclosure of information that is confidential under State law. Local agencies should consider both the benefits of public dissemination of information and water supply security in developing reporting requirements.

Manage with the Guidance of an Advisory Committee

The managing entity should establish an advisory committee of interested parties that will help guide the development and implementation of the plan. The committee can benefit management in several ways. First, the committee can bring a variety of perspectives to the management team. As the intent of local groundwater management is to maintain and expand local benefits from the availability of the resource, it makes sense that the intended beneficiaries are a part of the management process. Second, the committee is free to focus on the specifics of groundwater management without being distracted by the many operational activities that the managing entity (such as a water district) must complete. Third, some parties could be negatively impacted by certain groundwater management decisions, and these actions and potential adverse impacts should be a part of the decision-making process to help reduce future conflicts. Finally, the advisory committee helps the managing entity gain the confidence of the local constituency by providing the opportunity for interested parties to participate in the management process.

Many managing entities have already elected to use advisory committees for implementation of their groundwater management plans. The composition of these committees varies widely. Some groups consist entirely of stakeholders, others add local or State government representatives or academic members as impartial third parties, and some have included consultants as technical advisers. Some plans use multiple advisory committees to manage unique subareas. Some plans appoint advisory committees with different objectives, such as one that deals with technical issues and another that deals with policy issues. There is no formula for the composition of an advisory committee because it should ultimately be based on local management needs and should include representation of diverse local interests.

The Tulare Lake Bed Coordinated Management Plan provides an example of the benefit of an advisory committee. The plan includes nine groups of participants, making coordination and communication a complicated issue. To allow for greater communication, an executive committee was established consisting of one voting member from each public agency participating in the plan and one voting member representing a combined group of private landowner plan participants. The committee administers groundwater management activities and programs for the plan (TLBWSD 2002).

Describe the Area to Be Managed under the Plan

The plan should include a description of the physical setting and characteristics of the aquifer system underlying the plan area in the context of the overall basin. The summary should also include a description of historical data, including data related to groundwater levels, groundwater quality, subsidence, and groundwater-surface water interaction; known issues of concern with respect to the above data; and a general discussion of historical and projected water demands and supplies. All of these data are critical to effective groundwater management because they demonstrate the current understanding of the system to be managed and serve as a point of departure for monitoring activities as part of plan implementation.

Create a Link Between Management Objectives and Goals and Actions of the Plan

The major goal of any groundwater management plan is to maintain a reliable supply of groundwater for long-term beneficial uses of groundwater in the area covered by the plan. The plan should clearly describe how each of the adopted management objectives helps attain that goal. Further, the plan should clearly describe how current and planned actions by the managing entity help meet the adopted management objectives. The plan will have a greater chance of success by developing an understanding of the relationship between each action, management objectives, and the goal of the groundwater management plan.

For example, prevention of contamination of groundwater from the land surface is a management objective that clearly supports the goal of groundwater sustainability. Management actions that could help support this objective include (1) educating the public through outreach programs that explain how activities at the surface ultimately impact groundwater, (2) developing wellhead protection programs or re-evaluating existing programs, (3) working with the local responsible agency to ensure that permitted wells are constructed, abandoned, and destroyed according to State well standards, (4) investigating whether local conditions necessitate higher standards than those adopted by the local permitting agency for the construction, abandonment, or destruction of wells, and (5) working with businesses engaged in practices that might impact groundwater to reduce the risks of contamination.

The concept of having a management objective is certainly not new. While many existing plans do not clearly include management objectives nor specifically identify actions to achieve objectives, some plans indirectly include these components. As an example, Eastern Municipal Water District's (EMWD) Groundwater Management Plan states that its goal includes maximizing "the use of groundwater for all beneficial uses in such a way as to lower the cost of water supply and to improve the reliability of the total

water supply for all users." To achieve this goal, EMWD has listed several issues to be addressed. One is the prevention of long-term depletion of groundwater. This can be defined as a management objective even though it is not labeled as such. Where this management objective is currently unmet in the North San Jacinto watershed portion of the plan area, EMWD has identified specific actions to achieve that objective including the reduction of groundwater extraction coupled with pursuing the construction of a pipeline to act as an alternative source of surface water for the impacted area (EMWD 2002).

Describe the Plan Monitoring Program

The groundwater management plan should include a map indicating the locations of any applicable monitoring sites for groundwater levels, groundwater quality, subsidence, stream gaging, and other applicable monitoring. The groundwater management plan should summarize the type of monitoring (for example, groundwater level, groundwater quality, subsidence, streamflow, precipitation, evaporation, tidal influence), type of measurements, and the frequency of monitoring for each location. Site specific monitoring information should be included in each groundwater management plan. The plan should include the well depth, screened interval(s) and aquifer zone(s) monitored and the type of well (public, irrigation, domestic, industrial, monitoring). These components will serve as a tool for the local managing entity to assess the adequacy of the existing monitoring network in tracking the progress of plan activities.

The groundwater management plan developed for the Scotts Valley Water District (SVWD) provides a detailed description of the monitoring program in Santa Cruz County (Todd Engineers 1994) Table 6 is SVWD's monitoring table, which serves as an example of the level of detail that is useful in a plan (Todd Engineers 2003a). Figure 9 shows the locations and types of monitoring points for each monitoring site. The monitoring table specifies in detail the data available and the planned monitoring. These serve as useful tools for SVWD to visualize the types and distribution of data available for their groundwater management activities. In addition to the minimum types of monitoring, SVWD summarizes other types of data that are relevant to their groundwater management effort.

Describe Integrated Water Management Planning Efforts

Water law in California treats groundwater and surface water as two separate resources with the result that they have largely been managed separately. Such management does not represent hydrologic reality. Recently, managers of a number of resources are becoming increasingly aware of how their planning activities could impact or be impacted by the groundwater system. Because of this, the local managing entity should describe any current or planned actions to coordinate with other land use, zoning, or water management planning entities.

Integrated management is addressed in existing groundwater management plans in several ways, including conjunctively managing groundwater with surface water supplies, recharging water from municipal sewage treatment plants, and working with local planning agencies to provide comments when a project is proposed that could impact the groundwater system.

Examples of planning efforts that should be integrated with groundwater management may include watershed management, protection of recharge areas, agricultural water management, urban water management, flood management, drinking water source assessment and protection, public water system emergency and disaster response, general plans, urban development, agricultural land preservation, and environmental habitat protection or restoration. Another example that may appear insignificant is transportation infrastructure. However, local impacts on smaller aquifers could be significant when landscaping of medians and interchanges requires groundwater pumping for irrigation or when paved areas are constructed over highly permeable sediments that act as recharge zones for the underlying aquifer.

Table 6 Scotts Valley Water District's Groundwater Monitoring Plan

Monitoring type	Location	Measurement type	Date started	Frequency/ maintainer	Notes
Precipitation	El Pueblo Yard	15-minute recording	Feb-85	Daily/District, Monthly/City	Other historic gages:(1) Blair site on Granite Ck. Rd. (Jan. 1975 - Dec. 1980)
	WWTP	5-minute recording	1990	Daily/City	(2) Hacienda Dr. (Jul. 1974 - Mar. 1979) (3) El Pueblo Yard bucket gage (Jan. 1981 - Jan. 1985)
Evaporation	El Pueblo Yard	Pan	Jan-86	Daily/District	Evaporation pan raw data not compiled after July 1990
Evapotranspiration	De Laveaga Park, Santa Cruz	Automated active weather station	Sep-90	California Irrigation Management Information System/Monthly	Data available on-line through CIMIS
Streamflow	Carbonera Ck at Scotts Valley @ Cabonera Way Bridge (#111613000)	15-minute recording	Jan-85	USGS/ Daily	Other historic gages: (1) Carbonera Ck @ Santa Cruz (#11161400) 150 feet upstream from mouth (1974-1976 partial data)
	Bean Ck near Scotts Valley @ Hermon Crossing (#11160430)	15-minute recording	Dec-88	USGS/ Daily	(2) Bean Ck near Felton (#11160320) (1973-1978 partial data), low flows at same location (1983-1988)
	Eagle Creek In Henry Cowell Redwoods State Park	Bucket-Fall, Flow Meter-Spring	Mar-01	Semi-annually/ Todd Engineers	(3) Carbonera Creek @ Glen Canyon (1990-1994?)
Well Inventory	T10S/R01E Sections 6-9, 16-20, 30 and T10S/R02E Sections 1,11-14, 23-26, 36	Over 400 wells: location, log, type, capacity, etc. stored in GIS, and Access database	1950s	Logs from DWR maintained by Todd Engineers	
Groundwater Levels	~34 Santa Magarita aquifer and ~14 Lompico formation wells	Depth to water	1968	Quarterly/ District and cooperators	Data from over 75 wells, as early as 1968, bi-monthly 1983-1989
Pumpage	T10S/R01E Sections 6-9, 16-20, 30 and T10S/R02E Sections 1,11-14, 23-26, 36 District wells in production and on standby	Metered	1975	Monthly/ Scotts Valley Water District, Mt. Hermon Association, Hanson Aggregates West, San Lorenzo Valley Water District	Other historic pumpage data: Manana Woods (1988-1996 partial data)

Table 6 Scotts Valley Water District's Groundwater Monitoring Plan (continued)

Monitoring type	Location	Measurement type	Date started	Frequency/ maintainer	Notes
Groundwater Quality	T10S/R01E Sections 6-9, 16-20, 30 and T10S/R02E Sections 1,11-14,23-26, 36 District wells in production	Title 22 constituents	1963	At least semi-annual/ District and others	Data from over 80 wells, as early as 1963, monitoring frequency similar to groundwater level program
	North Scotts Valley 3 shallow monitoring wells	Metals, nitrogen species, general minerals	Mar-01	Semi-annually/ Todd Engineers	
Surface Water Quality	4 sites on Carbonera and 3 sites on Bean Creek	Grab samples - metals, nitrogen species, general minerals	Mar-01	Semi-annually/ Todd Engineers	
Wastewater Outflows	City of Scotts Valley WWTP @ Lundy Lane	Wastewater outflow volume and effluent quality	1965	Daily/City of Scotts Valley	Plant operational in 1965 (septic systems pre-1965)
Recycled Water Production	Scotts Valley WWTP	Recycled water quantity and quality	2002	At least quarterly/ WWTP	

Source: Todd Engineering 2003a

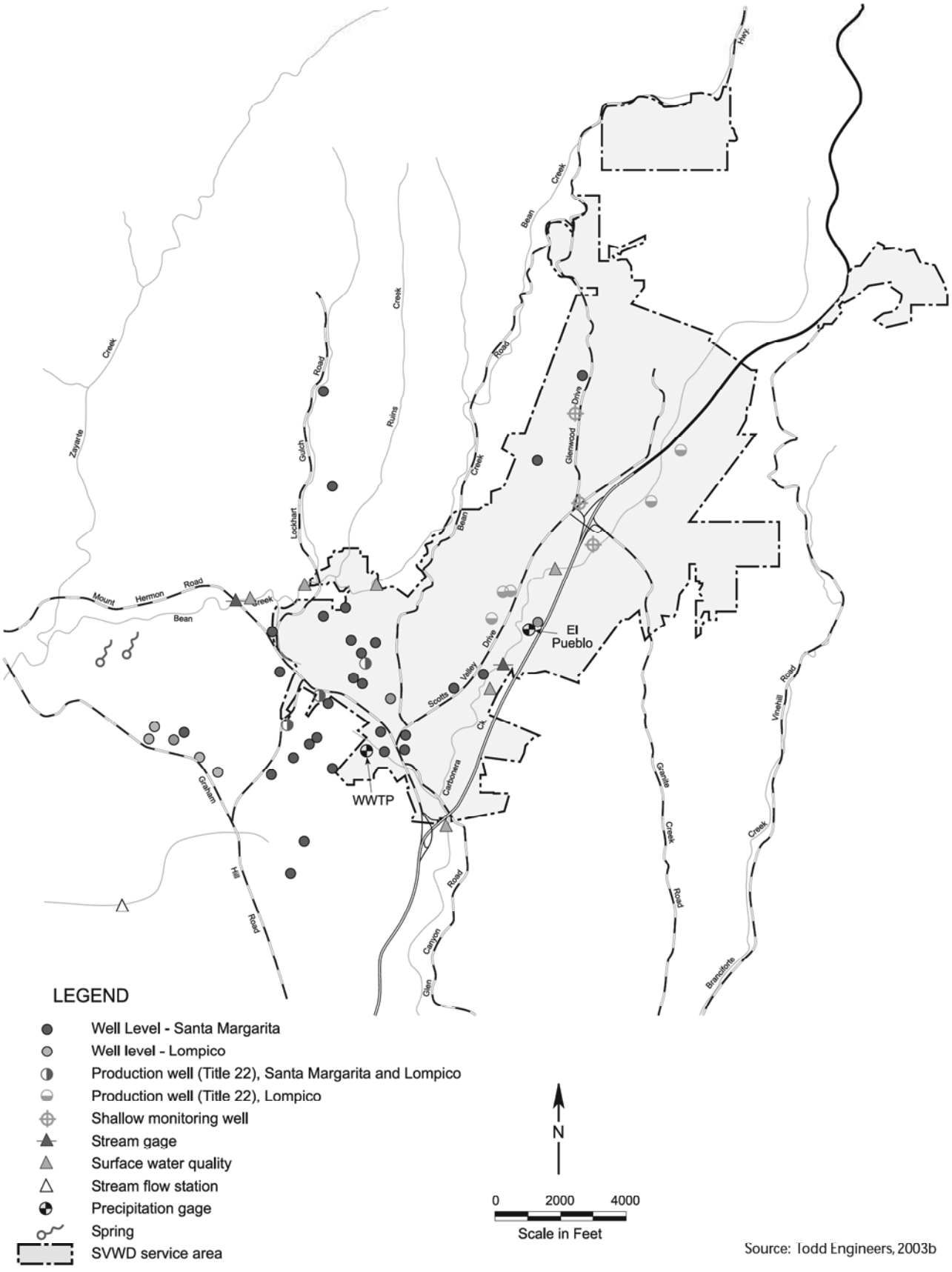

Figure 9 Scotts Valley Water District's Groundwater Management Plan monitoring locations

Box K What are Management Objectives?

Management objectives are the local managing entity's way of identifying the most important issues in meeting local resource needs; they can be seen as establishing a "value system" for the plan area. There is no fixed set of management objectives for any given plan area. Some of the more commonly recognized management objectives include the monitoring and managing of groundwater levels, groundwater quality, inelastic land subsidence, and changes in streamflow and surface water quality where they impact or are impacted by groundwater pumping. Management objectives may range from being entirely qualitative to strictly quantified.

Each management objective would have a locally determined threshold value associated with it, which can vary greatly. For example, in establishing a management objective for groundwater quality, one area may simply choose to establish an average value of total dissolved solids as the indicator of whether a management objective is met, while another agency may choose to have no constituents exceeding the maximum contaminant level for public drinking water standards. While there is great latitude in establishing management objectives, local managers should remember that the objectives should serve to support the goal of a sustainable supply for the beneficial use of the water in their particular area.

An example of an alternative management objective is Orange County Water District's (OCWD) objective of maintaining available storage space in its management area at 200,000 acre-feet. The objective does not require that groundwater elevations be fixed at any particular location, although managing to this objective would likely have the net benefit of stabilizing water levels. Groundwater storage is a dynamic value, so attempting to meet this management objective is an ongoing challenge. OCWD has implemented many management actions directly aimed at managing the basin to meet this objective.

The Deer Creek and Tule River Authority provides an excellent example of how groundwater management activities can be coordinated with other resources. The authority, in conjunction with the U.S. Bureau of Reclamation, has constructed more than 200 acres of recharge basins as part of its Deer Creek Recharge-Wildlife Enhancement Project. When available, the project takes surplus water during winter months and delivers it to the basins, which serve as winter habitat for migrating waterfowl, creating a significant environmental benefit. Most of the water also recharges into the underlying aquifer, thereby benefiting the local groundwater system.

Report on Implementation of the Plan

The managing entity should produce periodic reports—annually or at other frequencies determined by the local managing entity—summarizing groundwater basin conditions and groundwater management activities. For the period since the previous update, the reports should include:

- A summary of monitoring results, including historical trends,
- A summary of actual management actions,
- A summary, supported by monitoring results, of whether management actions are achieving progress in meeting management objectives,
- A summary of proposed management actions, and
- A summary of any plan component changes, including addition or modification of management objectives.

Unfortunately, many plans were prepared in the mid-1990s with little or no follow-up documentation of whether the plan is actually being implemented. This makes it difficult to determine what progress has been achieved in managing the groundwater resource. Periodic reports will serve as a tool for the managing entity to organize its many activities to implement the plan, act as a driving force for plan implementation, and help interested parties understand the progress made by local entities in managing their groundwater resource.

Progress reports on SVWD (Todd Engineers 2002) and EMWD (2002) groundwater management plans serve as excellent examples of the value of such an exercise. Both reports effectively portray the results of management actions: progress toward achieving objectives and specific recommendations for future management actions. An example of reporting on the modification of a management objective for water quality can be found in EMWD's 2000 Annual Report (EMWD 2001). A task force of more than 20 water suppliers and wastewater agencies, including EMWD, worked to update the Regional Water Quality Control Board's Region 5 Basin Plan objectives for nitrogen and total dissolved solids in water, effectively changing EMWD's management objectives for those constituents.

Evaluate the Plan Periodically

The managing entity and advisory committee should re-evaluate the entire plan. Periodic evaluation of the entire management plan is essential to define successes and failures under the plan and identify changes that may be needed. Additionally, re-evaluation of the plan should include assessment of changing conditions in the basin that may warrant modification of the plan or management objectives. Adjustment of components in the plan should occur on an ongoing basis if necessary. The re-evaluation of the plan should focus on determining whether the actions under the plan are meeting the management objectives and whether the management objectives are meeting the goal of sustaining the resource.

While there are several examples of existing groundwater management plans that demonstrate ongoing changes to plan activities, there are no known examples of such an approach to entirely re-evaluate an existing plan. This is likely due in part to the occurrence of several consecutive wet years in the mid- and late-1990s. The abundant surface water supplies reduced the need to actively manage groundwater supplies in many cases. More recent dry conditions and the recent passage of SB 1938 will create an excellent opportunity for managing entities to begin a re-evaluation of existing plans.

Model Groundwater Management Ordinance

As discussed in the previous chapter, ordinances are groundwater management mechanisms enacted by local governments through exercise of their police powers to protect the health and safety of their citizens. In Baldwin v. Tehama County (1994), the appellate court declared that State law does not preempt the field of groundwater management.

In the mid- to late-1990s, many counties adopted ordinances that effectively prevented export of groundwater from the county, even though none specifically prohibited export. The intent of each of these ordinances is to sustain groundwater as a viable local resource. To ensure that goal, an export project proponent is required by most of the ordinances to show that the proposed project will not cause depletion of the groundwater, degradation of groundwater quality, or subsidence before a permit to export groundwater can be issued. Although these ordinances do not specifically require threshold limits for each of these potential negative impacts, a project proponent can really only show that these negative effects will not occur if the proponent develops a groundwater management plan.

Many of these ordinances were developed in response to the plans of some agencies or landowners to export groundwater or develop a groundwater substitution project where surface water is exported and groundwater is substituted for local use. In some cases, short-term export actually took place, leading to a number of claims of negative third party impacts. Residents of some counties became concerned because no one knew how much groundwater was available for local use and how much groundwater was available for export. In short, details of the hydrology of the basin, including surface water and groundwater availability, water quality, and the interaction of surface water and groundwater were not known. This lack of detailed knowledge about the operating potential of their groundwater resources led counties to take what they viewed as protective action, which consisted of requiring a permit before anyone could export groundwater from the county.

From the perspective of DWR, groundwater should be managed in a manner that ensures long-term sustainability of the resource for beneficial uses. Those beneficial uses are to be decided by the local stakeholders within the basin. In some areas, there may be an ample supply of water, so groundwater exports or substitution projects are feasible while local beneficial uses of the water supply are maintained. In other areas, limiting exports may be necessary to maintain local beneficial uses. Such determinations can be made only after the data are collected and evaluated and the results are used to develop management objectives for the basin.

While developing both the criteria for evaluating groundwater management plans and the model groundwater management ordinance, DWR staff has borne two principles in mind. First, the goal of groundwater management, whether accomplished by a plan or by an ordinance, is to sustain and often expand a groundwater resource. Second, groundwater management, whether accomplished by a plan or by an ordinance, requires that local agencies address and resolve the same or similar issues within the boundaries of the agencies. To say it in different words, whether it is a plan or an ordinance, good groundwater management should address the same issues and problems and arrive at the same conclusions and solutions to satisfy the needs of the local area. While some areas may allow or promote exports, others may not.

As stated above, the Legislature required a model ordinance as one of the elements of this update of Bulletin 118. The model ordinance is included as Appendix D and can be used by local governments that have identified a need to adopt a groundwater management ordinance. The model is an example of what a local ordinance might include. Local conditions will require some additions, modifications, or deletions. The variety of political, institutional, legal, technical, and economic opportunities and constraints throughout California guarantees that there will be differences to which the model will have to be adapted. Local governments interested in adopting a groundwater management ordinance are encouraged to consider all components included in the model.

Water Code section 10753.7(b)(1)(A) allows an agency to participate in or consent to be subject to a groundwater management plan, a basin-wide management plan, or other integrated regional water management plan in order to meet the funding eligibility requirements that resulted from passage of SB 1938 (2001). A local government that adopts an ordinance should consider whether or not it will have local agencies that do not have their own groundwater management plan, but consent to be managed under the ordinance. If this situation is anticipated, the ordinance should include the required components described in the Water Code so State funding can be pursued.

Chapter 4

Recent Actions Related to Groundwater Management

Chapter 4
Recent Actions Related to Groundwater Management

The past few years have seen significant actions that impact groundwater management in California. Below are several examples of recent actions including legislation, ballot measures, and executive orders that show the State Legislature and the citizens of California clearly recognize the importance of groundwater and its appropriate management in meeting the present and future water supply needs of the State.

Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act of 2000 (Proposition 13)

On March 7, 2000, California voters approved a $1.97-billion general obligation bond known as the Safe Drinking Water, Clean Water, Watershed Protection and Flood Protection Act (Proposition 13). Of the nearly $2 billion, $230 million was earmarked for groundwater programs. The act authorizes $200 million for grants for feasibility studies, project design, and construction of conjunctive use facilities (Water Code, § 79170 et seq.) and $30 million in loans for local agency acquisition and construction of groundwater recharge facilities and feasibility study grants for projects potentially eligible for the loan program (Water Code, § 79161 et seq.). More than $120 million have been awarded in grants and loans to local agencies in the first two years of implementation of these programs.

California Bay-Delta Record of Decision

The goal of the California Bay-Delta (formerly CALFED) program is to restore ecosystem health and improve water management in the Bay-Delta system. The program has four primary objectives:

- Provide good water quality for all beneficial uses
- Improve and increase aquatic and terrestrial habitats and improve ecological functions in the Bay-Delta to support sustainable populations of diverse and valuable plant and animal species
- Reduce the mismatch between Bay-Delta water supplies and current and projected beneficial uses dependent on the Bay-Delta system
- Reduce the risk to land use and associated economic activities, water supply, infrastructure, and the ecosystem from catastrophic breaching of Delta levees

The Record of Decision (ROD), released in August 2000, sets forth a 30-year plan to address ecosystem health and water supply reliability problems in the Bay-Delta system. The ROD lays out specific actions and investments over the first seven years to meet program goals. Most important, with respect to groundwater is the California Bay-Delta program's commitment to local groundwater management. The ROD states, "CALFED will work with local governments and affected stakeholders to develop legislation to strengthen AB 3030 and provide technical and financial incentives to encourage more effective basin-wide groundwater management plans…" (CALFED 2000). The ROD encourages basin management that is developed at the subbasin level so that it addresses local needs, but is coordinated at the basin-wide level so that it considers impacts to other users in the basin. The ROD also commits Bay-Delta agencies to "facilitate and fund locally supported, managed, and controlled groundwater and conjunctive use projects with a total of 500,000 acre-feet to 1 million acre-feet (maf) of additional storage capacity by 2007" (CALFED 2000).

Local Groundwater Management Assistance Act of 2000 (AB 303, Water Code Section 10795 et seq.)

The goal of the Local Groundwater Management Assistance Act is to help local agencies better understand how to manage groundwater resources effectively to ensure the safe production, quality, and proper storage of groundwater in the State. The act created the Local Groundwater Assistance Fund, which must be appropriated annually. In three years, more than $15 million in grants were awarded for 71 projects. Grants went to local agencies for groundwater studies and projects that contribute to basin and subbasin management objectives, including but not limited to groundwater monitoring and groundwater basin management. Grants are available to all geographic areas of the State. This act serves to emphasize that groundwater is recognized as an important local resource and, to the extent that groundwater is properly managed at the local level, serves to benefit all Californians.

Groundwater Quality Monitoring Act of 2001 (AB 599, Water Code Section 10780 et seq.)

Assembly Bill 599, known as the Groundwater Quality Monitoring Act of 2001, set a goal to establish comprehensive groundwater monitoring and increase the availability of information about groundwater quality to the public. The objective of the program is to highlight those basins in which contamination has occurred or is likely to occur and provide information that will allow local managers to develop programs to curtail, treat, or avoid additional contamination. The act required the State Water Resources Control Board (SWRCB), in coordination with an Interagency Task Force (ITF) and a Public Advisory Committee (PAC), to integrate existing monitoring programs and design new program elements, as necessary, to establish a comprehensive statewide groundwater quality monitoring program.

Through the ITF and PAC, the Comprehensive Groundwater Quality Monitoring Program was developed. The program will seek to:

- Accelerate the monitoring and assessment program already established by the SWRCB,
- Implement monitoring and assessment in accordance with a prioritization of basins/subbasins,
- Increase coordination and data sharing among groundwater agencies, and
- Maintain groundwater data in a single repository to provide useful access by the public while maintaining appropriate security measures.

The Comprehensive Groundwater Quality Monitoring Program is expected to provide the following key benefits:

- A common base communications medium for agencies to utilize and supply groundwater quality data at multiple levels,
- A mechanism to unite local, regional and statewide groundwater programs in a common effort,
- Better understanding of local, regional and statewide water quality issues and concerns that in turn can provide agencies at all levels with better information to deal with the concerns of consumers and consumer advocate groups,
- Groundwater agencies with trend and long-term forecasting information, essential for groundwater management plan preparation and implementation, and
- The motivation for small- and medium-sized agencies to begin or improve their own groundwater monitoring and management programs.

Water Supply Planning

Three bills enacted by the Legislature to improve water supply planning processes at the local level became effective January 1, 2002. In general, the new laws are intended to improve the assessment of water supplies during the local planning process before land use projects that depend on water are approved. The new laws require the verification of sufficient water supplies as a condition for approving developments, and they compel urban water suppliers to provide more information on the reliability of groundwater if used as a supply.

SB 221 (Bus. and Prof. Code, § 11010 as amended; Gov. Code, § 65867.5 as amended; Gov. Code, §§ 66455.3 and 66473.7) prohibits approval of subdivisions consisting of more than 500 dwelling units unless there is verification of sufficient water supplies for the project from the applicable water supplier(s). This requirement also applies to increases of 10 percent or more of service connections for public water systems with less than 500 service connections. The law defines criteria for determining "sufficient water supply," such as using normal, single-dry, and multiple-dry year hydrology and identifying the amount of water that the supplier can reasonably rely on to meet existing and future planned uses. Rights to extract additional groundwater must be substantiated if used for the project.

SB 610 (Water Code, §§ 10631, 10656, 10910, 10911, 10912, and 10915 as amended; Pub. Resources Code, § 21151.9 as amended) and AB 901 (Water Code, §§ 10610.2 and 10631 as amended; Water Code § 10634) make changes to the Urban Water Management Planning Act to require additional information in Urban Water Management Plans (UWMP) if groundwater is identified as a source available to the supplier. Required information includes a copy of any groundwater management plan adopted by the supplier, proof that the developer or agency has rights to the groundwater, a copy of the adjudication order or decree for adjudicated basins, and if not adjudicated, whether the basin has been identified as being overdrafted or projected to be overdrafted in the most current DWR publication on the basin. If the basin is in overdraft, the UWMP must include current efforts to eliminate any long-term overdraft. A key provision in SB 610 requires that any project subject to the California Environmental Quality Act supplied with water from a public water system be provided a water supply assessment, except as specified in the law. AB 901 requires the plan to include information relating to the quality of existing sources of water available to an urban water supplier over given periods and include the manner in which water quality affects water management strategies and supply reliability.

Emergency Assistance to the Klamath Basin

On May 4, 2001, the Governor proclaimed a State of Emergency in the Klamath Basin in Siskiyou and Modoc counties. The proclamation included disaster assistance of up to $5 million under authority of the State Natural Disaster Assistance Act. This assistance went directly into constructing wells to extract groundwater for use on cover crops to avoid loss of critical topsoil. The Governor's proclamation also included $1 million for a study of the Klamath River Basin to determine the long-term water supply in the California portion of the basin.

Governor's Drought Panel

The Governor's Advisory Drought Planning Panel was formed in 2000 to develop a contingency plan to address the impacts of critical water shortages in California. The panel formed with the recognition that critical water shortages may severely impact the health, welfare, and economy of California. Panel recommendations included securing funding for the Local Groundwater Management Assistance Act (described above), continued support of critical groundwater monitoring in basins with inadequate data, and the formation of a technical assistance and education program for "rural homeowners and small domestic water systems relying on self-supplied groundwater" (GADPP 2000).

Sacramento Valley Water Management Agreement

On May 22, 1995, SWRCB adopted the "Water Quality Control Plan for the San Francisco Bay/Sacramento San Joaquin Delta Estuary" (the 1995 WQCP). Following this action, SWRCB initiated a water rights hearing process with the intent of allocating responsibility for meeting the standards of the 1995 WQCP among water right holders in areas tributary to the Delta. The water rights hearing was conducted in phases with all phases being resolved with the exception of Phase 8, which involved water rights holders in the Sacramento Valley.

Proceeding with Phase 8 may have involved litigation and judicial review for years. That extended process could have resulted in adverse impacts to the environment and undermined progress on other statewide water management initiatives. To avoid the consequences of delay, the Sacramento Valley Water Users, DWR, the U.S. Bureau of Reclamation (USBR), and export water users developed the Sacramento Valley Water Management Agreement. The agreement became effective April 20, 2001. At that time SWRCB issued an order staying the Phase 8 hearing for 18 months. The parties negotiated a short-term settlement agreement that obligated DWR and USBR to continue to fully meet the Bay-Delta water quality standards while providing for the development of conjunctive use and system improvement projects by participating upstream water rights holders that would make water available to help meet water quality standards while improving the reliability of local water supplies. SWRCB has subsequently dismissed the Phase 8 proceedings, and work is being undertaken on both short-term and long-term activities included in the Sacramento Valley Water Management Agreement.

Groundwater Management Water Code Amendments

In September 2002, SB 1938 (Water Code, § 10753.4 and § 10795.4 as amended; Water Code, § 10753.7, § 10753.8 and § 10753.9 as amended and renumbered; Water Code, § 10753.1 and § 10753.7 as added) was signed into law. The act amends existing law related to groundwater management by local agencies. The law requires any public agency seeking State funds administered through DWR for the construction of groundwater projects or groundwater quality projects to prepare and implement a groundwater management plan with certain specified components. Prior to this, there were no required plan components. New requirements include establishing basin management objectives, preparing a plan to involve other local agencies in a cooperative planning effort, and adopting monitoring protocols that promote efficient and effective groundwater management. The requirements apply to agencies that have already adopted groundwater management plans as well as agencies that do not overlie groundwater basins identified in Bulletin 118 and its updates when these agencies apply for state funds. The requirements do not apply to funds administered through the AB 303-Local Groundwater Management Assistance Act (Water Code, § 10795 et seq.) or to funds authorized or appropriated prior to September 1, 2002. Further discussion of the requirements is included in Chapter 3 and Appendix C.

Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 (Proposition 50)

California voters approved the Water Security, Clean Drinking Water, Coastal and Beach Protection Act of 2002 (Proposition 50; Water Code, § 79500 et seq.) in the November 2002 elections. The initiative provides for more than $3.4 billion of funding, subject to appropriation by the Legislature, for a number of land protection and water management activities.

Several chapters of Proposition 50 allocate funds for specified water supply and water quality projects, including:

- Chapter 3 Water Security. Provides $50 million to protect State, local, and regional drinking water systems from terrorist attack or deliberate acts of destruction or degradation.

- Chapter 4 Safe Drinking Water. Provides $435 million for grants and loans for infrastructure improvements to meet safe drinking water standards.
- Chapter 5 Clean Water and Water Quality. Provides $390 million for a number of water quality and environmental improvements.
- Chapter 6 Contaminant and Salt Removal Technologies. Provides $100 million for desalination of ocean or brackish waters as well as treatment and removal of contaminants.
- Chapter 7 California Bay-Delta program. Provides $825 million for continuing implementation of all elements of the program.
- Chapter 8 Integrated Regional Water Management. Provides $500 million for many categories of water management projects that will protect communities from drought, protect and improve water quality, and reduce dependence on imported water supplies.
- Chapter 9 Colorado River. Provides $70 million for canal-lining projects necessary to reduce water use and to meet commitments related to California's allocation of water from the Colorado River.

Chapter 5

The Roles of State and Federal Agencies in California Groundwater Management

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Even though groundwater management is a local responsibility and mostly voluntary, several State and federal agencies have key roles in California groundwater management. Some of these roles may not be immediately recognized, but because they work toward the goal of maintaining a reliable groundwater supply, they are closely related to groundwater management. Some of the programs available through the California Department of Water Resources (DWR) and other agencies that assist local agencies in managing groundwater resources are described below.

Local Groundwater Management Assistance from DWR

DWR's role in groundwater management begins with the fundamental understanding that groundwater management is locally driven and management programs should respond to local needs and concerns. DWR recognizes that when groundwater is effectively managed at the local level, benefits are realized at a statewide level.

DWR has historically maintained many programs that directly benefit local groundwater management efforts including:

- Providing assistance to local agencies to assess basin hydrogeologic characteristics,
- Assisting local agencies to identify opportunities to develop additional groundwater supply,
- Monitoring groundwater levels and quality,
- Providing watermaster services for court-adjudicated basins,
- Providing standards for well construction and destruction,
- Managing the State's extensive collection of well completion reports, and
- Reviewing proposals and distributing grant funds and low-interest loans for conjunctive use projects, as well as local groundwater management and monitoring programs.

Conjunctive Water Management Program

DWR's Conjunctive Water Management Program consists of a number of integrated efforts to assist local agencies in improving groundwater management and increasing water supply reliability.

One goal of the Integrated Storage Investigations (ISI) Program, an element of the Bay-Delta program, is to increase water supply reliability statewide through the planned, coordinated management and use of groundwater and surface water resources. The effort emphasizes forming working partnerships with local agencies and stakeholders to share technical data and costs for planning and developing locally controlled and managed conjunctive water management projects.

Toward that end, the Conjunctive Water Management Program has:

- Developed a vision in which DWR would assist local agencies throughout the State so that these agencies can effectively manage groundwater resources,
- Adopted a set of working principles to ensure local planning; local control, operation, and management of conjunctive use projects; voluntary implementation of projects; and local benefits from the proposed projects,
- Executed memoranda of understanding with 30 local agency partners and provided technical and financial assistance to study groundwater basins and assess opportunities for conjunctive water management,

- Provided technical assistance in the form of groundwater monitoring, groundwater modeling, and local water management planning, as well as a review of numerous regional and statewide planning efforts on a variety of water issues, and
- Provided facilitation assistance to promote broad stakeholder involvement in regional water management planning processes.

DWR staff review proposals and distribute grants pursuant to the Local Groundwater Management Assistance Act of 2000 (AB 303). To date, DWR has awarded more than $15 million to local agencies to fund 71 projects dealing with groundwater investigation, monitoring, or management.

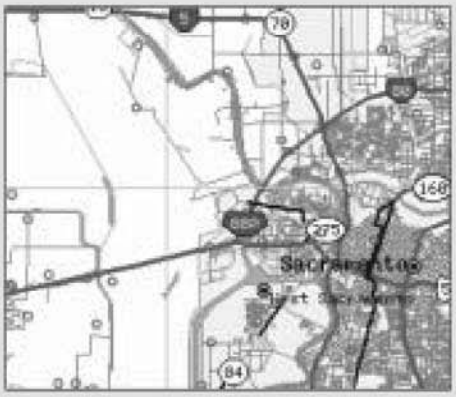
With funds provided under Proposition 13, DWR has awarded more than $170 million in loans and grants for groundwater recharge and storage studies and projects to local agencies throughout the State. Applicant estimates of the water supply reliability increases that will be realized from these projects exceeds 150 thousand acre-feet annually. Recipients of loans and grants must provide progress reports to allow an evaluation of the successes of the various programs. Figure 10 shows the distribution of loan and grant awardees throughout the State.

Both grant programs have active outreach efforts to inform and to assist agencies in preparation of applications. Selection of projects for funding relies in part on input from advisory committees composed of stakeholders from throughout the State.

Box L Providing Data:

The Internet Makes Groundwater Elevation Data Readily Accessible to the Public

In 1996, the California Department of Water Resources (DWR) began providing Internet access to groundwater level data and hydrographs for wells in groundwater basins throughout California. The website, which distributes historical data for more than 35,000 wells monitored by DWR and its many cooperators, has proven very popular, with more than 60,000 visits to date. Options include a form or map interface to locate wells with water level data and the ability to download long-term water levels for specific wells or seasonal measurements for specific areas to create groundwater contour maps. The accessibility of this data makes it a significant resource for local agencies in making sound groundwater management decisions. The address of the site is http://wdl.water.ca.gov/.



Wells can be located with a map interface. By clicking on a well, a hydrograph with the latest data available is automatically generated.

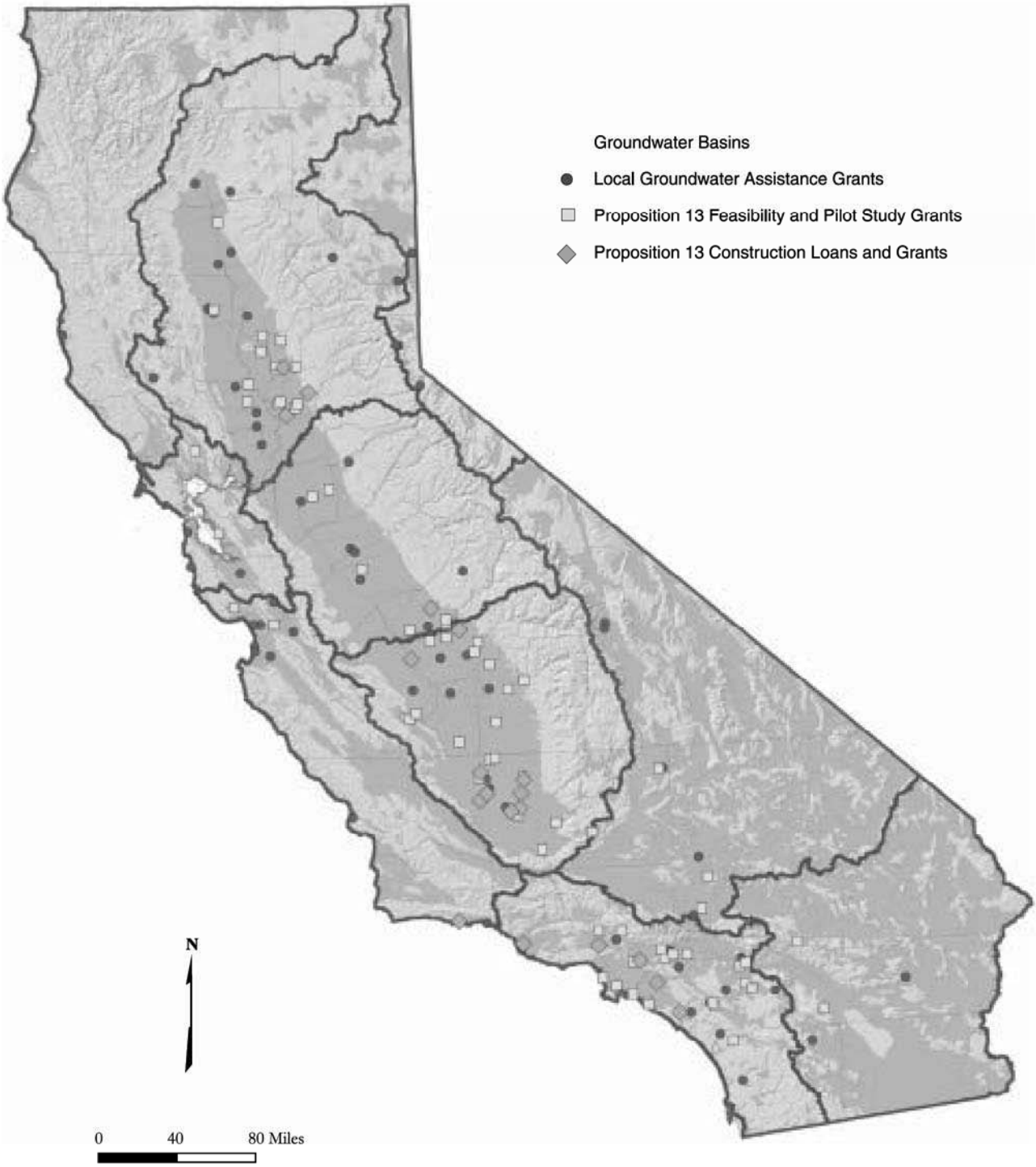


Figure 10 Broad distribution of grant and loan awardees for 2001 through 2003

Assistance from Other State and Federal Agencies

Many other State and federal agencies provide groundwater management assistance to local agencies. Some of those roles are described below. For more information on the roles of various agencies in protecting the groundwater resource, see the California Department of Health Services' Drinking Water Source Assessment and Protection Program Document (DHS 2000), California Groundwater Management (Bachman and others 1997), or the individual agency websites.

State Water Resources Control Board and Regional Water Quality Control Boards

http://www.swrcb.ca.gov The mission of the State Water Resources Control Board (SWRCB) is to ensure the highest reasonable quality of waters of the State, while allocating those waters to achieve the optimum balance of beneficial uses. In turn, the nine Regional Water Quality Control Boards (RWQCB) develop and enforce water quality objectives and implement plans to protect the beneficial uses of the State's waters, recognizing differences in climate, topography, geology, and hydrology.

SWRCB has many responsibilities regarding the protection of the groundwater resource. One of the more notable is the Groundwater Ambient Monitoring and Assessment (GAMA) Program. GAMA is a recently enacted program that will provide a comprehensive assessment of water quality in water wells throughout the state. GAMA has two main components: the California Aquifer Susceptibility (CAS) Assessment and the Voluntary Domestic Well Assessment Project.

The CAS combines age dating of water and sampling for low-level volatile organic compounds (VOCs), such as methyl tertiary-butyl ether (MTBE), to assess the relative susceptibility of all of approximately 16,000 public supply wells throughout the State. Age dating provides a general assessment of how quickly groundwater is moving through the system, while the sampling of low-level VOCs allows greater reaction time for potential remediation strategies before contaminants reach action levels. Sampling is being conducted by staff from the U.S. Geological Survey (USGS) and Lawrence Livermore National Laboratory. The CAS Assessment was developed cooperatively with DHS and DWR.

The Voluntary Domestic Well Assessment Project will provide a previously unavailable sampling of water quality in domestic wells, which will assist in assessing the relative susceptibility of California's groundwater. Because water quality in individual domestic wells is unregulated, the program is voluntary and will focus, as resources permit, on specific areas of the state. Constituents to be analyzed include nitrate, total and fecal coliform bacteria, MTBE, and minerals. Additional constituents will be added in areas with known water quality problems.

Other SWRCB/RWQCB activities related to groundwater protection include developing basin plans that identify existing and potential beneficial uses of marine water, groundwater, and surface waters; regulating the discharge of waste that may affect water quality in California; monitoring of landfills and hazardous waste facilities; establishing standards for the construction and monitoring of underground storage tanks; establishing management plans for control of nonpoint source pollutants; and issuing cleanup and abatement orders that require corrective actions by the responsible party for a surface water or groundwater pollution problem or nuisance.

The Groundwater Quality Monitoring Act of 2001 (AB599, Water Code, § 10780 et seq.) required the SWRCB to develop a comprehensive monitoring program in a report to the Legislature. See Chapter 4 for details.

California Department of Health Services

http://www.dhs.ca.gov/ps/ddwem The DHS Drinking Water Program, part of the Division of Drinking Water and Environmental Management, is responsible for DHS implementation of the federal Safe Drinking Water Act, as well as California statutes and regulations related to drinking water. As part of this responsibility, DHS inspects and provides regulatory oversight of approximately 8,500 public water systems (and approximately 16,000 drinking water wells) to assure delivery of safe drinking water to all California consumers.

Public water system operators are required to regularly monitor their drinking water sources for microbiological, chemical and radiological contaminants to show that drinking water supplies meet regulatory requirements (called primary maximum contaminant levels–MCLs). Among these contaminants are approximately 80 specific inorganic and organic chemical contaminants and six radiological contaminants that reflect the natural environment as well as human activities.

Public water system operators also monitor their water for a number of other contaminants and characteristics that deal with the aesthetic properties of drinking water (known as secondary MCLs). They are also required by regulation to analyze for certain unregulated contaminants (to allow DHS to collect information on emerging contaminants, for example), and to report findings of other contaminants that may be detected during routine monitoring. The DHS water quality monitoring database contains the results of analyses since 1984. These data, collected for purposes of regulatory compliance with drinking water laws, also provide an extensive body of information on the quality of groundwater throughout the State.

California Department of Pesticide Regulation

http://www.cdpr.ca.gov/dprprograms.htm The California Department of Pesticide Regulation (DPR) protects human health and the environment by regulating pesticide sales and use and by promoting reduced-risk pest management. DPR plays a significant role in monitoring for the presence of pesticides and in preventing further contamination of the groundwater resource.

DPR conducts six types of groundwater monitoring:

1) Monitoring for pesticides on a DPR-determined Ground Water Protection List, which lists pesticides with the potential to pollute groundwater;
2) Four-section survey monitoring to verify a reported detection and to help determine if a detected pesticide resulted from legal agricultural use;
3) Areal extent monitoring to identify the extent of contaminated wells;
4) Adjacent section monitoring to identify additional areas sensitive to pesticide movement to groundwater;
5) Monitoring to repeatedly sample a network of wells to determine whether pesticide residues are declining; and
6) Special project monitoring.

When pesticides are found in groundwater, they are normally regulated in one-square mile areas identified in regulation as sensitive to groundwater pollution. These pesticides are subject to permitting by the county agricultural commissioner and to use restrictions specified in regulation. DPR maintains an extensive database of pesticide sampling in groundwater and reports a summary of annual sampling and detections to the State Legislature.

California Department of Toxic Substances Control

http://www.dtsc.ca.gov The California Department of Toxic Substances Control (DTSC) has two programs related to groundwater resources protection: the Hazardous Waste Management Program and the Site Mitigation Program. These programs are authorized under Division 20 of the California Health and Safety Code, and implementing regulations are codified in Title 22 of the California Code of Regulations.

A critical element of both programs is maintaining environmental quality and economic vitality through the protection of groundwater resources. This is accomplished through hazardous waste facility permitting and design; oversight of hazardous waste handling, removal, and disposal; oversight of remediation of hazardous substances releases; funding of emergency removal actions involving hazardous substances, including the cleanup of illegal drug labs; cleanup of abandoned hazardous waste sites; oversight of the closure of military bases; and pollution prevention.

If groundwater is threatened or impacted by a hazardous substance release, DTSC provides technical oversight for the characterization and remediation of soil and groundwater contamination. DTSC and the nine RWQCBs coordinate regulatory oversight of groundwater remediation. To ensure site-specific groundwater quality objectives are met, DTSC consults with RWQCB staff and appropriate groundwater basin plans.

Box M Improving Coordination of Groundwater Information

California's groundwater resources are addressed by an array of different State and federal agencies. Each agency approaches groundwater from a unique perspective, based on its individual statutory mandate. As a result, each agency collects different types of groundwater data and information. To facilitate the effective and efficient exchange of groundwater resource information, the State Water Resources Control Board (SWRCB) is coordinating the Groundwater Resources Information Sharing Team (GRIST), which is composed of representatives from various groundwater agencies. Agencies currently participating in GRIST are:

- State Water Resources Control Board
- Department of Health Services
- Department of Water Resources
- Department of Pesticide Regulation
- Lawrence Livermore National Laboratory
- U.S. Geological Survey

One of the tasks of the GRIST is to identify data relevant to California groundwater resources. A listing of the data, along with the appropriate agency contacts and Internet links, will be maintained by SWRCB on the Groundwater Resources Information Database. In addition, to facilitate effective information sharing and communication among stakeholders, groundwater data will be made available on the SWRCB GeoTracker system. GeoTracker is a geographic information system that provides Internet access to environmental data. The centralization of environmental data through GeoTracker will enable more in-depth geospatial and statistical analyses of groundwater data in the future. For more information about GeoTracker, visit the GeoTracker Internet site at http://geotracker.arsenautlegg.com.

California Bay-Delta Authority

http://calwater.ca.gov The California Bay-Delta program was initiated in 1994 to develop and implement a long-term comprehensive plan that will restore ecological health and improve water management for beneficial uses of the Sacramento-San Joaquin Bay-Delta System. The partnership currently consists of more than 20 State and federal agencies. An important element of the program is to increase storage by developing an additional 500,000 acre-feet to 1.0 million acre-feet of groundwater storage capacity by the year 2007 (CALFED 2000).

Effective January 1, 2003, a newly formed State agency assumed responsibility for overseeing implementation of the Bay-Delta program. The California Bay-Delta Authority provides a permanent governance structure for the collaborative state-federal effort. The authority was established by enactment of Senate Bill 1653 in 2002. The legislation calls for the authority to sunset on January 1, 2006, unless federal legislation has been enacted authorizing the participation of appropriate federal agencies in the authority.

U.S. Environmental Protection Agency

http://www.epa.gov/safewater The U.S. Environmental Protection Agency (EPA) Office of Ground Water and Drinking Water, together with states, tribes, and many partners, protects public health by ensuring safe drinking water and protecting groundwater. The EPA's role in California groundwater is primarily related to protection of the resource and comes in the form of administering several federal programs in close coordination with State agencies such as SWRCB, DHS, and DTSC.

U.S. Geological Survey

http://ca.water.usgs.gov USGS has published results of many studies of California groundwater basins. USGS maintains an extensive groundwater level and groundwater quality monitoring network and has compiled this data in a database. The California District is working on cooperative programs with local, State, and other federal agencies. The most notable programs include three regional studies of the San Joaquin-Tulare Basin, the Sacramento River Basin, and the Santa Ana River basin under the National Water Quality Assessment Program. Results were published for the San Joaquin-Tulare Basin in 1995 and the Sacramento River Basin in 2000. The Santa Ana River basin study is in progress.

U.S. Bureau of Reclamation

http://www.usbr.gov The U.S. Bureau of Reclamation (USBR) operates the Central Valley Project (CVP), an extensive network of dams, canals, and related facilities that delivers about 7 maf during normal years for agricultural, urban, and wildlife use. USBR's role with respect to groundwater is generally limited to monitoring for impacts to the groundwater systems adjacent to its CVP facilities. Through the cooperative efforts of USBR, DWR, irrigation districts, farmers, and other local entities, groundwater level data have been collected continuously since project conception in the 1930s and 1940s.

In addition to CVP monitoring, USBR monitors groundwater levels to identify potential impacts as a result of two other projects in California. That monitoring includes the Santa Ynez basin as part of the Cachuma Project on the central coast, and the Putah Creek Cone as part of the Solano Project in the southwest Sacramento Valley. Both monitoring efforts are required as part of permitting for the projects.

USBR is planning to implement a groundwater information system to collect and distribute to the public the large volume of historical groundwater level data associated with its projects.

Chapter 6
Basic Groundwater Concepts

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Basic Groundwater Concepts

This chapter presents general concepts relating to the origin, occurrence, movement, quantity, and quality of groundwater. The concepts will be useful in providing the nontechnical reader with a basic understanding of groundwater. For more experienced readers, many topics are discussed specifically as they apply to California or as the terms are used in this report. A glossary of terms is included at the end of this report. For additional reading on basic groundwater concepts see *Basic Ground-Water Hydrology* (Heath 1983).

Origin of Groundwater

Groundwater is a component of the hydrologic cycle (Figure 11), which describes locations where water may occur and the processes by which it moves or is transformed to a different phase. In simple terms, water or one of its forms—water vapor and ice—can be found at the earth's surface, in the atmosphere, or beneath the earth's surface. The hydrologic cycle is a continuum, with no beginning or end; however, it is often thought of as beginning in the oceans. Water evaporates from a surface water source such as an ocean, lake, or through transpiration from plants. The water vapor may move over the land and condense to form clouds, allowing the water to return to the earth's surface as precipitation (rain or snow). Some of the snow will end up in polar ice caps or in glaciers. Most of the rain and snowmelt will either become overland flow in channels or will infiltrate into the subsurface. Some of the infiltrated water will be transpired by plants and returned to the atmosphere, while some will cling to particles surrounding the pore spaces in the subsurface, remaining in the vadose (unsaturated) zone. The rest of the infiltrated water will move gradually under the influence of gravity into the saturated zone of the subsurface, becoming groundwater. From here, groundwater will flow toward points of discharge such as rivers, lakes, or the ocean to begin the cycle anew. This flow from recharge areas to discharge areas describes the groundwater portion of the hydrologic cycle.

The importance of groundwater in the hydrologic cycle is illustrated by considering the distribution of the world's water supply. More than 97 percent of all earth's water occurs as saline water in the oceans (Fetter 1988). Of the world's fresh water, almost 75 percent is in polar ice caps and glaciers, which leaves a very small amount of fresh water readily available for use. Groundwater accounts for nearly all of the remaining fresh water (Alley and others 1999). All of the fresh water stored in the world's rivers and lakes accounts for less than 1 percent of the world's fresh water.

Occurrence of Groundwater

Groundwater is the water occurring beneath the earth's surface that completely fills (saturates) the void space of rocks or sediment. Given that all rock has some open space (voids), groundwater can be found underlying nearly any location in the State. Several key properties help determine whether the subsurface environment will provide a significant, usable groundwater resource. Most of California's groundwater occurs in material deposited by streams, called alluvium. Alluvium consists of coarse deposits, such as sand and gravel, and finer-grained deposits such as clay and silt. The coarse and fine materials are usually coalesced in thin lenses and beds in an alluvial environment. In this environment, coarse materials such as sand and gravel deposits usually provide the best source of water and are termed aquifers; whereas, the finer-grained clay and silt deposits are relatively poor sources of water and are referred to as aquitards. California's groundwater basins usually include one or a series of alluvial aquifers with intermingled aquitards. Less frequently, groundwater basins include aquifers composed of unconsolidated marine sediments that have been flushed by fresh water. We include the marine-deposited aquifers in the discussion of alluvial aquifers in this bulletin.

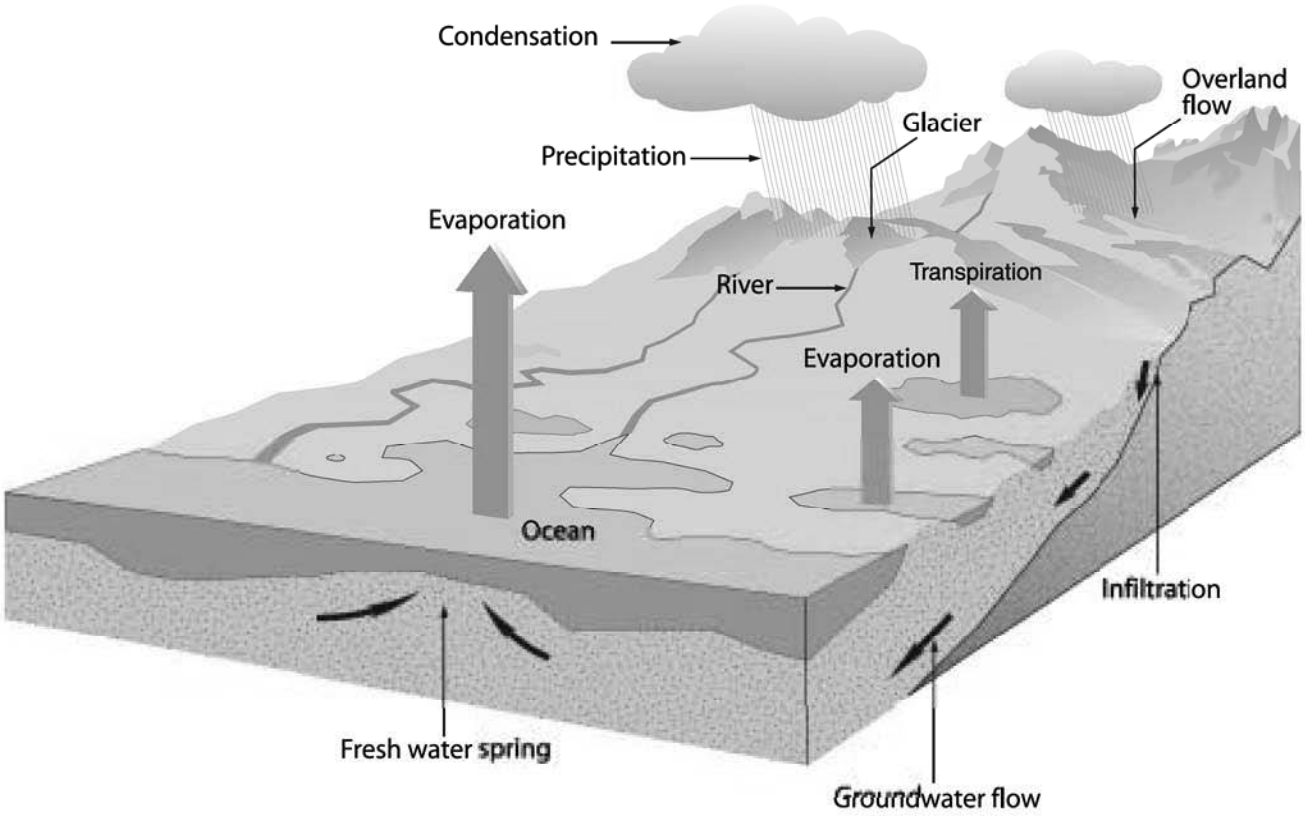

Figure 11 The Hydrologic Cycle

Although alluvial aquifers are most common in California, other groundwater development occurs in fractured crystalline rocks, fractured volcanics, and limestones. For this report, these nonalluvial areas that provide groundwater are referred to as "groundwater source areas," while the alluvial aquifers are called groundwater basins. Each of these concepts is discussed more fully below.

Groundwater and Surface Water Interconnection

Groundwater and surface water bodies are connected physically in the hydrologic cycle. For example, at some locations or at certain times of the year, water will infiltrate the bed of a stream to recharge groundwater. At other times or places, groundwater may discharge, contributing to the base flow of a stream. Changes in either the surface water or groundwater system will affect the other, so effective management requires consideration of both resources. Although this physical interconnection is well understood in general terms, details of the physical and chemical relationships are the topic of considerable research.

These details are the subject of significant recent investigations into the hyporheic zone, the zone of sand and gravel that forms the channel of a stream. As surface water flows downstream it may enter the gravels in the

Box N One Resource, Two Systems of Law

In California, two distinct legal regimes govern the appropriation of surface water and subterranean streams, and percolating groundwater. The California Water Code requires that water users taking water for beneficial use from surface watercourses and "subterranean streams flowing through known and definite channels" obtain water right permits or licenses from the State Water Resources Control Board (SWRCB) (Water Code § 1200 et seq.). Groundwater classified as percolating groundwater is not subject to the Water Code provisions concerning the appropriation of water, and a water user can take percolating groundwater without having a State-issued water right permit or license. Current Water Code section 1200 is derived from a provision in the Water Commission Act of 1913, which became effective on December 19, 1914.

The SWRCB developed a test to identify groundwater that is in a subterranean stream flowing through a known and definite channel and is therefore subject to the SWRCB's permitting authority. The physical conditions that must be present in a subterranean stream flowing in a known and definite channel are: (1) a subsurface channel must be present; (2) the channel must have relatively impermeable bed and banks; (3) the course of the channel must be known or capable of being determined by reasonable inference; and (4) groundwater must be flowing in the channel. Whether groundwater is subject to the SWRCB's permitting authority under this test is a factual determination. Water that does not fit this test is "percolating groundwater" and is not subject to the SWRCB's permitting authority.

The SWRCB has issued decisions that find that groundwater under the following streams constitutes a "subterranean stream flowing through known and definite channels" and is therefore subject to the SWRCB's permitting authority (Murphey 2003 pers com):

Los Angeles River in Los Angeles County
Sheep Creek in San Bernardino County
Mission Basin of the San Luis Rey River in San Diego County
Bonsall Basin of the San Luis Rey River in San Diego County
Pala Basin of the San Luis Rey River in San Diego County
Carmel River in Monterey County
Garrapata Creek in Monterey County
Big Sur River in Monterey County
Russian River
Chorro Creek in San Luis Obispo County
Morro Creek in San Luis Obispo County
North Fork Gualala River in Mendocino County

Contact the SWRCB, Division of Water Rights for specific stream reaches and other details of these decisions.

hyporheic zone, mix with groundwater, and re-enter the surface water in the stream channel. The effects of this interchange between surface water and groundwater can change the dissolved oxygen content, temperature, and mineral concentrations of the water. These changes may have a significant effect on aquatic and riparian biota.

Significantly, the physical and chemical interconnection of groundwater and surface water is not well represented in California's water rights system (see Box N "One Resource, Two Systems of Law").

Physical Properties That Affect Groundwater

The degree to which a body of rock or sediments will function as a groundwater resource depends on many properties, some of which are discussed here. Two of the more important physical properties to consider are porosity and hydraulic conductivity. Transmissivity is another important concept to understand when considering an aquifer's overall ability to yield significant groundwater. Throughout the discussion of these properties, keep in mind that sediment size in alluvial environments can change significantly over short distances, with a corresponding change in physical properties. Thus, while these properties are often presented as average values for a large area, one might encounter different conditions on a more localized level. Determination of these properties for a given aquifer may be based on lithologic or geophysical observations, laboratory testing, or aquifer tests with varying degrees of accuracy.

Porosity

The ratio of voids in a rock or sediment to the total volume of material is referred to as porosity and is a measure of the amount of groundwater that may be stored in the material. Figure 12 gives several examples of the types of porosity encountered in sediments and rocks. Porosity is usually expressed as a percentage and can be classified as either primary or secondary. Primary porosity refers to the voids present when the sediment or rock was initially formed. Secondary porosity refers to voids formed through fracturing or weathering of a rock or sediment after it was formed. In sediments, porosity is a function of the uniformity of grain size (sorting) and shape. Finer-grained sediments tend to have a higher porosity than coarser sediments because the finer-grained sediments generally have greater uniformity of size and because of the tabular shape and surface chemistry properties of clay particles. In crystalline rocks, porosity becomes greater with a higher degree of fracturing or weathering. As alluvial sediments become consolidated, primary porosity generally decreases due to compaction and cementation, and secondary porosity may increase as the consolidated rock is subjected to stresses that cause fracturing.

Porosity does not tell the entire story about the availability of groundwater in the subsurface. The pore spaces must also interconnect and be large enough so that water can move through the ground to be extracted from a well or discharged to a water body. The term "effective porosity" refers to the degree of interconnectedness of pore spaces. For coarse sediments, such as the sand and gravel encountered in California's alluvial groundwater basins, the effective porosity is often nearly equal to the overall porosity. In finer sediments, effective porosity may be low due to water that is tightly held in small pores. Effective porosity is generally very low in crystalline rocks that are not highly fractured or weathered.

While porosity measures the total amount of water that may be contained in void spaces, there are two related properties that are important to consider: specific yield and specific retention. Specific yield is the fractional amount of water that would drain freely from rocks or sediments due to gravity and describes the portion of the groundwater that could actually be available for extraction. The portion of groundwater that is retained either as a film on grains or in small pore spaces is called specific retention. Specific yield and specific retention of the aquifer material together equal porosity. Specific retention increases with decreasing

grain size. Table 7 shows that clays, while having among the highest porosities, make poor sources of groundwater because they yield very little water. Sand and gravel, having much lower porosity than clay, make excellent sources of groundwater because of the high specific yield, which allows the groundwater to flow to wells. Rocks such as limestone and basalt yield significant quantities of groundwater if they are well-weathered and highly fractured.

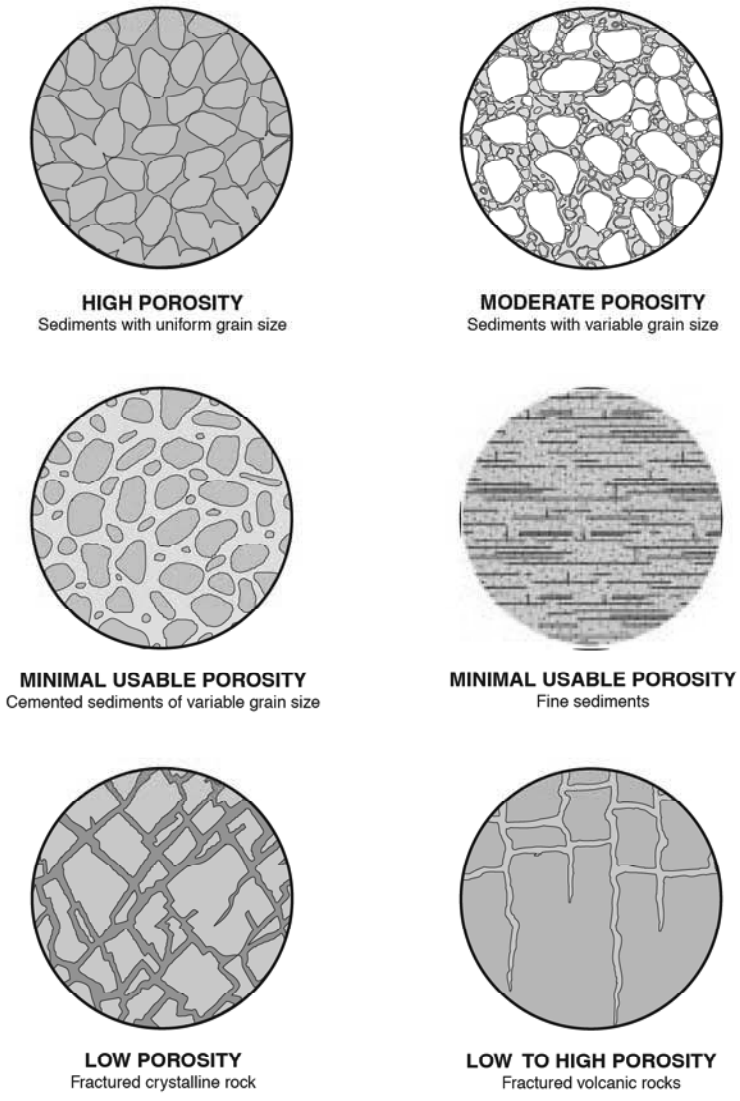

Figure 12 Examples of porosity in sediments and rocks

Table 7 Porosity (in percent) of soil and rock types

Material	Porosity	Specific yield	Specific retention
Clay	50	2	48
Sand	25	22	2
Gravel	20	19	1
Limestone	20	18	2
Sandstone (semiconsolidated)	11	6	5
Granite	0.1	0.09	0.01
Basalt (young)	11	8	3

Modified from Heath (1983)

Hydraulic Conductivity

Another major property related to understanding water movement in the subsurface is hydraulic conductivity. Hydraulic conductivity is a measure of a rock or sediment's ability to transmit water and is often used interchangeably with the term permeability. The size, shape, and interconnectedness of pore spaces affect hydraulic conductivity (Driscoll 1986).

Hydraulic conductivity is usually expressed in units of length/time: feet/day, meters/day, or gallons/day/square-foot. Hydraulic conductivity values in rocks range over many orders of magnitude from a low permeability unfractured crystalline rock at about 10^{-8} feet/day to a highly permeable well-sorted gravel at greater than 10^{4} feet/day (Heath 1983). Clays have low permeability, ranging from about 10^{-3} to 10^{-7} feet/day (Heath 1983). Figure 13 shows hydraulic conductivity ranges of selected rocks and sediments.

Transmissivity

Transmissivity is a measure of the aquifer's ability to transmit groundwater through its entire saturated thickness and relates closely to the potential yield of wells. Transmissivity is defined as the product of the hydraulic conductivity and the saturated thickness of the aquifer. It is an important property to understand because a given area could have a high value of hydraulic conductivity but a small saturated thickness, resulting in limited overall yield of groundwater.

Aquifer

An aquifer is a body of rock or sediment that yields significant amounts of groundwater to wells or springs. In many definitions, the word "significant" is replaced by "economic." Of course, either term is a matter of perspective, which has led to disagreement about what constitutes an aquifer. As discussed previously, coarse-grained sediments such as sands and gravels deposited in alluvial or marine environments tend to function as the primary aquifers in California. These alluvial aquifers are the focus of this report. Other aquifers, such as those found in volcanics, igneous intrusive rocks, and carbonate rocks are described briefly in the section Groundwater Source Areas.

Aquitard

An aquitard is a body of rock or sediment that is typically capable of storing groundwater but does not yield it in significant or economic quantities. Fine-grained sediments with low hydraulic conductivity, such as clays and silts, often function as aquitards. Aquitards are often referred to as confining layers because they retard the vertical movement of groundwater and under the right hydrogeologic conditions confine groundwater that is under pressure. Aquitards are capable of transmitting enough water to allow some flow between adjacent aquifers, and depending on the magnitude of this transfer of water, may be referred to as leaky aquitards.

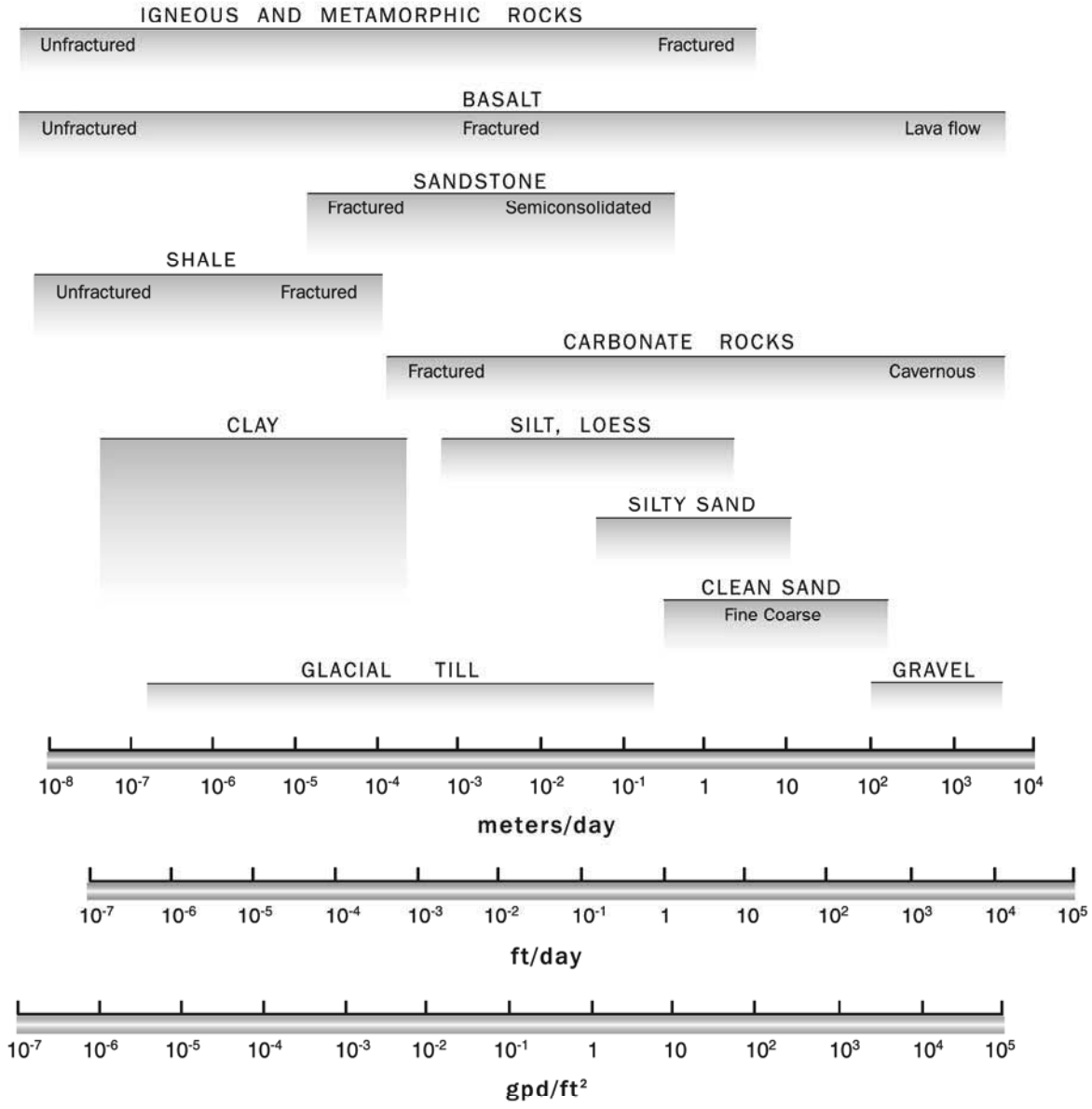

Figure 13 Hydraulic conductivity ranges of selected rocks and sediments

Unconfined and Confined Aquifers

In most depositional environments, coarser-grained deposits are interbedded with finer-grained deposits creating a series of aquifers and aquitards. When a saturated aquifer is bounded on top by an aquitard (also known as a confining layer), the aquifer is called a confined aquifer (Figure 14). Under these conditions, the water is under pressure so that it will rise above the top of the aquifer if the aquitard is penetrated by a well. The elevation to which the water rises is known as the potentiometric surface. Where an aquifer is not bounded on top by an aquitard, the aquifer is said to be unconfined. In an unconfined aquifer, the pressure on the top surface of the groundwater is equal to that of the atmosphere. This surface is known as the water table, so unconfined aquifers are often referred to as water table aquifers. The arrangement of aquifers and aquitards in the subsurface is referred to as hydrostratigraphy.

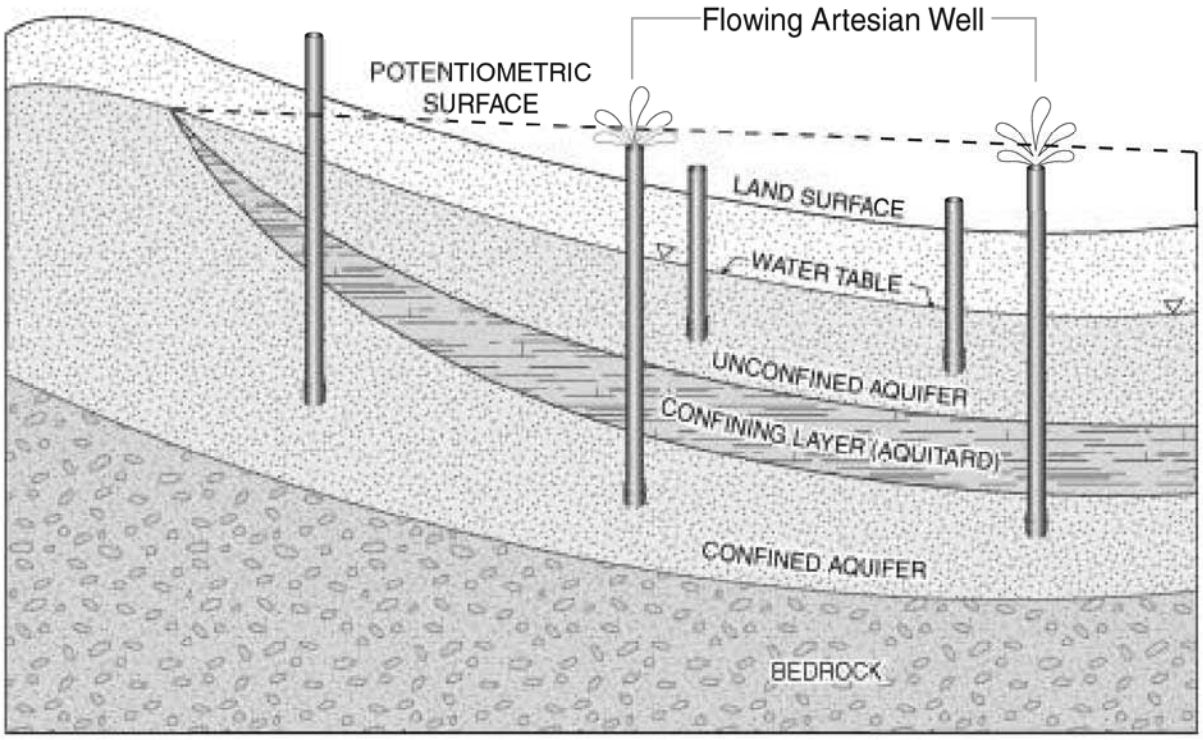

Figure 14 Interbedded aquifers with confined and unconfined conditions

With the notable exception of the Corcoran Clay of the Tulare Formation in the San Joaquin Valley and the aquitard in West Coast Basin in Los Angeles County, there are no clearly recognizable regional aquitards in California alluvial basins. Instead, due to the complexity of alluvial environments, it is the cumulative effect of multiple thin lenses of fine-grained sediments that causes increasing confinement of groundwater with increasing depth, creating what is often referred to as a semiconfined aquifer.

In some confined aquifers groundwater appears to defy gravity, but that is not the case. When a well penetrates a confined aquifer with a potentiometric surface that is higher than land surface, water will flow naturally to the surface. This is known as artesian flow, and results from pressure within the aquifer. The pressure results when the recharge area for the aquifer is at a higher elevation than the point at which discharge is occurring (Figure 14). The confining layer prevents the groundwater from returning to the surface until the confining layer is penetrated by a well. Artesian flow will discontinue as pressure in the aquifer is reduced and the potentiometric surface drops below the land surface elevation.

Groundwater Basin

A groundwater basin is defined as an alluvial aquifer or a stacked series of alluvial aquifers with reasonably well-defined boundaries in a lateral direction and a definable bottom. Lateral boundaries are features that significantly impede groundwater flow such as rock or sediments with very low permeability or a geologic structure such as a fault. Bottom boundaries would include rock or sediments of very low permeability if no aquifers occur below those sediments within the basin. In some cases, such as in the San Joaquin and Sacramento Valleys, the base of fresh water is considered the bottom of the groundwater basin. Table 8 is a generalized list of basin types and the features that define the basin boundaries.

Table 8 Types and boundary characteristics of groundwater basins

Characteristics of groundwater basins	
Groundwater basin	An aquifer or an aquifer system that is bounded laterally and at depth by one or more of the following features that affect groundwater flow: • Rocks or sediments of lower permeability • A geologic structure, such as a fault • Hydrologic features, such as a stream, lake, ocean, or groundwater divide
Types of basins and their boundaries	
Single simple basin	Basin surrounded on all sides by less permeable rock. Higher permeability near the periphery. Clays near the center. Unconfined around the periphery. Confined near the center. May have artesian flow near the center.
Basin open at one or more places to other basins	Many desert basins. Merged alluvial fans. Topographic ridges on fans. Includes some fault-bounded basins.
Basin open to Pacific Ocean	260 basins along the coast. Water-bearing materials extend offshore. May be in contact with sea water. Vulnerable to seawater intrusion.
Single complex basin	Basin underlain or surrounded by older water-bearing materials and water-bearing volcanics. Quantification is difficult because of unknown contacts between different rock types within the basin.
Groundwater in areas of volcanic rocks	Basin concept is less applicable in volcanic rocks. Volcanic rocks are highly variable in permeability.
Groundwater in weathered crystalline rocks (fractured hard rock)—not considered a basin	Small quantities of groundwater. Low yielding wells. Most wells are completed in the crystalline rock and rely on fractures to obtain groundwater.
Political boundaries or management area boundaries	Usually not related to hydrogeologic boundaries.Formed for convenience, usually to manage surface water storage and delivery.

Although only the upper surface of a groundwater basin can be shown on a map, the basin is three-dimensional and includes all subsurface fresh water-bearing material. These boundaries often do not extend straight down, but are dependent on the spatial distribution of geologic materials in the subsurface. In fact, in a few cases near California's coastal areas, aquifers in the subsurface are known to extend beyond the mapped surface of the basin and may actually be exposed under the ocean. Under natural conditions, fresh water flows from these aquifers into the ocean. If groundwater levels are lowered, sea water may flow into the aquifer. This has occurred in Los Angeles, Orange, Ventura, Santa Cruz and Monterey Counties, and some areas around San Francisco Bay. Depiction of a groundwater basin in three dimensions requires extensive subsurface investigation and data evaluation to delineate the basin geometry. Figure 15 is a cross-section showing how a coastal basin might appear in the subsurface.

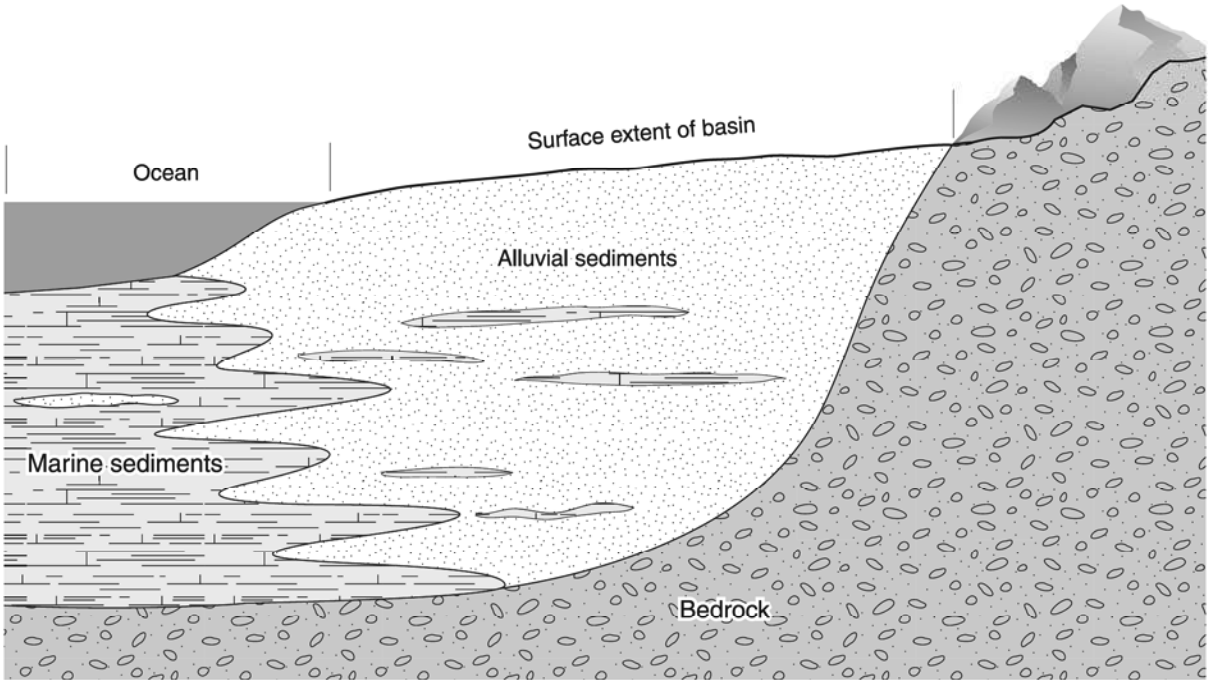

Figure 15 Groundwater basin near the coast with the aquifer extending beyond the surface basin boundary

Groundwater basin and subbasin boundaries shown on the map included with this bulletin are based on evaluation of the best available information. In basins where many studies have been completed and the basin has been operated for a number of years, the basin response is fairly well understood and the boundaries are fairly well defined. Even in these basins, however, there are many unknowns and changes in boundaries may result as more information about the basin is collected and evaluated. In many other basins where much less is known and understood about the basin, boundaries will probably change as a better understanding of the basin is developed. A procedure for collecting information from all the stakeholders should be developed for use statewide so that agreement on basin boundaries can be achieved.

Groundwater Subbasin

A subbasin is created by dividing a groundwater basin into smaller units using geologic and hydrologic barriers or, more commonly, institutional boundaries (see Table 8). These subbasins are created for the purpose of collecting and analyzing data, managing water resources, and managing adjudicated basins. As the definition implies, the designation of a subbasin boundary is flexible and could change in the future. The limiting rule for a subbasin is that it should not cross over a groundwater basin boundary.

An example of a hydrologic subbasin boundary would be a river or stream that creates a groundwater divide. While hydrologic boundaries may limit groundwater flow in the shallow subsurface, data indicate significant groundwater flow may occur across the boundary at greater depths. In addition, the location of the boundary may change over time if pumping or recharge patterns change. Institutional subbasin boundaries could be based on a political boundary, such as a county line or a water agency service area, or a legally mandated boundary such as a court adjudicated basin.

Groundwater Source Areas

Groundwater in California is also found outside of alluvial groundwater basins. Igneous extrusive (volcanic), igneous intrusive, metamorphic, and sedimentary rocks are all potential sources of groundwater. These rocks often supply enough water for domestic use, but in some cases can also yield substantial quantities. In this report the term groundwater source area is used for rocks that are significant in terms of being a local groundwater source, but do not fit the category of basin or subbasin. The term is not intended to imply that groundwater actually originates in these rocks, but that it is withdrawn from rocks underlying a generally definable area. Because of the increased difficulty in defining and understanding the hydrogeologic properties of these rocks, the limited data available for the areas in which these rocks occur, and the relatively small, though rapidly growing, segment of the population served by these water supplies, they are discussed separately from groundwater basins.

Volcanics

Groundwater in volcanics can occur in fractures that result from cooling or changes in stress in the crust of the Earth, lava tubes, tree molds, weathering surfaces, and porous tuff beds. Additionally, the volcanics could overlie other deposits from an alluvial environment. Flow in the fractures may approach the same velocities as that of surface water, but there is often very limited storage potential for groundwater. The tuff beds can act similarly to alluvial aquifers.

Some of the most productive volcanic rocks in the State include the Modoc Plateau volcanics in the northeast and the Napa-Sonoma volcanics northeast of San Francisco Bay (Figure 16). Wells in Modoc Plateau volcanics are commonly reported to yield between 100 and 1,000 gallons per minute, with some yields of 4,000 gpm (Planert and Williams 1995). Bulletin 118-75 assigned identification numbers to these volcanic rocks throughout the State (for example, Modoc Plateau Recent Volcanic Areas, 1-23). The numbers led some to interpret them as being groundwater basins. In this update, the numbers corresponding to the volcanics are being retired to eliminate this confusion.

Figure 16 Significant volcanic groundwater source areas

Igneous Intrusive, Metamorphic, and Sedimentary Rocks

Groundwater in igneous intrusive, metamorphic, and consolidated sedimentary rocks occurs in fractures resulting from tectonism and expansion of the rock as overburden pressures are relieved. Groundwater is extracted from fractured rock in many of the mountainous areas of the State, such as the Sierra Nevada, the Peninsular Range, and the Coast Ranges. Rocks in these areas often yield only enough supply for individual domestic wells, stock water wells, or small community water systems. Availability of groundwater in such formations can vary widely, even over a distance of a few yards. Areas of groundwater production from consolidated rocks were not defined in previous versions of Bulletin 118 and are not included in this update.

As population grows in areas underlain by these rocks, such as the foothills of the Sierra Nevada and southern California mountains, many new wells are being built in fractured rock. However, groundwater data are often insufficient to accurately estimate the long term reliability of groundwater supplies in these areas. Additional investigation, data evaluation, and management will be needed to ensure future sustainable supplies. The Legislature recognized both the complexity of these areas and the need for management in SB 1938 (2002), which amended the Water Code to require groundwater management plans with specific components be adopted for agencies to be eligible for certain funding administered by DWR for construction of groundwater projects. Water Code section 10753.7(a)(5) states:

> Local agencies that are located in areas outside the groundwater basins delineated on the latest edition of the department's groundwater basin and subbasin map shall prepare groundwater management plans incorporating the components in this subdivision, and shall use geologic and hydrologic principles appropriate to those areas.

In carbonate sedimentary rocks such as limestone, groundwater occurs in fractures and cavities formed as a result of dissolution of the rock. Flow in the largest fractures may approach the velocities of surface water, but where these rocks occur in California there is limited storage potential for groundwater. Carbonate rocks occur mostly in Inyo County near the Nevada border (USGS 1995), in the Sierra Nevada foothills, and in some parts of the Sacramento River drainage north of Redding. The carbonates near the Nevada state border in Inyo County are part of a regional aquifer that extends northeastward into Nevada. Springs in Nevada and in the Death Valley region in California are dependent on groundwater flow in this regional aquifer. In other parts of the country, such as Florida, carbonate rocks constitute significant sources of groundwater.

Movement of Groundwater

The movement of groundwater in the subsurface is quite complex, but in simple terms it can be described as being driven by potential energy. At any point in the saturated subsurface, groundwater has a hydraulic head value that describes its potential energy, which is the combination of its elevation and pressure. In an unconfined aquifer, the water table elevation represents the hydraulic head, while in a confined aquifer the potentiometric surface represents the hydraulic head (Figure 14). Water moves in response to the difference in hydraulic head from the point of highest energy toward the lowest. On a regional scale this results in flow of groundwater from recharge areas to discharge areas. In California, pumping depressions around extraction wells often create the discharge points to which groundwater flows. Groundwater may naturally exit the subsurface by flowing into a stream, lake, or ocean, by flowing to the surface as a spring or seep, or by being transpired by plants.

The rate at which groundwater flows is dependent on the hydraulic conductivity and the rate of change of hydraulic head over some distance. In the mid-19th century, Henry Darcy found through his experiments on sand filters that the amount of flow through a porous medium is directly proportional to the difference

between hydraulic head values and inversely proportional to the horizontal distance between them (Fetter 1988). His conclusions extend to flow through aquifer materials. The difference between hydraulic heads divided by the distance between them is referred to as the hydraulic gradient. When combined with the hydraulic conductivity of the porous medium and the cross-sectional area through which the groundwater flows, Darcy's law states:

$$Q = KA(dh/dl) \text{ (volume/time)}$$

Where:

Q = flow discharging through a porous medium
K = hydraulic conductivity (length/time)
A = cross-sectional area (length^2)
dh = change in hydraulic head between two points (length)
dl = distance between two points (length)

This version of Darcy's law provides a volumetric flow rate. To calculate the average linear velocity at which the water flows, the result is divided by the effective porosity. The rate of movement of groundwater is very slow, usually less than 1,000 feet per year because of the great amount of friction resulting from movement through the spaces between grains of sand and gravel.

Quantity of Groundwater

Because groundwater is a precious resource, the questions of how much there is and how more can be made available are important. There are many terms and concepts associated with the quantity of groundwater available in a basin, and some controversy surrounding their definition. Some of these include groundwater storage capacity, usable storage capacity, groundwater budget, change in storage, overdraft, and safe yield. This section discusses some of the more common terms used to represent groundwater quantity in California.

Groundwater Storage Capacity

The groundwater storage capacity of an individual basin or within the entire State is one of the questions most frequently asked by private citizens, water resource planners, and politicians alike. Total storage capacity seems easy to understand. It can be seen as how much physical space is available for storing groundwater. The computation of groundwater storage capacity is quite simple if data are available: capacity is determined by multiplying the total volume of a basin by the average specific yield. The total storage capacity is constant and is dependent on the geometry and hydrogeologic characteristics of the aquifer(s) (Figure 17).

Estimates of total groundwater storage capacity in California are staggering. Previous estimates of total storage range from 850 million acre-feet (maf) to 1.3 billion acre-feet (DWR 1975, DWR 1994). However, due to incomplete information about many of the groundwater basins, there has never been an accurately quantified calculation of total storage capacity statewide. Even if such a calculation were possible, the utility of such a number is questionable because total storage capacity might lead to overly optimistic estimates of how much additional groundwater development can contribute to meeting future demands.

Total groundwater storage capacity is misleading because it only takes into account one aspect of the physical character of the basin. Many other factors limit the ultimate development potential of a groundwater basin. These limiting factors may be physical, chemical, economic, environmental, legal, and institutional (Table 9). Some of these factors, such as the economic and institutional ones, can change with time. However, there may remain significant physical and chemical constraints that will limit groundwater development.

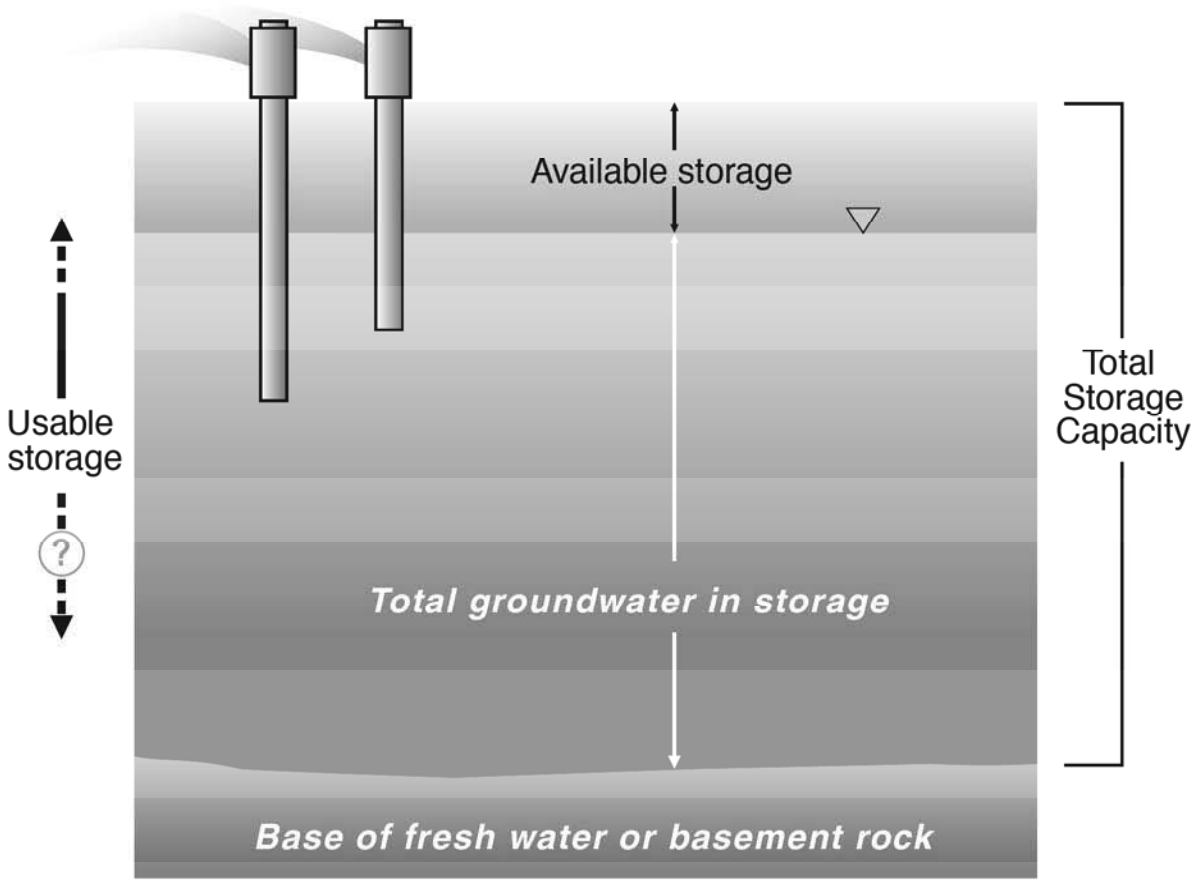

Figure 17 Schematic of total, usable, and available groundwater storage capacity

Table 9 Examples of factors that limit development of a groundwater basin

Limiting factor	Examples
Physical	Basin recharge area not adequate to sustain development; pumping too concentrated in a portion of basin; well yields too low for intended use.
Quality	Water quality not suitable for intended use; increased potential for seawater intrusion in coastal areas; upwelling of poorer quality water in deeper parts of basin.
Economic	Excessive costs associated with increased pump lifts and deepening of wells; cost of treating water if it does meet requirements for intended use.
Environmental	Need to maintain groundwater levels for wetlands, stream base flow, or other habitat.
Institutional	Local groundwater management plans or ordinances restricting use; basin adjudication; impacts on surface water rights of others.

Usable Groundwater Storage Capacity

Usable storage capacity is defined as the amount of groundwater of suitable quality that can be economically withdrawn from storage. It is typically computed as the product of the volume of the basin to some basin-specific depth that is considered economically available and the average specific yield of the basin (see Figure 17).

As more groundwater is extracted, groundwater levels may fall below some existing wells, which may then require replacement or deepening. This may be a consideration in management of the basin and will depend on the cost of replacement, the cost of pumping the water from deeper zones, and whether managers are willing to pay that cost. Other impacts that may increase the cost include subsidence and groundwater quality degradation. The usable storage may change because of changes in economic conditions.

Estimates of usable storage represent only the total volume of groundwater assumed to be usable in storage, not what would be available for sustained use on an annual basis. Previous estimates of usable groundwater storage capacity range from 143 to 450 maf (DWR 1975, DWR 1994). Unfortunately, the term "usable storage" is often used to indicate the amount of water that can be used from a basin as a source of long-term annual supply. However, the many limitations associated with total groundwater storage capacity discussed above may also apply to usable storage.

Available Groundwater Storage Capacity

Available storage capacity is defined as the volume of a basin that is unsaturated and capable of storing additional groundwater. It is typically computed as the product of the empty volume of the basin and the average specific yield of the unsaturated part of the basin (see Figure 17). The available storage capacity does not include the uppermost portion of the unsaturated zone in which saturation could cause problems such as crop root damage or increased liquefaction potential. The available storage will vary depending on the amount of groundwater taken out of storage and the recharge. The total groundwater in storage will change inversely as the available storage changes.

Available storage has often been used as a number to represent the potential for additional yield from a particular basin. Unfortunately, many of the limitations that exist in developing existing supply discussed above also limit taking advantage of available storage. Although limitations exist, looking only at available groundwater storage capacity may underestimate the potential for groundwater development. Opportunities to use groundwater already in storage and create additional storage space would be overlooked by this approach.

Groundwater Budget

A groundwater budget is an analysis of a groundwater basin's inflows and outflows to determine the change in groundwater storage. Alternatively, if the change in storage is known, the value of one of the inflows or outflows could be determined. The basic equation can be expressed as:

INFLOWS – OUTFLOWS = CHANGE IN STORAGE

Typical inflows include:

- natural recharge from precipitation;
- seepage from surface water channels;
- intentional recharge via ponds, ditches, and injection wells;
- net recharge of applied water for agricultural and other irrigation uses;
- unintentional recharge from leaky conveyance pipelines; and
- subsurface inflows from outside basin boundaries.

Outflows include:

- groundwater extraction by wells;
- groundwater discharge to surface water bodies and springs;
- evapotranspiration; and
- subsurface outflow across basin or subbasin boundaries.

Groundwater budgets can be useful tools to understand a basin, but detailed budgets are not available for most groundwater basins in California. A detailed knowledge of each budget component is necessary to obtain a good approximation of the change in storage. Absence or inaccuracy of one or more parameters can lead to an analysis that varies widely from a positive to a negative change in storage or vice versa. Since much of the data needed requires subsurface exploration and monitoring over a series of years, the collection of detailed field data is time-consuming and expensive. A management plan should develop a monitoring program as soon as possible.

Change in Groundwater Storage

As stated above, a groundwater budget is one potential way of estimating the change in storage in a basin, although it is limited by the accuracy and availability of data. There is a simpler way—by determining the average change in groundwater elevation over the basin, multiplied by the area overlying the basin and the average specific yield (or storativity in the case of a confined aquifer). The time interval over which the groundwater elevation change is determined is study specific, but annual spring-to-spring changes are commonly used. A change in storage calculation does not attempt to determine the volume of water in storage at any time interval, but rather the change from a previous period or baseline condition.

A change in storage calculation is a relatively quick way to represent trends in a basin over time. If change in storage is negligible over a representative period, the basin is in equilibrium under current use. Changes in storage calculations are more often available for a groundwater basin than groundwater budgets because water level measurements are available in many basins. Specific yield and storativity are readily estimated based on knowledge of the hydrogeologic setting and geologic materials or through aquifer pumping tests. Although simple, change in storage calculations have potential sources of error, so it is important to treat change in storage as just one of many tools in determining conditions in a groundwater basin. Well data sets must be carefully evaluated before use in these calculations. Mixing of wells constructed in confined and unconfined portions of the basin and measurement of different well sets over time can result in significant errors.

Although the change in storage calculation is a relatively quick and inexpensive method of observing changes in the groundwater system, the full groundwater budget is preferable. A detailed budget describes an understanding of the physical processes affecting storage in the basin, which the simple change in storage calculation does not. For example, the budget takes into account the relationship between the surface water and the groundwater system. If additional groundwater extraction induced additional infiltration of surface water, the calculated change in storage could be minimal. However, if the surface water is used as a source of supply downstream, the impact of reduced flows could be significant.

Overdraft

Groundwater overdraft is defined as the condition of a groundwater basin or subbasin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years, during which the water supply conditions approximate average conditions (DWR 1998). Overdraft can be characterized by groundwater levels that decline over a period of years and never fully recover, even in wet years. If overdraft continues for a number of years, significant adverse impacts may occur, including increased extraction costs, costs of well deepening or replacement, land subsidence, water quality degradation, and environmental impacts.

Despite its common usage, the term overdraft has been the subject of debate for many years. Groundwater management is a local responsibility, therefore, the decision whether a basin is in a condition of overdraft is the responsibility of the local groundwater or water management agency. In some cases local agencies may choose to deliberately extract groundwater in excess of recharge in a basin (known as "groundwater mining") as part of an overall management strategy. An independent analysis of water levels in such a basin might conclude that the basin is in overdraft. In other cases, where basin management is less active or nonexistent, declining groundwater levels are not considered a problem until levels drop below the depth of many wells in the basin. As a result, overdraft may not be reported for many years after the condition began.

Water quality changes and subsidence may also indicate that a basin has been overdrafted. For example, when groundwater levels decline in coastal aquifers, seawater fills the pore spaces in the aquifer that are vacated by the groundwater, indicating that the basin is being overdrafted. Overdraft has historically led to as much as 30 feet of land subsidence in one area of the State and lesser amounts in other areas.

The word "overdraft" has been used to designate two unrelated types of water shortages. The first is "historical overdraft" similar to the type illustrated in Figure 18, which shows that ground water levels began to decline in the mid 1950s and then leveled off in the mid 1980s, indicating less groundwater extraction or more recharge. The second type of shortage is "projected overdraft" as used in the *California Water Plan Update* (DWR 1998). In reality, this is an estimate of future water shortages based on an assumed management program within the basin, including projected supply and projected demand. If water management practices change in those basins in which a water shortage is projected, the amount of projected shortage will change.

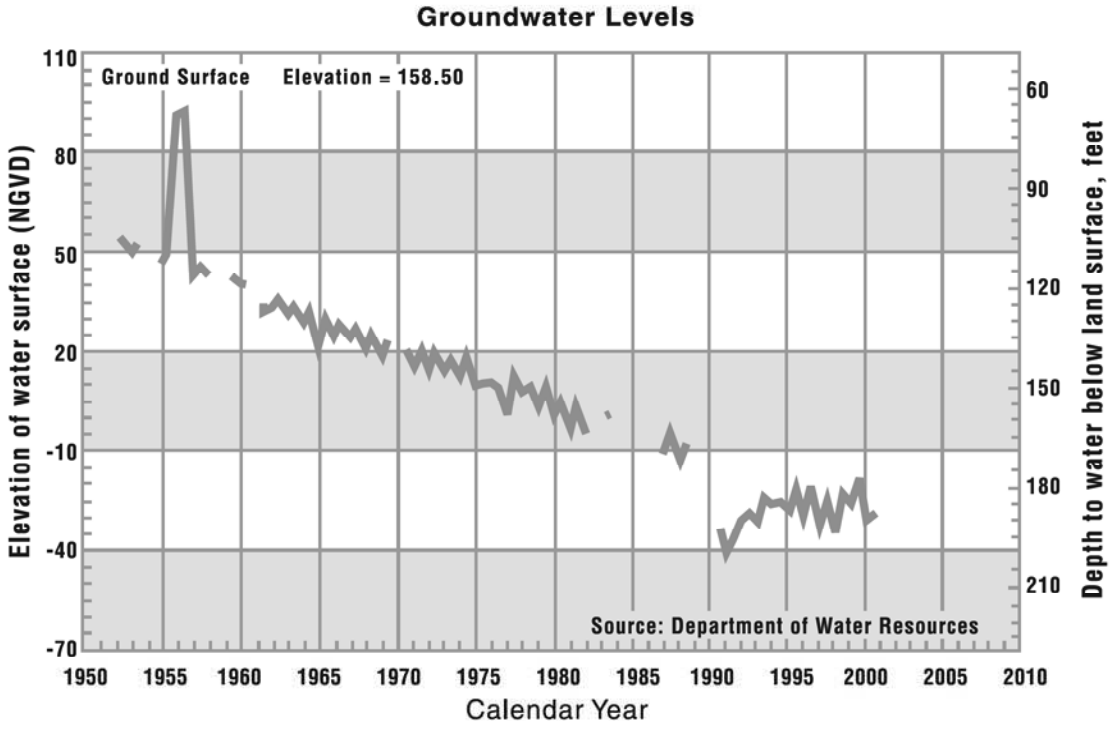

Figure 18 Hydrograph Indicating Overdraft

In some basins or subbasins, groundwater levels declined steadily over a number of years as agricultural or urban use of groundwater increased. In response, managing agencies developed surface water import projects to provide expanded water supplies to alleviate the declining groundwater levels. Increasing groundwater levels, or refilling of the aquifer, demonstrate the effectiveness of this approach in long-term water supply planning. In some areas of the State, the past overdraft is now being used to advantage. When the groundwater storage capacity that is created through historical overdraft is used in coordination with surface water supplies in a conjunctive management program, local and regional water supplies can be augmented.

In 1978 DWR was directed by the legislature to develop a definition of critical overdraft and to identify basins that were in a condition of critical overdraft (Water Code § 12924). The process that was followed and the basins that were deemed to be in a condition of critical overdraft are discussed in Box O, "Critical Conditions of Overdraft." This update to Bulletin 118 did not include similar direction from the legislature, nor funding to undertake evaluation of the State's groundwater basins to determine whether they are in a state of overdraft.

Box O Critical Conditions of Overdraft

In 1978 DWR was directed by the legislature to develop a definition of critical overdraft and to identify those basins in a critical condition of overdraft (Water Code §12924). DWR held public workshops around the state to obtain public and water managers' input on what the definition should include, and which basins were critically overdrafted. Bulletin 118-80, *Ground Water Basins in California* was published in 1980 with the results of that local input. The definition of critical overdraft is:

> *A basin is subject to critical conditions of overdraft when continuation of present water management practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts.*

No time is specified in the definition. Definition of the time frame is the responsibility of the local water managers, as is the definition of significant adverse impacts, which would be related to the local agency's management objectives.

Eleven basins were identified as being in a critical condition of overdraft. They are:

- Pajaro Basin
- Ventura Central Basin
- Chowchilla Basin
- Kings Basin
- Tulare Lake Basin
- Kern County Basin
- Cuyama Valley Basin
- Eastern San Joaquin County Basin
- Madera Basin
- Kaweah Basin
- Tule Basin

The task was not identified by the Legislature, nor was the funding for this update (2003) sufficient to consult with local water managers and fully re-evaluate the conditions of the 11 critically overdrafted basins. Funding and duration were not sufficient to evaluate additional basins with respect to conditions of critical overdraft.

If a basin lacks existing information, the cost of a thorough evaluation of overdraft conditions in a single basin could exceed $1 million. In this update of Bulletin 118, DWR has included groundwater budget information for each basin description, where available. In most cases, however, sufficient quantitative information is not available, so conditions of overdraft or critical overdraft were not reported.

While this bulletin does not specifically identify overdrafted basins (other than the 11 basins from Bulletin 118-80), the negative effects of overdraft are occurring or may occur in the future in many basins throughout the State. Declining water levels, diminishing water quality, and subsidence threaten the availability of groundwater to meet current and future demands. A thorough understanding of overdraft can help local groundwater managers minimize the impacts and take advantage of the opportunity created by available groundwater storage capacity. Local groundwater managers and DWR should seek funding and work cooperatively to evaluate the groundwater basins of the State with respect to overdraft and its potential impacts. Beginning with the most heavily used basins and relying to the extent possible on available data collected by DWR and through local groundwater management programs, current or projected conditions of critical overdraft should be identified. If local agencies take the lead in collecting and analyzing data to fully understand groundwater basin conditions, DWR can use the information to update the designations of critically overdrafted basins. This can be a cost effective approach since much of the data needed to update the overdraft designations are the same data that agencies need to effectively manage groundwater.

Safe Yield

Safe yield is defined as the amount of groundwater that can be continuously withdrawn from a basin without adverse impact. Safe yield is commonly expressed in terms of acre-feet per year. Depending on how it is applied, safe yield may be an annual average value, or may be calculated based on changed conditions each year. Although safe yield may be indicated by stable groundwater levels measured over a period of years, a detailed groundwater budget is needed to accurately estimate safe yield. Safe yield has commonly been determined in groundwater basin adjudications.

Proper application of the safe yield concept requires that the value be modified through time to reflect changing practices within the basin. One of the common misconceptions is that safe yield is a static number. That is, once it has been calculated, the amount of water can be extracted annually from the basin without any adverse impacts. An example of a situation in which this assumption could be problematic is when land use changes. In some areas, where urban development has replaced agriculture, surface pavement, storm drains, and sewers have increased runoff and dramatically reduced recharge into the basin. If extraction continued at the predetermined safe yield of the basin, water level decline and other negative impacts could occur.

Figure 19 Photograph of extensometer

An extensometer is a well with a concrete bench mark at the bottom. A pipe extends from the concrete to the land surface. If compaction of the finer sediments occurs, leading to land surface subsidence, the pipe in the well will appear to rise out of the well casing. When this movement is recorded, the data show how much the land surface has subsided.

Subsidence

When groundwater is extracted from some aquifers in sufficient quantity, compaction of the fine-grained sediments can cause subsidence of the land surface. As the groundwater level is lowered, water pressure decreases and more of the weight of the overlying sediments is supported by the sediment grains within the aquifer. If these sediments have not previously been surcharged with an equivalent load, the overlying load will compact them. Compaction decreases the porosity of the sediments and decreases the overall volume of the finer grain sediments, leading to subsidence at the land surface. While the finer sediments within the aquifer system are compacted, the usable storage capacity of the aquifer is not greatly decreased.

Data from extensometers (Figure 19) show that as groundwater levels decline in an aquifer, the land surface falls slightly. As groundwater levels rise, the land surface also rises to its original position. This component of subsidence is called elastic subsidence because it recovers. Inelastic subsidence, the second component of subsidence, is what occurs when groundwater levels decline to the point that the finer sediments are compacted. This compaction is not recoverable.

Conjunctive Management

Conjunctive management in its broadest definition is the coordinated and combined use of surface water and groundwater to increase the overall water supply of a region and improve the reliability of that supply. Conjunctive management may be implemented to meet other objectives as well, including reducing groundwater overdraft and land subsidence, protecting water quality, and improving environmental conditions. Although surface water and groundwater are sometimes considered to be separate resources, they are connected in the hydrologic cycle. By using or storing additional surface water when it is plentiful, and relying more heavily on groundwater during dry periods, conjunctive management can change the timing and location of water so it can be used more efficiently.

Although a specific project or program may be extremely complex, there are several components common to conjunctive management projects. The first is to recharge surplus surface water when it is available to increase groundwater in storage. Recharge may occur through surface spreading, by injection wells, or by reducing groundwater use by substituting surface water. The surplus surface water used for recharge may be local runoff, imported water, stored surface water, or recycled water. The second component is to reduce surface water use in dry years or dry seasons by switching to groundwater. This use of the stored groundwater may take place through direct extraction and use, pumping back to a conveyance facility, or through exchange of another water supply. A final component that should be included is an ongoing monitoring program to evaluate operations and allow water managers to respond to changes in groundwater, surface water, or environmental conditions that could violate management objectives or impact other water users.

Quality of Groundwater

All water contains dissolved constituents. Even rainwater, often described as being naturally pure, contains measurable dissolved minerals and gases. As it moves through the hydrologic cycle, water dissolves and incorporates many constituents. These include naturally occurring and man-made constituents.

Most natural minerals are harmless up to certain levels. In some cases higher mineral content is preferable to consumers for taste. For example, minerals are added to many bottled drinking waters after going through a filtration process. At some level, however, most naturally occurring constituents, along with those introduced by human activities, are considered contaminants. The point at which a given constituent is considered a contaminant varies depending on the intended use of the groundwater and the toxicity level of the constituents.

Beneficial Uses

For this report, water quality is a measure of the suitability of water for its intended use, with respect to dissolved solids and gases and suspended material. An assessment of water quality should include the investigation of the presence and concentration of any individual constituent that may limit the water's suitability for an intended use.

The SWRCB has identified 23 categories of water uses, referred to as beneficial uses. The beneficial use categories and a brief description of each are presented in Appendix E. The actual criteria that are used to evaluate water quality for each of the beneficial uses are determined by the nine Regional Water Quality Control Boards, resulting in a range of criteria for some of the uses. These criteria are published in each of the Regional Boards' Water Quality Control Plans (Basin Plans)[1].

A summary of water quality for all of the beneficial uses of groundwater is beyond the scope of this report. Instead, water quality criteria for two of the most common uses—municipal supply (referred to as public drinking water supply in this report) and agricultural supply—are described below.

Public Drinking Water Supply

Standards for maximum contaminant levels (MCLs) of constituents in drinking water are required under the federal Safe Drinking Water Act of 1974 and its updates. There are primary and secondary standards. Primary standards are developed to protect public health and are legally enforceable. Secondary standards are generally for the protection of aesthetic qualities such as taste, odor, and appearance, and cosmetic qualities, such as skin or tooth discoloration, and are generally non-enforceable guidelines. However, in California secondary standards are legally enforceable for all new drinking water systems and new sources developed by existing public water suppliers (DWR 1997). Under these primary and secondary standards, the U.S. Environmental Protection Agency regulates more than 90 contaminants, and the California Department of Health Services regulates about 100. Federal and State primary MCLs are listed in Appendix F.

Agricultural Supply

An assessment of the suitability of groundwater as a source of agricultural supply is much less straightforward than that for public water supply. An evaluation of water supply suitability for use in agriculture is difficult because the impact of an individual constituent can vary depending on many factors, including soil chemical and physical properties, crop type, drainage, and irrigation method. Elevated levels of constituents usually do not result in an area being taken entirely out of production, but may lower crop yields. Management decisions will determine appropriate land use and irrigation methods.

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[1] Digital versions of these plans are available online at http://www.swrcb.ca.gov/plnspols/index.html

There are no regulatory standards for water applied on agriculture. Criteria for crop water have been provided as guidelines. Many constituents have the potential to negatively impact agriculture, including more than a dozen trace elements (Ayers and Westcot 1985). Two constituents that are commonly considered with respect to agricultural water quality are salinity—expressed as total dissolved solids (TDS)—and boron concentrations.

Increasing salinity in irrigation water inhibits plant growth by reducing a plant's ability to absorb water through its roots (Pratt and Suarez 1996). While the impact will depend on crop type and soil conditions, it is useful to look at the TDS of the applied water as a general assessment tool. A range of values for TDS with their estimated suitability for agricultural uses is presented in Table 10. These ranges are modified from criteria developed for use in the San Joaquin Valley by the San Joaquin Valley Drainage Program. However, they are similar to values presented in Ayers and Westcot (1985).

Table 10 Range of TDS values with estimated suitability for agricultural uses

Range of TDS (mg/L)	Suitability
<500	Generally no restrictions on use
500 – 1,250	Generally slight restrictions on use
1,250 – 2,500	Generally moderate restrictions on use
>2,500	Generally severe restrictions on use

Modified from SJVDP (1990)
TDS = total dissolved solids

High levels of boron can present toxicity problems in plants by damaging leaves. The boron is absorbed through the root system and transported to the leaves. Boron then accumulates during plant transpiration, resulting in leaf burn (Ayers and Westcot 1985). Boron toxicity is highly dependent on a crop's sensitivity to the constituent. A range of values of dissolved boron in irrigation water, with their estimated suitability on various crops is presented in Table 11. These ranges are modified from Ayers and Westcot (1985).

Table 11 Range of boron concentrations with estimated suitability on various crops

Range of dissolved boron (mg/L)	Suitability
<0.5	Suitable on all but most highly boron sensitive crops
0.5 – 1.0	Suitable on most boron sensitive crops
1.0 – 2.0	Suitable on most moderately boron sensitive crops
>2.0	Suitable for only moderately to highly boron tolerant crops

Source: Modified from Ayers and Westcot 1985

Contaminant Groups

Because there are so many potential individual constituents to evaluate, researchers have often summarized contaminants into groups depending on the purpose of the study. Recognizing that there are exceptions to any classification scheme, this update considered groups according to their common sources of contamination—those naturally occurring and those caused by human activities (anthropogenic). Each of these sources includes more than one contaminant group. A listing of the contaminant groups and the individual constituents belonging to those groups, summarized in this report, is included in Appendix F.

Naturally Occurring Sources

In this report, naturally occurring sources include three primary groups: (1) inorganic constituents with primary MCLs, (2) inorganic constituents with secondary MCLs, and (3) radiological constituents. Inorganics primarily include naturally occurring minerals such as arsenic or mercury, although human activities may certainly contribute to observed concentrations. Radiological constituents include primarily naturally occurring constituents such as radon, gross alpha, and uranium. Although radioactivity is not considered a significant contaminant statewide, it can be locally important, particularly in communities in the Sierra Nevada.

Anthropogenic Sources

Anthropogenic contaminants include pesticides, volatile organic compounds (VOCs), and nitrates. Pesticides and VOCs are often grouped together into an organic contaminant group. However, separating the two gives a general idea of which contaminants are primarily from agricultural activities (pesticides) and which are primarily from industrial activities (VOCs). One notable exception to the groupings is dibromochloropropane (DBCP). Even though this compound is a VOC, DBCP is a soil fumigant and is included with pesticides. Nitrates are a surprising anthropogenic class to some observers. Nitrogen is certainly a naturally occurring inorganic constituent. However, because most nitrates are associated with agriculture (see Box P, "Focused on Nitrates: Detailed Study of a Contaminant") and nitrates are among California's leading contaminants, it is appropriate to consider them separately from inorganics.

Box P Focused on Nitrates: Detailed Study of a Contaminant

Because water has so many potential uses, the study of water quality means different things to different people. Thomas Harter, a professor at the University of California at Davis, has chosen to focus on nitrates as one of his research interests. Harter's monitoring network consists of 79 wells on 5 dairies in the San Joaquin Valley.

A common result of dairy activities is the release of nitrogen into the surroundings, which changes to nitrate in groundwater. Nitrates are notorious for their role in interfering with oxygen transport in babies, a condition commonly referred to as "blue baby syndrome." Nitrates are also of interest because more public supply wells have been closed due to nitrate contamination than from any other contaminant (Bachman and others 1997).

Harter's study has focused on two primary activities. The first is a meticulous examination of nitrogen at the surface and nitrates in the uppermost 25 feet of the subsurface. This monitoring has been ongoing since 1993, and has shown that a significant amount of nitrate can reach shallow groundwater. The second focus of the study has been to change management practices to reduce the amount of nitrogen available to reach groundwater, along with continued monitoring. This has occurred since 1998. Results of the study are better management practices that significantly reduce the amount of nitrogen available to groundwater. This will help minimize the potential adverse impacts to groundwater quality from nitrates.

Chapter 7

Inventory of California's Groundwater Information

Chapter 7
Inventory of California's Groundwater Information

The groundwater information in this chapter summarizes the available information on statewide and regional groundwater issues. For more detailed information on specific groundwater basins see the supplement to this report that is available on the California Department of Water Resources (DWR) website, http://www.waterplan.water.ca.gov/groundwater/118index.htm. See Appendix A for information on accessing individual basin descriptions and the map delineating California's groundwater basins.

Statewide Groundwater Information

There is a large amount of data available for many of the State's most heavily developed groundwater basins. Conversely, there is relatively little data available on groundwater in the undeveloped areas. The information in this report is generally limited to a compilation of the information readily available to DWR staff and may not include the most up-to-date data generated by studies that have been completed recently by water management agencies. For this reason, the collection of additional, more recent data on groundwater basins should be continued and integrated into the basin descriptions. Statewide summaries are included below.

Groundwater Basins

There are currently 431 groundwater basins delineated, underlying about 40 percent of the surface area of the State. Of those, 24 basins are subdivided into a total of 108 subbasins, giving a total of 515 distinct groundwater systems described in this report (Figure 20). Basin delineation methods are described in Appendix G. Additionally, many of the subbasin boundaries were developed or modified with public input, but little physical data. These boundaries should not be considered as precisely defining a groundwater basin boundary; the determination of whether any particular area lies within a groundwater basin boundary should be determined only after detailed local study.

Groundwater basin and subbasin boundaries shown on the map included with this bulletin are based on evaluation of the best available information. In basins where many studies have been completed and the basin has been operated for a number of years, the basin response is fairly well understood and the boundaries are fairly well defined. Even in these basins, however, there are many unknowns and changes in boundaries may result as more information about the basin is collected and evaluated.

Groundwater Budgets

Rather than simply providing all groundwater budget data collected during this update, the budget information was classified into one of three categories indicating the relative level of detail of information available. These categories, types A, B, and C, are discussed in Box R, "Explanation of Groundwater Data Tables." A type A budget indicates that much of the information needed to characterize the groundwater budget for the basin or subbasin was available. DWR staff did not verify these type A budgets, so DWR cannot address the accuracy of the data provided by them. Type B indicates that enough data are available to estimate the groundwater extraction to meet local water use needs. This is useful in understanding the reliance of a particular area on groundwater. Type C indicates a low level of knowledge of any of the budget components for the area.

Figure 21 depicts where these type A, B, and C budgets occur. In general, there is a greater level of understanding (type A or B) in the more heavily developed areas in terms of groundwater use. These include the Central Valley and South Coast. The lowest level of knowledge of groundwater budget data is in the southeast desert area. A discussion of groundwater use in each region is included below.

Box Q How Does the Information in This Report Relate to the Recently Enacted Laws Senate Bill 221 and Senate Bill 610 (2002)?

Recently enacted legislation requires developers of certain new housing projects to demonstrate an available water supply for that development. If a part of that proposed water supply is groundwater, urban water suppliers must provide additional information on the availability of an adequate supply of groundwater to meet the projected demand and show that they have the legal right to extract that amount of groundwater. SB 610 (2002) amended the Water Code to require, among other things, the following information (Section 10631(b)(2)):

> *For basins that have not been adjudicated, information as to whether the department has identified the basin or basins as overdrafted or has projected that the basin will become overdrafted if present management conditions continue, in the most current official departmental bulletin that characterizes the condition of the groundwater basin, and a detailed description of the efforts being undertaken by the urban water supplier to eliminate the long-term overdraft condition.*

The hydrogeologic information contained in the basin descriptions that supplement this update of Bulletin 118 includes only the information that was available in California Department of Water Resources (DWR) files through reference searches and through limited contact with local agencies. Local agencies may have conducted more recent studies that have generated additional information about water budgets and aquifer characteristics. Unless the agency notified DWR, or provided a copy of the recent reports to DWR staff, that recent information has not been included in the basin descriptions. Therefore, although SB 610 refers to groundwater basins identified as overdrafted in Bulletin 118, it would be prudent for local water suppliers to evaluate the potential for overdraft of any basin included as a part of a water supply assessment.

Persons interested in collecting groundwater information in accordance with the Water Code as amended by SB 221 and SB 610 may start with the information in Bulletin 118, but should follow up by consulting the references listed for each basin and contacting local water agencies to obtain any new information that is available. Otherwise, evaluation of available groundwater resources as mandated by SB 221 and SB 610 may not be using the most complete and recent information about water budgets and aquifer characteristics.

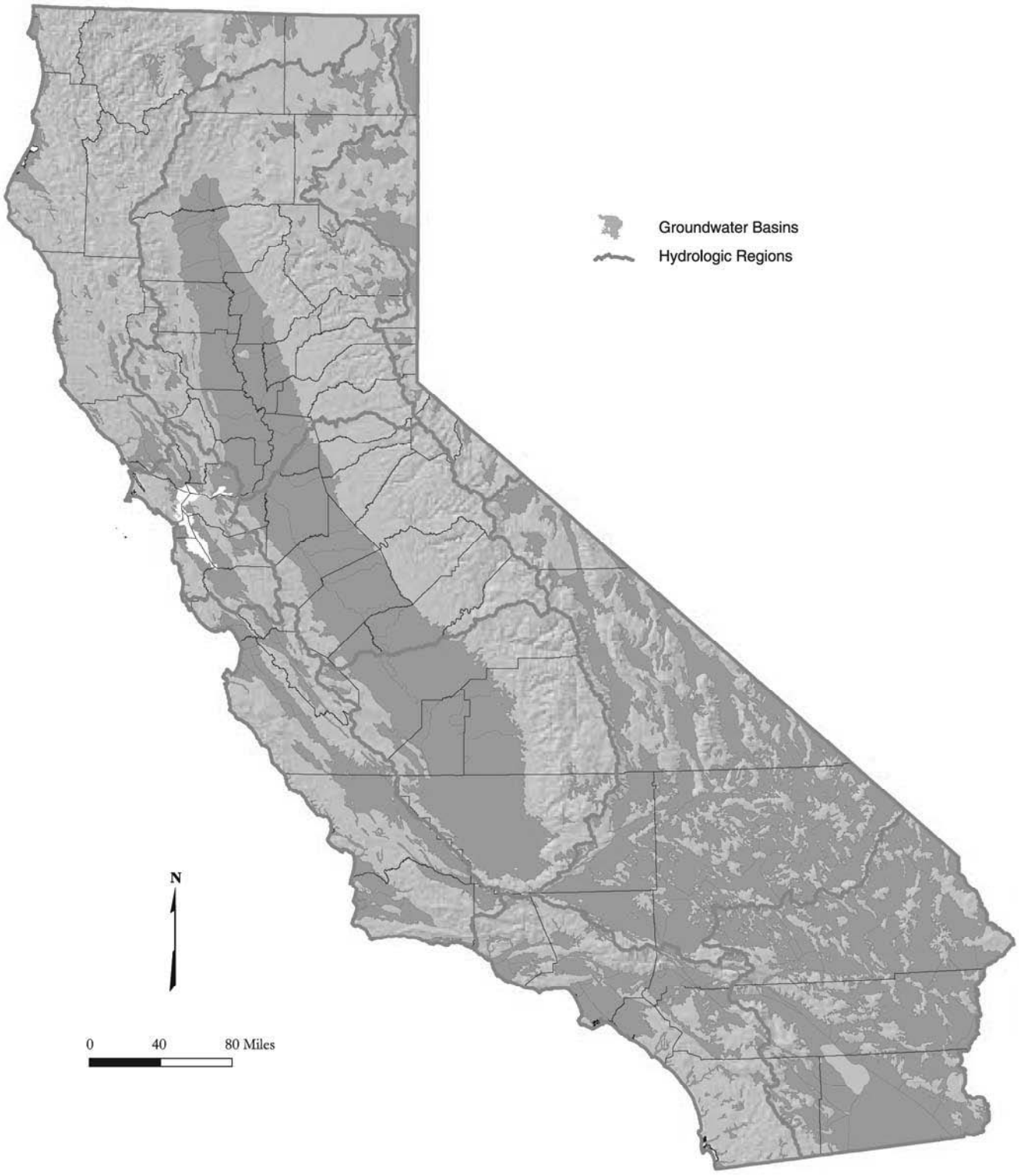

Figure 20 Groundwater basins and subbasins

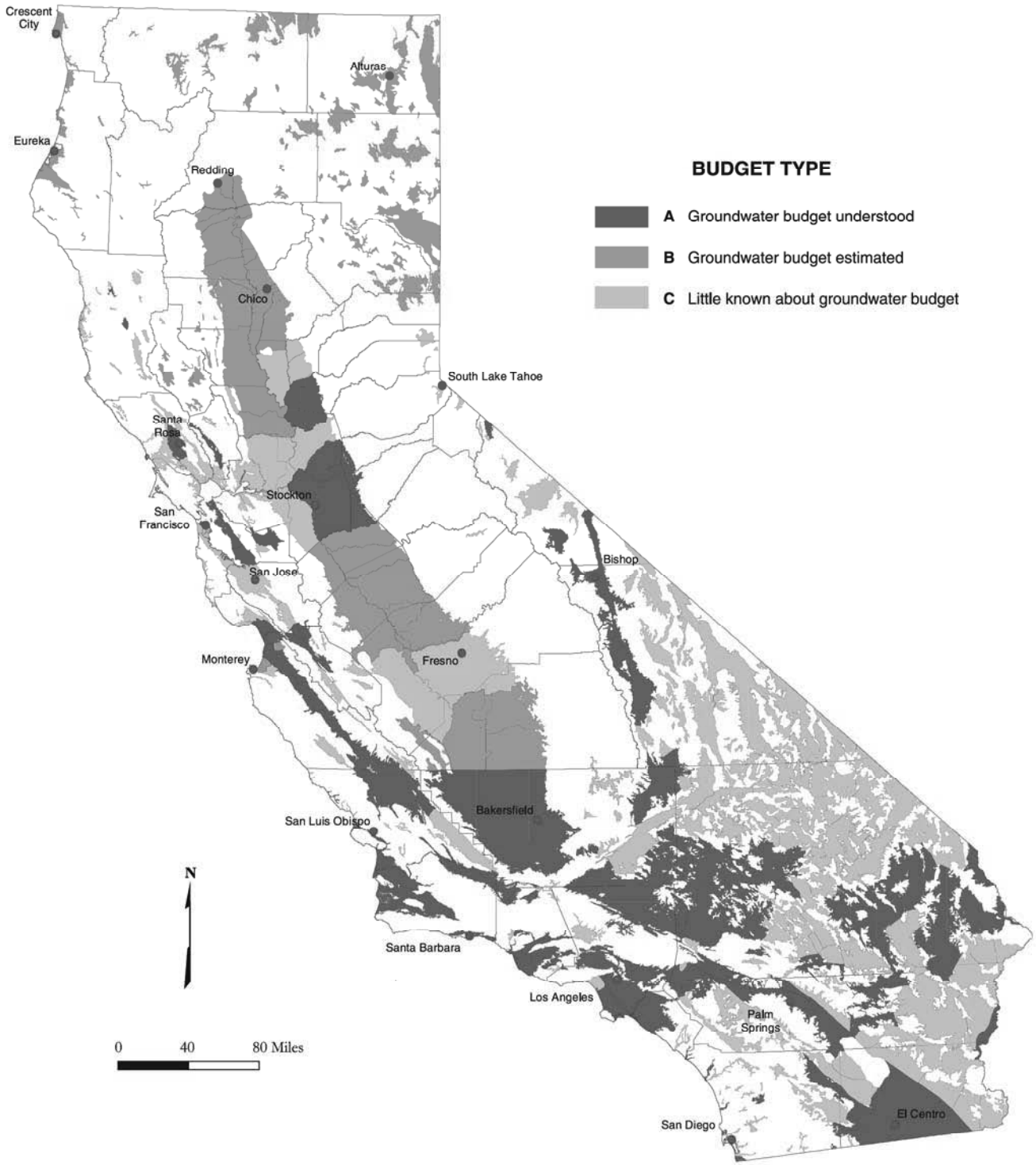

Figure 21 Basin and subbasin groundwater budget types

Box R Explanation of Groundwater Data Tables

A groundwater data table for each hydrologic region is included at the end of each hydrologic region section in Chapter 7. The tables include the following information:

Basin/Subbasin Number. The basin numbering format is x-xxx.xx. The first number in the sequence assigns the basin to one of the nine Regional Water Quality Control Board boundaries. The second number is the groundwater basin number. Any number following the decimal identifies that the groundwater basin has been further divided into subbasins. Reevaluation of available hydrogeologic information resulted in the deletion of some basins and subbasins identified in Bulletins 118-75 and 118-80. Because of this, there are some gaps in the sequence of basin numbers in this report. The methods used for developing the current groundwater basin maps are discussed in Appendix H. The names and numbers of the basins deleted, along with any comments related to their elimination are included in the appropriate region in Chapter 7. Previously unidentified groundwater basins or subbasins that were delineated during this update are assigned new identification numbers that sequentially follow the last number used in Bulletin 118-80 for groundwater basins or subbasins.

Basin or Subbasin Name. Basin names are based on published and unpublished reports, topographic maps, and local terminology. Names of more recently delineated basins or subbasins are based on the principal geographic feature, which in most cases corresponds to the name of a valley. In the case of a subbasin, its formal name should include the name of the basin (for example, Sacramento Valley Groundwater Basin, North American Subbasin). However, both locally and informally, the term subbasin is used interchangeably with basin (for example, North American Basin).

Area. The area for each basin or subbasin is presented in acres rounded to three significant figures (for example, 147,148 acres was rounded to 147,000 acres). The area describes only the upper surface or map view of a basin. The basin underlies the area and may extend beyond the surface expression (discussed in Chapter 6).

Groundwater Budget Type. The type of groundwater budget information available was classified as Type A, B, or C based on the following criteria:

Type A – indicates one of the following: (1) a groundwater budget exists for the basin or enough components from separate studies could be combined to give a general indication of the basin's groundwater budget, (2) a groundwater model exists for the basin that can be used to calculate a groundwater budget, or (3) actual groundwater extraction data exist for the basin.

Type B – indicates that a use-based estimate of groundwater extraction is calculated for the basin. The use-based estimate is determined by calculating the overall use from California Department of Water Resources land use and urban water use surveys. Known surface water supplies are then subtracted from the total demand leaving the rest of the use to be met by groundwater extraction.

Type C – indicates that there are not enough data to provide either an estimate of the basin's groundwater budget or groundwater extraction from the basin.

Well Yields. Maximum and average well yields in gallons per minute (gpm) are reported for municipal supply and agricultural wells where available. Most of the values reported are from initial tests reported during construction of the well, which may not be an accurate indication of the long-term production capacity of the wells.

Box R continued on next page

Box R Explanation of Groundwater Data Tables (continued)

Types of Monitoring. This includes monitoring of both groundwater levels and quality. "Levels" indicate the number of wells actively monitored without consideration of frequency. Most wells are monitored semi-annually, but many are monitored monthly. "Quality" indicates the number of wells monitored for various constituents; these could range from a grab sample taken for a field specific conductance measurement to a full analysis of organic and inorganic constituents. "Title 22" indicates the number of public water system wells that are actively sampled and monitored under the direction of California Department of Health Services (DHS) Title 22 Program.

Total Dissolved Solids. This category includes range and average values of total dissolved solids (TDS). This data primarily represents data from published reports. In some cases, a range of average TDS values is presented.

Active Monitoring

The summary of active monitoring includes wells that are monitored for groundwater elevation or groundwater quality within the delineated groundwater basins as of 1999. Groundwater elevation data collected by DWR and cooperators are available online at http://wdl.water.ca.gov. Most of the water quality data are for public supply wells and were provided by the California Department of Health Services (DHS). Other groundwater level and water quality monitoring activities were reported by local agencies during this update. The summary indicates that there are nearly 14,000 wells monitored for groundwater levels, 10,700[1] wells monitored under DHS water quality monitoring program, and 4,700 wells monitored for miscellaneous water quality by other agencies.

[1] These numbers include the wells in basins and subbasins only; throughout the entire state, DHS has responsibility for more than 16,000 public supply wells.

Box S What Happens When an MCL Exceedance Occurs?

All suppliers of domestic water to the public are subject to regulations adopted by the U.S. Environmental Protection Agency under the Safe Drinking Water Act (42 U.S.C. 300f et seq.) as well as by the California Department of Health Services under the California Safe Drinking Water Plan Act (Health and Safety Code §§ 116270-116750).

These regulations include primary drinking water standards that establish maximum contaminant levels (MCLs) for inorganic and organic chemicals and radioactivity. MCLs are based on health protection, technical feasibility, and economic factors.

California requires public water systems to sample their drinking water sources, analyze for regulated contaminants, and determine compliance with the MCLs on a regular basis. Sampling frequency depends on the contaminant, type of water source, and previous sampling results; frequency can range from monthly to once every nine years, or none at all if sampling is waived because the source is not vulnerable to the contaminant.

Primary MCLs are enforceable standards. In California, compliance is usually determined at the wellhead or the surface water intake. To meet water quality standards and comply with regulations, a water system with a contaminant exceeding an MCL must notify the public and remove the source from service or initiate a process and schedule to install treatment for removing the contaminant.

Notification requirements reflect the severity of the associated health risks; immediate health concerns prompt immediate notice to consumers. Violations that do not pose a significant health concern may use a less immediate notification process. In addition to consumer notification, a water system is required by statute to notify the local governing body (for example, city council or county board of supervisors) whenever a drinking water well exceeds an MCL, even if the well is taken out of service.

Detections of regulated contaminants (and certain unregulated contaminants) must also be reported to consumers in the water system's annual Consumer Confidence Report.

Groundwater Quality

The summary of water quality relied heavily on data from the DHS Title 22 water quality monitoring program. The assessment consisted of querying the DHS database for active wells that have constituents exceeding the maximum contaminant level (MCL) for drinking water. Summaries of this assessment for each of the State's hydrologic regions (HRs) are discussed in this chapter.

DHS data are the most comprehensive statewide water quality data set available, but this data set should not be used as a sole indicator of the groundwater quality in California. Data from these wells are not necessarily representative of any given basin; it only represents the quality of groundwater where a public water supply is extracted.

The Natural Resources Defense Council (NRDC 2001) issued a report that concludes California's groundwater resources face a serious long-term threat from contamination. Despite heavy reliance on groundwater, no comprehensive statewide assessments of groundwater quality were available. In response to the NRDC report, the State Water Resources Control Board (SWRCB) is planning a comprehensive assessment of the State's groundwater quality. This program is discussed in Chapter 4, in the section titled "Groundwater Quality Monitoring Act of 2001 (AB 599)."

Regional Groundwater Use

The importance of groundwater as a resource varies regionally throughout the State. For planning purposes, DWR divides California into 10 hydrologic regions (HRs), which correspond to the State's major drainage areas. HR boundaries are shown in Figure 22. A review of average water year supplies from the California Water Plan (DWR 1998) shows the importance of groundwater as a local supply for agricultural and municipal use throughout the State and in each of California's 10 HRs (Table 12 and Figure 23).

Table 12 Annual agricultural and municipal water demands met by groundwater

Hydrologic region	Total Demand Volume (TAF)	Demand met by Groundwater (TAF)	Demand met by Groundwater (%)
North Coast	1063	263	25
San Francisco Bay	1353	68	5
Central Coast	1263	1045	83
South Coast	5124	1177	23
Sacramento River	8720	2672	31
San Joaquin River	7361	2195	30
Tulare Lake	10556	4340	41
North Lahontan	568	157	28
South Lahontan	480	239	50
Colorado River	4467	337	8

Source: DWR 1998

With more than 80 percent of demand met by groundwater, the Central Coast HR is heavily reliant on groundwater to meet its local needs. The Tulare Lake and South Lahontan HRs meet more than 40 percent of their local demand from groundwater. The South Coast, North Coast, North Lahontan, San Joaquin River, and Sacramento River HRs take between 20 and 40 percent of their supply from groundwater. Groundwater is a relatively minor source of supply in the San Francisco Bay and Colorado River HRs.

Of all the groundwater extracted annually in the state, an estimated 35 percent is produced from the Tulare Lake HR. More than 70 percent of groundwater extraction occurs in the Central Valley (Tulare Lake, San Joaquin River, and Sacramento River HRs combined). Nearly 20 percent is extracted in the highly urbanized South Coast and Central Coast HRs, while less than 10 percent is extracted in the remaining five HRs combined.

Figure 22 California's 10 hydrologic regions

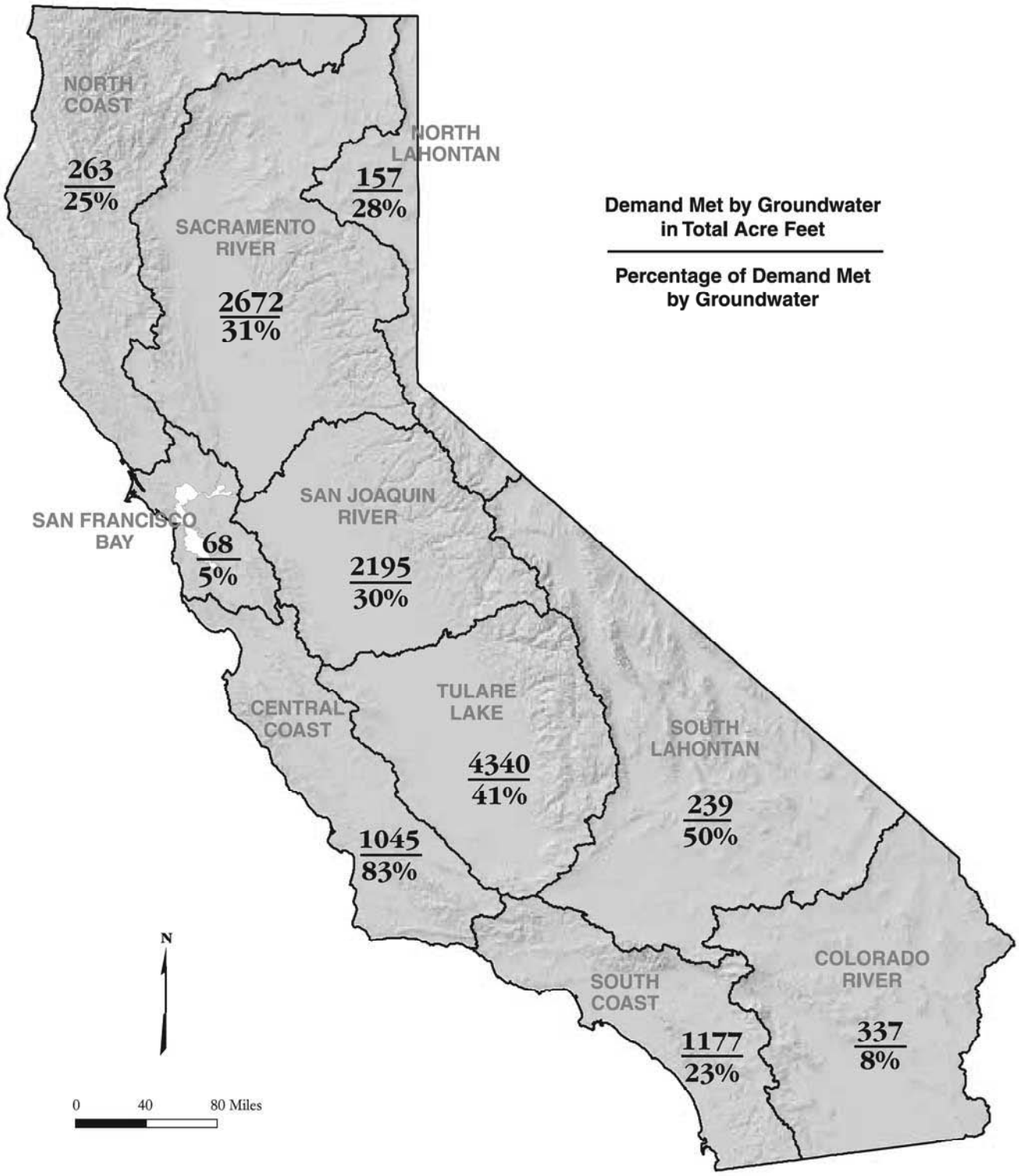

Figure 23 Agricultural and urban demand supplied by groundwater in each hydrologic region

The remainder of this chapter provides a summary of each of the 10 HRs. A basin location map for each HR is followed by a brief discussion of groundwater occurrence and groundwater conditions. A summary tabulation of groundwater information for each groundwater basin within the HR is provided. Greater detail for the data presented in these tables, including a bibliography, is provided in the individual basin/subbasin descriptions in the supplemental report (see Appendix A). Because the groundwater basin numbers are based on the boundaries of the State's nine Regional Water Quality Control Boards (RWQCB), Figure 24 shows the relationship between the Regional Board boundaries and DWR's HR boundaries.

The groundwater basin tabulations give an overview of available data. Where a basin is divided into subbasins, only the information for the subbasins is provided. The data for each subbasin generally come from different sources, so it is inappropriate to sum the data into a larger basin summary. An explanation of each of the data items presented in the summary table is provided in Box R.

Figure 24 Regional Water Quality Control Board regions and Department of Water Resources hydrologic regions

North Coast Hydrologic Region

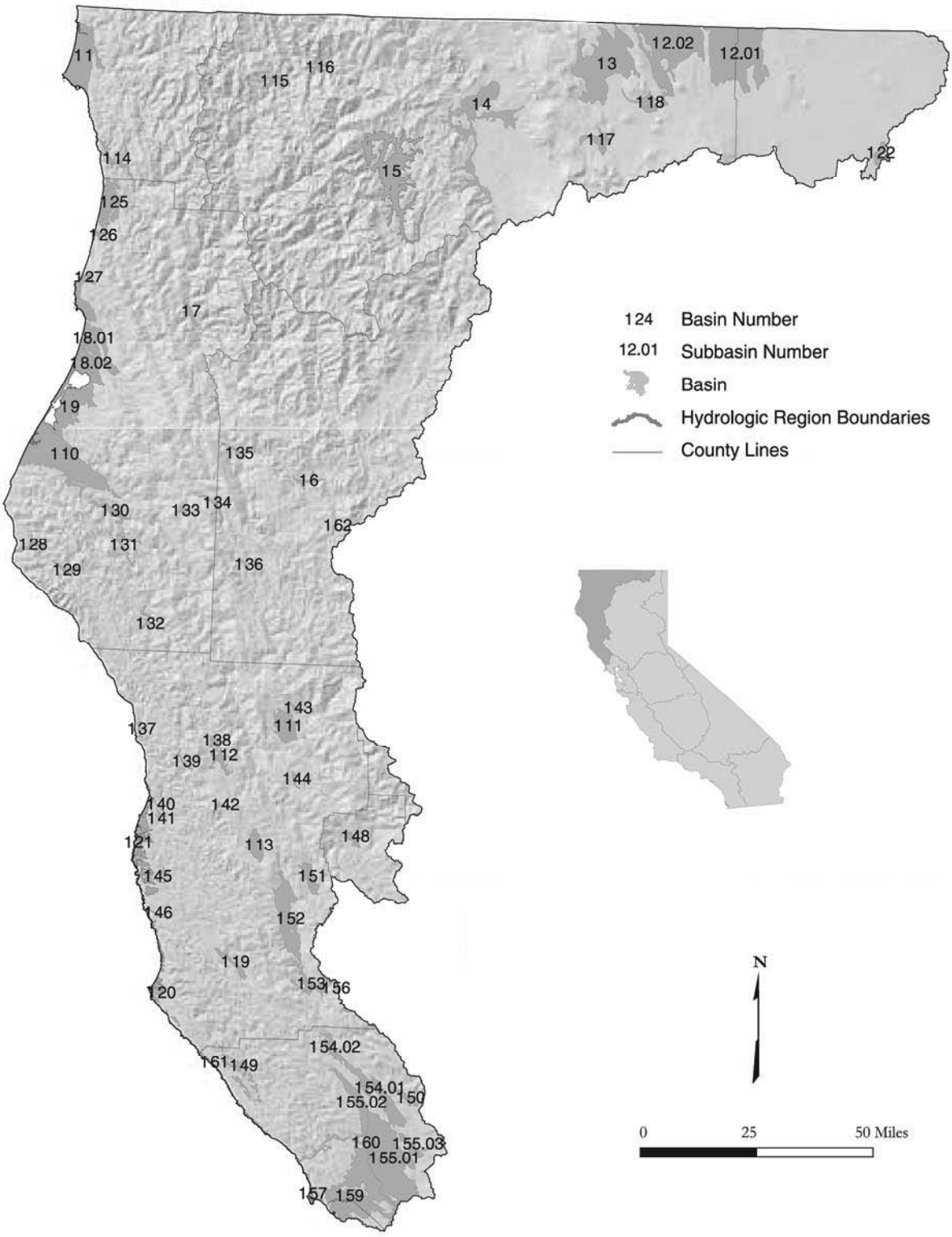

Figure 25 North Coast Hydrologic Region

Basins and Subbasins of the North Coast Hydrologic Region

Basin/subbasin	Basin name
1-1	Smith River Plain
1-2	Klamath River Valley
1-2.01	Tule Lake
1-2.02	Lower Klamath
1-3	Butte Valley
1-4	Shasta Valley
1-5	Scott River Valley
1-6	Hayfork Valley
1-7	Hoopa Valley
1-8	Mad River Valley
1-8.01	Mad River Lowland
1-8.02	Dows Prairie School Area
1-9	Eureka Plain
1-10	Eel River Valley
1-11	Covelo Round Valley
1-12	Laytonville Valley
1-13	Little Lake Valley
1-14	Lower Klamath River Valley
1-15	Happy Camp Town Area
1-16	Seiad Valley
1-17	Bray Town Area
1-18	Red Rock Valley
1-19	Anderson Valley
1-20	Garcia River Valley
1-21	Fort Bragg Terrace Area
1-22	Fairchild Swamp Valley
1-25	Prairie Creek Area
1-26	Redwood Creek Area
1-27	Big Lagoon Area
1-28	Mattole River Valley
1-29	Honeydew Town Area
1-30	Pepperwood Town Area
1-31	Weott Town Area
1-32	Garberville Town Area
1-33	Larabee Valley
1-34	Dinsmores Town Area
1-35	Hyampom Valley
1-36	Hettenshaw Valley
1-37	Cottoneva Creek Valley
1-38	Lower Laytonville Valley
1-39	Branscomb Town Area
1-40	Ten Mile River Valley
1-41	Little Valley
1-42	Sherwood Valley
1-43	Williams Valley
1-44	Eden Valley
1-45	Big River Valley
1-46	Navarro River Valley
1-48	Gravelley Valley
1-49	Annapolis Ohlson Ranch Formation Highlands
1-50	Knights Valley
1-51	Potter Valley
1-52	Ukiah Valley
1-53	Sanel Valley
1-54	Alexander Valley
1-54.01	Alexander Area
1-54.02	Cloverdale Area
1-55	Santa Rosa Valley
1-55.01	Santa Rosa Plain
1-55.02	Healdsburg Area
1-55.03	Rincon Valley
1-56	McDowell Valley
1-57	Bodega Bay Area
1-59	Wilson Grove Formation Highlands
1-60	Lower Russian River Valley
1-61	Fort Ross Terrace Deposits
1-62	Wilson Point Area

Description of the Region

The North Coast HR covers approximately 12.46 million acres (19,470 square miles) and includes all or portions of Modoc, Siskiyou, Del Norte, Trinity, Humboldt, Mendocino, Lake, and Sonoma counties (Figure 25). Small areas of Shasta, Tehama, Glenn, Colusa, and Marin counties are also within the region. Extending from the Oregon border south to Tomales Bay, the region includes portions of four geomorphic provinces. The northern Coast Range forms the portion of the region extending from the southern boundary north to the Mad River drainage and the fault contact with the metamorphic rocks of the Klamath Mountains, which continue north into Oregon. East of the Klamath terrane along the State border are the volcanic terranes of the Cascades and the Modoc Plateau. In the coastal mountains, most of the basins are along the narrow coastal strip between the Pacific Ocean and the rugged Coast Range and Klamath Mountains and along inland river valleys; alluviated basin areas are very sparse in the steep Klamath Mountains. In the volcanic terrane to the east, most of the basins are in block faulted valleys that once held Pleistocene-age lakes. The North Coast HR corresponds to the boundary of RWQCB 1. Significant geographic features include basin areas such as the Klamath River Basin, the Eureka/Arcata area, Hoopa Valley, Anderson Valley, and the Santa Rosa Plain. Other significant features include Mount Shasta, forming the southern border of Shasta Valley, and the rugged north coastal shoreline. The 1995 population of the entire region was about 606,000, with most being centered along the Pacific Coast and in the inland valleys north of the San Francisco Bay Area.

The northern mountainous portion of the region is rural and sparsely populated, primarily because of the rugged terrain. Most of the area is heavily forested. Some irrigated agriculture occurs in the narrow river valleys, but most occurs in the broader valleys on the Modoc Plateau where pasture, grain and alfalfa predominate. In the southern portion of the region, closer to urban centers, crops like wine grapes, nursery stock, orchards, and truck crops are common.

A majority of the surface water in the North Coast HR goes to environmental uses because of the "wild and scenic" designation of most of the region's rivers. Average annual precipitation ranges from 100 inches in the Smith River drainage to 29 inches in the Santa Rosa area and about 10 inches in the Klamath drainage; as a result, drought is likely to affect the Klamath Basin more than other portions of the region. Communities that are not served by the area's surface water projects also tend to experience shortages. Surface water development in the region includes the U.S. Bureau of Reclamation (USBR) Klamath Project, Humboldt Bay Municipal Water District's Ruth Lake, and U.S. Army Corps of Engineer's Russian River Project. An important factor concerning water demand in the Klamath Project area is water allocation for endangered fish species in the upper and lower basin. Surface water deliveries for agriculture in 2001, a severe drought year, were only about 20 percent of normal.

Groundwater Development

Groundwater development in the North Coast HR occurs along the coast, near the mouths of some of the region's major rivers, on the adjacent narrow marine terraces, or in the inland river valleys and basins. Reliability of these supplies varies significantly from area to area. There are 63 groundwater basins/subbasins delineated in the region, two of which are shared with Oregon. These basins underlie approximately 1.022 million acres (1,600 square miles).

Along the coast, most groundwater is developed from shallow wells installed in the sand and gravel beds of several of the region's rivers. Under California law, the water produced in these areas is considered surface water underflow. Water from Ranney collectors installed in the Klamath River, Rowdy Creek, the Smith

River, and the Mad River supply the towns of Klamath, Smith River and Crescent City in Del Norte County and most of the Humboldt Bay area in Humboldt County. Except on the Mad River, which has continuous supply via releases from Ruth Reservoir, these supplies are dependent on adequate precipitation and flows throughout the season. In drought years when streamflows are low, seawater intrusion can occur causing brackish or saline water to enter these systems. This has been a problem in the town of Klamath, which in 1995 had to obtain community water from a private well source. Toward the southern portion of the region, along the Mendocino coast, the Town of Mendocino typifies the problems related to groundwater development in the shallow marine terrace aquifers. Groundwater supply is limited by the aquifer storage capacity, and surveys done in the Town of Mendocino in the mid-1980s indicate that about 10 percent of wells go dry every year and up to 40 percent go dry during drought years.

Groundwater development in the inland coastal valleys north of the divide between the Russian and Eel Rivers is generally of limited extent. Most problems stemming from reliance on groundwater in these areas is a lack of alluvial aquifer storage capacity. Many groundwater wells rely on hydrologic connection to the rivers and streams of the valleys. The City of Rio Dell has experienced water supply problems in community wells and, as a result, recently developed plans to install a Ranney collector near the Eel River. South of the divide, in the Russian River drainage, a significant amount of groundwater development has occurred on the Santa Rosa Plain and surrounding areas. The groundwater supplies augment surface supplies from the Russian River Project.

In the north-central part of the North Coast HR, the major groundwater basins include the Klamath River Valley, Shasta Valley, Scott River Valley, and Butte Valley. The Klamath River Valley is shared with Oregon. Of these groundwater basins, Butte Valley has the most stable water supply conditions. The historical annual agricultural surface water supply has been about 20,000 acre-feet. As farming in the valley expanded from the early 1950s to the early 1990s, bringing nearly all the arable land in the valley into production, groundwater was developed to farm the additional acres. It has been estimated that current, fully developed demands are only about 80 percent of the available groundwater supply. By contrast, water supply issues in the other three basins are contingent upon pending management decisions regarding restoration of fish populations in the Klamath River and the Upper Klamath Basin system. The Endangered Species Act (ESA) fishery issues include lake level requirements for two sucker fish species and in-stream flow requirements for coho salmon and steelhead trout. Since about 1905, the Klamath Project has provided surface water to the agricultural community, which in turn has provided water to the wildlife refuges. Since the early 1990s, it has been recognized that surface water in the Klamath Project is over-allocated, but very little groundwater development had occurred. In 2001, which was a severe drought year, USBR delivered a total of about 75,000 acre-feet of water to agriculture in California, about 20 percent of normal. In the Klamath River Groundwater Basin this translated to a drought disaster, both for agriculture and the wildlife refuges. In addition, there were significant impacts for both coho salmon and sucker fisheries in the Klamath River watershed. As a result of the reduced surface water deliveries, significant groundwater development occurred, and groundwater extraction increased from an estimated 6,000 acre-feet in 1997 to roughly 60,000 acre-feet in 2001. Because of the complexity of the basin's water issues, a long-term Klamath Project Operation plan has not yet been finalized. Since 1995, USBR has issued an annual operation plan based on estimates of available supply. The Scott River Valley and Shasta Valley rely to a significant extent on surface water diversions. In most years, surface water supplies the majority of demand, and groundwater extraction supplements supply as needed depending on wet or dry conditions. Discussions are under way to develop strategies to conjunctively use surface water and groundwater to meet environmental, agricultural, and other demands.

Groundwater Quality

Groundwater quality characteristics and specific local impairments vary with regional setting within the North Coast HR. In general, seawater intrusion and nitrates in shallow aquifers are problems in the coastal groundwater basins; high total dissolved solids (TDS) content and general alkalinity are problems in the lake sediments of the Modoc Plateau basins; and iron, boron, and manganese can be problems in the inland basins of Mendocino and Sonoma counties.

Water Quality in Public Supply Wells

From 1994 through 2000, 584 public supply water wells were sampled in 32 of the 63 basins and subbasins in the North Coast HR. Analyzed samples indicate that 553 wells, or 95%, met the state primary Maximum Contaminant Levels (MCL) for drinking water. Thirty-one wells, or 5%, sampled have constituents that exceed one or more MCL. Figure 26 shows the percentage of each contaminant group that exceeded MCLs in the 31 wells.

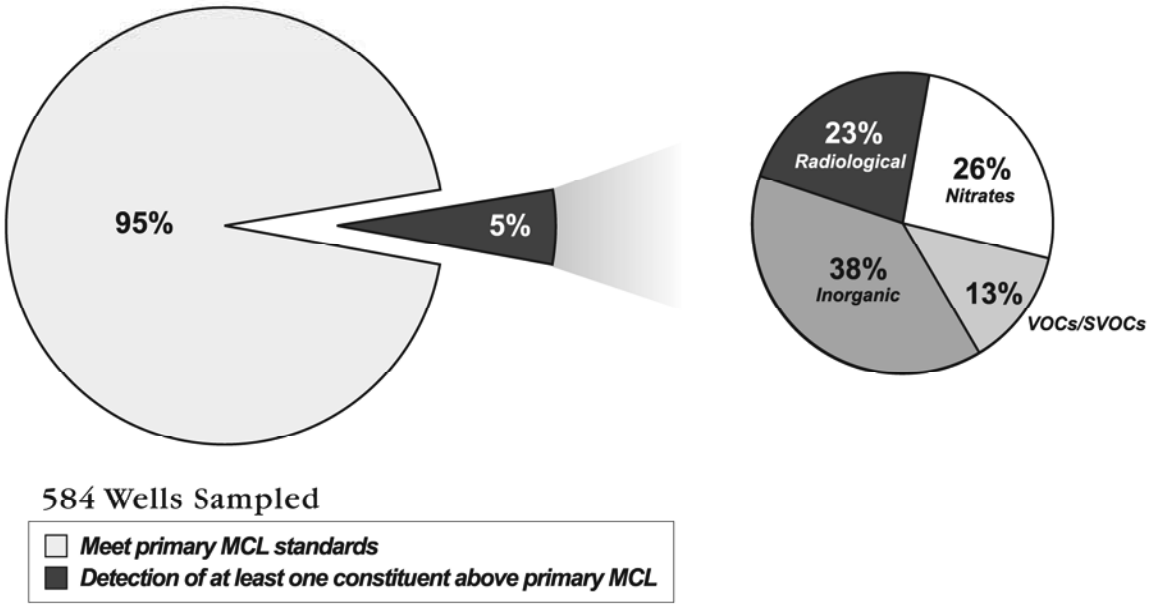

Figure 26 MCL exceedances in public supply wells in the North Coast Hydrologic Region

Table 13 lists the three most frequently occurring individual contaminants in each of the five contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 13 Most frequently occurring contaminants by contaminant group in the North Coast Hydrologic Region

Contaminant group wellsInorganics – Primary exceedance	Contaminant - # of wells Aluminum – 4	Contaminant - # of wells Arsenic – 4	Contaminant - # of 4 tied at 1
Inorganics – Secondary	Manganese – 150	Iron – 108	Copper – 2
Radiological	Radium 228 – 3	Combined RA226 + RA228 – 3	Radium 226 – 1
Nitrates	Nitrate(as NO_3) – 7	Nitrite(as N) – 1	
VOCs/SVOCs	TCE – 2	3 tied at 1 exceedance	

TCE = Trichloroethylene
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

Changes from Bulletin 118-80

Since Bulletin 118-80 was published, RWQCB 2 boundary has been modified. This resulted in several basins being reassigned to RWQCB 1. These are listed in Table 14, along with other modifications to North Coast HR.

Table 14 Modifications since Bulletin 118-80 of groundwater basins in North Coast Hydrologic Region

Basin name	New number	Old number
McDowell Valley	1-56	2-12
Knights Valley	1-50	2-13
Potter Valley	1-51	2-14
Ukiah Valley	1-52	2-15
Sanel Valley	1-53	2-16
Alexander Valley	1-54	2-17
Santa Rosa Valley	1-55	2-18
Lower Russian River Valley	1-60	2-20
Bodega Bay Area	1-57	2-21
Modoc Plateau Recent Volcanic Area	deleted	1-23
Modoc Plateau Pleistocene Volcanic Area	deleted	1-24
Gualala River Valley	deleted	1-47
Wilson Grove Formation Highlands	1-59	2-25
Fort Ross Terrace Deposits	1-61	
Wilson Point Area	1-62	

Fort Ross Terrace Deposits (1-61) and Wilson Point Area (1-62) have been defined since B118-80 and are included in this update. Mad River Valley Groundwater Basin (1-8) has been subdivided into two subbasins. Sebastopol Merced Formation (2-25) merged into Basin 1-59 and was renamed Wilson Grove Formation Highlands.

There are a couple of deletions of groundwater basins from Bulletin 118-80. The Modoc Plateau Recent Volcanic Area (1-23) and the Modoc Plateau Pleistocene Volcanic Area (1-24) are volcanic aquifers and were not assigned basin numbers in this bulletin. These are considered to be groundwater source areas as discussed in Chapter 6. Gualala River Valley (1-47) was deleted because the State Water Resources Control Board determined the water being extracted in this area as surface water within a subterranean stream.

Table 15 North Coast Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
1-1	SMITH RIVER PLAIN	40,450	B	500	50	7	10	33	164	32 - 496
1-2	KLAMATH RIVER VALLEY									
1-2.01	UPPER KLAMATH LAKE BASIN - Tule Lake	85,930	B	3,380	1,208	40	8	5	721	140 - 2,200
1-2.02	UPPER KLAMATH LAKE BASIN - Lower Klamath	73,330	B	2,600	1,550	4	-	-	-	-
1-3	BUTTE VALLEY	79,700	B	5,000	2,358	28	13	9	310	55 - 1,110
1-4	SHASTA VALLEY	52,640	B	1,200	273	9	15	24	-	-
1-5	SCOTT RIVER VALLEY	63,900	B	3,000	794	6	10	5	258	47 - 1,510
1-6	HAYFORK VALLEY	3,300	B	200	-	-	5	-	-	-
1-7	HOOPA VALLEY	3,900	B	300	-	-	4	-	125	95 - 159
1-8	MAD RIVER VALLEY									
1-8.01	MAD RIVER VALLEY LOWLAND	25,600	B	120	72	4	9	2	184	55 - 280
1-8.02	DOWS PRAIRIE SCHOOL AREA	14,000	B	-	-	-	3	-	-	-
1-9	EUREKA PLAIN	37,400	B	1,200	-	4	4	6	177	97 - 460
1-10	EEL RIVER VALLEY	73,700	B	1,200	-	8	11	29	237	110 - 340
1-11	COVELO ROUND VALLEY	16,400	C	850	193	9	5	29	239	116 - 381
1-12	LAYTONVILLE VALLEY	5,020	A	700	7	4	3	-	149	53 - 251
1-13	LITTLE LAKE VALLEY	10,000	A	1,000	45	7	7	-	340	97 - 1,710
1-14	LOWER KLAMATH RIVER VALLEY	7,030	B	-	-	-	-	-	-	43 - 150
1-15	HAPPY CAMP TOWN AREA	2,770	B	-	-	-	-	17	-	-
1-16	SEIAD VALLEY	2,250	B	-	-	-	2	2	-	-
1-17	BRAY TOWN AREA	8,030	B	-	-	-	-	-	-	-
1-18	RED ROCK VALLEY	9,000	B	-	-	-	-	-	-	-
1-19	ANDERSON VALLEY	4,970	C	300	30	7	5	7	-	80 - 400
1-20	GARCIA RIVER VALLEY	2,240	C	-	-	-	-	-	-	-
1-21	FORT BRAGG TERRACE AREA	24,100	C	75	14	-	-	51	185	26 - 650
1-22	FAIRCHILD SWAMP VALLEY	3,300	B	-	-	-	-	-	-	-
1-25	PRAIRIE CREEK AREA	20,000	B	-	-	-	-	1	106	-
1-26	REDWOOD CREEK AREA	2,000	B	-	-	1	0	4	-	102 - 332
1-27	BIG LAGOON AREA	13,400	B	-	-	1	0	31	174	-
1-28	MATTOLE RIVER VALLEY	3,150	B	-	-	-	-	2	-	-
1-29	HONEYDEW TOWN AREA	2,370	B	-	-	-	-	1	-	-
1-30	PEPPERWOOD TOWN AREA	6,290	B	-	-	-	-	1	-	-
1-31	WEOTT TOWN AREA	3,650	B	-	-	-	-	2	-	-
1-32	GARBERVILLE TOWN AREA	2,100	B	-	-	-	-	5	-	-
1-33	LARABEE VALLEY	970	B	-	-	-	-	-	-	-
1-34	DINSMORES TOWN AREA	2,300	B	-	-	-	-	3	-	-
1-35	HYAMPOM VALLEY	1,350	B	-	-	-	-	1	-	-
1-36	HETTENSHAW VALLEY	850	B	-	-	-	-	-	-	-
1-37	COTTONEVA CREEK VALLEY	760	C	-	-	-	-	-	118	118
1-38	LOWER LAYTONVILLE VALLEY	2,150	C	-	-	-	-	-	-	-
1-39	BRANSCOMB TOWN AREA	1,320	C	-	-	-	-	-	130	80 - 179
1-40	TEN MILE RIVER VALLEY	1,490	C	-	-	-	-	-	-	-
1-41	LITTLE VALLEY	810	C	-	-	-	-	-	-	-

Table 15 North Coast Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
1-42	SHERWOOD VALLEY	1,150	C	-	-	-	-	-	-	-
1-43	WILLIAMS VALLEY	1,640	C	-	-	-	-	-	-	-
1-44	EDEN VALLEY	1,380	C	-	-	-	-	-	140	140
1-45	BIG RIVER VALLEY	1,690	C	-	-	-	-	2	-	-
1-46	NAVARRO RIVER VALLEY	770	C	-	-	-	-	-	-	-
1-48	GRAVELLEY VALLEY	3,000	C	-	-	-	-	3	-	-
1-49	ANAPOLIS OHLSON RANCH FOR. HIGHLANDS	8,650	C	36	-	-	0	1	260	260
1-50	KNIGHTS VALLEY	4,090	C	-	-	-	-	-	-	-
1-51	POTTER VALLEY	8,240	C	100	-	2	0	1	-	140 - 395
1-52	UKIAH VALLEY									
1-53	SANEL VALLEY	5,570	C	1,250	-	5	8	6	-	174 - 306
1-54	ALEXANDER VALLEY									
1-54.01	ALEXANDER AREA									
1-54.02	CLOVERDALE AREA	6,500	C	-	500	3	-	13	-	130 - 304
1-55	SANTA ROSA VALLEY									
1-55.01	SANTA ROSA PLAIN	80,000	A	1,500	-	43	-	155	-	-
1-55.02	HEALDSBURG AREA	15,400	C	500	-	8	-	28	-	90 - 500
1-55.03	RINCON VALLEY	5,600	C	-	-	2	-	12	-	-
1-56	McDOWELL VALLEY	1,500	C	1,200	-	-	-	-	145	143 - 146
1-57	BODEGA BAY AREA	2,680	A	150	-	-	-	6	-	-
1-59	WILSON GROVE FORMATION HIGHLANDS	81,500	C	-	-	14	-	68	-	-
1-60	LOWER RUSSIAN RIVER VALLEY	6,600	C	500 +	-	1	-	32	-	120 - 210
1-61	FORT ROSS TERRACE DEPOSITS	8,490	C	75	27	-	-	13	320	230 - 380
1-62	WILSON POINT AREA	700	B	-	-	-	-	-	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS = total dissolved solids

San Francisco Bay Hydrologic Region

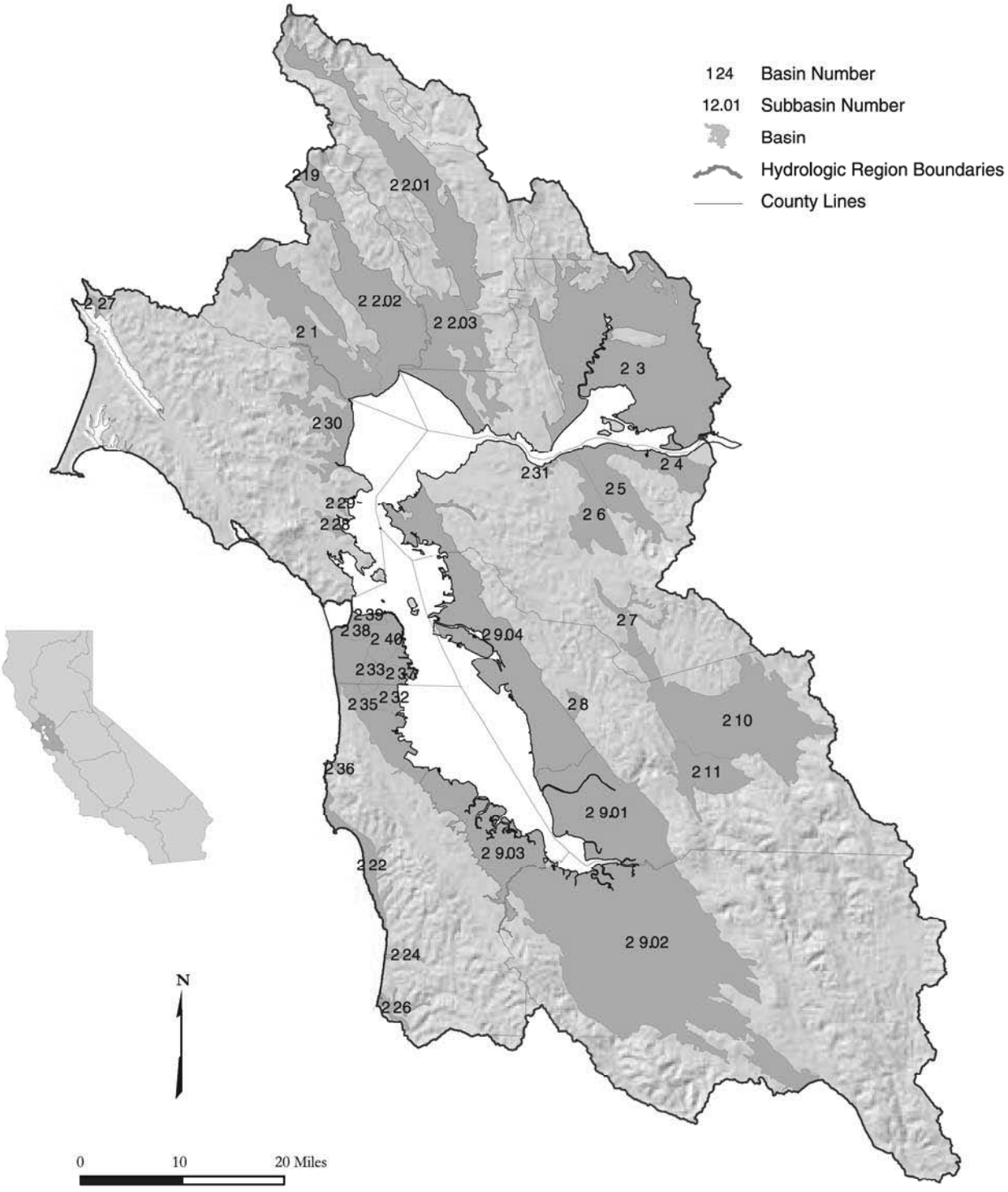

Figure 27 San Francisco Bay Hydrologic Region

Basins and Subbasins of the San Francisco Bay Hydrologic Region

Basin/subbasin	Basin name
2-1	Petaluma Valley
2-2	Napa-Sonoma Valley
2-2.01	Napa Valley
2-2.02	Sonoma Valley
2-2.03	Napa-Sonoma Lowlands
2-3	Suisun-Fairfield Valley
2-4	Pittsburg Plain
2-5	Clayton Valley
2-6	Ygnacio Valley
2-7	San Ramon Valley
2-8	Castro Valley
2-9	Santa Clara Valley
2-9.01	Niles Cone
2-9.02	Santa Clara
2-9.03	San Mateo Plain
2-9.04	East Bay Plain
2-10	Livermore Valley
2-11	Sunol Valley
2-19	Kenwood Valley
2-22	Half Moon Bay Terrace
2-24	San Gregorio Valley
2-26	Pescadero Valley
2-27	Sand Point Area
2-28	Ross Valley
2-29	San Rafael Valley
2-30	Novato Valley
2-31	Arroyo Del Hambre Valley
2-32	Visitacion Valley
2-33	Islais Valley
2-35	Merced Valley
2-36	San Pedro Valley
2-37	South San Francisco
2-38	Lobos
2-39	Marina
2-40	Downtown San Francisco

Description of the Region

The San Francisco Bay HR covers approximately 2.88 million acres (4,500 square miles) and includes all of San Francisco and portions of Marin, Sonoma, Napa, Solano, San Mateo, Santa Clara, Contra Costa, and Alameda counties (Figure 27). The region corresponds to the boundary of RWQCB 2. Significant geographic features include the Santa Clara, Napa, Sonoma, Petaluma, Suisun-Fairfield, and Livermore valleys; the Marin and San Francisco peninsulas; San Francisco, Suisun, and San Pablo bays; and the Santa Cruz Mountains, Diablo Range, Bolinas Ridge, and Vaca Mountains of the Coast Range. While being the smallest in size of the 10 HRs, the region has the second largest population in the State at about 5.8 million in 1995 (DWR 1998). Major population centers include the cities of San Francisco, San Jose and Oakland.

Groundwater Development

The region has 28 identified groundwater basins. Two of those, the Napa-Sonoma Valley and Santa Clara Valley groundwater basins, are further divided into three and four subbasins, respectively. The groundwater basins underlie approximately 896,000 acres (1,400 square miles) or about 30 percent of the entire HR.

Despite the tremendous urban development in the region, groundwater use accounts for only about 5 percent (68,000 acre-feet) of the region's estimated average water supply for agricultural and urban uses, and accounts for less than one percent of statewide groundwater uses.

In general, the freshwater-bearing aquifers are relatively thin in the smaller basins and moderately thick in the more heavily utilized basins. The more heavily utilized basins in this region include the Santa Clara Valley, Napa-Sonoma Valley, and Petaluma Valley groundwater basins. In these basins, the municipal and irrigation wells have average depths ranging from about 200 to 500 feet. Well yields in these basins range from less than 50 gallons per minute (gpm) to approximately 3,000 gpm. In the smaller basins, most municipal and irrigation wells have average well depths in the 100- to 200-foot range. Well yields in the smaller and less utilized basins are typically less than 500 gpm.

Land subsidence has been a significant problem in the Santa Clara Valley Groundwater Basin in the past. An extensive annual monitoring program has been set up within the basin to evaluate changes in an effort to maintain land subsidence at less than 0.01 feet per year (SCVWD 2001). Additionally, groundwater recharge projects have been implemented in the Santa Clara Valley to ensure that groundwater will continue to be a viable water supply in the future.

Groundwater Quality

In general, groundwater quality throughout most of the region is suitable for most urban and agricultural uses with only local impairments. The primary constituents of concern are high TDS, nitrate, boron, and organic compounds.

The areas of high TDS (and chloride) concentrations are typically found in the region's groundwater basins that are situated close to the San Francisco Bay, such as the northern Santa Clara, southern Sonoma, Petaluma, and Napa valleys. Elevated levels of nitrate have been detected in a large percentage of private wells tested within the Coyote Subbasin and Llagas Subbasin of the Gilroy-Hollister Valley Groundwater Basin (in the Central Coast HR) located to the south of the Santa Clara Valley (SCVWD 2001). The shallow aquifer zone within the Petaluma Valley also shows persistent nitrate contamination. Groundwater with high TDS, iron, and boron levels is present in the Calistoga area of Napa Valley, and elevated boron levels in other parts of Napa Valley make the water unfit for agricultural uses. Releases of fuel hydrocarbons from leaking underground storage tanks and spills/leaks of organic solvents at industrial sites have caused minor to significant groundwater impacts in many basins throughout the region. Methyl tertiary-butyl ether (MTBE) and chlorinated solvent releases to soil and groundwater continue to be problematic. Environmental oversight for many of these sites is performed either by local city and county enforcement agencies, the RWQCB, the Department of Toxic Substances Control, and/or the U.S. Environmental Protection Agency.

Water Quality in Public Supply Wells

From 1994 through 2000, 485 public supply water wells were sampled in 18 of the 33 basins and subbasins in the San Francisco Bay HR. Analyzed samples indicate that 410 wells, or 85 percent, met the state primary MCLs for drinking water standards. Seventy-five wells, or 15 percent, have constituents that exceed one or more MCL. Figure 28 shows the percentages of each contaminant group that exceeded MCLs in the 75 wells.

Table 16 lists the three most frequently occurring contaminants in each contaminant group and the number of wells in the HR that exceeded the MCL for those contaminants.

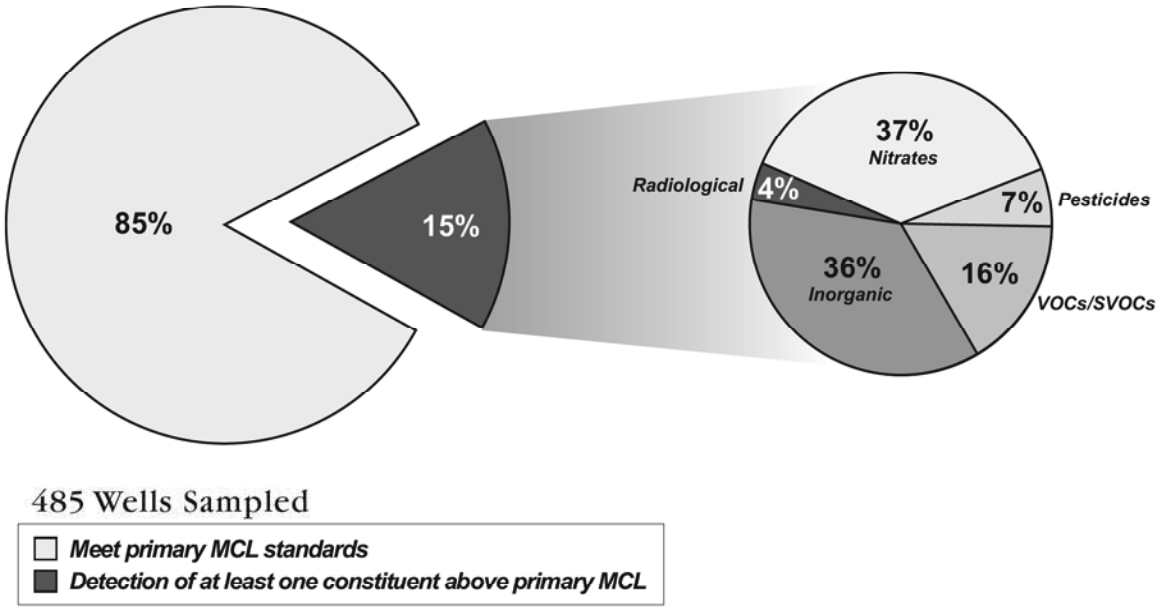

Figure 28 MCL exceedances in public supply wells in the San Francisco Bay Hydrologic Region

Table 16 Most frequently occurring contaminants by contaminant group in the San Francisco Bay Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics	Iron – 57	Manganese – 57	Fluoride – 7
Radiological	Gross Alpha – 2	Radium 226 – 1	
Nitrates	Nitrate (as NO_3) – 27	Nitrate + Nitrite – 3	Nitrite (as N) – 1
Pesticides	Di(2-Ethylhexyl)phthalate – 4	Heptachlor – 1	
VOCs/SVOCs	PCE – 4	Dichloromethane – 3	TCE– 2 Vinyl Chloride – 2

TCE = Trichloroethylene
PCE = Tetrachloroethylene
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Coumpound

Changes from Bulletin 118-80

Since Bulletin 118-80 was published, RWQCB 2 boundary has been modified. This resulted in several basins being reassigned to RWQCB 1. These are listed in Table 17.

Table 17 Modifications since Bulletin 118-80 of groundwater basins in San Francisco Bay Hydrologic Region

Basin name	New number	Old number
McDowell Valley	1-56	2-12
Knights Valley	1-50	2-13
Potter Valley	1-51	2-14
Ukiah Valley	1-52	2-15
Sanel Valley	1-53	2-16
Alexander Valley	1-54	2-17
Santa Rosa Valley	1-55	2-18
Lower Russian River Valley	1-60	2-20
Bodega Bay Area	1-57	2-21

No additional basins were assigned to the San Francisco Bay HR in this revision. However, the Santa Clara Valley Groundwater Basin (2-9) has been subdivided into four subbasins instead of two, and the Napa-Sonoma Valley Groundwater Basin is now three subbasins instead of two.

There are several deletions of groundwater basins from Bulletin 118-80. The San Francisco Sand Dune Area (2-34) was deleted when the San Francisco groundwater basins were redefined in a USGS report in the early 1990s. The Napa-Sonoma Volcanic Highlands (2-23) is a volcanic aquifer and was not assigned a basin number in this bulletin. This is considered to be a groundwater source area as discussed in Chapter 6. Bulletin 118-80 identified seven groundwater basins that were stated to differ from 118-75: Sonoma County Basin, Napa County Basin, Santa Clara County Basin, San Mateo Basin, Alameda Bay Plain Basin, Niles Cone Basin, and Livermore Basin. They were created primarily by combining several smaller basins and subbasins within individual counties. This report does not consider these seven as basins. There is no change in numbering because the basins were never assigned a basin number.

Table 18 San Francisco Bay Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Active Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
2-1	PETALUMA VALLEY	46,100	C	100	-	16	7	24	347	58-650
2-2	NAPA-SONOMA VALLEY									
2-2.01	NAPA VALLEY	45,900	A	3,000	223	19	10	23	272	150-370
2-2.02	SONOMA VALLEY	44,700	C	1,140	516	18	9	35	321	100-550
2-2.03	NAPA-SONOMA LOWLANDS	40,500	C	300	98	0	6	9	185	50-300
2-3	SUISUN-FAIRFIELD VALLEY	133,600	C	500	200	21	17	35	410	160-740
2-4	PITTSBURG PLAIN	11,600	C	-	-	-	-	9	-	-
2-5	CLAYTON VALLEY	17,800	C	-	-	-	-	48	-	-
2-6	YGNACIO VALLEY	15,500	C	-	-	-	-	-	-	-
2-7	SAN RAMON VALLEY	7,060	C	-	-	-	-	-	-	-
2-8	CASTRO VALLEY	1,820	C	-	-	-	-	-	-	-
2-9	SANTA CLARA VALLEY									
2-9.01	NILES CONE	57,900	A	3,000	2,000	350	120	20	-	-
2-9.02	SANTA CLARA	190,000	C	-	-	-	10	234	408	200-931
2-9.03	SAN MATEO PLAIN	48,100	C	-	-	-	2	14	407	300-480
2-9.04	EAST BAY PLAIN	77,400	A	1,000	UNK	29	16	7	638	364-1,420
2-10	LIVERMORE VALLEY	69,500	A	-	-	-	-	36	-	-
2-11	SUNOL VALLEY	16,600	C	-	-	-	-	2	-	-
2-19	KENWOOD VALLEY	3,170	C	-	-	-	-	13	-	-
2-22	HALF MOON BAY TERRACE	9,150	C	-	-	5	-	9	-	-
2-24	SAN GREGORIO VALLEY	1,070	C	-	-	-	-	-	-	-
2-26	PESCADERO VALLEY	2,900	C	-	-	3	-	4	-	-
2-27	SAND POINT AREA	1,400	C	-	-	-	-	6	-	-
2-28	ROSS VALLEY	1,770	C	-	-	-	-	-	-	-
2-29	SAN RAFAEL VALLEY	880	C	-	-	-	-	-	-	-
2-30	NOVATO VALLEY	20,500	C	-	-	-	-	1	-	-
2-31	ARROYO DEL HAMBRE VALLEY	790	C	-	-	-	-	-	-	-
2-32	VISITACION VALLEY	880	C	-	-	-	-	-	-	-
2-33	ISLAIS VALLEY	1,550	C	-	-	-	-	-	-	-
2-35	MERCED VALLEY	10,400	C	-	-	-	-	10	-	-
2-36	SAN PEDRO VALLEY	880	C	-	-	-	-	-	-	-
2-37	SOUTH SAN FRANCISCO	2,170	C	-	-	-	-	-	-	-
2-38	LOBOS	2,400	A	-	-	-	-	-	-	-
2-39	MARINA	220	A	-	-	-	-	-	-	-
2-40	DOWNTOWN SAN FRANCISCO	7,600	C	-	-	-	-	-	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS - total dissolved solids

Central Coast Hydrologic Region

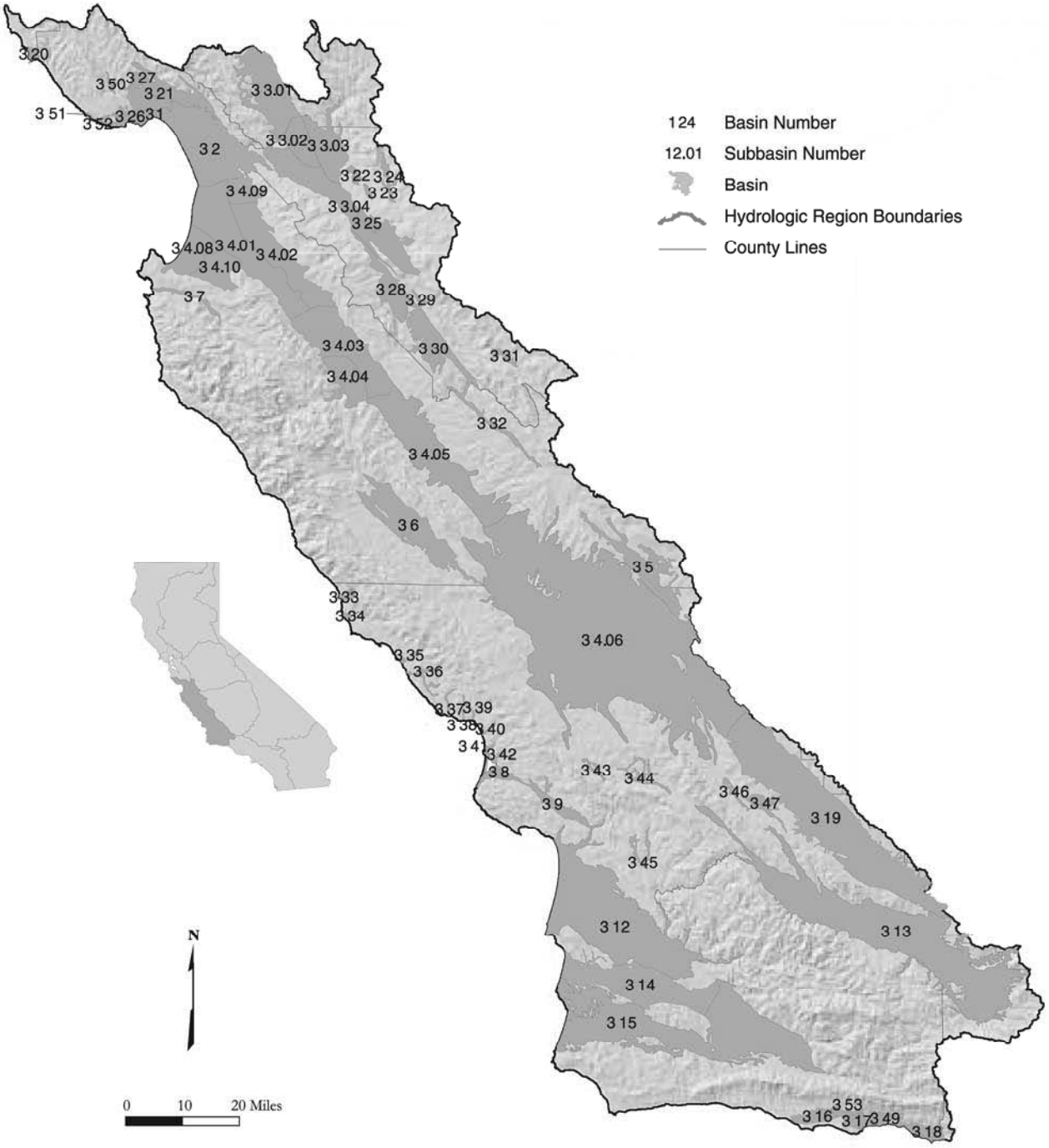

Figure 29 Central Coast Hydrologic Region

Basins and Subbasins of Central Coast Hydrologic Region

RegionBasin/ subbasin	Basin name
3-1	Soquel Valley
3-2	Pajaro Valley
3-3	Gilroy-Hollister Valley
3-3.01	Llagas Area
3-3.02	Bolsa Area
3-3.03	Hollister Area
3-3.04	San Juan Bautista Area
3-4	Salinas Valley
3-4.01	180/400 Foot Aquifer
3-4.02	East Side Aquifer
3-4.04	Forebay Aquifer
3-4.05	Upper Valley Aquifer
3-4.06	Paso Robles Area
3-4.08	Seaside Area
3-4.09	Langley Area
3-4.10	Corral de Tierra Area
3-5	Cholame Valley
3-6	Lockwood Valley
3-7	Carmel Valley
3-8	Los Osos Valley
3-9	San Luis Obispo Valley
3-12	Santa Maria River Valley
3-13	Cuyama Valley
3-14	San Antonio Creek Valley
3-15	Santa Ynez River Valley
3-16	Goleta
3-17	Santa Barbara
3-18	Carpinteria
3-19	Carrizo Plain
3-20	Ano Nuevo Area
3-21	Santa Cruz Purisima Formation
3-22	Santa Ana Valley
3-23	Upper Santa Ana Valley
3-24	Quien Sabe Valley
3-25	Tres Pinos Valley
3-26	West Santa Cruz Terrace
3-27	Scotts Valley
3-28	San Benito River Valley
3-29	Dry Lake Valley
3-30	Bitter Water Valley
3-31	Hernandez Valley
3-32	Peach Tree Valley
3-33	San Carpoforo Valley
3-34	Arroyo de la Cruz Valley
3-35	San Simeon Valley
3-36	Santa Rosa Valley
3-37	Villa Valley
3-38	Cayucos Valley
3-39	Old Valley
3-40	Toro Valley
3-41	Morro Valley
3-42	Chorro Valley
3-43	Rinconada Valley
3-44	Pozo Valley
3-45	Huasna Valley
3-46	Rafael Valley
3-47	Big Spring Area
3-49	Montecito
3-50	Felton Area
3-51	Majors Creek
3-52	Needle Rock Point
3-53	Foothill

Description of the Region

The Central Coast HR covers approximately 7.22 million acres (11,300 square miles) in central California (Figure 29). This HR includes all of Santa Cruz, Monterey, San Luis Obispo, and Santa Barbara counties, most of San Benito County, and parts of San Mateo, Santa Clara, and Ventura counties. Significant geographic features include the Pajaro, Salinas, Carmel, Santa Maria, Santa Ynez, and Cuyama valleys; the coastal plain of Santa Barbara; and the Coast Range. Major drainages in the region include the Salinas, Cuyama, Santa Ynez, Santa Maria, San Antonio, San Lorenzo, San Benito, Pajaro, Nacimiento, Carmel, and Big Sur Rivers.

Population data from the 2000 Census suggest that about 1.4 million people or about 4 percent of the population of the State live in this HR. Major population centers include Santa Barbara, Santa Maria, San Luis Obispo, Gilroy, Hollister, Morgan Hill, Salinas, and Monterey.

The Central Coast HR has 50 delineated groundwater basins. Within this region, the Gilroy-Hollister Valley and Salinas Valley groundwater basins are divided into four and eight subbasins, respectively. Groundwater basins in this HR underlie about 2.390 million acres (3,740 square miles) or about one-third of the HR.

Groundwater Development

Locally, groundwater is an extremely important source of water supply. Within the region, groundwater accounted for 83 percent of the annual supply used for agricultural and urban purposes in 1995. For an average year, groundwater in the region accounts for about 8.4 percent of the statewide groundwater supply and about 1.3 percent of the total state water supply for agricultural and urban needs. In drought years, groundwater in this region is expected to account for about 7.2 percent of the statewide groundwater supply and about 1.9 percent of the total State water supply for agricultural and urban needs (DWR 1998).

Aquifers are varied and range from large extensive alluvial valleys with thick multilayered aquifers and aquitards to small inland valleys and coastal terraces. Several of the larger basins provide a dependable and drought-resistant water supply to coastal cities and farms.

Conjunctive use of surface water and groundwater is a long-standing practice in the region. Several reservoirs including Hernandez, Twitchell, Lake San Antonio, and Lake Nacimiento are operated primarily for the purpose of groundwater recharge. The concept is to maintain streamflow over a longer period than would occur without surface water storage and thus provide for increased recharge of groundwater. Seawater intrusion is a major problem throughout much of the region. In the Salinas Valley Groundwater Basin, seawater intrusion was first documented in the 1930s and has been observed more than 5 miles inland.

Groundwater Quality

Much of the groundwater in the region is characterized by calcium sulfate to calcium sodium bicarbonate sulfate water types because of marine sedimentary rock in the watersheds. Aquifers intruded by seawater are typically characterized by sodium chloride to calcium chloride, and have chloride concentrations greater than 500 mg/L. In several areas, groundwater exceeds the MCL for nitrate.

Water Quality in Public Supply Wells

From 1994 through 2000, 711 public supply water wells were sampled in 38 of the 60 basins and subbasins in the Central Coast HR. Analyzed samples indicate that 587 wells, or 83 percent, met the state primary MCLs for drinking water. One-hundred-twenty-four wells, or 17 percent, have constituents that exceed one or more MCL. Figure 30 shows the percentages of each contaminant group that exceeded MCLs in the 124 wells.

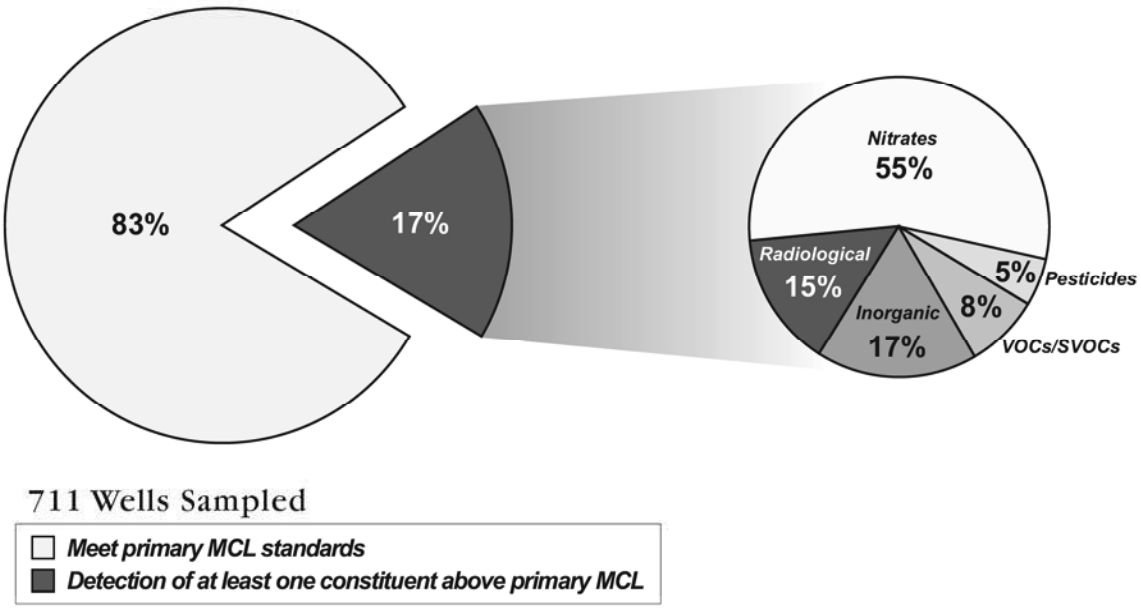

Figure 30 MCL exceedances in public supply wells in the Central Coast Hydrologic Region

Table 19 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 19 Most frequently occurring contaminants by contaminant group in the Central Coast Hydrologic Region

Contaminant group wells	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of
Inorganics – Primary	Antimony – 6	Aluminum – 4	Chromium (Total) – 4
Inorganics – Secondary	Iron – 145	Manganese – 135	TDS – 11
Radiological	Gross Alpha – 15	Radium 226 – 3	Uranium – 3
Nitrates	Nitrate (as NO_3) – 69	Nitrate + Nitrite – 24	
Pesticides	Heptachlor – 4	Di (2-Ethylhexyl) phthalate – 2	
VOCs/SVOCs	TCE – 3	3 are tied at 2 exceedances	

TCE = Trichloroethylene
VOC = Volatile Organic Compound
SVOC= Semivolatile Organic Compound

Changes from Bulletin 118-80

Four new basins have been defined since Bulletin 118-80. They are Felton Area, Majors Creek, Needle Rock Point, and Foothill groundwater basins. Additionally, new subbasins have been broken out in both the Gilroy-Hollister Valley Groundwater Basin (3-3) and the Salinas Valley Groundwater Basin (3-4) (Table 20).

Table 20 Modifications since Bulletin 118-80 of groundwater basins and subbasins in Central Coast Hydrologic Region

Subbasin name	New number	Old number
Llagas Area	3-3.01	3-3
Bolsa Area	3-3.02	3-3
Hollister Area	3-3.03	3-3
San Juan Bautista Area	3-3.04	3-3
180/400 Foot Aquifer	3-4.01	3-4
East Side Aquifer	3-4.02	3-4
Upper Forebay Aquifer	3-4.04	3-4
Upper Valley Aquifer	3-4.05	3-4
Pismo Creek Valley Basin	3-12	3-10
Arroyo Grande Creek Basin	3-12	3-11
Careaga Sand Highlands Basin	3-12 and 3-14	3-48
Felton Area	3-50	
Majors Creek	3-51	
Needle Rock Point	3-52	
Foothill	3-53	

Pismo Creek Valley Basin (3-10) and Arroyo Grande Creek Basin (3-11) have been merged into the Santa Maria River Valley Basin (3-12). Careaga Sand Highlands Basin (3-48) has been merged into the Santa Maria River Valley Basin (3-12) and San Antonio Creek Valley Basin (3-14).

Table 21 Central Coast Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
3-1	SOQUEL VALLEY	2,500	C	1,421	665	6	6	16	482	270-990
3-2	PAJARO VALLEY	76,800	A	2,000	500	185	185	149	580-910	300-30,000
3-3	GILROY-HOLLISTER VALLEY									
3-3.01	LLAGAS AREA	55,600	C	-	-	-	-	95	-	-
3-3.02	BOLSA AREA	21,000	A	-	400	11	<11	3	-	400-1800
3-3.03	HOLLISTER AREA	32,700	A	-	400	42	<42	35	-	400-1600
3-3.04	SAN JUAN BAUTISTA AREA	74,300	A	-	400	37	<37	40	-	460-1700
3-4	SALINAS VALLEY									
3-4.01	180/400 FOOT AQUIFER	84,400	A	-	-	166	218	82	478	223-1,013
3-4.02	EAST SIDE AQUIFER	57,500	A	-	-	74	67	53	450	168-977
3-4.04	FOREBAY AQUIFER	94,100	A	-	-	89	91	35	624	300-1,100
3-4.05	UPPER VALLEY AQUIFER	98,200	A	4,000	-	36	37	17	443	140-3,700
3-4.06	PASO ROBLES AREA	597,000	A	3,300	-	183	-	58	614	165-3,868
3-4.08	SEASIDE AREA	25,900	B	3,500	1,000		7	24	400	200-900
3-4.09	LANGLEY AREA	15,400	B	1,570	450	-	-	52	-	52-348
3-4.10	CORRAL DE TIERRA AREA	22,300	C	948	450	-	3	26	-	355-679
3-5	CHOLAME VALLEY	39,800	C	3,000	1,000	1	-	1	-	-
3-6	LOCKWOOD VALLEY	59,900	C	1,500	100	-	-	9	-	-
3-7	CARMEL VALLEY	5,160	C	1,000	600	50	23	12	260-670	220-1,200
3-8	LOS OSOS VALLEY	6,990	A	700	230	-	-	10	354	78-33,700
3-9	SAN LUIS OBISPO VALLEY	12,700	A	600	300	-	-	11	583	278-1,949
3-12	SANTA MARIA RIVER VALLEY	184,000	A	2,500	1,000	286	10	108	598	139-1,200
3-13	CUYAMA VALLEY	147,000	A	4,400	1,100	17	2	8	-	206-3,905
3-14	SAN ANTONIO CREEK VALLEY	81,800	A	-	400	30	-	9	415	129-8,040
3-15	SANTA YNEZ RIVER VALLEY	204,000	A	1,300	750	163	21	76	507	400-700
3-16	GOLETA	9,210	A	800	500	49	11	17	755	617-929
3-17	SANTA BARBARA	6,160	A	625	560	75	36	5	-	217-385
3-18	CARPINTERIA	8,120	A	500	300	41	41	4	557	317-1,780
3-19	CARRIZO PLAIN	173,000	C	1,000	500	-	-	1	-	-
3-20	ANO NUEVO AREA	2,032	C	-	-	-	-	2	-	-
3-21	SANTA CRUZ PURISIMA FORMATION	40,200	C	200	20	-	-	39	440	380-560
3-22	SANTA ANA VALLEY	2,720	C	130	-	-	-	-	-	-
3-23	UPPER SANTA ANA VALLEY	1,430	C	-	-	-	-	-	-	-
3-24	QUIEN SABE VALLEY	4,710	C	122	122	-	-	-	-	-
3-25	TRES PINOS VALLEY	3,390	C	1,225	-	-	-	3	-	-
3-26	WEST SANTA CRUZ TERRACE	7,870	C	550	200	-	-	7	480	378-684
3-27	SCOTTS VALLEY	774	C	410	100-900	26	7	7	360	100-980
3-28	SAN BENITO RIVER VALLEY	24,200	C	2,000	-	-	-	3	-	-
3-29	DRY LAKE VALLEY	1,420	C	-	-	-	-	-	-	-
3-30	BITTER WATER VALLEY	32,200	C	-	-	-	-	-	-	-
3-31	HERNANDEZ VALLEY	2,860	C	160	58	-	-	-	-	-

Table 21 Central Coast Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
3-32	PEACH TREE VALLEY	9,790	C	117	84	-	-	-	-	-
3-33	SAN CARPOFORO VALLEY	200	C	-	-	-	-	-	-	217-385
3-34	ARROYO DE LA CRUZ VALLEY	750	C	-	-	-	-	-	-	211-381
3-35	SAN SIMEON VALLEY	620	A	170	100	-	-	4	413	46-2,210
3-36	SANTA ROSA VALLEY	4,480	A	708	400	-	-	2	-	298-2,637
3-37	VILLA VALLEY	980	C	-	-	-	-	-	-	260-1,635
3-38	CAYUCOS VALLEY	530	C	166	100	-	-	-	-	815-916
3-39	OLD VALLEY	750	C	335	200	-	-	-	-	346-2,462
3-40	TORO VALLEY	721	C	500	0	-	-	-	-	458-732
3-41	MORRO VALLEY	1,200	C	442	300	-	-	6	1150	469-5,100
3-42	CHORRO VALLEY	3,200	C	700	200	-	-	6	656	60-3,606
3-43	RINCONADA VALLEY	2,580	C	0	0	-	-	-	-	-
3-44	POZO VALLEY	6,840	C	230	100	-	-	5	-	287-676
3-45	HUASNA VALLEY	4,700	C	0	0	-	-	-	-	-
3-46	RAFAEL VALLEY	2,990	C	0	0	-	-	-	-	-
3-47	BIG SPRING AREA	7,320	C	0	0	-	-	-	-	-
3-49	MONTECITO	6,270	A	1,000	750	88	2	4	700	600-1,100
3-50	FELTON AREA	1,160	C	825	244	6	-	2	-	69-400
3-51	MAJORS CREEK	364	C	50	38	-	-	-	-	-
3-52	NEEDLE ROCK POINT	480	C	450	320	-	-	-	-	-
3-53	FOOTHILL	3,120	A	-	-	-	8	7	828	554-1,118

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

South Coast Hydrologic Region

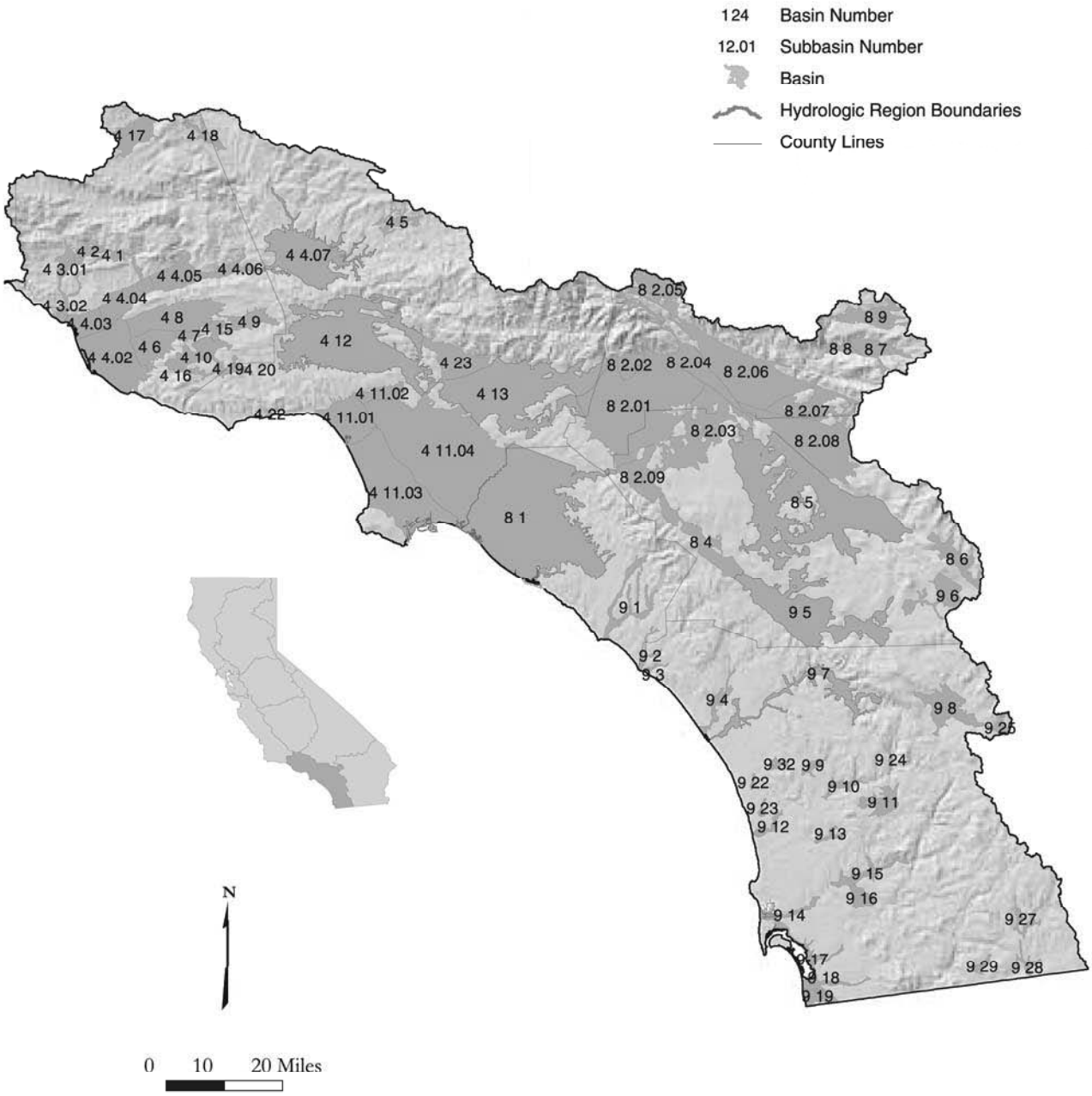

Figure 31 South Coast Hydrologic Region

Basins and Subbasins of the South Coast Hydrologic Region

Basin/subbasin	Basin name
4-1	Upper Ojai Valley
4-2	Ojai Valley
4-3	Ventura River Valley
4-3.01	Upper Ventura River
4-3.02	Lower Ventura River
4-4	Santa Clara River Valley
4-4.02	Oxnard
4-4.03	Mound
4-4.04	Santa Paula
4-4.05	Fillmore
4-4.06	Piru
4-4.07	Santa Clara River Valley East
4-5	Acton Valley
4-6	Pleasant Valley
4-7	Arroyo Santa Rosa Valley
4-8	Las Posas Valley
4-9	Simi Valley
4-10	Conejo Valley
4-11	Coastal Plain of Los Angeles
4-11.01	Santa Monica
4-11.02	Hollywood
4-11.03	West Coast
4-11.04	Central
4-12	San Fernando Valley
4-13	San Gabriel Valley
4-15	Tierre Rejada
4-16	Hidden Valley
4-17	Lockwood Valley
4-18	Hungry Valley
4-19	Thousand Oaks Area
4-20	Russell Valley
4-22	Malibu Valley
4-23	Raymond
8-1	Coastal Plain of Orange County
8-2	Upper Santa Ana Valley
8-2.01	Chino
8-2.02	Cucamonga
8-2.03	Riverside-Arlington
8-2.04	Rialto-Colton
8-2.05	Cajon
8-2.06	Bunker Hill
8-2.07	Yucaipa
8-2.08	San Timoteo
8-2.09	Temescal
8-4	Elsinore
8-5	San Jacinto
8-6	Hemet Lake Valley
8-7	Big Meadows Valley
8-8	Seven Oaks Valley
8-9	Bear Valley
9-1	San Juan Valley
9-2	San Mateo Valley
9-3	San Onofre Valley
9-4	Santa Margarita Valley
9-5	Temecula Valley
9-6	Coahuila Valley
9-7	San Luis Rey Valley
9-8	Warner Valley
9-9	Escondido Valley
9-10	San Pasqual Valley
9-11	Santa Maria Valley
9-12	San Dieguito Creek
9-13	Poway Valley
9-14	Mission Valley
9-15	San Diego River Valley
9-16	El Cajon Valley
9-17	Sweetwater Valley
9-18	Otay Valley
9-19	Tijuana Basin
9-22	Batiquitos Lagoon Valley
9-23	San Elijo Valley
9-24	Pamo Valley
9-25	Ranchita Town Area
9-27	Cottonwood Valley
9-28	Campo Valley
9-29	Potrero Valley
9-32	San Marcos Area

Description of the Region

The South Coast HR covers approximately 6.78 million acres (10,600 square miles) of the southern California watershed that drains to the Pacific Ocean (Figure 31). The HR is bounded on the west by the Pacific Ocean and the watershed divide near the Ventura-Santa Barbara County line. The northern boundary corresponds to the crest of the Transverse Ranges through the San Gabriel and San Bernardino mountains. The eastern boundary lies along the crest of the San Jacinto Mountains and low-lying hills of the Peninsular Range that form a drainage boundary with the Colorado River HR. The southern boundary is the international boundary with the Republic of Mexico. Significant geographic features include the coastal plain, the central Transverse Ranges, the Peninsular Ranges, and the San Fernando, San Gabriel, Santa Ana River, and Santa Clara River valleys.

The South Coast HR includes all of Orange County, most of San Diego and Los Angeles Counties, parts of Riverside, San Bernardino, and Ventura counties, and a small amount of Kern and Santa Barbara Counties. This HR is divided into Los Angeles, Santa Ana and San Diego subregions, RWQCBs 4, 8, and 9 respectively. Groundwater basins are numbered according to these subregions. Basin numbers in the Los Angeles subregion are preceded by a 4, in Santa Ana by an 8, and in San Diego by a 9. The Los Angeles subregion contains the Ventura, Santa Clara, Los Angeles, and San Gabriel River drainages, Santa Ana encompasses the Santa Ana River drainage, and San Diego includes the Santa Maria River, San Luis Rey River and the San Diego River and other drainage systems.

According to 2000 census data, about 17 million people live within the boundaries of the South Coast HR, approximately 50 percent of the population of California. Because this HR amounts to only about 7 percent of the surface area of the State, this has the highest population density of any HR in California (DWR 1998). Major population centers include the metropolitan areas surrounding Ventura, Los Angeles, San Diego, San Bernardino, and Riverside.

The South Coast HR has 56 delineated groundwater basins. Twenty-one basins are in subregion 4 (Los Angeles), eight basins in subregion 8 (Santa Ana), and 27 basins in subregion 9 (San Diego).

The Los Angeles subregion overlies 21 groundwater basins and encompasses most of Ventura and Los Angeles counties. Within this subregion, the Ventura River Valley, Santa Clara River Valley, and Coastal Plain of Los Angeles basins are divided into subbasins. The basins in the Los Angeles subregion underlie 1.01 million acres (1,580 square miles) or about 40 percent of the total surface area of the subregion.

The Santa Ana subregion overlies eight groundwater basins and encompasses most of Orange County and parts of Los Angeles, San Bernardino, and Riverside counties. The Upper Santa Ana Valley Groundwater Basin is divided into nine subbasins. Groundwater basins underlie 979,000 acres (1,520 square miles) or about 54 percent of the Santa Ana subregion.

The San Diego subregion overlies 27 groundwater basins, encompasses most of San Diego County, and includes parts of Orange and Riverside counties. Groundwater basins underlie about 277,000 acres (433 square miles) or about 11 percent of the surface of the San Diego subregion.

Overall, groundwater basins underlie about 2.27 million acres (3,530 square miles) or about 33 percent of the South Coast HR.

Groundwater Development

Groundwater has been used in the South Coast HR for well over 100 years. High demand and use of groundwater in Southern California has given rise to many disputes over management and pumping rights, with the resolution of these cases playing a large role in the establishment and clarification of water rights law in California. Raymond Groundwater Basin, located in this HR, was the first adjudicated basin in the State. Of the 16 adjudicated basins in California, 11 are in the South Coast HR. Groundwater provides about 23 percent of water demand in normal years and about 29 percent in drought years (DWR 1998).

Groundwater is found in unconfined alluvial aquifers in most of the basins of the San Diego subregion and the inland basins of the Santa Ana and Los Angeles subregions. In some larger basins, typified by those underlying the coastal plain, groundwater occurs in multiple aquifers separated by aquitards that create confined groundwater conditions. Basins range in depth from tens or hundreds of feet in smaller basins, to thousands of feet in larger basins. The thickness of aquifers varies from tens to hundreds of feet. Well yields vary in this HR depending on aquifer characteristics and well location, size, and use. Some aquifers are capable of yielding thousands of gallons per minute to municipal wells.

Conjunctive Use

Conjunctive use of surface water and groundwater is a long-standing practice in the region. At present, much of the potable water used in Southern California is imported from the Colorado River and from sources in the eastern Sierra and Northern California. Several reservoirs are operated primarily for the purpose of storing surface water for domestic and irrigation use, but groundwater basins are also recharged from the outflow of some reservoirs. The concept is to maintain streamflow over a longer period of time than would occur without regulated flow and thus provide for increased recharge of groundwater basins. Most of the larger basins in this HR are highly managed, with many conjunctive use projects being developed to optimize water supply.

Coastal basins in this HR are prone to intrusion of seawater. Seawater intrusion barriers are maintained along the Los Angeles and Orange County sections of the coastal plain. In Orange County, recycled water is injected into the ground to form a mound of groundwater between the coast and the main groundwater basin. In Los Angeles County, imported and recycled water is injected to maintain a seawater intrusion barrier.

Groundwater Quality

Groundwater in basins of the Los Angeles subregion is mainly calcium sulfate and calcium bicarbonate in character. Nitrate content is elevated in some parts of the subregion. Volatile organic compounds (VOCs) have created groundwater impairments in some of the industrialized portions of the region. The San Gabriel Valley and San Fernando Valley groundwater basins both have multiple sites of contamination from VOCs. The main constituents in the contamination plumes are trichloroethylene (TCE) and tetrachloroethylene (PCE). Some of the locations have been declared federal Superfund sites. Contamination plumes containing high concentrations of TCE and PCE also occur in the Bunker Hill Subbasin of the Upper Santa Ana Valley Groundwater Basin. Some of these plumes are also designated as Superfund sites. Perchlorate is emerging as an important contaminant in several areas in the South Coast HR.

Groundwater in basins of the Santa Ana subregion is primarily calcium and sodium bicarbonate in character. Local impairments from excess nitrate or VOCs have been recognized. Groundwater and surface water in the Chino Subbasin of the Santa Ana River Valley Groundwater Basin have elevated nitrate concentrations, partly derived from a large dairy industry in that area. In Orange County, water from the Santa Ana River provides a large part of the groundwater replenishment. Wetlands maintained along the Santa Ana River near the boundary of the Upper Santa Ana River and Orange County Groundwater Basins provide effective removal of nitrate from surface water, while maintaining critical habitat for endangered species.

Groundwater in basins of the San Diego subregion has mainly calcium and sodium cations and bicarbonate and sulfate anions. Local impairments by nitrate, sulfate, and TDS are found. Camp Pendleton Marine Base, in the northwestern part of this subregion, is on the EPA National Priorities List for soil and groundwater contamination by many constituents.

Water Quality in Public Supply Wells

From 1994 through 2000, 2,342 public supply water wells were sampled in 47 of the 73 basins and subbasins in the South Coast HR. Analyzed samples indicate that 1,360 wells, or 58 percent, met the state primary MCLs for drinking water. Nine-hundred-eighty-two wells, or 42 percent, have constituents that exceed one or more MCL. Figure 32 shows the percentages of each contaminant group that exceeded MCLs in the 982 wells.

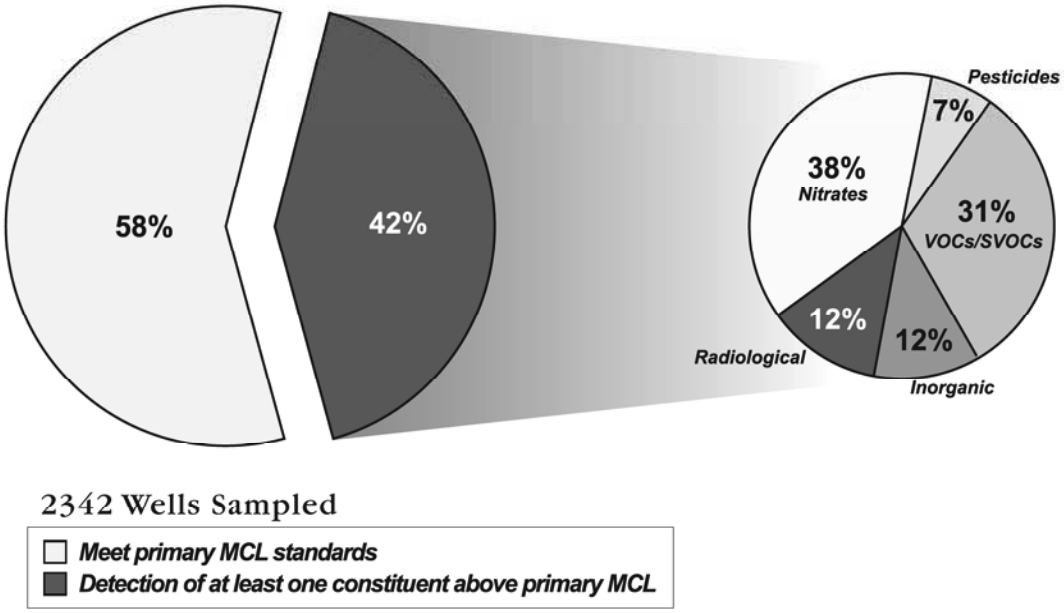

Figure 32 MCL exceedances in public supply wells in the South Coast Hydrologic Region

Table 22 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Changes from Bulletin 118-80

Several modifications from the groundwater basins presented in Bulletin 118-80 are incorporated in this report (Table 23). The Cajalco Valley (8-3), Jamul Valley (9-20), Las Pulgas Valley (9-21), Pine Valley (9-26), and Tecate Valley (9-30) Groundwater Basins have been deleted in this report because they have thin deposits of alluvium and well completion reports indicate that groundwater production is from underlying fractured bedrock. The Conejo Tierra Rejada Volcanic (4-21) is a volcanic aquifer and was not assigned a basin number in this bulletin. This is considered to be groundwater source area as discussed in Chapter 6.

Table 22 Most frequently occurring contaminants by contaminant group in the South Coast Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Fluoride – 56	Thallium – 13	Aluminum – 12
Inorganics – Secondary	Iron – 337	Manganese – 335	TDS – 36
Radiological	Gross Alpha – 104	Uranium – 40	Radium 226 – 9 Radium 228 – 9
Nitrates	Nitrate (as NO_3) – 364	Nitrate + Nitrite – 179	Nitrate Nitrogen (NO_3-N) – 14
Pesticides	DBCP – 61	Di(2-Ethylhexyl)phthalate –5	Heptachlor – 2 EDB – 2
VOCs/SVOCs	TCE – 196	PCE – 152	1,2 Dichloroethane – 89

DBCP = Dibromochloropropane
EDB = Ethylene Dibromide
VOCs = Volatile Organic Compounds
SVOCs = Semivolatile Organic Compounds

The Ventura River Valley (4-3), Santa Clara River Valley (4-4), Coastal Plain of Los Angeles (4-11), and Upper Santa Ana Valley (8-2) Groundwater Basins have been divided into subbasins in this report. The extent of the San Jacinto Groundwater Basin (8-5) has been decreased because completion of Diamond Valley Reservoir has inundated the valley. Paloma Valley has been removed because well logs indicate groundwater production is solely from fractured bedrock. The Raymond Groundwater Basin (4-23) is presented as an individual basin instead of being incorporated into the San Gabriel Valley Groundwater Basin (4-13) because it is bounded by physical barriers and has been managed as a separate and individual groundwater basin for many decades. In Bulletin 118-75, groundwater basins in two different subregions were designated the Upper Santa Ana Valley Groundwater Basin (4-14 and 8-2). To alleviate this confusion, basin 4-14 has been divided, with parts of the basin incorporated into the neighboring San Gabriel Valley Groundwater Basin (4-13) and the Chino subbasin of the Upper Santa Ana Valley Groundwater Basin (8-2.01). The San Marcos Area Groundwater Basin (9-32) in central San Diego County is presented as a new basin in this report.

Table 23 Modifications since Bulletin 118-80 of groundwater basins and subbasins in South Coast Hydrologic Region

Basin/subbasin name	Number	Old number
Upper Ventura River	4-3.01	4-3
Lower Ventura River	4-3.02	4-3
Oxnard	4-4.02	4-4
Mound	4-4.03	4-4
Santa Paula	4-4.04	4-4
Fillmore	4-4.05	4-4
Piru	4-4.06	4-4
Santa Clara River Valley East	4-4.07	4-4
Santa Monica	4-11.01	4-11
Hollywood	4-11.02	4-11
West Coast	4-11.03	4-11
Central	4-11.04	4-11
Upper Santa Ana Valley	Incorporated into 8-2.01 and 4-13	4-14
Conejo-Tierra Rejada Volcanic	deleted	4-21
Raymond	4-23	4-13
Chino	8-2.01	8-2
Cucamonga	8-2.02	8-2
Riverside-Arlington	8-2.03	8-2
Rialto-Colton	8-2.04	8-2
Cajon	8-2.05	8-2
Bunker Hill	8-2.06	8-2
Yucaipa	8-2.07	8-2
San Timoteo	8-2.08	8-2
Temescal	8-2.09	8-2
Cajalco Valley	deleted	8-3
Tijuana Basin	9-19	
Jamul Valley	deleted	9-20
Las Pulgas Valley	deleted	9-21
Batiquitos Lagoon Valley	9-22	
San Elijo Valley	9-23	
Pamo Valley	9-24	
Ranchita Town Area	9-25	
Pine Valley	deleted	9-26
Cottonwood Valley	9-27	
Campo Valley	9-28	
Potrero Valley	9-29	
Tecate Valley	deleted	9-30
San Marcos Area	9-32	Not previously identified

Table 24 South Coast Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Active Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
4-1	UPPER OJAI VALLEY	3,800	A	200	50	4	-	1	707	438-1,249
4-2	OJAI VALLEY	6,830	A	600	383	24	-	22	640	450-1,140
4-3	VENTURA RIVER VALLEY									
4-3.01	UPPER VENTURA RIVER	7,410	C	-	600	17	-	18	706	500-1,240
4-3.02	LOWER VENTURA RIVER	5,300	A	-	20	-	-	2	-	760-3,000
4-4	SANTA CLARA RIVER VALLEY									
4-4.02	OXNARD	58,000	A	1,600	-	127	127	69	1,102	160-1,800
4-4.03	MOUND	14,800	A	-	700	11	11	4	1,644	1,498-1,908
4-4.04	SANTA PAULA	22,800	A	-	700	60	50	10	1,198	470-3,010
4-4.05	FILLMORE	20,800	A	2,100	700	23	-	10	1,100	800-2,400
4-4.06	PIRU	8,900	A	-	800	19	-	3	1,300	608-2,400
4-4.07	SANTA CLARA RIVER VALLEY EAST	66,200	C	-	-	-	-	62	-	-
4-5	ACTON VALLEY	8,270	A	1,000	140	-	-	7	-	-
4-6	PLEASANT VALLEY	21,600	A	-	1,000	9	-	12	1,110	597-3,490
4-7	ARROYO SANTA ROSA VALLEY	3,740	A	1,200	950	6	-	7	1,006	670-1,200
4-8	LAS POSAS VALLEY	42,200	A	750	-	-	-	24	742	338-1,700
4-9	SIMI VALLEY	12,100	A	-	394	13	-	1	-	1,580
4-10	CONEJO VALLEY	28,900	A	1,000	100	-	-	3	631	335-2,064
4-11	COASTAL PLAIN OF LOS ANGELES									
4-11.01	SANTA MONICA	32,100	C	4,700	-	-	-	12	916	729-1,156
4-11.02	HOLLYWOOD	10,500	A	-	-	5	5	1	-	526
4-11.03	WEST COAST	91,300	A	1,300	-	67	58	33	456	-
4-11.04	CENTRAL	177,000	A	11,000	1,730	302	64	294	453	200-2,500
4-12	SAN FERNANDO VALLEY	145,000	A	3,240	1,220	1398	2385	126	499	176-1,16
4-13	SAN GABRIEL VALLEY	154,000	A	4,850	1,000	67	296	259	367	90-4,288
4-15	TIERRA REJADA	4,390	A	1,200	172	4	1	-	-	619-930
4-16	HIDDEN VALLEY	2,210	C	-	-	-	-	1	453	289-743
4-17	LOCKWOOD VALLEY	21,800	A	350	25	-	-	1	-	-
4-18	HUNGRY VALLEY	5,310	C	-	28	-	-	-	<350	-
4-19	THOUSAND OAKS AREA	3,110	C	-	39	2	-	-	1,410	1,200-2,300
4-20	RUSSELL VALLEY	3,100	A	-	25	-	-	-	-	-
4-22	MALIBU VALLEY	613	C	1,060	1,030	-	-	-	-	-
4-23	RAYMOND	26,200	A	3,620	1,880	88	-	70	346	138-780
8-1	COASTAL PLAIN OF ORANGE COUNTY	224,000	A	4,500	2,500	521	411	240	475	232-661
8-2	UPPER SANTA ANA VALLEY									
8-2.01	CHINO	154,000	A	1,500	1,000	12	8	187	484	200-600
8-2.02	CUCAMONGA	9,530	C	4,400	2,115	1	1	21	-	-
8-2.03	RIVERSIDE-ARLINGTON	58,600	A	-	-	11	3	43	-	370-756
8-2.04	RIALTO-COLTON	30,100	A	5,000	545	50	5	41	337	
8-2.05	CAJON	23,200	C	200	60	-	-	5	-	-
8-2.06	BUNKER HILL	89,600	A	5,000	1,245	398	169	204	-	150-550
8-2.07	YUCAIPA	25,300	A	2,800	206	19	3	45	334	-

Table 24 South Coast Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Active Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
8-2.08	SAN TIMOTEO	73,100	A	-	-	67	12	36	-	-
8-2.09	TEMESCAL	23,500	C	-	-	2	2	20	753	373-950
8-4	ELSINORE	25,700	C	5,400	-	1	1	18	-	
8-5	SAN JACINTO	188,000	C	-	-	150	115	56	463	160-12,000
8-6	HEMET LAKE VALLEY	16,700	C	820	196	-	-	9	-	-
8-7	BIG MEADOWS VALLEY	14,200	C	120	34	-	-	8	-	-
8-8	SEVEN OAKS VALLEY	4,080	C	-	-	-	-	1	-	-
8-9	BEAR VALLEY	19,600	A	1,000	500	57	57	52	-	-
9-1	SAN JUAN VALLEY	16,700	C	1,000	-	-	-	8	760	430-12,880
9-2	SAN MATEO VALLEY	2,990	A	-	-	-	-	5	586	490-770
9-3	SAN ONOFRE VALLEY	1,250	A	-	-	-	-	2	-	600-1,500
9-4	SANTA MARGARITA VALLEY	626	A	1,980	-	4	-	-	-	337-9,030
9-5	TEMECULA VALLEY	87,800	C	1,750	-	140	4	67	476	220-1,500
9-6	COAHUILA VALLEY	18,200	C	500	-	2	-	1	-	304-969
9-7	SAN LUIS REY VALLEY	37,000	C	2,000	500	-	-	28	1,258	530-7,060
9-8	WARNER VALLEY	24,000	C	1,800	800	-	-	4	-	263
9-9	ESCONDIDO VALLEY	2,890	C	190	50	-	-	1	-	250-5,000
9-10	SAN PASQUAL VALLEY	4,540	C	1,700	1,000	-	-	2	-	500-1,550
9-11	SANTA MARIA VALLEY	12,300	A	500	36	3	-	2	1,000	324-1,680
9-12	SAN DIEGUITO CREEK	3,560	A	1,800	700	-	-	-	-	2,000
9-13	POWAY VALLEY	2,470	C	200	100	-	-	1	-	610-1,500
9-14	MISSION VALLEY	7,350	C	-	1,000	-	-	-	-	-
9-15	SAN DIEGO RIVER VALLEY	9,890	C	2,000	-	-	-	5	-	260-2,870
9-16	EL CAJON VALLEY	7,160	C	300	50	1	-	2,340		
9-17	SWEETWATER VALLEY	5,920	C	1,500	300	7	7	9	2,114	300-50,000
9-18	OTAY VALLEY	6,830	C	1,000	185	-	-	-	-	500->2,000
9-19	TIJUANA BASIN	7,410	A	2,000	350	-	-	-	-	380-3,620
9-22	BATIQUITOS LAGOON VALLEY	741	C	-	-	-	-	-	1,280	788-2,362
9-23	SAN ELIJO VALLEY	883	C	1,800	-	-	-	-	-	1,170-5,090
9-24	PAMO VALLEY	1,500	C	-	-	-	-	-	369	279-455
9-25	RANCHITA TOWN AREA	3,130	C	125	22	-	-	-	-	283-305
9-27	COTTONWOOD VALLEY	3,850	C	-	-	-	-	1	-	-
9-28	CAMPO VALLEY	3,550	C	-	<40	-	-	4	-	800
9-29	POTRERO VALLEY	2,020	C	-	-	-	-	4	-	-
9-32	SAN MARCOS VALLEY	2,130	C	60	-	-	-	-	-	500-700

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

Sacramento River Hydrologic Region

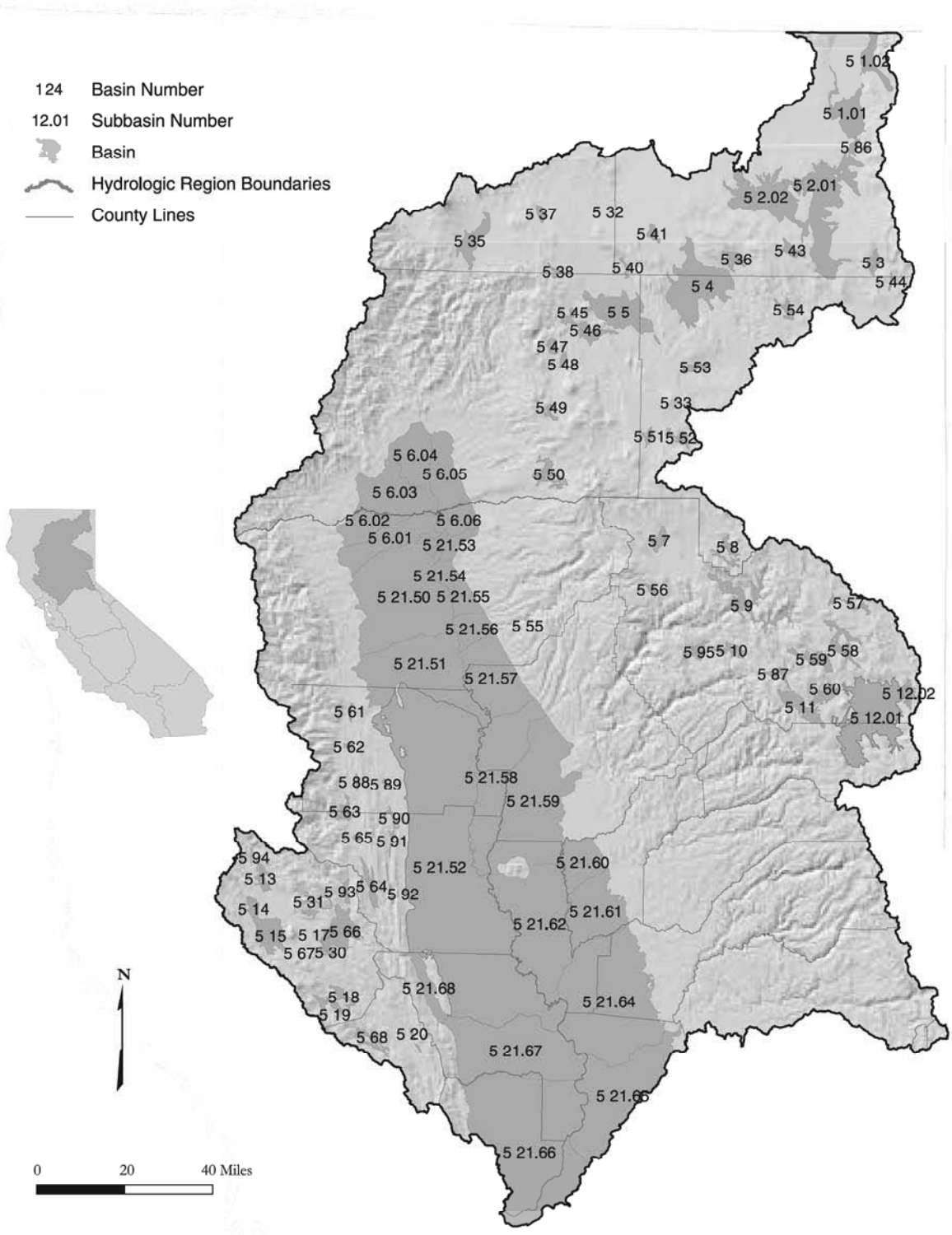

Figure 33 Sacramento River Hydrologic Region

Basins and Subbasins of the Sacramento River Hydrologic Region

Basin/subbasins	Basin name
5-1	Goose Lake Valley
5-1.01	Lower Goose Lake Valley
5-1.02	Fandango Valley
5-2	Alturas Area
5-2.01	South Fork Pitt River
5-2.02	Warm Springs Valley
5-3	Jess Valley
5-4	Big Valley
5-5	Fall River Valley
5-6	Redding Area
5-6.01	Bowman
5-6.02	Rosewood
5-6.03	Anderson
5-6.04	Enterprise
5-6.05	Millville
5-6.06	South Battle Creek
5-7	Lake Almanor Valley
5-8	Mountain Meadows Valley
5-9	Indian Valley
5-10	American Valley
5-11	Mohawk Valley
5-12	Sierra Valley
5-12.01	Sierra Valley
5-12.02	Chilcoot
5-13	Upper Lake Valley
5-14	Scotts Valley
5-15	Big Valley
5-16	High Valley
5-17	Burns Valley
5-18	Coyote Valley
5-19	Collayomi Valley
5-20	Berryessa Valley
5-21	Sacramento Valley
5-21.50	Red Bluff
5-21.51	Corning
5-21.52	Colusa
5-21.53	Bend
5-21.54	Antelope
5-21.55	Dye Creek
5-21.56	Los Molinos
5-21.57	Vina
5-21.58	West Butte
5-21.59	East Butte
5-21.60	North Yuba
5-21.61	South Yuba
5-21.62	Sutter
5-21.64	North American
5-21.65	South American
5-21.66	Solano
5-21.67	Yolo
5-21.68	Capay Valley

Basin/subbasins	Basin name
5-30	Lower Lake Valley
5-31	Long Valley
5-35	Mccloud Area
5-36	Round Valley
5-37	Toad Well Area
5-38	Pondosa Town Area
5-40	Hot Springs Valley
5-41	Egg Lake Valley
5-43	Rock Prairie Valley
5-44	Long Valley
5-45	Cayton Valley
5-46	Lake Britton Area
5-47	Goose Valley
5-48	Burney Creek Valley
5-49	Dry Burney Creek Valley
5-50	North Fork Battle Creek
5-51	Butte Creek Valley
5-52	Gray Valley
5-53	Dixie Valley
5-54	Ash Valley
5-56	Yellow Creek Valley
5-57	Last Chance Creek Valley
5-58	Clover Valley
5-59	Grizzly Valley
5-60	Humbug Valley
5-61	Chrome Town Area
5-62	Elk Creek Area
5-63	Stonyford Town Area
5-64	Bear Valley
5-65	Little Indian Valley
5-66	Clear Lake Cache Formation
5-68	Pope Valley
5-86	Joseph Creek
5-87	Middle Fork Feather River
5-88	Stony Gorge Reservoir
5-89	Squaw Flat
5-90	Funks Creek
5-91	Antelope Creek
5-92	Blanchard Valley
5-93	North Fork Cache Creek
5-94	Middle Creek
5-95	Meadow Valley

Description of the Region

The Sacramento River HR covers approximately 17.4 million acres (27,200 square miles). The region includes all or large portions of Modoc, Siskiyou, Lassen, Shasta, Tehama, Glenn, Plumas, Butte, Colusa, Sutter, Yuba, Sierra, Nevada, Placer, Sacramento, El Dorado, Yolo, Solano, Lake, and Napa counties (Figure 33). Small areas of Alpine and Amador counties are also within the region. Geographically, the region extends south from the Modoc Plateau and Cascade Range at the Oregon border, to the Sacramento-San Joaquin Delta. The Sacramento Valley, which forms the core of the region, is bounded to the east by the crest of the Sierra Nevada and southern Cascades and to the west by the crest of the Coast Range and Klamath Mountains. Other significant features include Mount Shasta and Lassen Peak in the southern Cascades, Sutter Buttes in the south central portion of the valley, and the Sacramento River, which is the longest river system in the State of California with major tributaries the Pit, Feather, Yuba, Bear and American rivers. The region corresponds approximately to the northern half of RWQCB 5. The Sacramento metropolitan area and surrounding communities form the major population center of the region. With the exception of Redding, cities and towns to the north, while steadily increasing in size, are more rural than urban in nature, being based in major agricultural areas. The 1995 population of the entire region was 2.372 million.

The climate in the northern, high desert plateau area of the region is characterized by cold snowy winters with only moderate precipitation and hot dry summers. This area depends on adequate snowpack to provide runoff for summer supply. Annual precipitation ranges from 10 to 20 inches. Other mountainous areas in the northern and eastern portions of the region have cold wet winters with large amounts of snow, which typically provide abundant runoff for summer supplies. Annual precipitation ranges from 40 to more than 80 inches. Summers are generally mild in these areas. The Coast Range and southern Klamath Mountains receive copious amounts of precipitation, but most of the runoff flows to the coast in the North Coastal drainage. Sacramento Valley comprises the remainder of the region. At a much lower elevation than the rest of the region, the valley has mild winters with moderate precipitation. Annual precipitation varies from about 35 inches in Redding to about 18 inches in Sacramento. Summers in the valley are hot and dry.

Most of the mountainous portions of the region are heavily forested and sparsely populated. Three major national forests (Mendocino, Trinity, and Shasta) make up the majority of lands in the Coast Range, southern Klamath Mountains, and the southern Cascades; these forests and the region's rivers and lakes provide abundant recreational opportunities. In the few mountain valleys with arable land, alfalfa, grain and pasture are the predominant crops. In the foothill areas of the region, particularly adjacent to urban centers, suburban to rural housing development is occurring along major highway corridors. This development is leading to urban sprawl and is replacing the former agricultural production on those lands. In the Sacramento Valley, agriculture is the largest industry. Truck, field, orchard, and rice crops are grown on approximately 2.1 million acres. Rice represents about 23 percent of the total irrigated acreage.

The Sacramento River HR is the main water supply for much of California's urban and agricultural areas. Annual runoff in the HR averages about 22.4 maf, which is nearly one-third of the State's total natural runoff. Major water supplies in the region are provided through surface storage reservoirs. The two largest surface water projects in the region are USBR's Shasta Lake (Central Valley Project) on the upper Sacramento River and Lake Oroville (DWR's State Water Project) on the Feather River. In all, there are more than 40 major surface water reservoirs in the region. Municipal, industrial, and agricultural supplies to the region are about 8 maf, with groundwater providing about 2.5 maf of that total. Much of the remainder of the runoff goes to dedicated natural flows, which support various environmental requirements, including in-stream fishery flows and flushing flows in the Delta.

Groundwater Development

Groundwater provides about 31 percent of the water supply for urban and agricultural uses in the region, and has been developed in both the alluvial basins and the hard rock uplands and mountains. There are 88 basins/subbasins delineated in the region. These basins underlie 5.053 million acres (7,900 square miles), about 29 percent of the entire region. The reliability of the groundwater supply varies greatly. The Sacramento Valley is recognized as one of the foremost groundwater basins in the State, and wells developed in the sediments of the valley provide excellent supply to irrigation, municipal, and domestic uses. Many of the mountain valleys of the region also provide significant groundwater supplies to multiple uses.

Geologically, the Sacramento Valley is a large trough filled with sediments having variable permeabilities; as a result, wells developed in areas with coarser aquifer materials will produce larger amounts of water than wells developed in fine aquifer materials. In general, well yields are good and range from one-hundred to several thousand gallons per minute. Because surface water supplies have been so abundant in the valley, groundwater development for agriculture primarily supplement the surface supply. With the changing environmental laws and requirements, this balance is shifting to a greater reliance on groundwater, and conjunctive use of both supplies is occurring to a greater extent throughout the valley, particularly in drought years. Groundwater provides all or a portion of municipal supply in many valley towns and cities. Redding, Anderson, Chico, Marysville, Sacramento, Olivehurst, Wheatland, Willows, and Williams rely to differing degrees on groundwater. Red Bluff, Corning, Woodland, Davis, and Dixon are completely dependent on groundwater. Domestic use of groundwater varies, but in general, rural unincorporated areas rely completely on groundwater.

In the mountain valleys and basins with arable land, groundwater has been developed to supplement surface water supplies. Most of the rivers and streams of the area have adjudicated water rights that go back to the early 1900s, and diversion of surface water has historically supported agriculture. Droughts and increased competition for supply have led to significant development of groundwater for irrigation. In some basins, the fractured volcanic rock underlying the alluvial fill is the major aquifer for the area. In the rural mountain areas of the region, domestic supplies come almost entirely from groundwater. Although a few mountain communities are supplied in part by surface water, most rely on groundwater. These groundwater supplies are generally quite reliable in areas that have sufficient aquifer storage or where surface water replenishes supply throughout the year. In areas that depend on sustained runoff, water levels can be significantly depleted in drought years and many old, shallow wells can be dewatered. During 2001, an extreme drought year on the Modoc Plateau, many well owners experienced problems with water supply.

Groundwater development in the fractured rocks of the foothills of the southern Cascades and Sierra Nevada is fraught with uncertainty. Groundwater supplies from fractured rock sources are highly variable in terms of water quantity and water quality and are an uncertain source for large-scale residential development. Originally, foothill development relied on water supply from springs and river diversions with flumes and ditches for conveyance that date back to gold mining era operations. Current development is primarily based on individual private wells, and as pressures for larger scale development increase, questions about the reliability of supply need to be addressed. Many existing foothill communities have considerable experience with dry or drought year shortages. In Butte County residents in Cohasset, Forest Ranch, and Magalia have had to rely on water brought up the ridges in tanker trucks. The suggested answer has been the development of regional water supply projects. Unfortunately, the area's development pattern of small, geographically dispersed population centers does not lend itself to the kind of financial base necessary to support such projects.

Groundwater Quality

Groundwater quality in the Sacramento River HR is generally excellent. However, there are areas with local groundwater problems. Natural water quality impairments occur at the north end of the Sacramento Valley in the Redding subbasin, and along the margins of the valley and around the Sutter Buttes, where Cretaceous-age marine sedimentary rocks containing brackish to saline water are near the surface. Water from the older underlying sediments mixes with the fresh water in the younger alluvial aquifer and degrades the quality. Wells constructed in these areas typically have high TDS. Other local natural impairments are moderate levels of hydrogen sulfide in groundwater in the volcanic and geothermal areas in the western portion of the region. In the Sierra foothills, there is potential for encountering uranium and radon-bearing rock or sulfide mineral deposits containing heavy metals. Human-induced impairments are generally associated with individual septic system development in shallow unconfined portions of aquifers or in fractured hard rock areas where insufficient soil depths are available to properly leach effluent before it reaches the local groundwater supply.

Water Quality in Public Supply Wells

From 1994 through 2000, 1,356 public supply water wells were sampled in 51 of the 88 basins and subbasins in the Sacramento River HR. Samples analyzed indicate that 1,282 wells, or 95 percent, met the state primary MCLs for drinking water. Seventy-four wells, or 5 percent, have constituents that exceed one or more MCL. Figure 34 shows the percentages of each contaminant group that exceeded MCLs in the 74 wells.

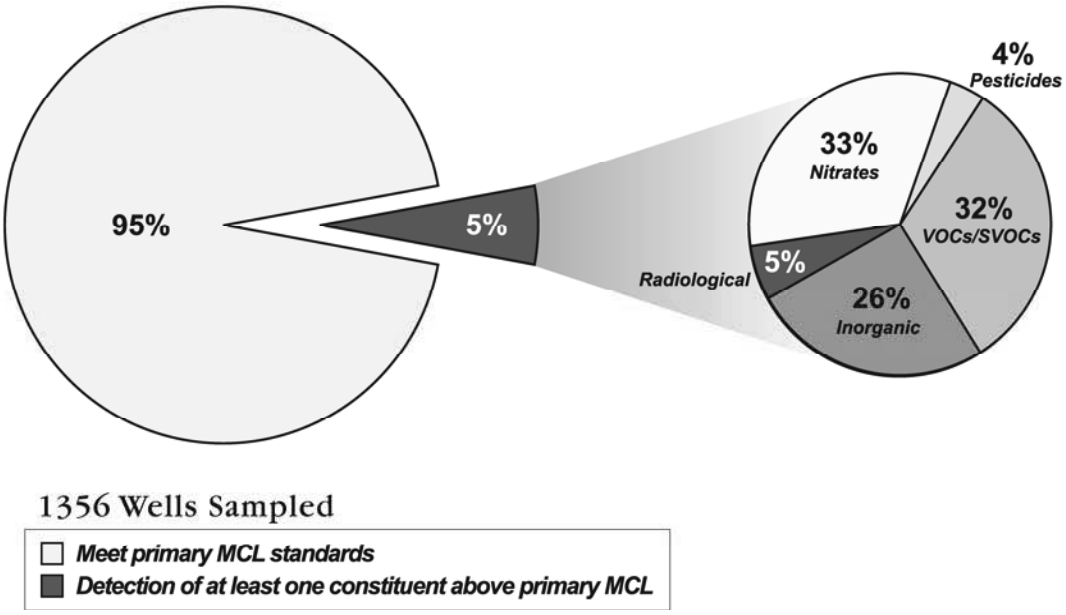

Figure 34 MCL exceedances in public supply wells in the Sacramento River Hydrologic Region

Table 25 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 25 Most frequently occurring contaminants by contaminant group in the Sacramento River Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Cadmium – 4	Chromium (Total) – 3	3 tied at 2
Inorganics – Secondary	Manganese – 221	Iron – 166	Specific Conductance – 3
Radiological	Gross Alpha – 4		
Nitrates	Nitrate (as NO_3) – 22	Nitrate + Nitrite – 5	Nitrate Nitrogen (NO_3-N) – 2
Pesticides	Di(2-Ethylhexyl)phthalate – 4		
VOCs/SVOCs	PCE – 11	TCE – 7	Benzene – 4

PCE = Tetrachloroethylene
TCE = Trichloroethylene
VOC = Volatile Organic Compounds
SVOC = Semivolatile Organic Compound

Changes from Bulletin 118-80

Some modifications from the groundwater basins presented in Bulletin 118-80 are incorporated in this report. These are listed in Table 26.

Table 26 Modifications since Bulletin 118-80 of groundwater basins and subbasins in Sacramento River Hydrologic Region

Basin name	New number	Old number
Fandango Valley	5-1.02	5-39
Bucher Swamp Valley	deleted	5-42
Modoc Plateau Recent Volcanic Areas	deleted	5-32
Modoc Plateau Pleistocene Volcanic Areas	deleted	5-33
Mount Shasta Area	deleted	5-34
Sacramento Valley Eastside Tuscan Formation Highlands	deleted	5-55
Clear Lake Pleistocene Volcanics	deleted	5-67

No additional basins were assigned to the Sacramento River HR in this revision. However, four basins have been divided into subbasins. Goose Lake Valley Groundwater Basin (5-1) has been subdivided into two subbasins, Fandango Valley (5-39) was modified to be a subbasin of Goose Lake Valley. Redding Area Groundwater Basin has been subdivided into six subbasins, Sierra Valley Groundwater Basin has been subdivided into two subbasins, and the Sacramento Valley Groundwater Basin has been subdivided into 18 subbasins.

There are several deletions of groundwater basins from Bulletin 118-80. Bucher Swamp Valley Basin (5-42) was deleted due to a thin veneer of alluvium over rock. Modoc Plateau Recent Volcanic Areas (5-32), Modoc Plateau Pleistocene Volcanic Areas (5-33), Mount Shasta Area (5-34), Sacramento Valley Eastside Tuscan Formation Highlands (5-55), and Clear Lake Pleistocene Volcanics (5-67) are volcanic aquifers and were not assigned basin numbers in this bulletin. These are considered to be groundwater source areas as discussed in Chapter 6.

Table 27 Sacramento River Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
5-1	GOOSE LAKE VALLEY									
5-1.01	LOWER GOOSE LAKE	36,000	B	-	400	9	9	-	183	68 - 528
5-1.02	FANDANGO VALLEY	18,500	B	2,000	-	3	-	-	-	-
5-2	ALTURAS AREA								357	180 - 800
5-2.01	SOUTH FORK PITT RIVER	114,000	B	5,000	1,075	9	-	8	-	-
5-2.02	WARM SPRINGS VALLEY	68,000	B	400	314	3	-	11	-	-
5-3	JESS VALLEY	6,700	B		3,000	-	-	-	-	-
5-4	BIG VALLEY	92,000	B	4,000	880	19	9	10	260	141 - 633
5-5	FALL RIVER VALLEY	54,800	B	1,500	266	16	7	3	174	115 - 232
5-6	REDDING AREA									
5-6.01	BOWMAN	85,330	B	2,000	589	8	2	13	-	70 - 247
5-6.02	ROSEWOOD	45,320	B	-	-	4	-	-	-	118 - 218
5-6.03	ANDERSON	98,500	B	1,800	46	11	10	69	194	109-320
5-6.04	ENTERPRISE	60,900	B	700	266	11	3	43	-	160 - 210
5-6.05	MILLVILLE	67,900	B	500	254	6	5	4	140	-
5-6.06	SOUTH BATTLE CREEK	32,300	B	-	-	0	0	0	360	-
5-7	LAKE ALMANOR VALLEY	7,150	B	-	-	10	4	4	105	53 - 260
5-8	MOUNTAIN MEADOWS VALLEY	8,150	B	-	-	-	-	-	-	-
5-9	INDIAN VALLEY	29,400	B	-	-	-	4	9	-	-
5-10	AMERICAN VALLEY	6,800	B	40	40		4	11	-	-
5-11	MOHAWK VALLEY	19,000	B	-	500	1	2	15	248	210 - 285
5-12	SIERRA VALLEY									
5-12.01	SIERRA VALLEY	117,700	B	1,500	640	34	15	9	312	110 - 1,620
5-12.02	CHILCOOT	7,550	B	-	-	15	-	8	-	-
5-13	UPPER LAKE VALLEY	7,260	B	900	302	12	3	6	-	-
5-14	SCOTTS VALLEY	7,320	B	1,200	171	9	1	9	158	140 - 175
5-15	BIG VALLEY	24,210	B	1,470	475	49	11	7	535	270 - 790
5-16	HIGH VALLEY	2,360	B	100	37	5	2	-	598	480 - 745
5-17	BURNS VALLEY	2,900	B	-	30	1	5	-	335	280 - 455
5-18	COYOTE VALLEY	6,530	B	800	446	6	3	3	288	175 - 390
5-19	COLLAYOMI VALLEY	6,500	B	1,000	121	10	4	3	202	150 - 255
5-20	BERRYESSA VALLEY	1,400	C	-	-	0	-	0	-	-
5-21	SACRAMENTO VALLEY									
5-21.50	RED BLUFF	266,750	B	1,200	363	30	10	56	207	120 - 500
5-21.51	CORNING	205,640	B	3,500	977	29	7	30	286	130 - 490
5-21.52	COLUSA	918,380	B	5,600	984	98	30	134	391	120 - 1,220
5-21.53	BEND	20,770	B	-	275	0	3	9		334-360
5-21.54	ANTELOPE	18,710	B	800	575	4	5	22	296	-
5-21.55	DYE CREEK	27,730	B	3,300	890	8	1	3	240	159 - 396
5-21.56	LOS MOLINOS	33,170	B	1,000	500	3	3	9	217	
5-21.57	VINA	125,640	B	3,850	1,212	23	5	69	285	48 - 543
5-21.58	WEST BUTTE	181,600	B	4,000	1,833	32	8	36	293	130 - 676

Table 27 Sacramento River Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
5-21.59	EAST BUTTE	265,390	B	4,500	1,019	43	4	44	235	122 - 570
5-21.60	NORTH YUBA	100,400	C	4,000	-	21	-	32	-	-
5-21.61	SOUTH YUBA	107,000	C	4,000	1,650	56	-	6	-	-
5-21.62	SUTTER	234,000	C	-	-	34	-	115	-	-
5-21.64	NORTH AMERICAN	351,000	A	-	800	121	-	339	300	150 - 1,000
5-21.65	SOUTH AMERICAN	248,000	C	-	-	105	-	247	221	24-581
5-21.66	SOLANO	425,000	C	-	-	123	23	136	427	150 - 880
5-21.67	YOLO	226,000	B	4,000+	1,000	127	20	185	880	480 - 2,060
5-21.68	CAPAY VALLEY	25,000	C	-	-	11	-	3	-	-
5-30	LOWER LAKE VALLEY	2,400	B	100	37		3	5	568	290 - 1,230
5-31	LONG VALLEY	2,600	B	100	63	-	-	-	-	-
5-35	MCCLOUD AREA	21,320	B	-	380	-	-	1	-	-
5-36	ROUND VALLEY	7,270	B	2,000	800	2				148 - 633
5-37	TOAD WELL AREA	3,360	B	-	-	-	-	-	-	-
5-38	PONDOSA TOWN AREA	2,080	B	-	-	-	-	-	-	-
5-40	HOT SPRINGS VALLEY	2,400	B	-	-	-	-	-	-	-
5-41	EGG LAKE VALLEY	4,100	B	-	20	-	-	-	-	-
5-43	ROCK PRAIRIE VALLEY	5,740	B	-	-	-	-	-	-	-
5-44	LONG VALLEY	1,090	B	-	-	-	-	-	-	-
5-45	CAYTON VALLEY	1,300	B	-	400	-	-	-	-	-
5-46	LAKE BRITTON AREA	14,060	B	-	-	-	-	2	-	-
5-47	GOOSE VALLEY	4,210	B	-	-	-	-	-	-	-
5-48	BURNEY CREEK VALLEY	2,350	B	-	-	-	-	2	-	-
5-49	DRY BURNEY CREEK VALLEY	3,070	B	-	-	-	-	-	-	-
5-50	NORTH FORK BATTLE CREEK VALLEY	12,760	B	-	-	-	-	3	-	-
5-51	BUTTE CREEK VALLEY	3,230	B	-	-	-	-	-	-	-
5-52	GRAYS VALLEY	5,440	B	-	-	-	-	-	-	-
5-53	DIXIE VALLEY	4,870	B	-	-	-	-	-	-	-
5-54	ASH VALLEY	6,010	B	3,000	2,200	-	-	-	-	-
5-56	YELLOW CREEK VALLEY	2,310	B	-	-	-	-	-	-	-
5-57	LAST CHANCE CREEK VALLEY	4,660	B	-	-	-	-	-	-	-
5-58	CLOVER VALLEY	16,780	B	-	-	-	-	-	-	-
5-59	GRIZZLY VALLEY	13,400	B	-	-	-	-	1	-	-
5-60	HUMBUG VALLEY	9,980	B	-	-	-	-	8	-	-
5-61	CHROME TOWN AREA	1,410	B	-	-	-	-	-	-	-
5-62	ELK CREEK AREA	1,440	B	-	-	-	-	-	-	-
5-63	STONYFORD TOWN AREA	6,440	B	-	-	-	-	-	-	-
5-64	BEAR VALLEY	9,100	B	-	-	-	-	-	-	-
5-65	LITTLE INDIAN VALLEY	1,270	B	-	-	-	-	-	-	-
5-66	CLEAR LAKE CACHE FORMATION	30,000	B	245	52		-	4	-	-
5-68	POPE VALLEY	7,180	C	-	-	-	-	1	-	-
5-86	JOSEPH CREEK	4,450	B	-	-	-	-		-	-

Table 27 Sacramento River Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
5-87	MIDDLE FORK FEATHER RIVER	4,340	B	-	-	-	-	2	-	-
5-88	STONY GORGE RESERVOIR	1,070	B	-	-	-	-	-	-	-
5-89	SQUAW FLAT	1,300	C	-	-	-	-	-	-	-
5-90	FUNKS CREEK	3,000	C	-	-	-	-	-	-	-
5-91	ANTELOPE CREEK	2,040	B	-	-	-	-	-	-	-
5-92	BLANCHARD VALLEY	2,200	B	-	-	-	-	-	-	-
5-93	NORTH FORK CACHE CREEK	3,470	C	-	-	-	-	-	-	-
5-94	MIDDLE CREEK	700	B	-	75	-	-	1	-	-
5-95	MEADOW VALLEY	5,730	B	-	-	-	-	1	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

San Joaquin River Hydrologic Region

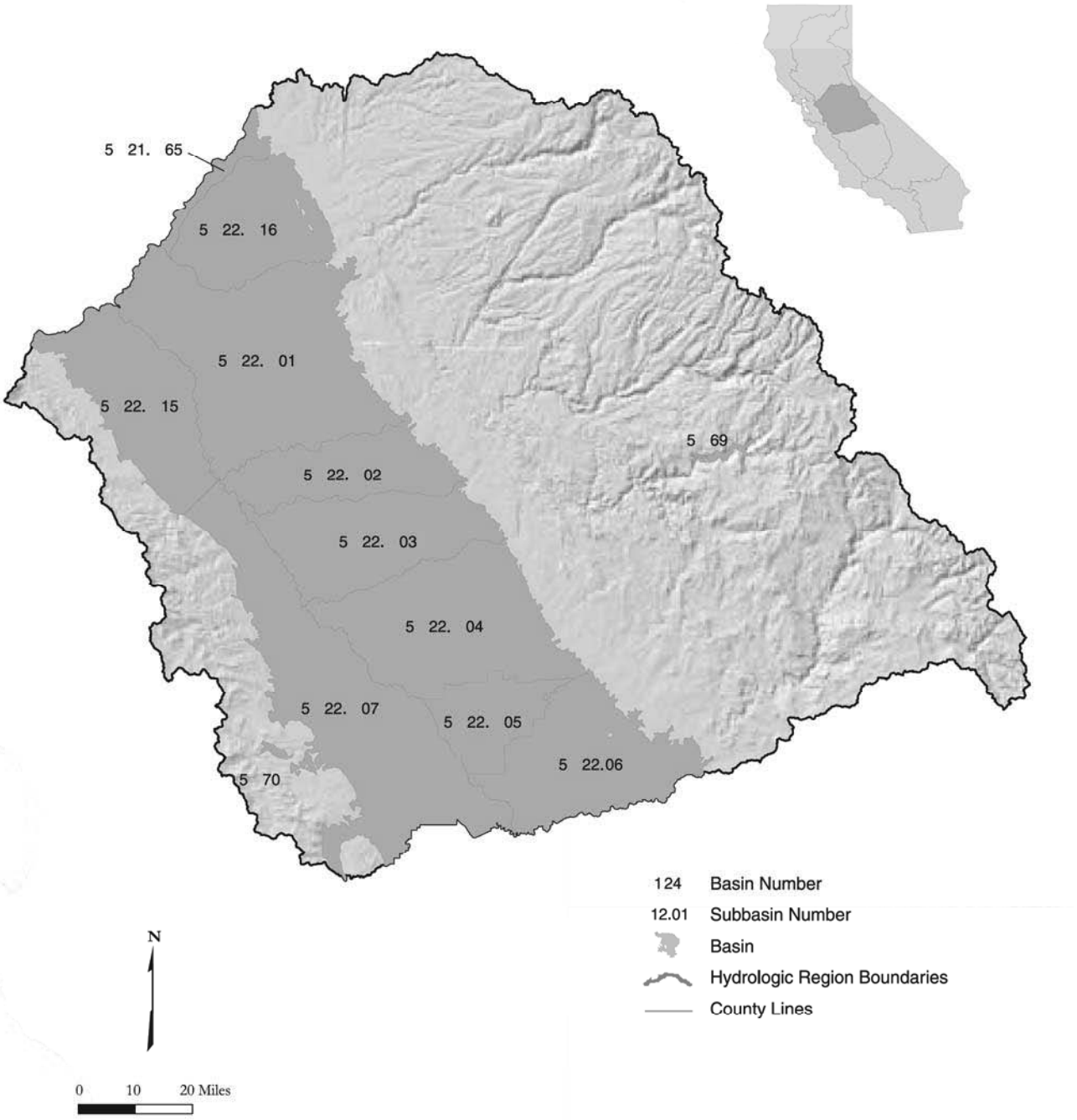

Figure 35 San Joaquin River Hydrologic Region

Basins and Subbasins of the San Joaquin River Hydrologic Region

Basin/subbasin	Basin name
5-22	San Joaquin Valley
5-22.01	Eastern San Joaquin
5-22.02	Modesto
5-22.03	Turlock
5-22.04	Merced
5-22.05	Chowchilla
5-22.06	Madera
5-22.07	Delta-Mendota
5-22.15	Tracy
5-22.16	Cosumnes
5-69	Yosemite Valley
5-70	Los Banos Creek Valley

Description of the Region

The San Joaquin River HR covers approximately 9.7 million acres (15,200 square miles) and includes all of Calaveras, Tuolumne, Mariposa, Madera, San Joaquin, and Stanislaus counties, most of Merced and Amador counties, and parts of Alpine, Fresno, Alameda, Contra Costa, Sacramento, El Dorado, and San Benito counties (Figure 35). The region corresponds to a portion near the middle of RWQCB 5. Significant geographic features include the northern half of the San Joaquin Valley, the southern part of the Sacramento-San Joaquin Delta, the Sierra Nevada and Diablo Range. The region is home to about 1.6 million people (DWR 1998). Major population centers include Merced, Modesto, and Stockton. The Merced area is entirely dependent on groundwater for its supply, as will be the new University of California at Merced campus.

Groundwater Development

The region contains two entire groundwater basins and part of the San Joaquin Valley Groundwater Basin, which continues south into the Tulare Lake HR. The San Joaquin Valley Groundwater Basin is divided into nine subbasins in this region. The basins underlie 3.73 million acres (5,830 square miles) or about 38 percent of the entire HR area.

The region is heavily groundwater reliant. Within the region groundwater accounts for about 30 percent of the annual supply used for agricultural and urban purposes. Groundwater use in the region accounts for about 18 percent of statewide groundwater use for agricultural and urban needs. Groundwater use in the region accounts for 5 percent of the State's overall supply from all sources for agricultural and urban uses (DWR 1998).

The aquifers are generally quite thick in the San Joaquin Valley subbasins, with groundwater wells commonly extending to depths of up to 800 feet. Aquifers include unconsolidated alluvium and consolidated rocks with unconfined and confined groundwater conditions. Typical well yields in the San Joaquin Valley range from 300 to 2,000 gpm with yields of 5,000 gpm possible. The region's only significant basin located outside of San Joaquin Valley is Yosemite Valley. Yosemite Valley Basin supplies water to Yosemite National Park and has substantial well yields.

Conjunctive Use

Since near the beginning of the region's agricultural development, groundwater has been used conjunctively with surface water to meet water needs. Groundwater was and is used when and where surface water is unable to fully meet demands either in time or area. For several decades, this situation was more of an incidental conjunctive use than a formal one. Historical groundwater use has resulted in some land subsidence in the southwest portion of the region.

Groundwater Quality

In general, groundwater quality throughout the region is suitable for most urban and agricultural uses with only local impairments. The primary constituents of concern are TDS, nitrate, boron, chloride, and organic compounds. The Yosemite Valley Groundwater Basin has exceptionally high quality groundwater.

Areas of high TDS content are primarily along the west side of the San Joaquin Valley and in the trough of the valley. The high TDS content of west-side groundwater is due to recharge of streamflow originating from marine sediments in the Coast Range. High TDS content in the trough of the valley is the result of concentration of salts due to evaporation and poor drainage. Nitrates may occur naturally or as a result of disposal of human and animal waste products and fertilizer. Boron and chloride are likely a result of concentration from evaporation near the valley trough. Organic contaminants can be broken into two categories, agricultural and industrial. Agricultural pesticides and herbicides have been detected in groundwater throughout the region, but primarily along the east side of the San Joaquin Valley where soil permeability is higher and depth to groundwater is shallower. The most notable agricultural contaminant is dibromochloropropane (DBCP), a now-banned soil fumigant and known carcinogen once used extensively on grapes and cotton. Industrial organic contaminants include TCE, dichloroethylene (DCE), and other solvents. They are found in groundwater near airports, industrial areas, and landfills.

Water Quality in Public Supply Wells

From 1994 through 2000, 689 public supply water wells were sampled in 10 of the 11 basins and subbasins in the San Joaquin River HR. Samples analyzed indicate that 523 wells, or 76 percent, met the state primary MCLs for drinking water. One-hundred-sixty-six wells, or 24 percent, have constituents that exceed one or more MCL. Figure 36 shows the percentages of each contaminant group that exceeded MCLs in the 166 wells.

Table 28 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Changes from Bulletin 118-80

The subbasins of the San Joaquin Valley, which were delineated as part of the 118-80 update, are given their first numeric designation in this report. Additionally, the Cosumnes Subbasin has been added to the subbasins within the San Joaquin River HR. It is worth noting that the southern portion of the South American Subbasin of the Sacramento Valley Groundwater Basin is also included as part of this HR. The subbasin names and numbers within the region are listed in Table 29.

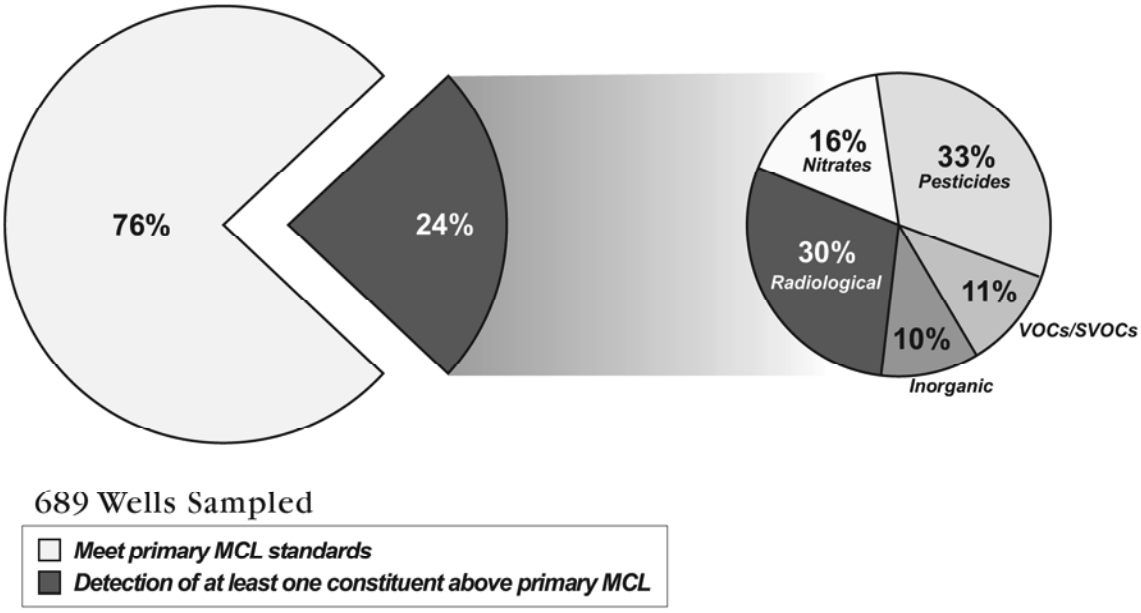

Figure 36 MCL exceedances in public supply wells in the San Joaquin River Hydrologic Region

Table 28 Most frequently occurring contaminants by contaminant group in the San Joaquin River Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Aluminum – 4	Arsenic – 4	4 tied at 2 exceedances
Inorganics – Secondary	Manganese – 123	Iron – 102	TDS – 9
Radiological	Uranium – 33	Gross Alpha – 26	Radium 228 – 6
Nitrates	Nitrate (as NO_3) – 23	Nitrate + Nitrite – 6	Nitrate Nitrogen (NO_3-N) – 3
Pesticides	DBCP – 44	Di(2-Ethylhexyl)phthalate – 11	EDB – 6
VOCs	PCE – 8	Dichloromethane – 3	TCE – 3

DBCP = Dibromochloropropane
EDB = Ethylenedibromide
PCE = Tetrachloroethylene
TCE = Trichloroethylene
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

Table 29 Modifications since Bulletin 118-80 of groundwater basins and subbasins in San Joaquin Hydrologic Region

Subbasin name	New number	Old number
Eastern San Joaquin	5-22.01	5-22
Modesto	5-22.02	5-22
Turlock	5-22.03	5-22
Merced	5-22.04	5-22
Chowchilla	5-22.05	5-22
Madera	5-22.06	5-22
Delta-Mendota	5-22.07	5-22
Tracy	5-22.15	5-22
Cosumnes	5-22.16	5-22

Table 30 San Joaquin River Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
5-22	SAN JOAQUIN VALLEY									
5-22.01	EASTERN SAN JOAQUIN	707,000	A	1,500	-	345	69	540	310	30 - 1,632
5-22.02	MODESTO	247,000	B	4,500	1000-2000	230	15	209	60-500	200-8300
5-22.03	TURLOCK	347,000	B	4,500	1000-2000	307	0	163	200-500	100-8300
5-22.04	MERCED	491,000	B	4,450	1500-1900	378	0	142	200-400	100-3600
5-22.05	CHOWCHILLA	159,000	B	4,750	750-2000	203	0	28	200-500	120-6400
5-22.06	MADERA	394,000	B	4,750	750-2000	378	0	127	200-400	100-6400
5-22.07	DELTA-MENDOTA	747,000	B	5,000	800-2000	816	0	120	770	210-86,000
5-22.15	TRACY	345,000	C	3,000	500-3,000	18	14	183	1,190	210-7,800
5-22.16	COSUMNES	281,000	A	1,500	-	75	13	72	218	140-438
5-69	YOSEMITE VALLEY	7,500	C	1,200	900	0	0	3	54	43-73
5-70	LOS BANOS CREEK VALLEY	4,840	C	-	-	0	0	0	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

Tulare Lake Hydrologic Region

Figure 37 Tulare Lake Hydrologic Region

Basins and Subbasins of Tulare Lake Hydrologic Region

Basin/subbasin	Basin name
5-22	San Joaquin Valley
5-22.08	Kings
5-22.09	Westside
5-22.10	Pleasant Valley
5-22.11	Kaweah
5-22.12	Tulare Lake
5-22.13	Tule
5-22.14	Kern County
5-23	Panoche Valley
5-25	Kern River Valley
5-26	Walker Basin Creek Valley
5-27	Cummings Valley
5-28	Tehachapi Valley West
5-29	Castaic Lake Valley
5-71	Vallecitos Creek Valley
5-80	Brite Valley
5-82	Cuddy Canyon Valley
5-83	Cuddy Ranch Area
5-84	Cuddy Valley
5-85	Mil Potrero Area

Description of the Region

The Tulare Lake HR covers approximately 10.9 million acres (17,000 square miles) and includes all of Kings and Tulare counties and most of Fresno and Kern counties (Figure 37). The region corresponds to approximately the southern one-third of RWQCB 5. Significant geographic features include the southern half of the San Joaquin Valley, the Temblor Range to the west, the Tehachapi Mountains to the south, and the southern Sierra Nevada to the east. The region is home to more than 1.7 million people as of 1995 (DWR, 1998). Major population centers include Fresno, Bakersfield, and Visalia. The cities of Fresno and Visalia are entirely dependent on groundwater for their supply, with Fresno being the second largest city in the United States reliant solely on groundwater.

Groundwater Development

The region has 12 distinct groundwater basins and 7 subbasins of the San Joaquin Valley Groundwater Basin, which crosses north into the San Joaquin River HR. These basins underlie approximately 5.33 million acres (8,330 square miles) or 49 percent of the entire HR area.

Groundwater has historically been important to both urban and agricultural uses, accounting for 41 percent of the region's total annual supply and 35 percent of all groundwater use in the State. Groundwater use in the region represents about 10 percent of the State's overall supply for agricultural and urban uses (DWR 1998).

The aquifers are generally quite thick in the San Joaquin Valley subbasins with groundwater wells commonly exceeding 1,000 feet in depth. The maximum thickness of freshwater-bearing deposits (4,400 feet) occurs at the southern end of the San Joaquin Valley. Typical well yields in the San Joaquin Valley range from 300 gpm to 2,000 gpm with yields of 4,000 gpm possible. The smaller basins in the mountains surrounding the San Joaquin Valley have thinner aquifers and generally lower well yields averaging less than 500 gpm.

The cities of Fresno, Bakersfield, and Visalia have groundwater recharge programs to ensure that groundwater will continue to be a viable water supply in the future. Extensive groundwater recharge programs are also in place in the south valley where water districts have recharged several million acre-feet for future use and transfer through water banking programs.

The extensive use of groundwater in the San Joaquin Valley has historically caused subsidence of the land surface primarily along the west side and south end of the valley.

Groundwater Quality

In general, groundwater quality throughout the region is suitable for most urban and agricultural uses with only local impairments. The primary constituents of concern are high TDS, nitrate, arsenic, and organic compounds.

The areas of high TDS content are primarily along the west side of the San Joaquin Valley and in the trough of the valley. High TDS content of west-side water is due to recharge of stream flow originating from marine sediments in the Coast Range. High TDS content in the trough of the valley is the result of concentration of salts because of evaporation and poor drainage. In the central and west-side portions of the valley, where the Corcoran Clay confining layer exists, water quality is generally better beneath the clay than above it. Nitrates may occur naturally or as a result of disposal of human and animal waste products and fertilizer. Areas of high nitrate concentrations are known to exist near the town of Shafter and other isolated areas in the San Joaquin Valley. High levels of arsenic occur locally and appear to be associated with lakebed areas. Elevated arsenic levels have been reported in the Tulare Lake, Kern Lake and Buena Vista Lake bed areas. Organic contaminants can be broken into two categories, agricultural and industrial. Agricultural pesticides and herbicides have been detected throughout the valley, but primarily along the east side where soil permeability is higher and depth to groundwater is shallower. The most notable agricultural contaminant is DBCP, a now-banned soil fumigant and known carcinogen once used extensively on grapes. Industrial organic contaminants include TCE, DCE, and other solvents. They are found in groundwater near airports, industrial areas, and landfills.

Water Quality in Public Supply Wells

From 1994 through 2000, 1,476 public supply water wells were sampled in 14 of the 19 groundwater basins and subbasins in the Tulare Lake HR. Evaluation of analyzed samples shows that 1,049 of the wells, or 71 percent, met the state primary MCLs for drinking water. Four-hundred-twenty-seven wells, or 29 percent, exceeded one or more MCL. Figure 38 shows the percentages of each contaminant group that exceeded MCLs in the 427 wells.

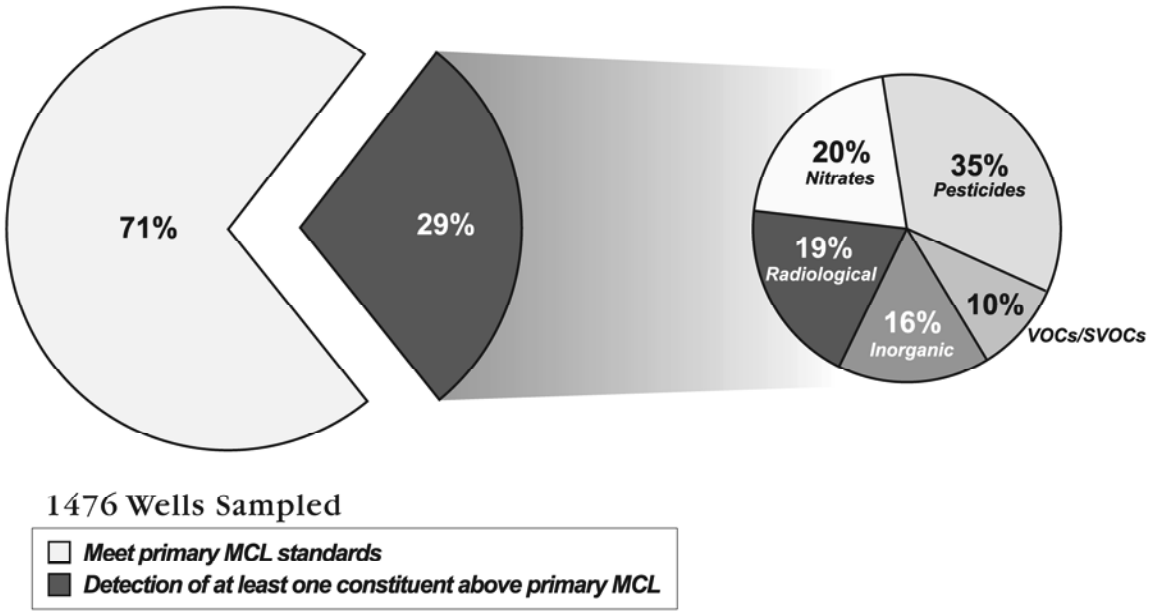

Figure 38 MCL exceedances by contaminant group in public supply wells in the Tulare Lake Hydrologic Region

Table 31 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 31 Most frequently occurring contaminants by contaminant group in the Tulare Lake Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics - Primary	Fluoride – 32	Arsenic – 16	Aluminum – 13
Inorganics - Secondary	Iron – 155	Manganese – 82	TDS – 9
Radiological	Gross Alpha – 74	Uranium – 24	Radium 228 – 8
Nitrates	Nitrate(as NO_3) – 83	Nitrate + Nitrite – 14	Nitrite(as N) – 3
Pesticides	DBCP – 130	EDB – 24	Di(2-Ethylhexyl)phthalate – 7
VOCs/SVOCs	TCE – 17	PCE – 16	Benzene – 6 MTBE – 6

DBCP = Dibromochloropropane
EDB = Ethylenedibromide
TCE = Trichloroethylene
PCE = Tetrachloroehylene
VOC = Volatile organic compound
SVOC = Semivolatile organic compound

Changes from Bulletin 118-80

There are no newly defined basins since Bulletin 118-80. However, the subbasins of the San Joaquin Valley, which were delineated as part of the 118-80 update, are given their first numeric designation in this report (Table 32).

Table 32 Modifications since Bulletin 118-80 of groundwater basins and subbasins in Tulare Lake Hydrologic Region

Subbasin name	New number	Old number
Kings	5-22.08	5-22
Westside	5-22.09	5-22
Pleasant Valley	5-22.10	5-22
Kaweah	5-22.11	5-22
Tulare Lake	5-22.12	5-22
Tule	5-22.13	5-22
Kern County	5-22.14	5-22
Squaw Valley	deleted	5-24
Cedar Grove Area	deleted	5-72
Three Rivers Area	deleted	5-73
Springville Area	deleted	5-74
Templeton Mountain Area	deleted	5-75
Manache Meadow Area	deleted	5-76
Sacator Canyon Valley	deleted	5-77
Rockhouse Meadows Valley	deleted	5-78
Inns Valley	deleted	5-79
Bear Valley	deleted	5-81

Several basins have been deleted from the Bulletin 118-80 report. In Squaw Valley (5-24) all 118 wells are completed in hard rock. Cedar Grove Area (5-72) is a narrow river valley in Kings Canyon National Park with no wells. Three Rivers Area (5-73) has a thin alluvial terrace deposit but 128 of 130 wells are completed in hard rock. Springville Area (5-74) is this strip of alluvium adjacent to Tule River and all wells are completed in hard rock. Templeton Mountain Area (5-75), Manache Meadow Area (5-76), and Sacator Canyon Valley (5-77) are all at the crest of mountains with no wells. Rockhouse Meadows Valley (5-78) is in wilderness with no wells. Inns Valley (5-79) and Bear Valley (5-81) both have all wells completed in hard rock.

Table 33 Tulare Lake Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
5-22	SAN JOAQUIN VALLEY									
5-22.08	KINGS	976,000	C	3,000	500-1,500	909	-	722	200-700	40-2000
5-22.09	WESTSIDE	640,000	C	2,000	1,100	960	-	50	520	220-35,000
5-22.10	PLEASANT VALLEY	146,000	B	3,300	-	151	-	2	1,500	1000-3000
5-22.11	KAWEAH	446,000	B	2,500	1,000-2,000	568	-	270	189	35-580
5-22.12	TULARE LAKE	524,000	B	3,000	300-1,000	241	-	86	200-600	200-40,000
5-22.13	TULE	467,000	B	3,000	-	459	-	150	256	200-30,000
5-22.14	KERN COUNTY	1,950,000	A	4,000	1,200-1,500	2,258	249	476	400-450	150-5000
5-23	PANOCHE VALLEY	33,100	C	-	-	48	-	-	1,300	394-3530
5-25	KERN RIVER VALLEY	74,000	C	3,650	350	-	-	92	378	253-480
5-26	WALKER BASIN CREEK VALLEY	7,670	C	650	-	-	-	1	-	-
5-27	CUMMINGS VALLEY	10,000	A	150	56	51	-	15	344	-
5-28	TEHACHAPI VALLEY WEST	14,800	A	1,500	454	64	-	19	315	280-365
5-29	CASTAC LAKE VALLEY	3,600	C	400	375	-	-	3	583	570-605
5-71	VALLECITOS CREEK VALLEY	15,100	C	-	-	-	-	0	-	-
5-80	BRITE VALLEY	3,170	A	500	50	-	-	-	-	-
5-82	CUDDY CANYON VALLEY	3,300	C	500	400	-	-	3	693	695
5-83	CUDDY RANCH AREA	4,200	C	300	180	-	-	4	550	480-645
5-84	CUDDY VALLEY	3,500	A	160	135	3	-	3	407	325-645
5-85	MIL POTRERO AREA	2,300	C	3,200	240	7	-	7	460	372-657

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

North Lahontan Hydrologic Region

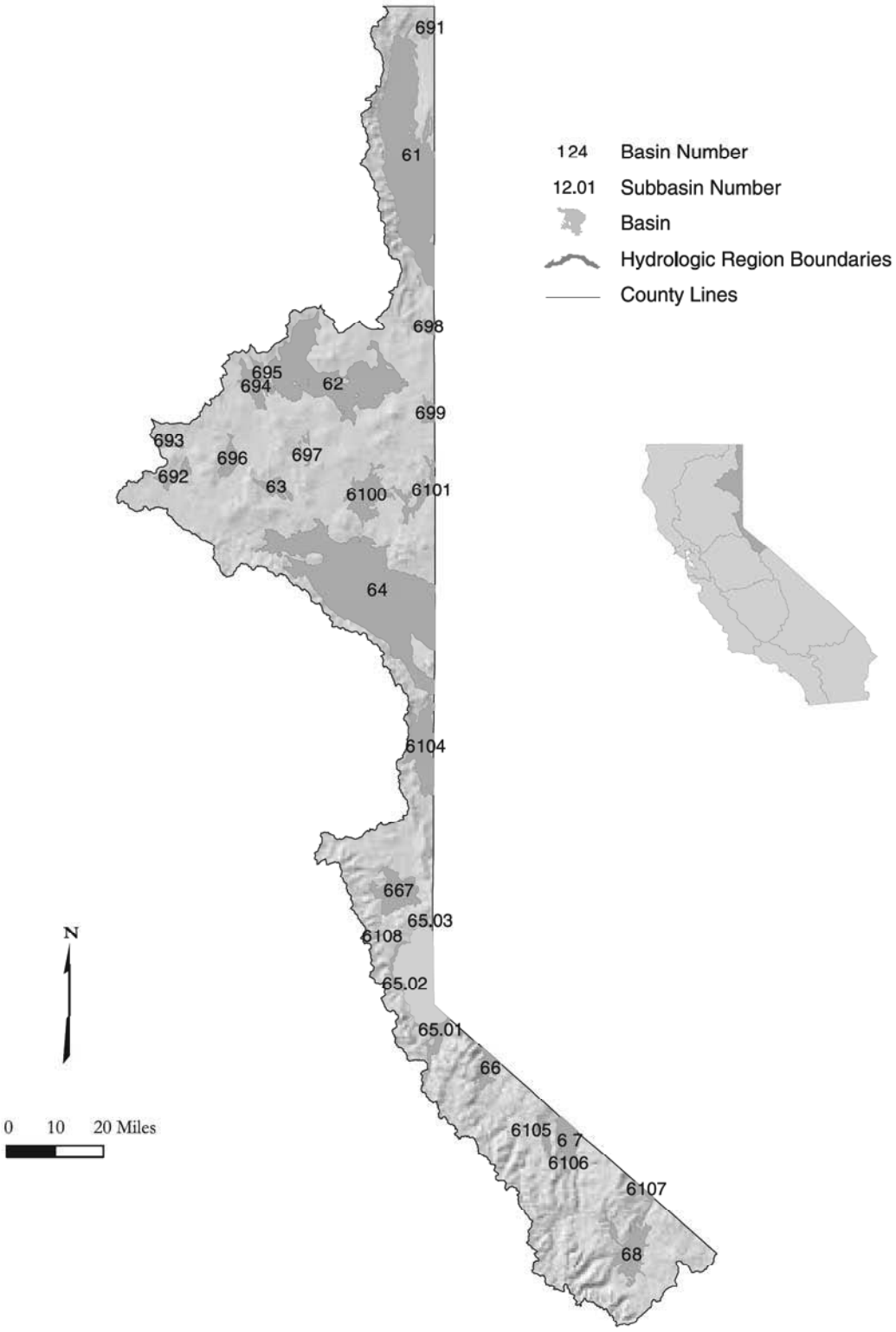

Figure 39 North Lahontan Hydrologic Region

Basins and Subbasins of the North Lahontan Hydrologic Region

Basin/subbasin	Basin name
6-1	Surprise Valley
6-2	Madeline Plains
6-3	Willow Creek Valley
6-4	Honey Lake Valley
6-5	Tahoe Valley
6-5.01	Tahoe Valley South
6-5.02	Tahoe Valley West
6-5.03	Tahoe Valley North
6-6	Carson Valley
6-7	Antelope Valley
6-8	Bridgeport Valley
6-67	Martis (Truckee) Valley
6-91	Cow Head Lake Valley
6-92	Pine Creek Valley
6-93	Harvey Valley
6-94	Grasshopper Valley
6-95	Dry Valley
6-96	Eagle Lake Area
6-97	Horse Lake Valley
6-98	Tuledad Canyon
6-99	Painters Flat
6-100	Secret Valley
6-101	Bull Flat
6-104	Long Valley
6-105	Slinkard Valley
6-106	Little Antelope Valley
6-107	Sweetwater Flat
6-108	Olympic Valley

Description of the Region

The North Lahonton HR covers approximately 3.91 million acres (6,110 square miles) and includes portions of Modoc, Lassen, Sierra, Nevada, Placer, El Dorado, Alpine, Mono, and Tuolumne counties (Figure 39). Reaching south from the Oregon border almost to Mono Lake on the east side of the Sierra, this region encompasses portions of two geomorphic provinces. From Long Valley north, most of the groundwater basins of the region were formed by basin and range block faulting near the western extent of the province. South from Long Valley, most of the basins are in the alpine valleys of the Sierra Nevada or are at the foot of the Sierra along the California-Nevada border where streams and rivers draining the eastern Sierran slopes terminate in desert sinks or lakes. The region corresponds to approximately the northern half of RWQCB 6. Significant geographic features include the Sierra Nevada, the volcanic terrane of the Modoc Plateau, Honey Lake Valley, and Lake Tahoe. The latter two areas are the major population centers in the region. The 1995 population of the entire region was about 84,000 people (DWR, 1998).

The northern portion of the region is rural and sparsely populated. Cattle ranching and associated hay cropping are the predominant land uses in addition to some pasture irrigation. Less than 4 percent of the entire region is irrigated. About 75 percent of the irrigated lands are in Modoc and Lassen counties, and most of the remainder is in Alpine and Mono counties. Much of the southern portion of the region is federally owned and managed as national forest lands where tourism and recreation constitute much of the economic base.

Much of the North Lahontan HR is chronically short of water due to the arid, high desert climate, which predominates in the region. Throughout the northern portion of the region where annual precipitation can be as low as 4 inches, runoff is typically scant and streamflows decrease rapidly during the irrigation season as the snowpack in the higher elevations melts. In the southern portion of the region, annual precipitation ranges from more than 70 inches (mostly snow in the higher elevations of the mountains) to as little as 8 inches in the low elevation valleys. In wet years, surface water can meet much of the agricultural demand, but in dry years, most of the region relies heavily on groundwater to meet water supply needs.

Groundwater Development

There are 24 groundwater basins in the region, one of which is divided into three subbasins. Thirteen of these basins are shared with Nevada and one with Oregon. These basins underlie approximately 1.03 million acres (1,610 square miles) or about 26 percent of the entire region. Although the groundwater basins were delineated based on mapped alluvial fill, much of the groundwater produced in many of them actually comes from underlying fractured rock aquifers. This is particularly true in the volcanic areas of Modoc and Lassen counties where, in many basins, volcanic flows are interstratified with lake sediments and alluvium. Wells constructed in the volcanics commonly produce large amounts of groundwater, whereas wells constructed in fine-grained lake deposits produce less. Because the thickness and lateral extent the of the hard rocks outside of the defined basin are generally not known, actual groundwater in storage in these areas is unknown.

Locally, groundwater is an important resource accounting for about 28 percent of the annual supply for agricultural and urban uses. Groundwater use in the region represents less than 1 percent of the State's overall supply for agricultural and urban uses (DWR 1998).

In the northern portion of the region, a sizable quantity of groundwater (nearly 130,000 acre-feet) is extracted annually for agricultural and municipal purposes. Groundwater extracted from the Honey Lake Valley Basin accounts for 41,900 acre-feet of the agricultural supply and 12,000 acre-feet of the municipal supply (based on normalized data from 1990). An additional 3,100 acre-feet is extracted to meet the demands of the Honey Lake Wildlife Area, which provides habitat for several threatened species (Bald Eagle, Sandhill Crane, Bank Swallow, and Peregrine Falcon).

Well yields in the Honey Lake Valley Basin are greatest in alluvial and volcanic deposits. Wells drawing from these deposits may have yields that vary from 10 gpm to more than 2,000 gpm, but drawdown in these cases is generally high. Eight wells in the Honey Lake Wildlife Area have an average yield of between 1,260 and 2,100 gpm. Depths of completed wells in the region range from 20 to 720 feet.

The Honey Lake Valley Basin is very close to exceeding prudent perennial yield, and future development could come at the expense of water for agriculture. A 1987 agreement between DWR, the state of Nevada, and the U.S. Geological Survey resulted in a study of the groundwater flow system in eastern Honey Lake Valley. Upon conclusion of the study in September 1990, a Nevada state engineer ruled that only about 13,000 acre-feet could be safely transferred from the basin.

No major changes in water use are anticipated in the near future in the northern portion of the region. Irrigated agriculture is already constrained by economically available water supplies. A small amount of agricultural expansion is expected but only in areas that can support minor additional groundwater development. Likewise, the modest need for additional municipal and irrigation supplies can be met by minor expansion of present surface systems or by increased use of groundwater.

The principal drainages in the southern portion of the region are the Truckee, Walker and Carson rivers. Water rights in these drainages historically have been heavily contested, and allocations are limited by interstate agreements with Nevada, in-stream environmental requirements, and miscellaneous private rights holders. In the Lake Tahoe Basin, further development is strictly limited because of concerns regarding water quality in the lake. Surface water storage developed in the region's drainages provides urban and agricultural supply to the Reno/Sparks area and to the many smaller communities in the eastern Sierra and at the foot of the mountain slopes. Most communities rely on a combination of surface water and groundwater supply.

In the upper Truckee drainage, the primary groundwater basins underlie the areas around Lake Tahoe and Martis Valley, where the Town of Truckee is located. Both areas use surface water and groundwater for urban and surrounding rural domestic supplies.

Little is known about the small groundwater basins developed along the foot of the eastern Sierra. Most communities overlying these basins are along the streams and rivers flowing down the mountains, and groundwater is extracted from the underlying alluvium. Groundwater augments surface supplies for agricultural purposes and supports municipal and rural domestic supplies.

Groundwater Quality

In basins in the northern portion of the region, groundwater quality ranges widely from excellent to poor. Wells that obtain their water supply from lake deposits can have high concentrations of boron, arsenic, fluoride, nitrate, and TDS. TDS content generally increases toward the central portions of these basins where concentrations have accumulated over time. The groundwater quality along the margins of most of these basins tends to be of much better quality. There is a potential for future groundwater pollution occurring in urban/suburban areas where single-family septic systems have been installed, especially in hard rock areas. Groundwater quality in the alpine basins is good to excellent; but, as in any area where single-family septic systems have been installed, there is potential for degradation of groundwater quality.

Water Quality in Public Supply Wells

From 1994 through 2000, 169 public supply water wells were sampled in 8 of the 26 basins and subbasins in the North Lahontan HR. Evaluation of the analyzed samples indicates that 147 wells, or 87 percent, met the state primary MCLs for drinking water. Twenty-two wells, or 13 percent, have constituents that exceed one or more MCL. Figure 40 shows the percentages of each contaminant group that exceeded MCLs in the 22 wells.

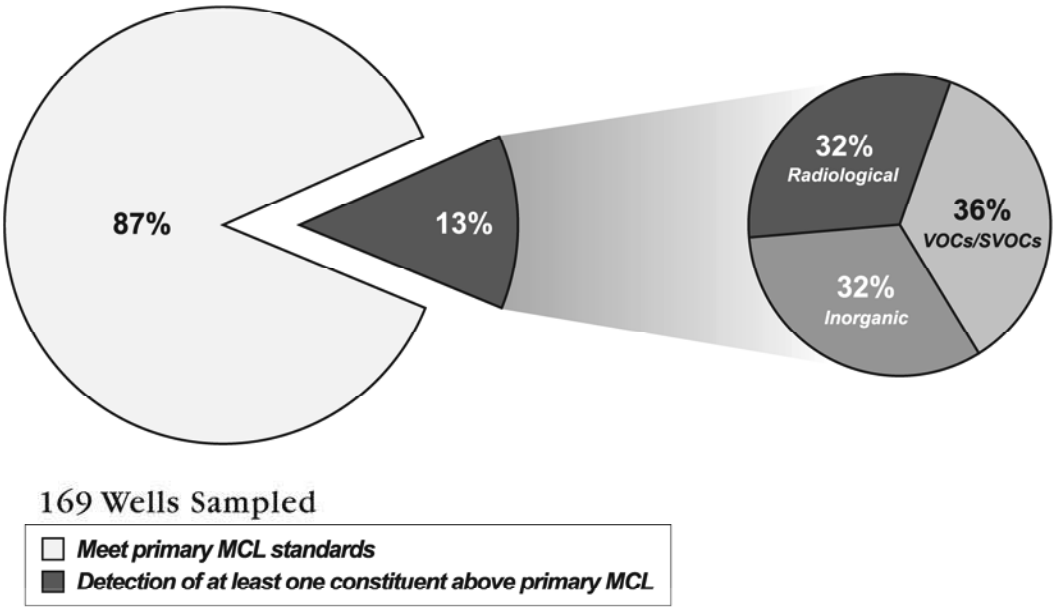

Figure 40 MCL exceedances in public supply wells in the North Lahontan Hydrologic Region

Table 34 lists the three most frequently occurring contaminants in each contaminant group and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 34 Most frequently occurring contaminants by contaminant group in the North Lahontan Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Fluoride – 3	Thallium – 3	3 tied at 1 exceedance
Inorganics – Secondary	Iron – 14	Manganese – 13	TDS – 1
Radiological	Gross Alpha – 7	Uranium – 5	Radium 226 – 1
VOCs/SVOCs	1,2 Dichloroethane – 8	TCE – 2	MTBE – 1

TCE = Trichloroethylene
MTBE = Methyltertiarybutylether
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

Changes from Bulletin 118-80

There are no newly defined basins since Bulletin 118-80. The only delineated areas removed from the list of region basins are the Recent and Pleistocene volcanic areas of the Modoc Plateau, previously numbered 6-102 and 6-103, respectively.

Table 35 North Lahontan Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
6-1	SURPRISE VALLEY	228,000	B	2,500	1,383	16	11	4	224	87 - 1,800
6-2	MADELINE PLAINS	156,150	B	-	450	2	6	-	402	81 - 1,790
6-3	WILLOW CREEK VALLEY	11,700	B	-	-	7	4	-	401	90 - 1,200
6-4	HONEY LAKE VALLEY	311,150	B	2,500	784	39	24	49	518	89 - 2,500
6-5	TAHOE VALLEY									
6-5.01	TAHOE SOUTH	14,800	C	4,000	-	6	-	54	-	59 - 206
6-5.02	TAHOE WEST	6,000	C	-	-	-	9	3	103	68 - 128
6-5.03	TAHOE VALLEY NORTH	2,000	C	900	-	-	-	-	141	-
6-6	CARSON VALLEY	10,700	C	-	-	-	-	-	-	-
6-7	ANTELOPE VALLEY	20,100	A	-	-	-	-	12	-	-
6-8	BRIDGEPORT VALLEY	32,500	C	-	-	-	-	6	-	-
6-67	MARTIS VALLEY	35,600	C	-	-	-	-	-	-	-
6-91	COW HEAD LAKE VALLEY	5,600	B	-	-	-	-	-	-	-
6-92	PINE CREEK VALLEY	9,530	B	-	-	-	-	1	-	-
6-93	HARVEY VALLEY	4,500	B	-	-	-	-	-	-	-
6-94	GRASSHOPPER VALLEY	17,670	B	-	-	-	-	-	-	-
6-95	DRY VALLEY	6,500	B	-	-	-	-	-	-	-
6-96	EAGLE LAKE AREA	-	B	-	-	-	4	4	-	-
6-97	HORSE LAKE VALLEY	3,800	B	-	-	-	-	-	-	-
6-98	TULEDAD CANYON	5,200	B	-	-	-	-	-	-	-
6-99	PAINTERS FLAT	6,400	B	-	-	-	-	-	-	-
6-100	SECRET VALLEY	33,680	B	-	-	2	2	-	-	125 - 3,200
6-101	BULL FLAT	18,100	B	-	-	-	-	-	-	-
6-104	LONG VALLEY	46,840	B	-	-	31	4		302	127 - 570
6-105	SLINKARD VALLEY	4,500	C	-	-	-	-	-	-	-
6-106	LITTLE ANTELOPE VALLEY	2,500	C	-	-	-	-	-	-	-
6-107	SWEETWATER FLAT	4,700	C	-	-	-	-	-	-	-
6-108	OLYMPIC VALLEY	700	C	600	330	-	-	2	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

South Lahontan Hydrologic Region

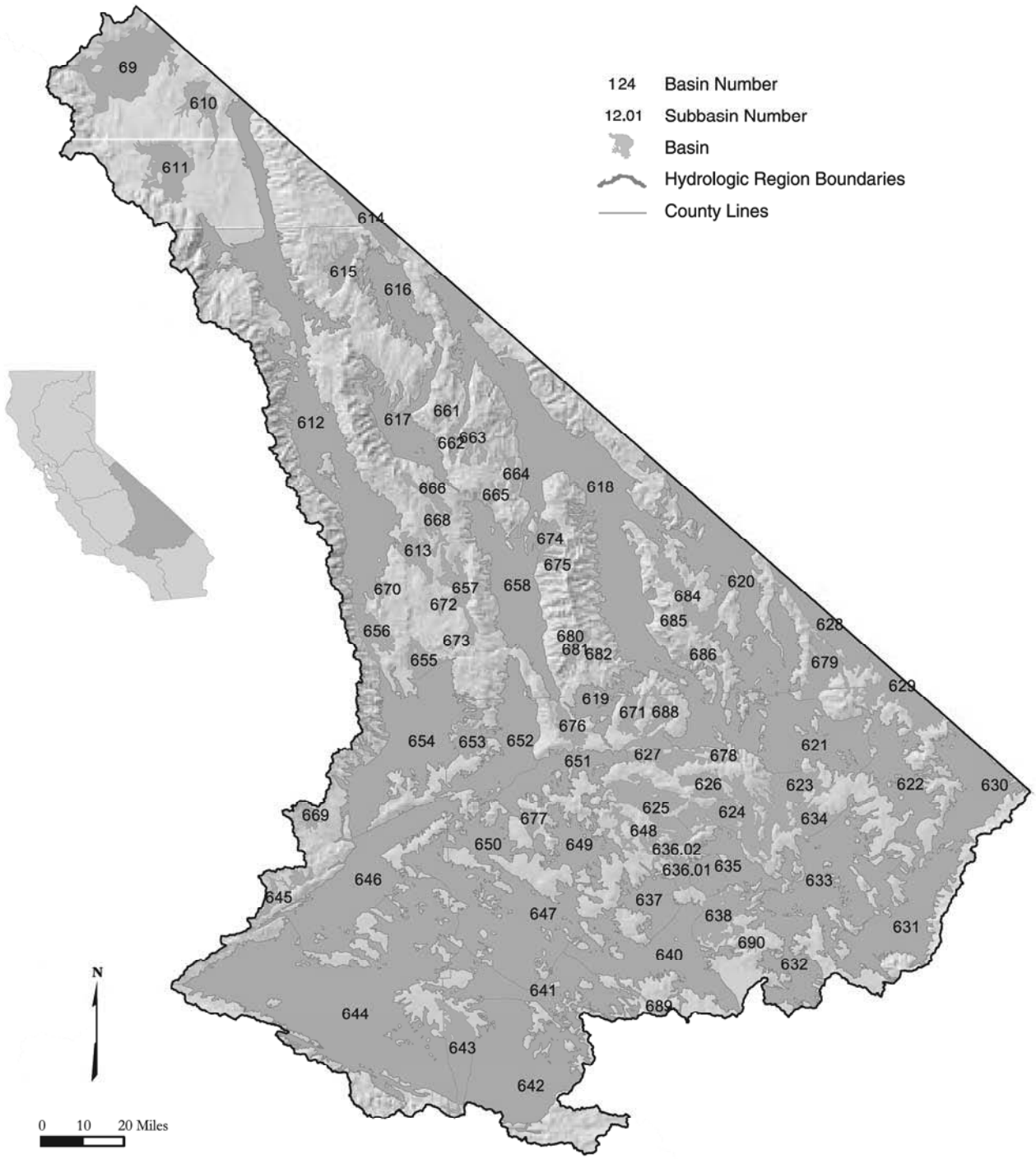

Figure 41 South Lahontan Hydrologic Region

Basins and Subbasins of the South Lahontan Hydrologic Region

Basin/subbasin	Basin name
6-9	Mono Valley
6-10	Adobe Lake Valley
6-11	Long Valley
6-12	Owens Valley
6-13	Black Springs Valley
6-14	Fish Lake Valley
6-15	Deep Springs Valley
6-16	Eureka Valley
6-17	Saline Valley
6-18	Death Valley
6-19	Wingate Valley
6-20	Middle Amargosa Valley
6-21	Lower Kingston Valley
6-22	Upper Kingston Valley
6-23	Riggs Valley
6-24	Red Pass Valley
6-25	Bicycle Valley
6-26	Avawatz Valley
6-27	Leach Valley
6-28	Pahrump Valley
6-29	Mesquite Valley
6-30	Ivanpah Valley
6-31	Kelso Valley
6-32	Broadwell Valley
6-33	Soda Lake Valley
6-34	Silver Lake Valley
6-35	Cronise Valley
6-36	Langford Valley
6-36.01	Langford Well Lake
6-36.02	Irwin
6-37	Coyote Lake Valley
6-38	Caves Canyon Valley
6-40	Lower Mojave River Valley
6-41	Middle Mojave River Valley
6-42	Upper Mojave River Valley
6-43	El Mirage Valley
6-44	Antelope Valley
6-45	Tehachapi Valley East
6-46	Fremont Valley
6-47	Harper Valley
6-48	Goldstone Valley
6-49	Superior Valley
6-50	Cuddeback Valley
6-51	Pilot Knob Valley
6-52	Searles Valley
6-53	Salt Wells Valley
6-54	Indian Wells Valley
6-55	Coso Valley
6-56	Rose Valley
6-57	Darwin Valley
6-58	Panamint Valley
6-61	Cameo Area
6-62	Race Track Valley
6-63	Hidden Valley
6-64	Marble Canyon Area
6-65	Cottonwood Spring Area
6-66	Lee Flat
6-68	Santa Rosa Flat
6-69	Kelso Lander Valley
6-70	Cactus Flat
6-71	Lost Lake Valley
6-72	Coles Flat
6-73	Wild Horse Mesa Area
6-74	Harrisburg Flats
6-75	Wildrose Canyon
6-76	Brown Mountain Valley
6-77	Grass Valley
6-78	Denning Spring Valley
6-79	California Valley
6-80	Middle Park Canyon
6-81	Butte Valley
6-82	Spring Canyon Valley
6-84	Greenwater Valley
6-85	Gold Valley
6-86	Rhodes Hill Area
6-88	Owl Lake Valley
6-89	Kane Wash Area
6-90	Cady Fault Area

Description of the Region

The South Lahontan HR covers approximately 21.2 million acres (33,100 square miles) in eastern California. This region includes about 21 percent of the surface area of California and both the highest (Mount Whitney) and lowest (Death Valley) surface elevations of the contiguous United States. The HR is bounded on the west by the crest of the Sierra Nevada and on the north by the watershed divide between Mono Lake and East Walker River drainages; on the east by Nevada and the south by the crest of the San Gabriel and San Bernardino mountains and the divide between watersheds draining south toward the Colorado River and those draining northward. This HR includes the Owens, Mojave, and Amargosa River systems, the Mono Lake drainage system, and many other internally drained basins. Average annual precipitation is about 7.9 inches, and runoff is about 1.3 maf per year (DWR 1994).

The South Lahontan HR includes Inyo County, much of Mono and San Bernardino counties, and parts of Kern and Los Angeles counties (Figure 41). National forests, national and state parks, military bases and other public lands comprise most of the land in this region. The Los Angeles Department of Water and Power is also a major landowner in the northern part of the HR and controls rights to much of the water draining the eastern Sierra Nevada.

According to 2000 census data, the South Lahontan HR is home to about 530,000 people, or 1.6 percent of the state's population. The major population centers are in the southern part of the HR and include Palmdale, Lancaster, Victorville, Apple Valley, and Hesperia.

Groundwater Development

In this report, 76 groundwater basins are delineated in the South Lahontan HR, and the Langford Valley Groundwater Basin (6-36) is divided into two subbasins. The groundwater basins underlie about 11.60 million acres (18,100 square miles) or about 55 percent of the HR.

Most of the groundwater production is concentrated, along with the population, in basins in the southern part of this region. Groundwater provides 41 percent of water supply for agriculture and urban uses (DWR 1998). Much of this HR is public land with very low population density, within these areas there has been little groundwater development and little is known about the basins.

In most smaller basins, groundwater is found in unconfined alluvial aquifers; however, in some of the larger basins, or near dry lakes, aquifers may be separated by aquitards that cause confined groundwater conditions. Depths of the basins range from tens or hundreds of feet in smaller basins to thousands of feet in larger basins. The thickness of aquifers varies from tens to hundreds of feet. Well yields vary in this region depending on aquifer characteristics and well location, size, and use.

Conjunctive use of surface water and groundwater is practiced in the more heavily pumped basins. Some water used in the southern part of the HR is imported from Northern California by the State Water Project. Some of this imported water is used to recharge groundwater in the Mojave River Valley basins (6-40, 6-41, and 6-42). Surface water and groundwater are exported from the South Lahontan HR to the South Coast HR by the Los Angeles Department of Water and Power.

Groundwater Quality

The chemical character of the groundwater varies throughout the region, but most often is calcium or sodium bicarbonate. Near and beneath dry lakes, sodium chloride and sodium sulfate-chloride water is common. In general, groundwater near the edges of valleys contains lower TDS content than water beneath the central part of the valleys or near dry lakes.

Drinking water standards are most often exceeded for TDS, fluoride, and boron content. The EPA lists 13 sites of contamination in this HR. Of these, three military installations in the Antelope Valley and Mojave River Valley groundwater basins are federal Superfund sites because of VOCs and other hazardous contaminants.

Water Quality in Public Supply Wells

From 1994 through 2000, 605 public supply water wells were sampled in 19 of the 77 basins and subbasins in the South Lahontan HR. Analyzed samples indicate that 506 wells, or 84 percent, met the state primary MCLs for drinking water. Ninety-nine wells, or 16 percent, have constituents that exceed one or more MCL. Figure 42 shows the percentages of each contaminant group that exceeded MCLs in the 99 wells.

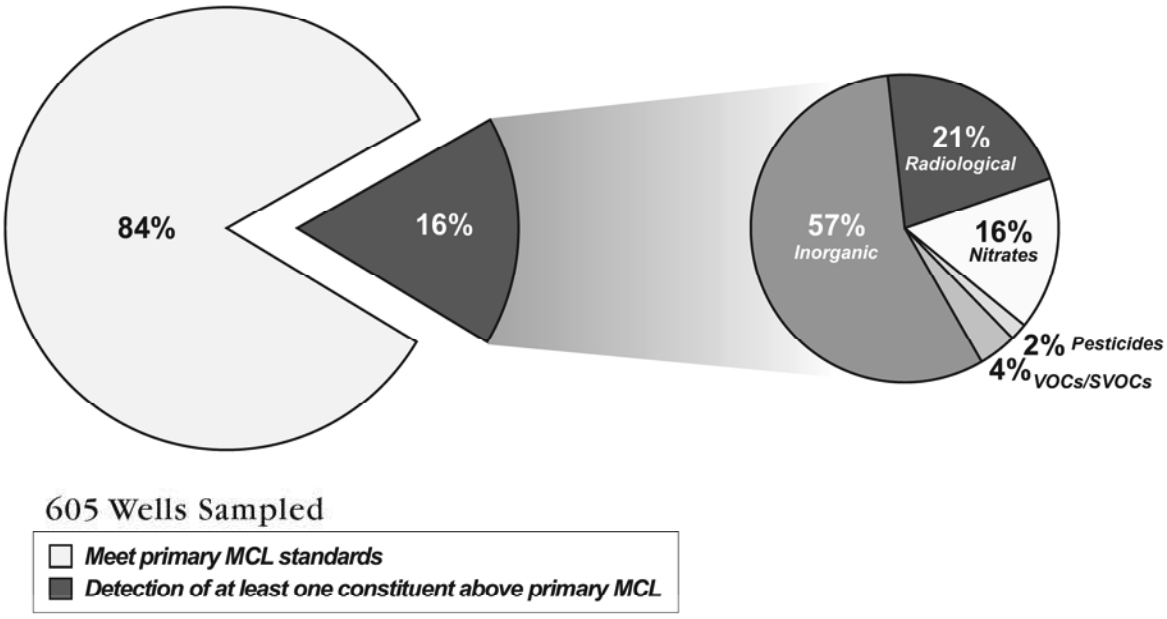

Figure 42 MCL exceedances in public supply wells in the South Lahontan Hydrologic Region

Table 36 lists the three most frequently occurring contaminants in each of the six contaminant groups and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 36 Most frequently occurring contaminants by contaminant group in the South Lahontan Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Fluoride – 30	Arsenic – 19	Antimony – 5
Inorganics – Secondary	Iron – 82	Manganese – 36	Specific Conductance – 5 TDS – 5
Radiological	Gross Alpha – 18	Uranium – 7	Radium 228 – 2
Dissolved Nitrogen	Nitrate (as NO_3) – 12	Nitrate + Nitrite–6	Nitrite (as N) – 4
Pesticides	Di(2-Ethylhexyl)phthalate) – 2		
VOCs/SVOCs	MTBE – 2	TCE – 2	Carbon Tetrachloride – 2

TCE = Trichloroethylene
MTBE = Methyltertiarybutylether
VOC = Volatile Organic Compound
SVOC = Semivolatile Organic Compound

Changes from Bulletin 118-80

Several modifications from the groundwater basins presented in Bulletin 118-80 are incorporated in this report (Table 37). Langford Valley Groundwater Basin (6-36) has been divided into two subbasins. Granite Mountain Area (6-59) and Fish Slough Valley (6-60) groundwater basins have been deleted because no information was found concerning wells or groundwater in these basins or because well completion reports indicate that groundwater production is derived from fractured rocks beneath the basin. Furnace Creek Area Groundwater Basin (6-83) has been incorporated into Death Valley Groundwater Basin (6-18), and Butterbread Canyon Valley Groundwater Basin (6-87) has been incorporated into Lost Lake Valley Groundwater Basin (6-71).

Table 37 Modifications since Bulletin 118-80 of groundwater basins and subbasins in South Lahontan Hydrologic Region

Basin/subbasin name	New number	Old number
Langford Well Lake	6-36.01	6-36
Irwin	6-36.02	6-36
Troy Valley	Incorporated into 6-40 and 7-14.	6-39
Granite Mountain Area	Deleted	6-59
Fish Slough Valley	Deleted	6-60
Furnace Creek Area	Deleted – incorporated into 6-18	6-83
Butterbread Canyon Valley	Deleted – incorporated into 6-71	6-87

Troy Valley Groundwater Basin (6-39) has been split at the Pisgah fault, which is a groundwater barrier, and has been incorporated into Lower Mojave River Valley (6-40) and Lavic Valley (7-14) groundwater basins. This change incorporates part of the South Lahontan HR into a basin in the Colorado River HR[1]. The Middle Mojave River Valley Groundwater Basin (6-41) has changed boundaries along the north (Harper Valley; 6-47) and east sides (Lower Mojave River Valley; 6-40). The new boundaries are along the Camp Rock-Harper Lake fault zone, Waterman fault, and Helendale fault. Groundwater level elevations indicate that these faults are likely strong barriers to groundwater movement.

The boundary between the Upper Mojave River Valley Groundwater Basin (6-42) and the Lucerne Valley Groundwater Basin (7-19) was changed from the regional surface divide to the southern part of the Helendale fault, which is a groundwater barrier. This change incorporates part of the Colorado Desert HR into a basin in the South Lahontan HR[2].

[1] The boundaries of the hydrologic regions are defined by surface drainage patterns. In this case, faults impede groundwater flow causing it to flow beneath the surface drainage divide into the adjacent hydrologic region.
[2] See previous note.

Table 38 South Lahontan Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
6-09	MONO VALLEY	173,000	A	800	480	-	-	-	-	2060
6-10	ADOBE LAKE VALLEY	39,800	C	-	-	-	-	-	-	-
6-11	LONG VALLEY	71,800	A	250	90	20	-	5	-	-
6-12	OWENS VALLEY	661,000	A	8,100	1,870	700	7	89	-	300-450,000
6-13	BLACK SPRINGS VALLEY	30,800	C	-	-	-	-	-	-	-
6-14	FISH LAKE VALLEY	48,100	C	-	-	-	-	-	-	-
6-15	DEEP SPRINGS VALLEY	29,900	C	700	390	-	-	-	-	-
6-16	EUREKA VALLEY	129,000	C	-	-	-	-	1	-	-
6-17	SALINE VALLEY	146,000	C	-	-	-	-	-	-	-
6-18	DEATH VALLEY	921,000	C	-	-	28	-	6	-	-
6-19	WINGATE VALLEY	71,400	C	-	-		-		-	-
6-20	MIDDLE AMARGOSA VALLEY	390,000	C	3,000	2,500	2	-	4	-	-
6-21	LOWER KINGSTON VALLEY	240,000	C	-	-	-	-	-	-	-
6-22	UPPER KINGSTON VALLEY	177,000	C	24	-	-	-	5	-	-
6-23	RIGGS VALLEY	87,700	C	-	-	-	-	-	-	-
6-24	RED PASS VALLEY	96,500	C	-	-	-	-	-	-	-
6-25	BICYCLE VALLEY	89,600	C	710	-	-	12	6	618	508-810
6-26	AVAWATZ VALLEY	27,700	C	-	-	-	-	-	-	-
6-27	LEACH VALLEY	61,300	C	-	-	-	-	-	-	-
6-28	PAHRUMP VALLEY	93,100	C	300	150	-	-	-	-	-
6-29	MESQUITE VALLEY	88,400	C	1,500	1,020	-	-	-	-	-
6-30	IVANPAH VALLEY	199,000	C	600	400	-	-	9	-	-
6-31	KELSO VALLEY	255,000	C	370	290	-	-		-	-
6-32	BROADWELL VALLEY	92,100	C	-	-	-	-	1	-	-
6-33	SODA LAKE VALLEY	381,000	C	2,100	1,100	-	-	3	-	-
6-34	SILVER LAKE VALLEY	35,300	C	-	-	-	-		-	-
6-35	CRONISE VALLEY	127,000	C	600	340	-	-	-	-	-
6-36	LANGFORD VALLEY									
6-36.01	LANGFORD WELL LAKE	19,300	C	1,700	410	11	7	3	498	440-568
6-36.02	IRWIN	10,500	C	550	-	40	-	3	528	496-598
6-37	COYOTE LAKE VALLEY	88,200	A	1,740	660	5	-	-	-	300-1000
6-38	CAVES CANYON VALLEY	73,100	A	300	-	4	1	4	-	300-1000
6-40	LOWER MOJAVE RIVER VALLEY	286,000	A	2,700	770	70	21	52	300	-
6-41	MIDDLE MOJAVE RIVER VALLEY	211,000	A	4,000	1,000	74	3	14	500	-
6-42	UPPER MOJAVE RIVER VALLEY	413,000	A	5,500	1,030	120	22	153	500	1105
6-43	EL MIRAGE VALLEY	75,900	A	1,000	230	50	3	21	-	-
6-44	ANTELOPE VALLEY	1,110,000	A	7,500	286	262	10	248	300	200-800
6-45	TEHACHAPI VALLEY EAST	24,000	C	150	31	31	-	9	361	298-405
6-46	FREMONT VALLEY	2,370,000	C	4,000	500	23	-	13	596	350-100,000
6-47	HARPER VALLEY	410,000	A	3,000	725	11	3	19	-	179-2391
6-48	GOLDSTONE VALLEY	28,100	C	-	-	-	-	-	-	-
6-49	SUPERIOR VALLEY	120,000	C	450	100	-	-	-	-	-

Table 38 South Lahontan Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
6-50	CUDDEBACK VALLEY	94,900	C	500	300	-	-	-	-	-
6-51	PILOT KNOB VALLEY	139,000	C	-	-	-	-	1	-	-
6-52	SEARLES VALLEY	197,000	C	1,000	300	-	-	-	-	-
6-53	SALT WELLS VALLEY	29,500	C	-	-	-	-	-	-	-
6-54	INDIAN WELLS VALLEY	382,000	A	3,800	815	116	20	63	312	110-1620
6-55	COSO VALLEY	25,600	C	-	-	-	-	-	-	-
6-56	ROSE VALLEY	42,500	C	-	-	-	-	1	-	-
6-57	DARWIN VALLEY	44,200	C	130	43	-	-	-	-	-
6-58	PANAMINT VALLEY	259,000	C	35	30	-	-	-	-	-
6-61	CAMEO AREA	9,310	C	-	-	-	-	-	-	-
6-62	RACE TRACK VALLEY	14,100	C	-	-	-	-	-	-	-
6-63	HIDDEN VALLEY	18,000	C	-	-	-	-	-	-	-
6-64	MARBLE CANYON AREA	10,400	C	-	-	-	-	-	-	-
6-65	COTTONWOOD SPRING AREA	3,900	C	-	-	-	-	-	-	-
6-66	LEE FLAT	20,300	C	-	-	-	-	-	-	-
6-68	SANTA ROSA FLAT	312	C	-	-	-	-	-	-	-
6-69	KELSO LANDER VALLEY	11,200	C	-	-	-	-	-	-	-
6-70	CACTUS FLAT	7,030	C	-	-	-	-	-	-	-
6-71	LOST LAKE VALLEY	23,300	C	-	-	-	-	-	-	-
6-72	COLES FLAT	2,950	C	-	-	-	-	-	-	-
6-73	WILD HORSE MESA AREA	3,320	C	-	-	-	-	-	-	-
6-74	HARRISBURG FLATS	24,900	C	-	-	-	-	1	-	-
6-75	WILDROSE CANYON	5,160	C	-	-	-	-	-	-	-
6-76	BROWN MOUNTAIN VALLEY	21,700	C	-	-	-	-	-	-	-
6-77	GRASS VALLEY	9,980	C	-	-	-	-	-	-	-
6-78	DENNING SPRING VALLEY	7,240	C	-	-	-	-	-	-	-
6-79	CALIFORNIA VALLEY	58,300	C	-	-	-	-	-	-	-
6-80	MIDDLE PARK CANYON	1,740	C	-	-	-	-	-	-	-
6-81	BUTTE VALLEY	8,810	C	-	-	-	-	-	-	-
6-82	ANVIL SPRING CANYON VALLEY	4,810	C	-	-	-	-	-	-	-
6-84	GREENWATER VALLEY	59,900	C	-	-	-	-	-	-	-
6-85	GOLD VALLEY	3,220	C	-	-	-	-	-	-	-
6-86	RHODES HILL AREA	15,600	C	-	-	-	-	-	-	-
6-88	OWL LAKE VALLEY	22,300	C	-	-	-	-	-	-	-
6-89	KANE WASH AREA	5,960	C	60	-	-	-	-	-	-
6-90	CADY FAULT AREA	7,960	C	-	-	-	-	-	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

Colorado River Hydrologic Region

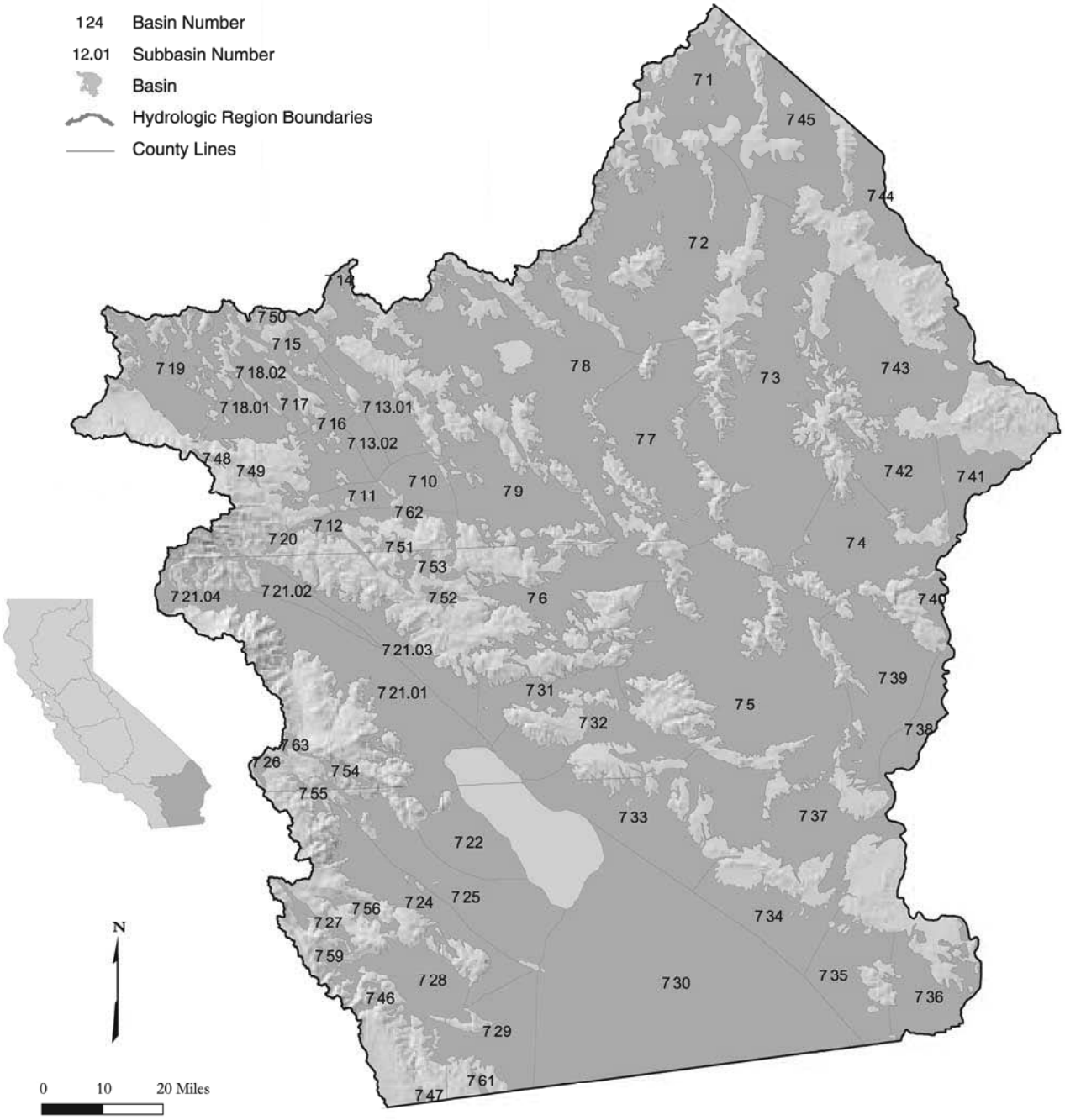

Figure 43 Colorado River Hydrologic Region

Basins and Subbasins of Colorado River Hydrologic Region

Basin/subbasin	Basin name
7-1	Lanfair Valley
7-2	Fenner Valley
7-3	Ward Valley
7-4	Rice Valley
7-5	Chuckwalla Valley
7-6	Pinto Valley
7-7	Cadiz Valley
7-8	Bristol Valley
7-9	Dale Valley
7-10	Twentynine Palms Valley
7-11	Copper Mountain Valley
7-12	Warren Valley
7-13	Deadman Valley
7-13.01	Deadman Lake
7-13.02	Surprise Spring
7-14	Lavic Valley
7-15	Bessemer Valley
7-16	Ames Valley
7-17	Means Valley
7-18	Johnson Valley Area
7-18.01	Soggy Lake
7-18.02	Upper Johnson Valley
7-19	Lucerne Valley
7-20	Morongo Valley
7-21	Coachella Valley
7-21.01	Indio
7-21.02	Mission Creek
7-21.03	Desert Hot Springs
7-21.04	San Gorgonio Pass
7-22	West Salton Sea
7-24	Borrego Valley
7-25	Ocotillo-Clark Valley
7-26	Terwilliger Valley
7-27	San Felipe Valley
7-28	Vallecito-Carrizo Valley
7-29	Coyote Wells Valley
7-30	Imperial Valley
7-31	Orocopia Valley
7-32	Chocolate Valley
7-33	East Salton Sea
7-34	Amos Valley
7-35	Ogilby Valley
7-36	Yuma Valley
7-37	Arroyo Seco Valley
7-38	Palo Verde Valley
7-39	Palo Verde Mesa
7-40	Quien Sabe Point Valley
7-41	Calzona Valley
7-42	Vidal Valley
7-43	Chemehuevi Valley
7-44	Needles Valley
7-45	Piute Valley
7-46	Canebrake Valley
7-47	Jacumba Valley
7-48	Helendale Fault Valley
7-49	Pipes Canyon Fault Valley
7-50	Iron Ridge Area
7-51	Lost Horse Valley
7-52	Pleasant Valley
7-53	Hexie Mountain Area
7-54	Buck Ridge Fault Valley
7-55	Collins Valley
7-56	Yaqui Well Area
7-59	Mason Valley
7-61	Davies Valley
7-62	Joshua Tree
7-63	Vandeventer Flat

Description of the Region

The Colorado River HR covers approximately 13 million acres (20,000 square miles) in southeastern California. It is bounded on the east by Nevada and Arizona, the south by the Republic of Mexico, the west by the Laguna, San Jacinto, and San Bernardino mountains, and the north by the New York, Providence, Granite, Old Dad, Bristol, Rodman, and Ord Mountain ranges. An average annual precipitation of 5.5 inches and average annual runoff of only 200,000 acre-feet makes this the most arid HR of California (DWR 1994). Surface runoff drains to many closed basins or to the Colorado River.

This HR includes all of Imperial, most of Riverside, much of San Bernardino, and part of San Diego counties (Figure 43). Many of the alluvial valleys in the region are underlain by groundwater aquifers that are the sole source of water for local communities.

About 533,000 people live within the Colorado River HR (DWR, 1998). The largest population centers are Palm Springs, Palm Desert, Indio, Coachella, and El Centro.

Groundwater Development

The earliest groundwater development in California may have been prehistoric water wells dug by the Cahuilla Indians in Coachella Valley of the Colorado River HR. In this report, 64 groundwater basins/subbasins are delineated in this HR. The Deadman Valley, Johnson Valley Area, and Coachella Valley groundwater basins have been divided into subbasins. Groundwater basins underlie about 8.68 million acres or about 26 percent of this HR.

In the Colorado River HR, groundwater provides about 8 percent of the water supply in normal years for agricultural and urban uses (DWR 1998). In most smaller basins, groundwater is found in unconfined alluvial aquifers. In some of the larger basins, particularly near dry lakes, aquifers may be separated by aquitards that create confined groundwater conditions. Depths of basins range from tens or hundreds of feet in smaller basins and along arms of ephemeral rivers to thousands of feet in larger basins. The thickness of aquifers varies from tens to hundreds of feet. Well yields vary in this region depending on aquifer characteristics and well location, size, and use. Some aquifers are capable of yielding thousands of gallons per minute to municipal wells.

Conjunctive use of surface water and groundwater is a long-standing practice in the region. Water is imported from the Colorado River for irrigation in Imperial, Coachella, and Palo Verde Valleys and from groundwater recharge in Coachella Valley. Water imported from Northern California is used to replenish Warren and Joshua Tree groundwater basins. Many agencies have erected systems of barriers to allow more efficient percolation of ephemeral runoff from surrounding mountains. The concept of utilizing groundwater basins in this sparsely populated HR for storing water that would be pumped during drought years is getting much attention.

Groundwater Quality

The chemical character of groundwater in the Colorado River HR is variable. Cation concentration is dominated by sodium with calcium common and magnesium appearing less often. Bicarbonate is usually the dominant anion, although sulfate and chloride waters are also common. In basins with closed drainages, water character often changes from calcium-sodium bicarbonate near the margins to sodium chloride or chloride-sulfate beneath a dry lake. It is not uncommon for concentrations of dissolved constituents to rise dramatically toward a dry lake where saturation of mineral salts is reached. An example of this is found at Bristol Valley Groundwater Basin, where the mineral halite (sodium chloride) is formed and then mined by

evaporation of groundwater in trenches in Bristol (dry) Lake. The TDS content of groundwater is high in many of the basins in this region. High fluoride content is common; sulfate content occasionally exceeds drinking water standards; and high nitrate content is common, especially in agricultural areas.

Two of the primary challenges in the Colorado River HR are overdraft in the Coachella Valley and leaking underground storage tanks. The EPA has not yet placed any contamination sites in this HR on the Superfund National Priorities List; however, one site is under consideration because of high pesticide levels.

Water Quality in Public Supply Wells

From 1994 through 2000, 314 public supply water wells were sampled in 23 of the 64 basins and subbasins in the Colorado River HR. Analyzed samples indicate that 270 wells, or 86 percent, met the state primary MCLs for drinking water standards. Forty-four wells, or 14 percent, have constituents that exceed one or more MCL. Figure 44 shows the percentages of each contaminant group that exceeded MCLs in the 44 wells.

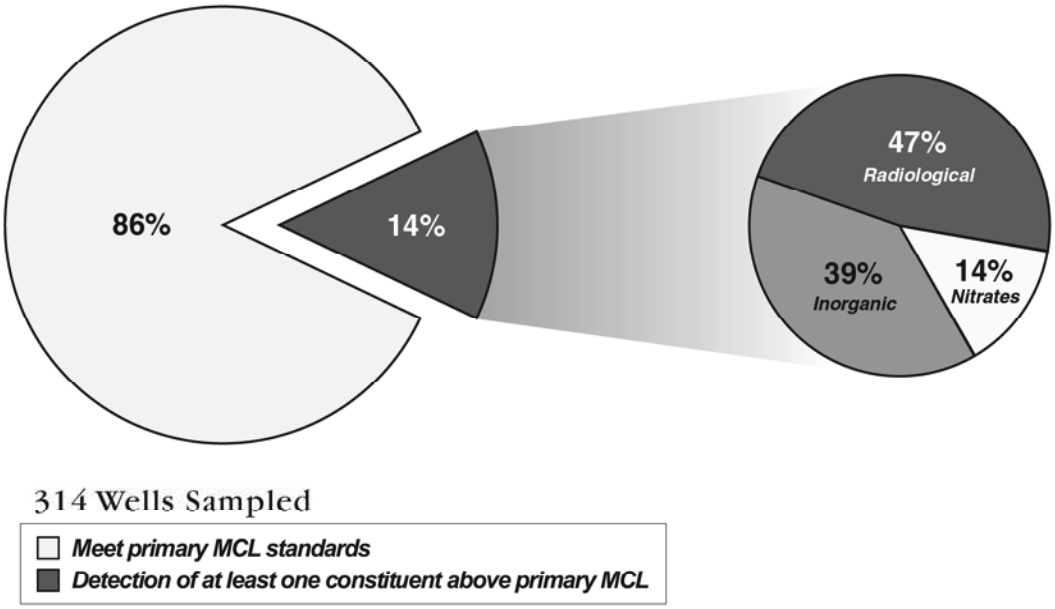

Figure 44 MCL exceedances in public supply wells in the Colorado River Hydrologic Region

Table 39 lists the three most frequently occurring contaminants in each contaminant group and shows the number of wells in the HR that exceeded the MCL for those contaminants.

Table 39 Most frequently occurring contaminants by contaminant group in the Colorado River Hydrologic Region

Contaminant group	Contaminant - # of wells	Contaminant - # of wells	Contaminant - # of wells
Inorganics – Primary	Fluoride – 17		
Inorganics – Secondary	Iron – 38	Manganese – 26	TDS – 5
Radiological	Radium 228 – 3	Combined RA226 + RA228 – 3	Radium 226 – 1
Nitrates	Nitrate (as NO_3) – 6	Nitrate + Nitrite – 1	

Changes from Bulletin 118-80

Several modifications from the groundwater basins presented in Bulletin 118-80 are incorporated in this report (Table 40). Jacumba Valley East Groundwater Basin (7-60) has been deleted because of lack of information about groundwater in this basin. The Pinyon Wash Area (7-57) and Whale Peak Area (7-58) groundwater basin names have been deleted because they are now incorporated into other larger basins. Similarly, Clark Valley (7-23) and Ocotillo Valley (7-25) groundwater basins are now the combined Ocotillo-Clark Valley Groundwater Basin (7-25). The Deadman Valley (7-13), Johnson Valley Area (7-18), and Coachella Valley (7-21) groundwater basins have been subdivided into subbasins in this report. The western boundary of Lucerne Valley Groundwater Basin (7-19) has been moved eastward from the HR boundary to the Helendale fault. Groundwater level elevations indicate that this fault is a groundwater barrier and that groundwater flows westward back under the surface divide into the Upper Mojave River Groundwater Basin (6-42). The boundary between Lucerne Valley (7-19) and Johnson Valley Area (7-18) groundwater basins is delineated in this report.

The boundaries of Twentynine Palms Valley (7-10), Copper Mountain Valley (7-11), Warren Valley (7-12), Deadman Lake (7-13), and Ames Valley (7-16) groundwater basins have been redrawn in light of newer groundwater level data. These data indicate that the Pinto Mountain fault is a groundwater barrier. Joshua Tree Groundwater Basin (7-62) is a new basin that has been delineated from parts of Copper Mountain Valley and Twentynine Palms Valley Groundwater Basins because the Pinto Mountain fault is such a strong barrier. Buck Ridge Fault Valley Groundwater Basin (7-54) was presented in Bulletin 118-80 as two unconnected deposits of water-bearing alluvium separated by outcrop of nonwater-bearing rocks. These water-bearing deposits have been designated as separate groundwater basins in this report, with the Buck Ridge Fault Valley Groundwater Basin (7-54) as the northern basin and Vandeventer Flat Groundwater Basin (7-63) presented as the southern basin.

Table 40 Modifications since Bulletin 118-80 of groundwater basins in Colorado River Hydrologic Region

Basin name	New number	Old number
Clark Valley	Delete – combined with 7-25	7-23
Ocotillo-Clark Valley	7-25 (now combined)	7-25
Pinyon Wash Area	Incorporated into 7-56	7-57
Whale Peak Area	Incorporated into 7-28	7-58
Jacumba Valley East	Deleted	7-60
Joshua Tree	7-62 (new)	
Vandeventer Flat	7-63 (new)	

Table 41 Colorado River Hydrologic Region groundwater data

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
7-1	LANFAIR VALLEY	157,000	C	70	16	-	-	9	515	173-2,260
7-2	FENNER VALLEY	454,000	A	200	100	-	-	4	515	173-2,260
7-3	WARD VALLEY	961,000	A	260	180	-	-	1	-	327-589
7-4	RICE VALLEY	189,000	C	65	-	-	-	-	-	-
7-5	CHUCKWALLA VALLEY	604,000	C	3,900	1,800	12	-	10	-	424
7-6	PINTO VALLEY	183,000	A	1,480	900	-	-	1	-	-
7-7	CADIZ VALLEY	270,000	C	167	66	-	-	-	400	300-3000
7-8	BRISTOL VALLEY	498,000	A	3,000	-	-	-	-		300-298,000
7-9	DALE VALLEY	213,000	C	380	275	-	-	2	-	-
7-10	TWENTYNINE PALMS VALLEY	62,400	C	3,000	540	27	-	2	640	-
7-11	COPPER MOUNTAIN VALLEY	30,300	A	2,450	250	2	-	2	-	180-214
7-12	WARREN VALLEY	17,200	A	4,000	350	27	18	17	196	129-269
7-13	DEADMAN VALLEY									
7-13.01	DEADMAN LAKE	89,200	C	2,000	-	28	3	1	-	311-985
7-13.02	SURPRISE SPRING	29,300	C	1,370	680	26	6	9	177	141-1,050
7-14	LAVIC VALLEY	102,000	C	140	80	-	-	-	-	-
7-15	BESSEMER VALLEY	39,100	C	0	-	-	-	-	-	-
7-16	AMES VALLEY	110,000	C	2,000	-	19	3	11	459	-
7-17	MEANS VALLEY	15,000	C	0	-	1	-	-	-	-
7-18	JOHNSON VALLEY AREA									
7-18.01	SOGGY LAKE	76,800	C	-	-	6	-	1	-	300-2,000
7-18.02	UPPER JOHNSON VALLEY	34,800	C	-	-	-	-	-	-	3,000
7-19	LUCERNE VALLEY	148,000	A	1,000	-	22	9	21	301	200-5,000
7-20	MORONGO VALLEY	7,240	C	600	90	-	-	5	-	-
7-21	COACHELLA VALLEY									
7-21.01	INDIO	336,000	A	1,880	650	30	-	204	300	-
7-21.02	MISSION CREEK	49,000	A	3,500	715	5	-	15	<500	-
7-21.03	DESERT HOT SPRINGS	101,000	C	2,500	985	10	-	2	-	800-1,000
7-21.04	SAN GORGONIO PASS	38,700	A	1,000	0	17	8	5	-	106-205
7-22	WEST SALTON SEA	106,000	C	540	400	v	-	-	-	-
7-24	BORREGO VALLEY	153,000	A	2,000	0	10	10	25	-	300-2,440
7-25	OCOTILLO-CLARK VALLEY	223,000	C	3,500	1,760	1	-	2	-	-
7-26	TERWILLIGER VALLEY	8,030	C	100	-	-	-	1	-	500
7-27	SAN FELIPE VALLEY	2,340	C	500	30	-	-	1	-	-
7-28	VALLECITO-CARRIZO VALLEY	122,000	C	2,500	260	-	-	1	-	-
7-29	COYOTE WELLS VALLEY	146,000	A	-	-	25	6	9	-	-
7-30	IMPERIAL VALLEY	961,000	A	1,000	-	19	-	45	1088	498-7,280
7-31	OROCOPIA VALLEY	96,500	A	210	165	0	-	1	-	-
7-32	CHOCOLATE VALLEY	130,000	C	0	0	0	-	-	-	-
7-33	EAST SALTON SEA	196,000	C	0	0	1	-	4	-	-
7-34	AMOS VALLEY	130,000	C	100	50	3	-	1	-	-
7-35	OGILBY VALLEY	134,000	C	4,000	50	27	1	3	-	-

Table 41 Colorado River Hydrologic Region groundwater data (continued)

Basin/Subbasin	Basin Name	Area (acres)	Groundwater Budget Type	Well Yields (gpm)		Types of Monitoring			TDS (mg/L)	
				Maximum	Average	Levels	Quality	Title 22	Average	Range
7-36	YUMA VALLEY	3,780	C	100	40	59	0	15	-	-
7-37	ARROYO SECO VALLEY	258,000	C	-	-	2	0	0	-	-
7-38	PALO VERDE VALLEY	73,400	A	-	-	11	-	19	840	658-1,030
7-39	PALO VERDE MESA	226,000	C	2,750	1,650	20	-	13	-	-
7-40	QUIEN SABE POINT VALLEY	25,300	C	25	-	-	-	3	-	-
7-41	CALZONA VALLEY	81,000	C	2,340	500	0	0	0	-	
7-42	VIDAL VALLEY	138,000	C	1,800	675	-	-	1	-	-
7-43	CHEMEHUEVI VALLEY	273,000	A	0	0	1	0	1	-	-
7-44	NEEDLES VALLEY	88,400	A	1,500	980	34	-	11	-	-
7-45	PIUTE VALLEY	176,000	C	1,500	200	-	-	-	-	-
7-46	CANEBRAKE VALLEY	5,420	C	125	-	-	-	-	-	-
7-47	JACUMBA VALLEY	2,450	A	1,000	-	-	-	3		296-6,100
7-48	HELENDALE FAULT VALLEY	2,620	C	-	-	-	-	-	-	-
7-49	PIPES CANYON FAULT VALLEY	3,390	C	-	-	-	-	-	-	-
7-50	IRON RIDGE AREA	5,250	C	-	-	-	-	-	-	-
7-51	LOST HORSE VALLEY	17,300	C	-	-	-	-	-	-	-
7-52	PLEASANT VALLEY	9,670	C	-	-	-	-	-	-	-
7-53	HEXIE MOUNTAIN AREA	11,200	C	-	-	-	-	-	-	-
7-54	BUCK RIDGE FAULT VALLEY	6,930	C	-	-	-	-	-	-	-
7-55	COLLINS VALLEY	7,080	C	1,500	-	-	-	-	-	-
7-56	YAQUI WELL AREA	15,000	C	0	-	-	-	1	-	-
7-59	MASON VALLEY	5,530	C	0	0	0	0	1	-	-
7-61	DAVIES VALLEY	3,570	C	0	0	0	0	-	-	-
7-62	JOSHUA TREE	33,800	A	2,200	1,110	25	5	14	180	117-185
7-63	VANDEVENTER FLAT	6,750	C	50	17	-	-	-	-	-

gpm - gallons per minute
mg/L - milligram per liter
TDS -total dissolved solids

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Glossary

Glossary

A

acre-foot (af) The volume of water necessary to cover one acre to a depth of one foot; equal to 43,560 cubic feet or 325,851 gallons.

adjudication A case that has been heard and decided by a judge. In the context of an adjudicated groundwater basin, landowners or other parties have turned to the courts to settle disputes over how much groundwater can be extracted by each party to the decision.

alluvial Of or pertaining to or composed of alluvium.

alluvium A general term for clay, silt, sand, gravel, or similar unconsolidated detrital material, deposited during comparatively recent geologic time by a stream or other body of running water, as a sorted or semi sorted sediment in the bed of the stream or on it's floodplain or delta, as a cone or fan at the base of a mountain slope.

anthropogenic Of human origin or resulting from human activity.

appropriative right The right to use water that is diverted or extracted by a nonriparian or nonoverlying party for nonriparian or nonoverlying uses. In California, surface water appropriative rights are subject to a statutory permitting process while groundwater appropriation is not.

aquitard A confining bed and/or formation composed of rock or sediment that retards but does not prevent the flow of water to or from an adjacent aquifer. It does not readily yield water to wells or springs, but stores ground water.

aquifer A body of rock or sediment that is sufficiently porous and permeable to store, transmit, and yield significant or economic quantities of groundwater to wells and springs.

aridity A term describing a climate or region in which precipitation is so deficient in quantity or occurs so infrequently that intensive agricultural production is not possible without irrigation.

artesian aquifer A body of rock or sediment containing groundwater that is under greater than hydrostatic pressure; that is, a confined aquifer. When an artesian aquifer is penetrated by a well, the water level will rise above the top of the aquifer.

artesian pressure Hydrostatic pressure of artesian water, often expressed in terms of pounds per square inch; or the height, in feet above the land surface, of a column of water that would be supported by the pressure.

artificial recharge The addition of water to a groundwater reservoir by human activity, such as putting surface water into dug or constructed spreading basins or injecting water through wells.

available groundwater storage capacity The volume of a groundwater basin that is unsaturated and capable of storing groundwater.

average annual runoff The average value of total annual runoff volume calculated for a selected period of record, at a specified location, such as a dam or stream gage.

average year water demand Demand for water under average hydrologic conditions for a defined level of development.

B

basin management objectives (BMOs) See management objectives

beneficial use One of many ways that water can be used either directly by people or for their overall benefit. The State Water Resources Control Board recognizes 23 types of beneficial use with water quality criteria for those uses established by the Regional Water Quality Control Boards.

borehole geophysics The general field of geophysics developed around the lowering of a variety of probes into a boring or well. Borehole logging provides additional information concerning physical, electrical, acoustic, nuclear and chemical aspects of the soils and rock encountered during drilling.

C

community water system A public water system that serves at least 15 service connections used by yearlong residents or regularly serves at least 25 year-long residents (DHS 2000).

confined aquifer An aquifer that is bounded above and below by formations of distinctly lower permeability than that of the aquifer itself. An aquifer containing confined ground water. See artesian aquifer.

conjunctive use The coordinated and planned management of both surface and groundwater resources in order to maximize the efficient use of the resource; that is, the planned and managed operation of a groundwater basin and a surface water storage system combined through a coordinated conveyance infrastructure. Water is stored in the groundwater basin for later and planned use by intentionally recharging the basin during years of above-average surface water supply.

contaminant Any substance or property preventing the use or reducing the usability of the water for ordinary purposes such as drinking, preparing food, bathing washing, recreation, and cooling. Any solute or cause of change in physical properties that renders water unfit for a given use. (Generally considered synonymous with pollutant).

critical conditions of overdraft A groundwater basin in which continuation of present practices would probably result in significant adverse overdraft-related environmental, social, or economic impacts. The definition was created after an extensive public input process during the development of the Bulletin 118-80 report.

D

deep percolation Percolation of water through the ground and beyond the lower limit of the root zone of plants into groundwater.

desalination A process that converts seawater or brackish water to fresh water or an otherwise more usable condition through removal of dissolved solids.

domestic well A water well used to supply water for the domestic needs of an individual residence or systems of four or fewer service connections.

drinking water system See public water system

drought condition Hydrologic conditions during a defined period when rainfall and runoff are much less than average.

drought year supply The average annual supply of a water development system during a defined drought period.

E

electrical conductivity (EC) The measure of the ability of water to conduct an electrical current, the magnitude of which depends on the dissolved mineral content of the water.

effective porosity The volume of voids or open spaces in alluvium and rocks that is interconnected and can transmit fluids.

environmental water Water serving environmental purposes, including instream fishery flow needs, wild and scenic river flows, water needs of fresh-water wetlands, and Bay-Delta requirements.

evapotranspiration (ET) The quantity of water transpired (given off), retained in plant tissues, and evaporated from plant tissues and surrounding soil surfaces.

G

groundwater basin An alluvial aquifer or a stacked series of alluvial aquifers with reasonably well-defined boundaries in a lateral direction and having a definable bottom.

groundwater budget A numerical accounting, the *groundwater equation*, of the recharge, discharge and changes in storage of an aquifer, part of an aquifer, or a system of aquifers.

groundwater in storage The quantity of water in the zone of saturation.

groundwater management The planned and coordinated management of a groundwater basin or portion of a groundwater basin with a goal of long-term sustainability of the resource.

groundwater management plan A comprehensive written document developed for the purpose of groundwater management and adopted by an agency having appropriate legal or statutory authority.

groundwater mining The process, deliberate or inadvertent, of extracting groundwater from a source at a rate in excess of the replenishment rate such that the groundwater level declines persistently, threatening exhaustion of the supply or at least a decline of pumping levels to uneconomic depths.

groundwater monitoring network A series of monitoring wells at appropriate locations and depths to effectively cover the area of interest. Scale and density of monitoring wells is dependent on the size and complexity of the area of interest, and the objective of monitoring.

groundwater overdraft The condition of a groundwater basin in which the amount of water withdrawn by pumping exceeds the amount of water that recharges the basin over a period of years during which water supply conditions approximate average conditions.

groundwater quality See water quality

groundwater recharge facility A structure that serves to conduct surface water into the ground for the purpose of replenishing groundwater. The facility may consist of dug or constructed spreading basins, pits, ditches, furrows, streambed modifications, or injection wells.

groundwater recharge The natural or intentional infiltration of surface water into the zone of saturation.

groundwater source area An area where groundwater may be found in economically retrievable quantities outside of normally defined groundwater basins, generally referring to areas of fractured bedrock in foothill and mountainous terrain where groundwater development is based on successful well penetration through interconnecting fracture systems. Well yields are generally lower in fractured bedrock than wells within groundwater basins.

groundwater storage capacity volume of void space that can be occupied by water in a given volume of a formation, aquifer, or groundwater basin.

groundwater subbasin A subdivision of a groundwater basin created by dividing the basin using geologic and hydrologic conditions or institutional boundaries.

groundwater table The upper surface of the zone of saturation in an unconfined aquifer.

groundwater Water that occurs beneath the land surface and fills the pore spaces of the alluvium, soil, or rock formation in which it is situated. It excludes soil moisture, which refers to water held by capillary action in the upper unsaturated zones of soil or rock.

H

hazardous waste Waste that poses a present or potential danger to human beings or other organisms because it is toxic, flammable, radioactive, explosive or has some other property that produces substantial risk to life.

hydraulic barrier A barrier created by injecting fresh water to control seawater intrusion in an aquifer, or created by water injection to control migration of contaminants in an aquifer.

hydraulic conductivity A measure of the capacity for a rock or soil to transmit water; generally has the units of feet/day or cm/sec.

hydrograph A graph that shows some property of groundwater or surface water as a function of time.

hydrologic cycle The circulation of water from the ocean through the atmosphere to the land and ultimately back to the ocean.

hydrologic region A study area consisting of multiple planning subareas. California is divided into 10 hydrologic regions.

hydrostratigraphy A geologic framework consisting of a body of rock having considerable lateral extent and composing a reasonably distinct hydrologic system.

hyporheic zone The region of saturated sediments beneath and beside the active channel and that contain some proportion of surface water that was part of the flow in the surface channel and went back underground and can mix with groundwater.

I

infiltration The flow of water downward from the land surface into and through the upper soil layers.

infiltration capacity The maximum rate at which infiltration can occur under specific conditions of soil moisture.

in-lieu recharge The practice of providing surplus surface water to historic groundwater users, thereby leaving groundwater in storage for later use.

ISI Integrated Storage Investigations Program, an element of the CALFED Bay Delta initiative.

J

joint powers agreement (JPA) An agreement entered into by two or more public agencies that allows them to jointly exercise any power common to the contracting parties. The JPA is defined in Chapter 5 (commencing with Section 6500) of Division 7 of Title 1 of the California Government Code.

L

land subsidence The lowering of the natural land surface due to groundwater (or oil and gas) extraction.

leaky confining layer A low-permeability layer that can transmit water at sufficient rates to furnish some recharge from an adjacent aquifer to a well.

lithologic log A record of the lithology of the soils, sediments and/or rock encountered in a borehole from the surface to the bottom.

lithology The description of rocks, especially in hand specimen and in outcrop, on the basis of such characteristics as color, mineralogic composition, and grain size.

losing stream A stream or reach of a stream that is losing water by seepage into the ground.

M

management objectives Objectives that set forth the priorities and measurable criteria of local groundwater basin management. For example, one management objective could be to minimize degradation of groundwater quality with a criteria set that groundwater will not be degraded by more than 100 mg/l in terms of TDS.

maximum contaminant level (MCL) The highest drinking water contaminant concentration allowed under federal and State Safe Drinking Water Act regulations.

N

natural recharge Natural replenishment of an aquifer generally from snowmelt and runoff; through seepage from the surface.

nonpoint source Pollution discharged over a wide land area, not from one specific location. These are forms of diffuse pollution caused by sediment, nutrients, etc., carried to lakes and streams by surface runoff.

O

operational yield An optimal amount of groundwater that should be withdrawn from an aquifer system or a groundwater basin each year. It is a dynamic quantity that must be determined from a set of alternative groundwater management decisions subject to goals, objectives, and constraints of the management plan.

ordinance A law set forth by a governmental authority.

overdraft See groundwater overdraft

overlying right Property owners above a common aquifer possess a mutual right to the reasonable and beneficial use of a groundwater resource on land overlying the aquifer from which the water is taken. Overlying rights are correlative (related to each other) and overlying users of a common water source must share the resource on a pro rata basis in times of shortage. A proper overlying use takes precedence over all non-overlying uses.

P

perched groundwater Groundwater supported by a zone of material of low permeability located above an underlying main body of groundwater.

perennial yield The maximum quantity of water that can be annually withdrawn from a groundwater basin over a long period of time (during which water supply conditions approximate average conditions) without developing an overdraft condition.

perforated interval The depth interval where slotted casing or screen is placed in a well to allow entry of water from the aquifer formation.

permeability The capability of soil or other geologic formations to transmit water. See hydraulic conductivity.

pesticide Any of a class of chemicals used for killing insects, weeds or other undesirable entities. Most commonly associated with agricultural activities, but has significant domestic use in California.

point source A specific site from which wastewater or polluted water is discharged into a water body.

pollution (of water) The alteration of the physical, chemical, or biological properties of water by the introduction of any substance into water that adversely affects any beneficial use of water.

porosity The ratio of the voids or open spaces in alluvium and rocks to the total volume of the alluvium or rock mass.

possible contaminating activity (PCA) Human activities that are actual or potential origins of contamination for a drinking water source. PCAs include sources of both microbiological and chemical contaminants that could have an adverse effect upon human health (DHS 2000).

potentiometric surface The surface to which the water in a confined aquifer will rise in a tightly cased well.

prescriptive right rights obtained through the open and notorious adverse use of another's water rights. By definition, adverse use is not use of a surplus, but the use of non-surplus water to the direct detriment of the original rights holder.

primary porosity Voids or open spaces that were present when alluvium and rocks were originally deposited or formed.

public supply well A well used as a part of a public water system.

public water system A system for the provision of water for human consumption through pipes or other constructed conveyances that has 15 or more service connections or regularly serves at least 25 individuals daily at least 60 days out of the year. (DHS 2000).

pueblo right A water right possessed by a municipality which, as a successor of a Spanish or Mexican pueblo, entitled to the beneficial use of all needed, naturally-occurring surface and groundwater of the original pueblo watershed Pueblo rights are paramount to all other claims.

R

recharge Water added to an aquifer or the process of adding water to an aquifer. Ground water recharge occurs either naturally as the net gain from precipitation, or artificially as the result of human influence. See artificial recharge.

recharge basin A surface facility constructed to infiltrate surface water into a groundwater basin.

riparian right A right to use surface water, such right derived from the fact that the land in question abuts upon the banks of streams.

runoff The volume of surface flow from an area.

S

safe yield The maximum quantity of water that can be continuously withdrawn from a groundwater basin without adverse effect.

salinity Generally, the concentration of mineral salts dissolved in water. Salinity may be expressed in terms of a concentration or as electrical conductivity. When describing salinity influenced by seawater, salinity often refers to the concentration of chlorides in the water. See also total dissolved solids.

saline intrusion The movement of salt water into a body of fresh water. It can occur in either surface water or groundwater bodies.

saturated zone The zone in which all interconnected openings are filled with water, usually underlying the unsaturated zone.

seawater intrusion barrier A system designed to retard, cease or repel the advancement of seawater intrusion into potable groundwater supplies along coastal portions of California. The system may be a series of specifically placed injection wells where water is injected to form a hydraulic barrier.

secondary porosity Voids in a rock formed after the rock has been deposited; not formed with the genesis of the rock, but later due to other processes. Fractures in granite and caverns in limestone are examples of secondary openings.

seepage The gradual movement of water into, through or from a porous medium. Also the loss of water by infiltration into the soil from a canal, ditches, laterals, watercourse, reservoir, storage facilities, or other body of water, or from a field.

semi-confined aquifer A semi-confined aquifer or leaky confined aquifer is an aquifer that has aquitards either above or below that allow water to leak into or out of the aquifer depending on the direction of the hydraulic gradient.

service area The geographic area served by a water agency.

specific conductance See electrical conductivity

specific retention The ratio of the volume of water a rock or sediment will retain against the pull of gravity to the total volume of the rock or sediment.

specific yield the ratio of the volume of water a rock or soil will yield by gravity drainage to the total volume of the rock or soil**.**

spring a location where groundwater flows naturally to the land surface or a surface water body.

stakeholders Any individual or organization that has an interest in water management activities. In the broadest sense, everyone is a stakeholder, because water sustains life. Water resources stakeholders are typically those involved in protecting, supplying, or using water for any purpose, including environmental uses, who have a vested interest in a water-related decision.

stratigraphy The science of rocks. It is concerned with the original succession and age relations of rock strata and their form, distribution, lithologic composition, fossil content, geophysical and geochemical properties—all characters and attributes of rocks as strata—and their interpretation in terms of environment and mode of origin and geologic history.

subsidence See land subsidence

subterranean stream Subterranean streams "flowing through known and definite channels" are regulated by California's surface water rights system.

surface supply Water supply obtained from streams, lakes, and reservoirs.

sustainability Of, relating to, or being a method of using a resource so that the resource is not depleted or permanently damaged.

T

total dissolved solids (TDS) a quantitative measure of the residual minerals dissolved in water that remain after evaporation of a solution. Usually expressed in milligrams per liter. See also salinity

toxic Poisonous, relating to or caused by a poison. Toxicity is determined for individual contaminants or for mixtures of contaminants as found in waste discharges.

transmissivity The product of hydraulic conductivity and aquifer thickness; a measure of a volume of water to move through an aquifer. Transmissivity generally has the units of ft^2/day or gallons per day/foot. Transmissivity is a measure of the subsurface's ability to transmit groundwater horizontally through its entire saturated thickness and affects the potential yield of wells.

transpiration An essential physiological process in which plant tissues give off water vapor to the atmosphere.

U

unconfined aquifer An aquifer which is not bounded on top by an aquitard. The upper surface of an unconfined aquifer is the water table.

underground stream Body of water flowing as a definite current in a distinct channel below the surface of the ground, usually in an area characterized by joints or fissures. Application of the term to ordinary aquifers is incorrect.

unsaturated zone The zone below the land surface in which pore space contains both water and air.

urban water management plan (UWMP) An UWMP is required for all urban water suppliers having more than 3,000 connections or supplying more than 3,000 acre-feet of water. The plans include discussions on water supply, supply reliability, water use, water conservation, and water shortage contingency and serve to assist urban water suppliers with their long-term water resources planning to ensure adequate water supplies for existing and future demands.

usable storage capacity The quantity of groundwater of acceptable quality that can be economically withdrawn from storage.

V

vadose zone See unsaturated zone

volatile organic compound (VOC) A manmade organic compound that readily vaporizes in the atmosphere. These compounds are often highly mobile in the groundwater system and are generally associated with industrial activities.

W

water quality Description of the chemical, physical, and biological characteristics of water, usually in regard to its suitability for a particular purpose or use.

water table See groundwater table

water year A continuous 12-month period for which hydrologic records are compiled and summarized. Different agencies may use different calendar periods for their water years.

watershed The land area from which water drains into a stream, river, or reservoir.

well completion report A required, confidential report detailing the construction, alteration, abandonment, or destruction of any water well, cathodic protection well, groundwater monitoring well, or geothermal heat exchange well. The reports were called *Water Well Drillers' Report* prior to 1991 and are often referred to as "driller's logs." The report requirements are described in the California Water Code commencing with Section 13750.

WQCP Water Quality Control Plan for the San Francisco Bay/Sacramento San Joaquin Delta Estuary.

Metric Conversions

Quantity	To Convert from Metric Unit	To Customary Unit	Multiply Metric Unit By	To Convert to Metric Unit Multiply Customary Unit By
Length	millimeters (mm)	inches (in)	0.03937	25.4
	centimeters (cm) for snow depth	inches (in)	0.3937	2.54
	meters (m)	feet (ft)	3.2808	0.3048
	kilometers (km)	miles (mi)	0.62139	1.6093
Area	square millimeters (mm2)	square inches (in2)	0.00155	645.16
	square meters (m2)	square feet (ft2)	10.764	0.092903
	hectares (ha)	acres (ac)	2.4710	0.40469
	square kilometers (km2)	square miles (mi2)	0.3861	2.590
Volume	liters (L)	gallons (gal)	0.26417	3.7854
	megaliters	million gallons (10*)	0.26417	3.7854
	cubic meters (m3)	cubic feet (ft3)	36.315	0.028317
	cubic meters (m3)	cubic yards (yd3)	1.308	0.76455
	cubic dekameters (dam3)	acre-feet (ac-ft)	0.8107	1.2335
Flow	cubic meters per second (m3/s)	cubic feet per second (ft3/s)	35.315	0.028317
	liters per minute (L/mn)	gallons per minute (gal/mn)	0.26417	3.7854
	liters per day (L/day)	gallons per day (gal/day)	0.26417	3.7854
	megaliters per day (ML/day)	million gallons per day (mgd)	0.26417	3.7854
	cubic dekameters per day (dam3/day)	acre-feet per day (ac-ft/day)	0.8107	1.2335
Mass	kilograms (kg)	pounds (lbs)	2.2046	0.45359
	megagrams (Mg)	tons (short, 2,000 lb.)	1.1023	0.90718
Velocity	meters per second (m/s)	feet per second (ft/s)	3.2808	0.3048
Power	kilowatts (k/W)	horsepower (hp)	1.3405	0.746
Pressure	kilopascals (kPa)	pounds per square inch (psi)	0.14505	6.8948
	kilopascals (kPa)	eet head of water	0.32456	2.989
Specific Capacity	liters per minute per meter drawdown	gallons per minute per foot drawdown	0.08052	12.419
Concentration	milligrams per liter (mg/L)	parts per million (ppm)	1.0	1.0
Electrical Conductivity	microsiemens per centimeter (µS/cm)	micromnos per centermeter	1.0	1.0
Temperature	degrees Celsius (°C)	degrees Fahrenheit (°F)	(1.8X°C)+32	(°F-321/18

Appendices

Appendix A
Obtaining Copies of Supplemental Material

Bulletin 118 Update 2003 includes this report and supplemental material consisting of individual basin descriptions and a GIS-compatible map of each of the delineated groundwater basins in California. The supplemental material will be updated as new information becomes available and can be viewed or downloaded at http://www.waterplan.water.ca.gov/groundwater/118index.htm

Appendix B
The Right to Use Groundwater in California

California does not have a statewide management program or statutory permitting system for groundwater. Some local agencies have adopted groundwater ordinances under their police powers, or have adopted groundwater management programs under a variety of statutory authorities.

Prior to a discussion of groundwater management, it is helpful to understand some of the laws governing the right to use groundwater in California. When the Water Commission Act of 1913 (Stats. 1913, Ch. 586) became effective in 1914, appropriative surface water rights became subject to a statutory permitting process. This appropriation procedure can be found in Water Code Section 1200 *et seq*. Groundwater classified as underflow of a surface stream, a "subterranean stream flowing through a known and definite channel," was made subject to the State permit system. However, most groundwater in California is presumed to be "percolating water," that is, water in underground basins and groundwater which has escaped from streams. This percolating water is not subject to a permitting process. As a result, most of the body of law governing groundwater use in California today has evolved through a series of court decisions beginning in the early 20th century. Key cases are listed in Table B-1, and some of the most significant are discussed below.

Table B-1 Significant court cases related to the right to use groundwater in California

Case	Issues addressed
Katz v. Walkinshaw, 141 Cal. 116 (1903)	Established Correlative Rights Doctrine. Correlative rights of overlying users, and surplus supply available for appropriation among non-overlying users.
Peabody v. City of Vallejo, 2 Cal. 2d 351 (1935)	Limited riparian rights under the reasonable and beneficial use requirement of the 1928 constitutional amendment; requirement of reasonable and beneficial use.
Pasadena v. Alhambra, 33 Cal. 2d 908 (1949)	First basin adjudication in California; established Doctrine of Mutual Prescription.
Niles Sand and Gravel Co. v. Alameda County Water District, 37 Cal. App. 3d 924 (1974)	Established right to store water underground as a servitude.
Techachapi-Cummings County Water District v. Armstrong, 49 Cal. App. 3d 992 (1975)	Modified the Mutual Prescription Doctrine articulated in Pasadena v. Alhambra. Overlying owners' water rights must be quantified on the basis of current, reasonable and beneficial need, not past use. By analogy to riparian rights, factors to be considered include: the amount of water available, the extent of ownership in the basin, and the nature of projected use.
Los Angeles v. San Fernando, 14 Cal. 3d 199 (1975)	Significantly modified Mutual Prescription Doctrine by disallowing it against public entities (Civil Code section 1007); established pueblo right above overlying owner right; established right to store imported water underground and recapture when needed above the right of overlying landowner.
Wright v. Goleta Water District, 174 Cal. App. 3d 74 (1985)	The unexercised water rights of overlying owners are protected from appropriators; notice and opportunity must be given to overlying owners to resist any interference with their rights.
Hi-Desert County Water District v. Blue Skies Country Club,	Retention of overlying right; no acquisition of prescriptive
23 Cal. App. 4th 1723 (1994)	right by overlying owner.
Baldwin v. Tehama County, 31 Cal. App. 4th 166 (1994)	City and County regulation of groundwater through police power. County limitations on export upheld.
City of Barstow v. Mojave Water Agency,	Held that in considering a stipulated physical solution
23 Cal. 4th 1224 (2000)	involving equitable apportionment, court must consider correlativerights of parties that did not join the stipulation.

This table modified from Bachman and others 1997

Katz v. Walkinshaw (141 Cal. 116)

In the 1903 decision, *Katz v. Walkinshaw*, the California Supreme Court rejected the English Common Law doctrine of groundwater rights and established the Doctrine of Correlative Rights. Prior to the *Katz* decision, California had followed the doctrine articulated in the 1843 English decision of *Acton v. Blundell* (12 M. & W. 324, 152 Eng. Rep. 1223), which established that landowners enjoyed absolute ownership of groundwater underneath their property. The 1903 decision rejected the English Common Law approach as unsuitable for the "natural conditions" in California, and instead established the Correlative Rights Doctrine analogous to a riparian right. Each overlying landowner was entitled to make reasonable beneficial use of groundwater with a priority equal to all other overlying users. Water in excess of the needs of the overlying owners could be pumped and used on nonoverlying lands on a first-in-time, first-in-right basis under what is known as an appropriative right. An appropriative groundwater right, unlike its surface water counterpart, is not subject to a permitting process. Where overlying owners made full use of available supplies, appropriative rights were extinguished. Where there was insufficient water to meet even the needs of the overlying owners, the court applied the Correlative Rights Doctrine to apportion the available groundwater among the overlying landowners. Figure B-1 depicts the rights to use groundwater established in *Katz v. Walkinshaw*.

City of Pasadena v. City of Alhambra (33 Cal. 2d 908)

The 1949 decision, *Pasadena v. Alhambra*, added significant complexity to the right to use groundwater in California. This decision, involving the adjudication of the Raymond Basin, established the doctrine of mutual prescription. Groundwater levels in the basin had been declining for many years by the time court action was initiated. Most substantial pumpers, both overlying and appropriators, were joined in the action. Previously, appropriators only had a right to water surplus to the needs of overlying users. However, based upon a stipulation by most of the parties, the court in *Pasadena* adopted a program of proportionate reductions. These appropriators had each effectively gained a prescriptive right, similar to that of surface water rights, in which they had taken the water in an open, notorious, and hostile manner for at least five years. Mutual prescription provided groundwater rights to both overlying users and appropriators in depleted groundwater basins by prorating their rights based on the highest continuous amount of pumping during the five years following commencement of the overdraft. All of the users in the Raymond Basin were thus entitled to extract their portion of the court-approved safe yield of the basin.

City of Los Angeles v. City of San Fernando (14 Cal. 3d 199)

In 1975, in *Los Angeles v. San Fernando*, the California Supreme Court significantly limited the Mutual Prescription Doctrine introduced in Pasadena v. Alhambra. This opinion had far-reaching impacts on both the right to use groundwater and the practice of conjunctive use of groundwater and surface water to manage a basin. The case began in 1955, when the City of Los Angeles sued the cities of San Fernando, Glendale, Burbank and other pumpers, asserting a prior right to the San Fernando Valley groundwater basins in the northern part of the City of Los Angeles. The court, relying on Civil Code Section 1007, held that public agencies and public utilities cannot lose their groundwater rights by prescription. This holding effectively ruled out any future "mutual prescription" settlements or judgments involving rights held by public entities.

With respect to the native water supply of the San Fernando Basin, the court found that the City of Los Angeles had prior rights to all of this supply pursuant to its "pueblo right." Pueblo rights are traceable to rights recognized by the Spanish crown and the Mexican government. Under the Spanish/Mexican system, water rights were held in trust by pueblos for the benefit of all of its inhabitants. Under the Treaty of Guadalupe Hidalgo executed by Mexico and the United States in 1848, the municipal successors to Spanish/Mexican pueblos retained their pueblo rights upon the cession of California. In the San Fernando decision, the court confirmed Los Angeles' pueblo right, finding it superior to the rights of all overlying landowners. While a pueblo right is rare, it is an example of the complexity of the rights to use groundwater in California.

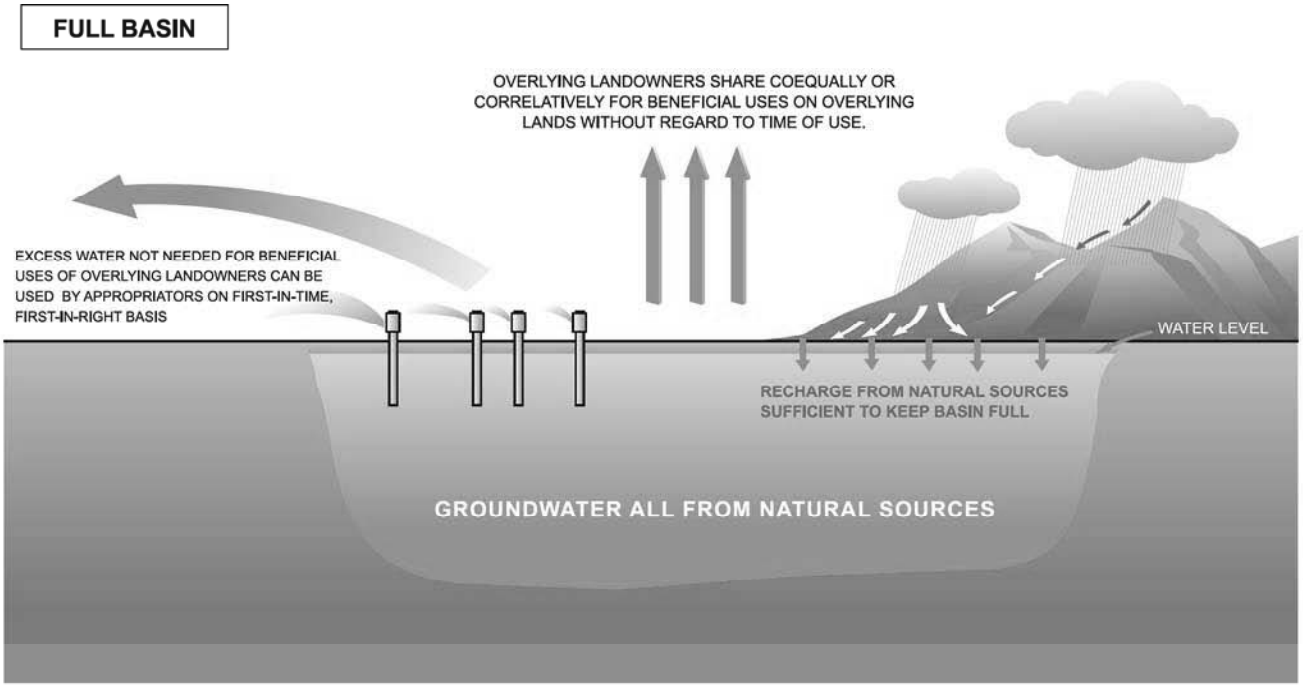

Figure B-1 Rights to groundwater use in full basin established in Katz v. Walkinshaw

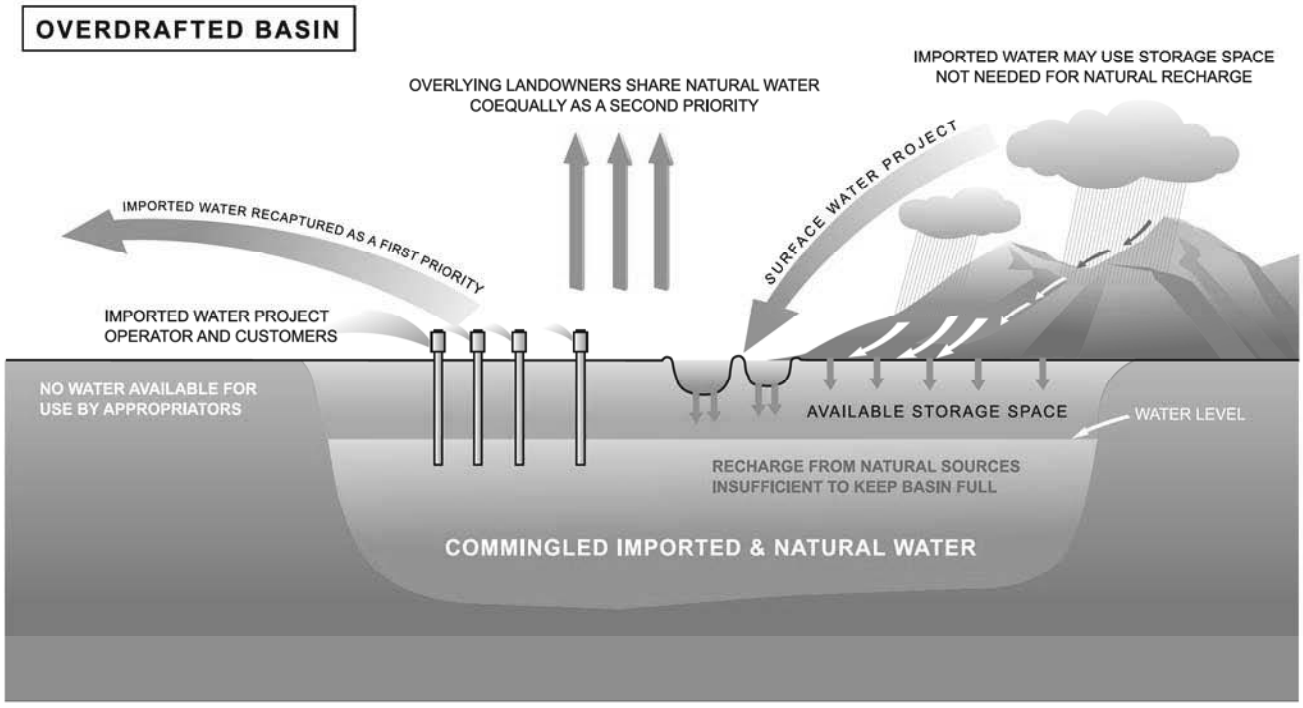

Figure B-2 Rights to groundwater use in overdrafted basin established in Los Angeles v. San Fernando

For the future of conjunctive use of groundwater basins, the court's holding with respect to the rights to available storage space in the Basin is significant. The court upheld the right of public agencies – namely the cities of San Fernando, Los Angeles, Burbank, and Glendale–to recapture the imported water they added to the Basin. The court held that the rights of the respective public agencies to recover such imported water are of equal priority to the City of Los Angeles' pueblo right, and that all such public agency rights are "prior to the rights dependent on ownership of overlying land or based solely upon appropriation of groundwater from the basin." The court remanded the case, directing the trial court to apportion the safe yield of the Basin accordingly.

The court noted that there did not appear to be any shortage of underground storage space in relation to the demand and, hence, the court did not find it necessary to determine priorities as to the future use of such space. The Judgment issued by the trial court on remand, however, provided: "To the extent of any future spreading or in lieu storage of import water or reclaimed water by Los Angeles, Glendale, Burbank or San Fernando, the party causing said water to be so stored shall have a right to extract an equivalent amount of ground water from the San Fernando Basin." Pursuant to the Judgment, a court-appointed Watermaster now manages the groundwater extraction and storage rights within the ULARA. Figure B-2 depicts the rights to use groundwater established in Los Angeles v. San Fernando in an overdrafted basin where water has been stored.

City of Barstow v. Mojave Water Agency (23 Cal. 4th 1224)

In 2000, the California Supreme Court partially overturned the 1995 adjudication of the Mojave River Basin. The trial court had approved a negotiated settlement (or stipulated agreement) that failed to include a well-by-well determination of water rights. The trial court held the negotiated settlement to be binding on all users in the basin, including some pumpers who had not agreed to the settlement. The lower court decision was based on the doctrine of "equitable apportionment," in which the available water is shared based on concepts of equity and fairness. The Court of Appeal had partially reversed the lower court, and held that the trial court did not have the authority to ignore California's traditional water rights doctrine giving overlying users a priority right to beneficial and reasonable use of the groundwater. The Court of Appeal affirmed the trial court's negotiated settlement except as it applied to two of the parties. First, the Court of Appeal reversed the holding against a non-negotiating party since the trial court had ignored that party's existing overlying water rights. Secondly, the Court of Appeal reversed the trial court's judgment as it applied to a company, where the negotiated agreement did not give the company a water-allowance equal to its actual water use. The Supreme Court affirmed the Court of Appeal decision, but reversed the judgment applying to the company's water-allowance. The Supreme Court also affirmed that the trial court could not apply the doctrine of equitable apportionment when overlying water users had already established a prior water right. The Court stated that, while the trial court could impose a physical solution (such as the negotiated settlement), the court could not simply ignore affected owners' legal water rights. Equitable apportionment, thus, remains a tool for adjudicating basin groundwater rights, but only if all parties stipulate to its use.

Appendix C
Required and Recommended Components of Local Groundwater Management Plans

Section 10750 et seq. of the Water Code, commonly referred to as Assembly Bill 3030, stipulates certain procedures that must be followed in adopting a groundwater management plan under this section.

Amendments to Section 10750 et seq. added the requirement that new groundwater management plans prepared under Section 10750 et seq. must include component 1 below (SB1938 (Stats 2002, Ch 603)).

In addition, the amendments mandate that if the agency preparing the groundwater management plan intends to apply for funding administered by the California Department of Water Resources (DWR) for groundwater or groundwater quality projects, the agency must prepare and implement a groundwater management plan that includes components 2, 3, 6, 7 and 9 below. DWR recommends that all the components below be included in any groundwater management plan to be adopted and implemented by a local managing entity.

Consideration and development of these components for the specific conditions of the basin to be managed under the plan will help to ensure effective groundwater management. In developing these criteria, DWR recognizes that the goal of a groundwater management plan and the goal of an ordinance to manage groundwater should be the same—assurance of a long-term, sustainable, reliable, good quality groundwater supply. Such efforts can benefit greatly from cooperative management within the basin or region.

None of the suggested data reporting in the components below should be construed as recommending disclosure of information that is confidential under State law.

1. Include documentation that a written statement was provided to the public "describing the manner in which interested parties may participate in developing the groundwater management plan," which may include appointing a technical advisory committee (Water Code § 10753.4 (b)).
2. Include a plan by the managing entity to "involve other agencies that enables the local agency to work cooperatively with other public entities whose service area or boundary overlies the groundwater basin." (Water Code § 10753.7 (a)(2)). A local agency includes "any local public agency that provides water service to all or a portion of its service area"
(Water Code § 10752 (g)).
3. Provide a map showing the area of the groundwater basin, as defined by DWR Bulletin 118, with the area of the local agency subject to the plan as well as the boundaries of other local agencies that overlie the basin in which the agency is developing a groundwater management plan (Water Code § 10753.7 (a)(3)).
4. Establish an advisory committee of stakeholders (interested parties) within the plan area that will help guide the development and implementation of the plan and provide a forum for resolution of controversial issues.
5. Describe the area to be managed under the plan, including:
    a. The physical structure and characteristics of the aquifer system underlying the plan area in the context of the overall basin.

b. A summary of the availability of historical data including, but not limited to, the components in Section 7 below.

c. Issues of concern including, but not limited to, issues related to the components in Section 7 below.

d. A general discussion of historical and projected water demands and supplies.

6. Establish management objectives (MOs) for the groundwater basin that is subject to the plan. (Water Code § 10753.7 (a)(1)).

7. Include components relating to the monitoring and management of groundwater levels, groundwater quality, inelastic land surface subsidence, and changes in surface flow and surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping. (Water Code § 10753.7 (a)(1)). Consider additional components listed in Water Code § 10753.8 (a) through (l).

8. For each MO, describe how meeting the MO will contribute to a more reliable supply for long-term beneficial uses of groundwater in the plan area, and describe existing or planned management actions to achieve MOs.

9. Adopt monitoring protocols for the components in Section 7 (Water Code § 10753.7 (a)(4)). Monitoring protocols are not defined in the Water Code, but the section is interpreted to mean developing a monitoring program capable of tracking changes in conditions for the purpose of meeting MOs.

10. Describe the monitoring program, including:

a. A map indicating the general locations of any applicable monitoring sites for groundwater levels, groundwater quality, subsidence stations, or stream gages.

b. A summary of monitoring sites indicating the type (groundwater level, groundwater quality, subsidence, stream gage) and frequency of monitoring. For groundwater level and groundwater quality wells, indicate the depth interval(s) or aquifer zone monitored and the type of well (public, irrigation, domestic, industrial, monitoring).

11. Describe any current or planned actions by the local managing entity to coordinate with other land use, zoning, or water management planning agencies or activities (Water Code § 10753.8 (k), (l)).

12. Provide for periodic report(s) summarizing groundwater basin conditions and groundwater management activities. The report(s), prepared annually or at other frequencies as determined by the local management agency, should include:

a. Summary of monitoring results, including a discussion of historical trends.

b. Summary of management actions during the period covered by the report.

c. A discussion, supported by monitoring results, of whether management actions are achieving progress in meeting MOs.

d. Summary of proposed management actions for the future.

e. Summary of any plan component changes, including addition or modification of MOs, during the period covered by the report.

f. Summary of actions taken to coordinate with other water management and land use agencies, and other government agencies.

13. Provide for the periodic re-evaluation of the entire plan by the managing entity.

14. For local agencies not overlying groundwater basins, plans should be prepared including the above listed components and using geologic and hydrologic principles appropriate to those areas (Water Code § 10753.7 (a)(5)).

Appendix D
Groundwater Management Model Ordinance

In developing this model ordinance, the California Department of Water Resources recognizes that the goal of a groundwater management plan and the goal of an ordinance to manage groundwater should be the same—assurance of a long-term, sustainable, reliable, good quality groundwater supply. Such efforts require cooperative management within the region or sub-region.

Chapter X

Groundwater Management Ordinance

Sections:

X.01 Declaration of Findings
X.02 Purpose
X.03 Declaration of Intent
X.04 Definitions
X.05 Groundwater Management Program
X.06 Management Objectives
X.07 Monitoring Program Network
X.08 Monitoring Frequency
X.09 Changes in Monitoring
X.10 Review of Technical Data
X.11 Data Dissemination
X.12 Actions when MO Noncompliance is Reported
X.13 Regional Coordination
X.14 Integrated Resource Management
X.15 Data Relating to Export and Substitution of Groundwater

X.01 Declaration of Findings - The Board finds that:

A. The protection of the groundwater resource for its use within the County is of major concern to the residents of the County for the protection of their health, welfare, and safety.
B. The reliability and sustainability of the groundwater supply for all beneficial uses are of critical importance to the economic, social, and environmental well-being of the County.
C. A lack of effective groundwater management may have significant negative impacts, including, but not limited to:
    1. Lower groundwater levels leading to additional expenses from:
        a) Increased energy consumption.
        b) The need to deepen existing wells.
        c) The need to build new wells.
        d) The need to destroy non-functioning wells.
    2. Costly damage to public roads, bridges, canals, and other structures caused by land subsidence.
    3. Reduction of surface and subsurface flows leading to the potential loss of critical riparian and wetland habitat.
    4. Degradation of groundwater quality.

D. It is essential for management purposes to adopt a monitoring program addressing groundwater levels, groundwater quality, land subsidence, and surface water flow and quality where it directly impacts or is impacted by groundwater.

X.02 Purpose - In support of the findings above, the County has determined that this groundwater management ordinance is necessary to ensure that:

A. Groundwater continues to be a reliable and sustainable resource.
B. The extraction of groundwater does not result in significant adverse economic, environmental, or social impacts.
C. Groundwater quality is protected.
D. Excessive land surface subsidence from groundwater extraction is prevented.

X.03 Declaration of Intent

A. The County intends to foster prudent groundwater management practices by establishing a policy that encourages appropriate management of the resource based on recommendations by a committee of stakeholders.
B. The County intends that its groundwater management activities occur as an open and public process that considers input from all stakeholders in the County.
C. The County intends to work cooperatively with interested local agencies to further develop and implement joint groundwater management activities.
D. The County does not intend to regulate, in any manner, the use of groundwater, except as a last resort to protect the groundwater resource.
E. The County intends to act as an enforcing agency should the local resource become threatened.
F. The County does not intend to infringe upon the rights of surface water users in the managed area.
G. The County does not intend to limit other authorized means of managing groundwater within the County.

X.04 Definitions

A. "Aquifer" means a geologic formation that stores groundwater and transmits and yields significant quantities of water to wells and springs. Significant quantity is an amount that that satisfies local needs and may range from thousands of gallons per minute to less than 5 gpm, depending on rock type and intended use.
B. "Board" means the Board of Supervisors of the County.
C. "District" means a district or municipality, located wholly or partially within the boundaries of the County, that is a purveyor of water for agricultural, domestic, or municipal use.
D. "Enforcement Agency" means the Board as the enforcement agency under this chapter.
E. "Groundwater" means all water beneath the surface of the earth below the zone of saturation, but does not include subterranean streams flowing in known and definite channels.
F. "Groundwater Basin" means an aquifer or series of aquifers with a reasonably defined lateral and vertical extent, as defined in Bulletin 118 by Department of Water Resources. "Non-basin areas" are outside defined groundwater basins and contain smaller amounts of groundwater in consolidated sediments or fractured hard rock.
G. "Groundwater Export" means the conveyance of groundwater outside of the boundaries of the County and outside of the boundaries of any district that is partially within the County.
H. "Groundwater Substitution" means the voluntary use of an available groundwater supply instead of surface water for the purposes of using the surface water outside the County and outside the boundaries of any district that is partially within the County.

I. "Land Subsidence" means the lowering of the ground surface caused by the inelastic consolidation of clay beds in the aquifer system.
J. "Management Objective"(MO) means a condition identified for each subunit to ensure that the groundwater supply is reliable and sustainable. The MOs set acceptable conditions with respect to groundwater levels, groundwater quality, inelastic land surface subsidence, and surface water flows and quality. Compliance with the MO is tracked by a monitoring program and threshold values that are adopted for each Management Objective.
K. "Recharge" means flow to groundwater storage from precipitation, and infiltration from streams, irrigation, spreading basins, injection wells, and other sources of water.
L. "Reliability" means having an available, predictable, and usable groundwater supply at any given point in time.
M. "Stakeholder" means an individual or an entity, such as a water supplier or a county resident, with a permanent interest in the availability of the groundwater resource.
N. "Subunit" means any subdivision of a groundwater basin or non-basin area in the County created for the purposes of representation of stakeholders and the establishment of local area management objectives.
O. "Sustainable" means the groundwater resource is maintained for use by residents in the basin over a prolonged period of time.
P. "Technical Advisory Committee" means a committee of persons knowledgeable in groundwater management, hydrology, and hydrogeology established for the purpose of providing technical guidance to the Water Advisory Committee.
Q. "Threshold values" mean the limits established by the WAC for groundwater levels, groundwater quality, land surface subsidence, and surface water flow and quality that are not to be exceeded if the MOs are to be met.
R. "Water Advisory Committee" (WAC) means a multimember advisory body established for the purpose of aiding the Board in providing effective management of the groundwater resources in the County, and representing all of the subunits that are identified.
S. "Water Management Entities" means any local agency, or group of agencies, authorized to manage groundwater.

X.05 Groundwater Management Program

A. The County recognizes that effective groundwater management is key to maintaining a reliable and sustainable resource. For the purposes of establishing an effective groundwater management program, the Board shall appoint a WAC to establish MOs and make recommendations to the Board to ensure that MOs are met.
B. For purposes of establishing a WAC, the groundwater basins and non-basin areas of the County will be divided into subunits based on hydrogeologic principles and institutional boundaries. These subunits shall be established by the Board based on public input to address the groundwater management needs of the County. The WAC shall consist of members that represent each subunit. Upon establishment of the subunits, the Board shall appoint a member to represent each subunit on the WAC.
C. The WAC shall have the following responsibilities to the Board:
    1. Recommend MOs for each groundwater management subunit.
    2. Recommend a groundwater monitoring network for purposes of tracking MOs.
    3. Recommend the frequency of monitoring.
    4. Propose changes in monitoring.
    5. Ensure monitoring data receive technical review.
    6. Ensure that monitoring data are made available to the public.

7. Recommend actions to resolve noncompliance with MOs.

D. For the purposes of providing technical advice to the WAC in carrying out its responsibilities, a technical advisory committee (TAC) shall be established. The TAC shall consist of local experts or a combination of local expertise and technical consultants from private and public organizations that are nominated by the WAC and approved by the Board. Individuals appointed to the TAC should be highly knowledgeable in groundwater management, hydrology, and hydrogeology. The TAC shall review technical data collected by monitoring programs within the County and advise the WAC.

X.06 Management Objectives

A. To ensure that the County maintains a reliable and sustainable groundwater supply, MOs for groundwater levels, groundwater quality, land subsidence, and surface water flow and quality shall be adopted for each subunit. Threshold values that are not to be exceeded shall be defined for each MO.
B. Compliance with the MOs will be determined by evaluation of data collected from groundwater level, groundwater quality, land subsidence, and surface water flow and quality monitoring networks. Evaluation of these data with respect to threshold values shall be the basis for determining compliance with the MOs.
C. Each WAC member shall recommend MOs for their subunit. The WAC shall develop a comprehensive set of recommendations for all subunits, and the Board shall adopt these MOs for the County. MOs may differ from subunit to subunit, but the established MOs shall be consistent with the overall goal of supply reliability for the County.
D. Groundwater management practices based on the established MOs for one subunit of the County shall not adversely impact adjacent subunits.

X.07 Monitoring Program Network

The WAC shall develop County-wide monitoring programs to collect representative data on groundwater levels, groundwater and surface water quality, land surface subsidence, and stream flow and quality. Each subunit shall propose its own monitoring program, and the WAC shall adopt a comprehensive monitoring program for the County. The data collected, showing current conditions and changes over time as a result of groundwater extraction, shall be evaluated by the WAC in consultation with the TAC. The WAC will recommend policies and actions to ensure that MOs for each subunit are met. The collection and evaluation of the data shall be based on scientifically sound principles, and shall incorporate appropriate quality assurance and quality control protocols.

A. Groundwater levels: The groundwater level monitoring network shall be proposed by the WAC and approved by the Board. The intent of the groundwater level monitoring network is to measure water levels in selected wells that can adequately determine representative conditions in the aquifer system for determination of compliance with the MOs. The network will include selected municipal, domestic, and irrigation wells owned by water districts, private parties, and municipal and industrial water suppliers. Where needed, dedicated monitoring wells may be installed. Participation by well owners will be voluntary.
B. Water Quality: The groundwater quality monitoring network shall be proposed by the WAC and approved by the Board. The intent of the groundwater quality monitoring network is to monitor selected wells that can adequately determine representative groundwater quality conditions in the aquifer system for identification of compliance with the MOs. The network will include selected municipal, domestic, and irrigation wells owned by water districts, private parties, and municipal

and industrial water suppliers. Where needed, dedicated monitoring wells may be installed. Participation by well owners will be voluntary.

C. Land Subsidence: The land subsidence program and network shall be proposed by the WAC and approved by the Board. The intent of the land subsidence monitoring is to detect land subsidence for determination of compliance with the MOs. The network may include benchmarks that are surveyed for changes in elevation throughout the County, based on the judgment of the WAC of the need for such a program.

D. Surface Water Flow and Quality: The surface water flow and quality network shall be proposed by the WAC and approved by the Board. The intent of this network is to detect changes in surface water flow or surface water quality that directly affect groundwater levels or quality or are caused by groundwater pumping for evaluation of compliance with MOs.

X.08 Monitoring Frequency

The recommended frequency of collection of data for each of the parameters listed above shall be determined by the WAC. Initially, each parameter should be measured at the frequencies outlined below, unless the WAC notes upon evaluation of existing data that more frequent monitoring or additional analyses are called for.

A. Groundwater levels should be measured at least three times during the year: one measurement prior to the period of highest groundwater use, one measurement during peak groundwater use, and one measurement following the period of highest groundwater use (approximately the months of _____, _____, and _____).

B. Groundwater quality measurements of electrical conductivity, temperature, and pH should be obtained at least twice annually during the periods of highest and lowest groundwater use (approximately the months of _____ and _____). Upon evaluation of the data, the WAC may propose analyses for other constituents.

C. Selected benchmarks in the County land subsidence monitoring network should be surveyed every five years at a minimum. These surveys should be conducted following aquifer recovery and prior to the period of highest groundwater extraction (approximately the month of_____).

D. Measurement of surface water flow and quality in areas determined to directly affect groundwater levels or quality or that are affected by groundwater pumping shall be obtained at least ___ times per month as long as there are flows in the channel.

X.09 Changes in Monitoring

If evaluation of the groundwater level, groundwater quality, land subsidence, surface water flow, or surface water quality data indicates a need for more or less frequent measurements or analyses, the WAC may propose a change in the monitoring frequency. Similarly, if evaluation of the data indicates that additional monitoring sites are necessary, the WAC may propose an additional or a reduced number of sites for data collection. The Board shall adopt these changes when supported by credible evidence.

X.10 Review of Technical Data

A. The TAC shall propose and the WAC shall adopt standard methods using scientifically sound principles for review and analysis of the collected data. The TAC will meet, as needed and requested by the WAC, to evaluate the technical data and shall report their findings at appropriate meetings of the WAC. The WAC shall meet at least __ times per month during the period of maximum groundwater use (months of _____ through _____) and quarterly during the off season (months of _____ through _____), or as necessary.

B. During the period of highest groundwater use, the WAC meetings will focus on data review and analysis with respect to compliance with the current MOs. During the period of low

groundwater use, the WAC meetings will focus on a review of compliance with MOs for the previous period of high groundwater use and consideration of the need for changes to the MOs.

X.11 Data Dissemination

The WAC, in addition to establishing methods for data collection and evaluation, shall establish methods for data storage and dissemination. The WAC shall disseminate the monitoring data and evaluation reports through public presentations and through a County-maintained groundwater Internet site. At a minimum, the WAC shall publicly present findings from the monitoring program to the Board twice annually.

X.12 Actions when MO Noncompliance is Reported

A. Action by Technical Advisory Committee. In the event that the TAC identifies an area that is not in compliance with the MOs, or if noncompliance is reported by any other means, the TAC shall report to the WAC on the regional extent and magnitude of the noncompliance. This information shall also be released to the public no later than ___ days from the time that noncompliance with MOs was identified. The TAC shall then collect all available pertinent hydrologic data, investigate possible causes for noncompliance with MOs, and recommend actions to the WAC to bring the area into compliance. These recommendations shall be made no later than ___ days after the report of noncompliance is released to the public. The TAC shall first make recommendations that focus on correcting the noncompliance through negotiations with all parties in the affected area.

B. Action by Water Advisory Committee. The WAC shall act as lead negotiator in re-establishing compliance with the MO. If negotiations with parties in the affected area do not result in timely and positive action to re-establish compliance with MOs for the basin, the WAC may recommend a plan to the Board to modify, reduce or terminate groundwater extraction in the affected area or take other necessary actions. Such a plan will be recommended to the Board only after the WAC has thoroughly reviewed the recommendations of the TAC at a public meeting. The modification, reduction, or termination of groundwater extraction in the affected area shall first be applied to wells involved in any export or substitution programs, and then to other wells if necessary. Domestic wells shall not be considered for any modification, reductions, or termination of groundwater extraction.

C. Action by Board of Supervisors. The Board of Supervisors, using its police powers, shall act as the enforcement agency for this ordinance. Any recommendation of the WAC may be appealed to the Board within __ working days.

X.13 Regional Coordination

Management decisions recommended by the WAC and adopted by the Board shall not deleteriously affect groundwater resources in any portions of groundwater basins or non-basin areas that share a common groundwater resource in adjacent counties. To accomplish this goal, the WAC shall meet and coordinate with water management entities outside the County that overlie a common groundwater basin at least twice per year once prior to the period of highest groundwater use and once following the period of highest groundwater use.

X.14 Integrated Resource Management

A. To ensure integration of planning activities within the County, the WAC shall inform County departments involved with groundwater related activities, including but not limited to Land Use or Zoning, Planning, Public Works, Utilities, and Environmental Health, of all WAC meetings and actions regarding MOs. In turn, these County departments shall take into consideration the

adopted MOs when approving development or zoning changes or construction projects that may rely on or affect groundwater quantity or quality.

B. To the greatest extent practicable, the WAC should also integrate resource management planning with other agencies within the basin. Resource activities that could benefit from integrated planning with groundwater management include, but are not limited to:
   - Groundwater management planning by other agencies—agricultural, municipal, industrial, local government
   - Watershed management plans
   - Urban water management plans
   - Management and disposal of municipal solid waste and municipal sewage
   - Drinking water source assessment and protection programs
   - Public water system emergency and disaster response plans
   - Surface water and groundwater conjunctive management programs
   - Expansion of surface and groundwater facilities
   - Water efficiency programs
   - Water recycling programs
   - Environmental habitat construction or restoration programs
   - Water quality protection programs
   - Recharge programs
   - Transportation infrastructure planning

X.15 Data Relating to Export and Substitution of Groundwater

A. Districts, persons, or contractors intending to operate a groundwater export or groundwater substitution program shall submit the following data to the WAC __ working days prior to commencing the program:
   1. A description of the project with the total amount of groundwater to be exchanged or substituted
   2. The dates over which the project will take place.
   3. A statement of the anticipated impacts of the project relative to adopted MOs.
   4. A discussion of possible contingencies in the event of MO noncompliance.
   5. A map showing the location of the wells to be used by the program.
   6. A summary of any monitoring program proposed.
   7. All required environmental documentation.

B. While the program is in operation, the following information shall be provided to the WAC at least ___ times per month:
   1. All static and pumping groundwater level measurements made in the pumping well during the period of extraction for the export or substitution program.
   2. The amount of groundwater extracted from each well per week.
   3. Static groundwater level measurements in at least __ of the most proximal wells to the project pumping wells that can be practicably monitored.

C. All costs for providing such information to the WAC shall be borne by the project participants.

Note: Although the terms “County” and “Board” are used throughout the model ordinance for clarity, the model could be used by any local government or agency with appropriate authority or powers.

Appendix E
SWRCB Beneficial Use Designations[1]

Agricultural Supply (AGR) – Uses of water for farming, horticulture, or ranching including, but not limited to irrigation, stock watering, or support of vegetation for ranch grazing.

Aquaculture (AQUA) – Uses of water for aquaculture or mariculture operations including, but not limited to, propagation, cultivation, maintenance, or harvesting of aquatic plants and animals for human consumption or bait purposes.

Cold Freshwater Habitat (COLD) – Uses of water that support cold water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Estuarine Habitat (EST) – Uses of water that support estuarine ecosystems including, but not limited to, preservation or enhancement of estuarine habitats, vegetation, fish, shellfish, or wildlife (e.g., estuarine mammals, waterfowl, shorebirds).

Freshwater Replenishment (FRSH) – Uses of water for natural or artificial maintenance of surface water quantity or quality (e.g., salinity).

Groundwater Recharge (GWR) – Uses of water for natural or artificial recharge of groundwater for purposes of future extraction, maintenance of water quality, or halting of saltwater intrusion into freshwater aquifers.

Hydropower Generation (POW) – Uses of water for hydropower generation.

Industrial Process Supply (PRO) – Uses of water for industrial activities that depend primarily on water quality.

Industrial Service Supply (IND) – Uses of water for industrial activities that do not depend primarily on water quality including, but not limited to, mining, cooling water supply, hydraulic conveyance, gravel washing, fire protection, or oil well repressurization.

Inland Saline Water Habitat (SAL) – Uses of water that support inland saline water ecosystems including, but not limited to, preservation or enhancement of aquatic saline habitats, vegetation, fish, or wildlife, including invertebrates.

Marine Habitat (MAR) – Uses of water that support marine ecosystems including, but not limited to, preservation or enhancement of marine habitats, vegetation such as kelp, fish, shellfish, or wildlife (e.g., marine mammals, shorebirds).

Migration of Aquatic Organisms (MIGR) – Uses of water that support habitats necessary for migration or other temporary activities by aquatic organisms, such as anadromous fish.

Municipal and Domestic Supply (MUN) – Uses of water for community, military, or individual water supply systems including, but not limited to, drinking water supply.

Navigation (NAV) – Uses of water for shipping, travel, or other transportation by private, military, or commercial vessels.

Noncontact Water Recreation (REC-2) – Uses of water for recreational activities involving proximity to water, but not normally involving body contact with water where ingestion of water is reasonably possible. These uses include, but are not limited to, picnicking, sunbathing, hiking, beachcombing, camping, boating, tidepool and marine life study, hunting, sightseeing, or aesthetic enjoyment in conjunction with the above activities.

Ocean Commercial and Sport Fishing (COMM) – Uses of water for commercial or recreational collection of fish, shellfish, or other organisms including, but not limited to, uses involving organisms intended for human consumption or bait purposes.

[1] From SWRCB 2000

Preservation of Biological Habitats of Special Significance (BIOL) – Uses of water that support designated areas or habitats, such as established refuges, parks, sanctuaries, ecological reserves, or Areas of Special Biological Significance (ASBS), where the preservation or enhancement of natural resources requires special protection.

Rare, Threatened, or Endangered Species (RARE) – Uses of water that support habitats necessary, at least in part, for the survival and successful maintenance or plant or animal species established under State or federal law as rare, threatened or endangered.

Shellfish Harvesting (SHELL) – Uses of water that support habitats suitable for the collection of filter-feeding shellfish (e.g., clams, oysters, and mussels) for human consumption, commercial, or sports purposes.

Spawning, Reproduction, and/or Early Development (SPWM) – Uses of water that support high quality aquatic habitats suitable for reproduction and early development of fish.

Warm Freshwater Habitat (WARM) – Uses of water that support warmwater ecosystems including, but not limited to, preservation or enhancement of aquatic habitats, vegetation, fish, or wildlife, including invertebrates.

Water Contact Recreation (REC-1) – Uses of water for recreational activities involving body contact with water, where ingestion of water is reasonably possible. These uses include, but are not limited to, swimming, wading, water-skiing, skin and scuba diving, surfing, white water activities, fishing, or use of natural hot springs.

Wildlife Habitat (WILD) – Uses of water that support terrestrial ecosystems including, but not limited to, preservation and enhancement of terrestrial habitats, vegetation, wildlife (e.g., mammals, birds, reptiles, amphibians, invertebrates), or wildlife water and food sources.

Appendix F
Federal and State MCLs and Regulation Dates for Drinking Water Contaminants

	U.S. Environmental Protection Agency		California Department of Health Services	
Contaminant	**MCL (mg/L)**	**Date[a]**	**MCL (mg/L)**	**Effective date**
Inorganics				
Aluminum	0.05 to 2[b]	1/91	1 0.2[b]	2/25/89 9/8/94
Antimony	0.006	7/92	0.006	9/8/94
Arsenic	0.05 0.01	eff: 6/24/77 2001	0.05	77
Asbestos	7 MFL[c]	1/91	7 MFL[c]	9/8/94
Barium	1 2	eff: 6/24/77 1/91	1	77
Beryllium	0.004	7/92	0.004	9/8/94
Cadmium	0.010 0.005	eff: 6/24/77 1/91	0.010 0.005	77 9/8/94
Chromium	0.05 0.1	eff: 6/24/77 1/91	0.05	77
Copper	1.3[d]	6/91	1[b] 1.3[d]	77 12/11/95
Cyanide	0.2	7/92	0.2 0.15	9/8/94 6/12/03
Fluoride	4 2[b]	4/86 4/86	2	4/98
Lead	0.05[e] 0.015[d]	eff: 6/24/77 6/91	0.05[e] 0.015[d]	771 2/11/95
Mercury	0.002	eff: 6/24/77	0.002	77
Nickel	Remanded	0.1	9/8/94	
Nitrate	(as N)10	eff: 6/24/77	(as N03) 45	77
Nitrite (as N)	1	1/91	1	9/8/94
Total Nitrate/Nitrite (as N)	10	1/91	10	9/8/94
Selenium	0.01 0.05	eff: 6/24/77 1/91	0.01 0.05	77 9/8/94
Thallium	0.002	7/92	0.002	9/8/94
Radionuclides				
Uranium	30 g/L	12/7/00	20 pCi/L	1/1/89
Combined radium-226 & 228	5 pCi/L	eff: 6/24/77	5 pCi/L	77
Gross Alpha particle activity	15 pCi/L	eff: 6/24/77	15 pCi/L	77
Gross Beta particle activity	dose of 4 millirem/yr	eff: 6/24/77	50 pCi/L[f]	77

Contaminant	U.S. Environmental Protection Agency MCL (mg/L)	Date[a]	California Department of Health Services MCL (mg/L)	Effective date
Strontium-90	8 pCi/L	eff: 6/24/77 now covered by Gross Beta	8 pCi/L[f]	77
Tritium	20,000 pCi/L	eff: 6/24/77 now covered by Gross Beta	20,000 pCi/L[f]	77
VOCs				
Benzene	0.005	6/87	0.001	2/25/89
Carbon Tetrachloride	0.005	6/87	0.0005	4/4/89
1,2-Dichlorobenzene	0.6	1/91	0.6	9/8/94
1,4-Dichlorobenzene	0.075	6/87	0.005	4/4/89
1,1-Dichloroethane	- -	- -	0.005	6/24/90
1,2-Dichloroethane	0.005	6/87	0.0005	4/4/89
1,1-Dichloroethylene	0.007	6/87	0.006	2/25/89
cis-1,2-Dichloroethylene	0.07	1/91	0.006	9/8/94
trans-1,2-Dichloroethylene	0.1	1/91	0.01	9/8/94
Dichloromethane	0.005	7/92	0.005	9/8/94
1,3-Dichloropropene	- -	- -	0.0005	2/25/89
1,2-Dichloropropane	0.005	1/91	0.005	6/24/90
Ethylbenzene	0.7	1/91	0.68 0.7 0.3	2/25/89 9/8/94 6/12/03
Methyl-tert-butyl ether (MTBE)	- -	- -	0.005[b] 0.013	1/7/99 5/17/00
Monochlorobenzene	0.1	1/91	0.03 0.07	2/25/89 9/8/94
Styrene	0.1	1/91	0.1	9/8/94
1,1,2,2-Tetrachloroethane	- -	- -	0.001	2/25/89
Tetrachloroethylene	0.005	1/91	0.005	5/89
Toluene	1	1/91	0.15	9/8/94
1,2,4 Trichorobenzene	0.07	7/92	0.07	9/8/94
1,1,1-Trichloroethane	0.200	6/87	0.200	2/25/89
1,1,2-Trichloroethane	0.005	7/92	0.032 0.005	4/4/89 9/8/94
Trichloroethylene	0.005	6/87	0.005	2/25/89
Trichlorofluoromethane	- -	- -	0.15	6/24/90
1,1,2-Trichloro-1,2,2- Trifluoroethane	- -	- -	1.2	6/24/90
Vinyl chloride	0.002	6/87	0.0005	4/4/89
Xylenes	10	1/91	1.750	2/25/89

Contaminant	U.S. Environmental Protection Agency MCL (mg/L)	Date[a]	California Department of Health Services MCL (mg/L)	Effective date
SVOC's				
Alachlor	0.002	1/91	0.002	9/8/94
Atrazine	0.003	1/91	0.003 0.001	4/5/89 6/12/03
Bentazon	- -	- -	0.018	4/4/89
Benzo(a) Pyrene	0.0002	7/92	0.0002	9/8/94
Carbofuran	0.04	1/91	0.018	6/24/90
Chlordane	0.002	1/91	0.0001	6/24/90
Dalapon	0.2	7/92	0.2	9/8/94
Dibromochloropropane	0.0002	1/91	0.0001 0.0002	7/26/89 5/3/91
Di(2-ethylhexyl)adipate	0.4	7/92	0.4	9/8/94
Di(2-ethylhexyl)phthalate	0.006	7/92	0.004	6/24/90
2,4-D	0.10.07	eff: 6/24/77 1/91	0.1 0.07	77 9/8/94
Dinoseb	0.007	7/92	0.007	9/8/94
Diquat	0.02	7/92	0.02	9/8/94
Endothall	0.1	7/92	0.1	9/8/94
Endrin	0.0002 0.002	eff: 6/24/77 7/92	0.0002 0.002	77 9/8/94
Ethylene Dibromide	0.00005	1/91	0.00002 0.00005	2/25/89 9/8/94
Glyphosate	0.7	7/92	0.7	6/24/90
Heptachlor	0.0004	1/91	0.00001	6/24/90
Heptachlor Epoxide	0.0002	1/91	0.00001	6/24/90
Hexachlorobenzene	0.001	7/92	0.001	9/8/94
Hexachlorocyclopentadiene	0.05	7/92	0.05	9/8/94
Lindane	0.004 0.0002	eff: 6/24/77 1/91	0.004 0.0002	77 9/8/94
Methoxychlor	0.1 0.04	eff: 6/24/77 1/91	0.1 0.04 0.03	77 9/8/94 6/12/03
Molinate	- -	- -	0.02	4/4/89
Oxamyl	0.2	7/92	0.2 0.05	9/8/94 6/12/03
Pentachlorophenol	0.001	1/91	0.001	9/8/94
Picloram	0.5	7/92	0.5	9/8/94
Polychlorinated Biphenyls	0.0005	1/91	0.0005	9/8/94
Simazine	0.004	7/92	0.010 0.004	4/4/89 9/8/94

Contaminant	U.S. Environmental Protection Agency MCL (mg/L)	Date[a]	California Department of Health Services MCL (mg/L)	Effective date
Thiobencarb	- -	- -	0.07 0.001[b]	4/4/89 4/4/89
Toxaphene	0.005 0.003	eff: 6/24/77 1/91	0.005 0.003	77 9/8/94
2,3,7,8-TCDD (Dioxin)	$3x10^{-8}$	7/92	$3x10^{-8}$	9/8/94
2,4,5-TP (Silvex)	0.01 0.05	eff: 6/24/77 1/91	0.01 0.05	77 9/8/94
Disinfection Byproducts				
Total trihalomethanes	0.10 0.080	11/29/79 eff: 11/29/83 eff: 1/1/02[g]	0.10	3/14/83
Total haloacetic acids	0.060	eff: 1/1/02[g]		
Bromate	0.010	eff: 1/1/02[g]		
Chlorite	1.0	eff: 1/1/02[g]		
Treatment Technique				
Acrylamide	TT[h]	1/91	TT[h]	9/8/94
Epichlorohydrin	TT[h]	1/91	TT[h]	9/8/94

Source: http://www.dhs.ca.gov/ps/ddwem/chemicals/MCL/EPAandDHS.pdf

a. "eff." indicates the date the MCL took effect; any other date provided indicates when EPA established (that is, published) the MCL.

b. Secondary MCL.

c. MFL = million fibers per liter, with fiber length > 10 microns.

d. Regulatory Action Level; if system exceeds, it must take certain actions such as additional monitoring, corrosion control studies and treatment, and for lead, a public education program; replaces MCL.

e. The MCL for lead was rescinded with the adoption of the regulatory action level described in footnote d.

f. MCLs are intended to ensure that exposure above 4 millirem/yr does not occur.

g. Effective for surface water systems serving more than 10,000 people; effective for all others 1/1/04.

h. TT = treatment technique, because an MCL is not feasible.

Federal and State MCLs – updated 05/23/03

Appendix G
Development of Current Groundwater Basin/Subbasin Map

This Bulletin 118 update represents the first time that groundwater basin boundaries have been released as a digital coverage. The basin boundaries for the revised groundwater basin map were primarily defined using geologic contacts and hydrogeologic barriers. Specifically the identification of the groundwater basins was initially based on the presence and areal extent of unconsolidated alluvial sediments identified on 1:250,000 scale, geologic maps published by the California Department of Conservation, Division of Mines and Geology. The identified groundwater basin areas were then further evaluated through review of relevant geologic and hydrogeologic reports and well completion reports, and using the basin definition criteria listed in Table 8. Basin boundaries that are specified in each of the court decisions has been used for the boundaries of adjudicated basins.

Well completion reports for wells present in basin areas that were identified from the geologic map were reviewed to identify the depth to the top of the water table and the top of impermeable bedrock. If there was less than 25 feet of permeable material present or if there was no groundwater present within the permeable material, the area was eliminated from the map. The well completion reports were also reviewed to determine if water supply wells located within the delineated basin area were extracting groundwater from the permeable materials underlying the area or from the bedrock beneath the permeable material. If the wells only extracted groundwater from the bedrock, the area was eliminated from the map. This resulted in the elimination of some areas identified as basins in previous Bulletin 118 publications. If there were no wells present in basin areas identified from the geologic map and no other information on the geology underlying these areas, the areas were retained in the current version of the map. Additional hydrogeologic information might or might not verify that these areas should be retained as groundwater basins.

Groundwater basins were delineated and separated from each other by the following restrictions on groundwater flow. For more detail on the types of basins and the flow boundaries of those basins, see Table 8.

Impermeable Bedrock. Impermeable bedrock with lower water yielding capacity. These include consolidated rocks of continental and marine origin and crystalline/or metamorphic rock.

Constrictions in Permeable Materials. A lower permeability material, even with openings that are filled with more permeable stream channel materials, generally forms a basin boundary for practical purposes. While groundwater may flow through the sediment-filled gaps, the flow is restricted to those gaps.

Fault. A fault that crosses permeable materials may form a barrier to groundwater movement if movement along the fault plane has created fine material that impedes groundwater movement or juxtaposed low permeability material adjacent to an aquifer. This is usually indicated by noticeable difference in water levels in wells and/or flow patterns on either side of the fault. Not all faults act as barriers to groundwater flow.

Low Permeability Zone. Areas of clay or other fine-grained material that have significant areal or vertical extent generally form a barrier to groundwater movement within the basin but do not form basin boundaries.

Groundwater Divide. A groundwater divide is generally considered a barrier to groundwater movement from one basin to another for practical purposes. Groundwater divides have noticeably divergent groundwater flow directions on either side of the divide with the water table sloping away from the divide. The location of the divide may change as water levels in either one of the basins change, making such a "divide" less useful. Such a boundary is often used for subbasins.

Adjudicated Basin Boundaries. The basin boundaries established by court order were used for all adjudicated basins. These court-decided boundaries affect the location of natural boundaries of adjoining basins. Some adjudicated basins are represented as subbasins in this bulletin.

Available reports on the geologic and hydrogeologic conditions in the delineated basin areas were also reviewed to determine if there was information that would further define the boundaries of the basin areas. This review resulted in changes to some of the basin boundaries identified in previous versions of Bulletin 118.

Several of the larger groundwater basins were further subdivided into groundwater subbasins in Bulletin 118-80 and additional large groundwater basins were subdivided during this 2003 revision. The subbasin boundaries were also primarily defined using geologic contacts and hydrogeologic divides where possible. If this was not possible, political or institutional boundaries were used.

The hydrogeologic information contained in the basin descriptions that supplement this update of Bulletin 118 includes only the information that was available in California Department of Water Resources (DWR) files through reference searches and through limited contact with local agencies. Local agencies may have conducted more recent studies that have generated additional information about water budgets and aquifer characteristics. Unless the agency notified DWR or provided a copy of the recent reports to DWR staff that recent information has not been included in the basin descriptions. Therefore, although Senate Bill 610 refers to groundwater basins identified as overdrafted in Bulletin 118, it would be prudent for local water suppliers to evaluate the potential for overdraft of any basin included as a part of a water supply assessment.

Persons interested in collecting groundwater information in accordance with the Water Code as amended by SB 221 and SB 610 may start with the information in Bulletin 118, but should follow up by consulting the references listed for each basin and contacting local water agencies to obtain any new information that is available. Otherwise, evaluation of available groundwater resources as mandated by SB 221 and SB 610 may not be using the most complete and recent information about water budgets and aquifer characteristics.

Groundwater basin and subbasin boundaries shown on the map included with this bulletin are based on evaluation of the best available information. In basins where many studies have been completed and the basin has been operated for a number of years, the basin response is fairly well understood and the boundaries are fairly well defined. Even in these basins, however, there are many unknowns and changes in boundaries may result as more information about the basin is collected and evaluated.

In many other basins where much less is known and understood about the basin, boundaries will probably change as a better understanding of the basin is developed. A procedure for collecting information from all the stakeholders should be developed for use statewide so that agreement on basin boundaries can be achieved.

2005
URBAN WATER MANAGEMENT PLAN

Prepared for:

Castaic Lake Water Agency (CLWA)
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company
(Los Angeles County Waterworks District No. 36/Cooperating Agency)

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SUMMARY

SUMMARY

The California Urban Water Planning Act (Act) requires most water utilities to update and submit an Urban Water Management Plan (UWMP) every five years. An UWMP is required in order for a water supplier to be eligible for the California Department of Water Resources (DWR) administered State grants and loans and drought assistance. This document presents the 2005 UWMP (Plan) for the Castaic Lake Water Agency (Agency, CLWA) service area, which includes four local retail water purveyors. This regional Plan builds upon previous documents, specifically CLWA's 2000 UWMP and an amendment to the 2000 Plan. Following a general discussion of Plan preparation and general project rationale, information is provided on water use, water resources, recycled water, water quality, reliability planning, demand management measures (DMMs), best management practices (BMPs), and water shortage contingency planning. This summary chapter presents an overview of each chapter in the Plan.

1.0 INTRODUCTION

CLWA's service area includes the service areas of four local retail water agencies. This regional Plan has been prepared for CLWA and three of the purveyors: CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC). The fourth purveyor, Los Angeles County Waterworks District No. 36 (LACWWD #36), does not prepare a plan because it does not provide water to more than 3,000 customers or supply more than 3,000 acre-feet (af) of water annually – the minimum requirements for plan preparation. However, LACWWD #36 participated in the development of the Plan on an "ad-hoc" basis. Chapter 1 describes the purpose of the Plan, discusses Plan implementation, and provides general information about CLWA, the retail water purveyors, and service area characteristics. In response to new documents by DWR, this Plan also acknowledges the potential effects of global warming as a component of water management planning.

2.0 WATER USE

Chapter 2 describes historic and current water usage and the methodology used to project future demands within CLWA's service area. Water usage is divided into sectors such as residential, industrial, institutional, landscape, agricultural, and other purposes. To undertake this evaluation, existing land use data and new housing construction information were compiled from each of the retail water purveyors and projections prepared by "One Valley One Vision" (OVOV), a joint planning effort by the City of Santa Clarita and Los Angeles County Department of Regional Planning (LACDRP). This information was then compared to historical trends for new water service connections and customer water usage. In addition, weather and water conservation effects on historical water usage were factored into the evaluation.

3.0 WATER RESOURCES

Chapter 3 describes the water resources available to CLWA and the retail water purveyors from 2005 to 2030 – the 25-year period covered by the Plan. Resources include: (1) wholesale (imported) water supplies from the State Water Project (SWP), (2) local groundwater supplies from the Alluvium and Saugus Formation aquifers, and (3) transfers, exchanges, and

groundwater banking programs. Also described are planned water supply projects and programs and the development of desalination. Current and future imported water supplies are discussed, including "Table A" water supplies, CLWA's Flexible Storage Accounts, and reliability issues associated with SWP supplies. CLWA's Groundwater Management Plan (GWMP) is described, and available groundwater supplies are assessed. The adequacy of groundwater supplies and the emergence of perchlorate contamination issues are introduced and discussed in more detail in subsequent chapters. The role of water transfers and groundwater banking is described, and recent and proposed cooperative agreements to maximize local supplies through these progressive water management strategies are also discussed.

4.0 RECYCLED WATER

State water policy identifies water recycling as a beneficial use of water, and recycled water is an important component of water management planning. Chapter 4 describes the existing and future recycled water opportunities available to the CLWA service area. Currently, CLWA serves recycled water to VWC for the Westridge Golf Course and miscellaneous landscape irrigation. This Plan presents estimates of potential supply and demand for 2005 to 2030 in five year increments, as well as CLWA's proposed incentives and optimization plan.

5.0 WATER QUALITY

Chapter 5 describes the water quality of both groundwater and imported water supplies and discusses potential water quality impacts on supply reliability. As mentioned above, perchlorate contamination control is a major issue in CLWA's service area. The contamination is associated with the former Whittaker-Bermite site. Extensive investigations, management plans, and control actions to address this issue have been undertaken and are described in detail in this Plan. It has been determined that the programs underway should restore the impaired wells during 2006.

6.0 RELIABILITY PLANNING

The Act requires urban water suppliers to assess water supply reliability that compares total projected water used with the expected water supply over the next twenty years in five year increments. The Act also requires an assessment for a single dry year and multiple dry years. Chapter 6 presents the reliability assessment for CLWA's service area.

It is the stated goal of CLWA and the retail water purveyors to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next 25 years in combination with conservation of non-essential demand during certain dry years, the Plan successfully achieves this goal.

The organization of the reliability tables presented in this Plan varies from those presented in the 2000 Plan Amendment to follow more closely with the recommended tables provided in the DWR "Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan," dated January 18, 2005.

7.0 WATER DEMAND MANAGEMENT MEASURES AND BEST MANAGEMENT PRACTICES

Establishing goals and choosing water conservation measures is a continuing planning process. Goals are developed, adopted, and then evaluated periodically. Specific conservation measures are phased in and then evaluated for their effectiveness, achievement of desired results, and customer satisfaction. Chapter 7 of this plan summarizes DMMs and BMPs in both the implementation and development stages. CLWA and the retail water purveyors have been aggressively implementing DMM and BMP programs even though implementation is voluntary. Activities include water audits/repairs, public outreach, conservation pricing, residential plumbing retrofit, residential ultra low flush toilet replacement, large landscape conservation, and conservation programs for commercial, industrial, and institutional accounts. CLWA and the retail purveyors continue development and implementation of a comprehensive program.

8.0 WATER SHORTAGE CONTINGENCY PLANNING

Water supplies may be interrupted or reduced significantly in a number of ways, such as a drought which limits supplies, an earthquake which damages water delivery or storage facilities, or a toxic spill that affects water quality. Chapter 8.0 of this Plan describes how CLWA and the retail water purveyors plan to respond to such emergencies so that customer needs are met promptly and equitably.

Chapter 1
INTRODUCTION

Chapter 1.0
INTRODUCTION

1.1 OVERVIEW

This volume presents the Urban Water Management Plan 2005 (Plan) for the Castaic Lake Water Agency (Agency, CLWA) service area, which includes four retail water purveyors. This chapter describes the general purpose of the Plan, discusses Plan implementation, and provides general information about CLWA, retail purveyors, and service area characteristics. A list of acronyms and abbreviations is also provided.

1.2 PURPOSE

An Urban Water Management Plan (UWMP) is a planning tool that generally guides the actions of water management agencies. It provides managers and the public with a broad perspective on a number of water supply issues. It is not a substitute for project-specific planning documents, nor was it intended to be when mandated by the State Legislature. For example, the Legislature mandated that a plan include a section which "describes the opportunities for exchanges or water transfers on a short-term or long-term basis." (California Urban Water Planning Act, Article 2, Section 10630(d).) The identification of such opportunities, and the inclusion of those opportunities in a general water service reliability analysis, neither commits a water management agency to pursue a particular water exchange/transfer opportunity, nor precludes a water management agency from exploring exchange/transfer opportunities not identified in the plan. When specific projects are chosen to be implemented, detailed project plans are developed, environmental analysis, if required, is prepared, and financial and operational plans are detailed.

In short, this Plan is a management tool, providing a framework for action, but not functioning as a detailed project development or action. It is important that this Plan be viewed as a long-term, general planning document, rather than as an exact blueprint for supply and demand management. Water management in California is not a matter of certainty, and planning projections may change in response to a number of factors. From this perspective, it is appropriate to look at the Plan as a general planning framework, not a specific action plan. It is an effort to generally answer a series of planning questions including:

- What are the potential sources of supply and what is the reasonable probable yield from them?
- What is the probable demand, given a reasonable set of assumptions about growth and implementation of good water management practices?
- How well do supply and demand figures match up, assuming that the various probable supplies will be pursued by the implementing agency?

Using these "framework" questions and resulting answers, the implementing agency will pursue feasible and cost-effective options and opportunities to meet demands. CLWA and the retail water purveyors will explore enhancing basic supplies from traditional sources such as the State Water Project (SWP) as well as other options. These include groundwater extraction, water

exchanges, recycling, desalination, and water banking/conjunctive use. Specific planning efforts will be undertaken in regard to each option, involving detailed evaluations of how each option would fit into the overall supply/demand framework, how each option would impact the environment, and how each option would affect customers. The objective of these more detailed evaluations would be to find the optimum mix of conservation and supply programs that ensure that the needs of the customers are met.

The California Urban Water Management Planning Act (Act) requires preparation of a plan that:

- Accomplishes water supply planning over a 20-year period in five year increments. (CLWA and the purveyors are going beyond the requirements of the Act by developing a plan which spans 25 years.)
- Identifies and quantifies adequate water supplies, including recycled water, for existing and future demands, in normal, single-dry, and multiple-dry years.
- Implements conservation and efficient use of urban water supplies.

A checklist to ensure compliance of this Plan with the Act requirements is provided in Appendix A.

In short, the Plan answers the question: *Will there be enough water for the Santa Clarita Valley community in future years, and what mix of programs should be explored for making this water available?*

It is the stated goal of CLWA and the retail water purveyors to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next 25 years in combination with conservation of non-essential demand during certain dry years, the Plan successfully achieves this goal.

1.3 IMPLEMENTATION OF THE PLAN

The CLWA service area includes the service areas of four local retail water agencies. This Plan has been prepared for the CLWA and three of the purveyors: CLWA Santa Clarita Water Division (SCWD), Newhall County Water District (NCWD), and Valencia Water Company (VWC). The fourth purveyor, Los Angeles County Waterworks District No. 36 (LACWWD #36), is not required to prepare a Plan because the District does not provide water to more than 3,000 customers or supply more than 3,000 acre-feet (af) of water annually; however, LACWWD #36 participated in the development of the Plan on an "ad-hoc" basis. This subsection provides the cooperative framework within which the Plan will be implemented including agency coordination, public outreach, and resources maximization.

1.3.1 Joint Preparation of the Plan

Water agencies are permitted by the State to work together to develop a cooperative regional plan. This approach has been adopted by the water agencies in the Santa Clarita Valley (Valley), which are jointly sponsoring the current Plan. Water resource specialists with expertise in water resource management were retained to assist the local water agencies in preparing the details of the Plan. Agency coordination for this Plan is summarized in Table 1-1.

Table 1-1
Agency Coordination Summary

	Participated in UWMP Development	Received Copy of Draft	Commented on Draft	Attended Public Meetings	Contacted for Assistance	Sent Notice of Intent to Adopt	Not Involved
Antelope Valley-East Kern Water Agency					✓		
California Department of Water Resources	✓				✓		
Castaic Lake Water Agency	✓	✓	✓	✓	✓		
Castaic Town Council		✓	✓	✓	✓		
City of Santa Clarita Department of Planning and Building Services		✓		✓	✓	✓	
CLWA Santa Clarita Water Division	✓	✓	✓	✓	✓		
LA County Department of Regional Planning		✓			✓	✓	
Los Angeles County Supervisor Mike Antonovich (representatives)				✓	✓		
LA County Waterworks District No. 36	✓	✓	✓	✓	✓		
Metropolitan Water District of Southern California		✓			✓		
Newhall County Water District	✓	✓	✓	✓	✓		
Valencia Water Company	✓	✓	✓	✓	✓		
Ventura County Resource Management Agency		✓			✓	✓	
Westranch Town Council					✓		

1.3.2 Public Outreach

The water agencies have encouraged community participation in water planning. For the current Plan, public sessions were held for review and to solicit input on the Draft Plan before its adoption. Interested groups were informed about the development of the Plan along with the schedule of public activities. Notices of public meetings were published in the local press. Copies of the Draft Plan were made available at the water agencies' offices, local public libraries and sent to the City of Santa Clarita, the County of Los Angeles, and the County of Ventura, as well as interested parties. Water agencies also convened meetings with various interests to gather data concerning planned development and the probable implementation of approved development. Such informed data gathering on important issues is a means of checking the short-term "reality" of official projections and understanding the concerns of various groups.

CLWA contracted with a local public relations firm to coordinate preparation of the Plan with the local community. CLWA notified the cities and counties within its service area of the opportunity to provide input regarding the Plan. Table 1-2 presents a timeline for public participation during the development of the Plan. A copy of the public outreach materials,

including paid advertisements, newsletter covers, website postings, and invitation letters are attached in Appendix B.

Table 1-2
Public Participation Timeline

April 7, 2005	Kick-off Community Workshop	Describe UWMP requirements and process
June 27, 2005	Preliminary Draft UWMP	Preliminary Draft released to solicit input
June 29, 2005	Community Workshop	Review UWMP and solicit input
August 31, 2005	Follow-up Community Workshop	Release Draft UWMP and review contents
September 28, 2005	First CLWA Public Hearing	Review contents of Draft UWMP and take comments
October 26, 2005	Second CLWA Public Hearing	UWMP considered for approval by the CLWA Board and NCWD Board (at a joint meeting)

The components of public participation include:

Local Media

- Paid advertisements in local newspapers
- Meeting(s) with local editorial boards (Daily News and Signal)

Community-based Outreach

- Building Industry Association
- Castaic Town Council
- Chamber of Commerce
- Friends of the Santa Clara River
- Santa Clarita Valley Well Owners Association
- Santa Clarita Organization for Planning the Environment (SCOPE)
- Sierra Club
- Valencia Industrial Association
- Westranch Town Council

Water Agencies Public Participation

- Presentation(s) to NCWD Board – March, May, September, and October
- Presentation(s) to CLWA Board – March, May, July, September, and October

City/County Outreach

- Meeting with City Planning Division – March, May, and July

- Meeting with Los Angeles County Department of Regional Planning – March, May, and July
- Meeting with Supervisor Antonovich representative(s) Millie Jones, Paul Novak – May and July

Public Availability of Documents

- Water Agencies' websites
- City Hall
- Local libraries

1.3.3 Resources Maximization

Several documents were developed to enable CLWA to maximize the use of available resources and minimize use of imported water, including the Groundwater Management Plan (GWMP), Santa Clara River Valley Memorandum of Understanding, Water Supply Reliability Plan Draft Report, and the 2004 Santa Clarita Valley Water Report. Chapter 3 of this Plan describes in detail the water resources available to CLWA and the retail purveyors for the 25-year period covered by the Plan. Additional discussion regarding documents developed to maximize resources is included in Section 3.3.2 and Chapter 6.

1.4 THE WATER AGENCIES OF THE SANTA CLARITA VALLEY

1.4.1 Castaic Lake Water Agency

CLWA was formed in 1962 for the purpose of contracting with the California Department of Water Resources (DWR) to provide a supplemental supply of imported water to the water purveyors in the Valley. CLWA serves an area of 195 square miles in Los Angeles and Ventura Counties.

CLWA is a SWP contractor with an annual contractual Table A Amount of 95,200 af. Table A Amount (formerly referred to as "entitlement") is named for the "Table A" in each SWP contractor's Water Supply Contract. It contains an annual buildup in Table A Amounts of SWP water, from the first year of the Water Supply Contract through a specific year, based on growth projections made before the Water Supply Contract was executed. For most contractors, the maximum annual Table A Amount was reached in 1990. The total of all SWP contractors' maximum Table A Amounts is currently about 4.17 million af.

CLWA's original SWP Water Supply Contract with DWR was amended in 1966 for a maximum annual Table A Amount of 41,500 af. In 1991, CLWA purchased 12,700 af of annual Table A Amount from a Kern County water district and in 1999 purchased 41,000 af of annual Table A Amount from another Kern County water district, for a current total annual Table A Amount of 95,200 af.[1] CLWA wholesales this imported water to each of the local retail water purveyors through an extensive transmission pipeline system.

Though the reliability of SWP water is variable due to weather-related issues and environmental factors, SWP water remains an important supplemental water supply source for the Valley in the long-term. An important element to enhancing the long-term water supply reliability of SWP supplies is the effective use of water banking/conjunctive-use programs, such as those described in this Plan.

1.4.2 Retail Water Purveyors

Four retail purveyors provide water service to most residents of the Valley.

SCWD's service area includes portions of the city of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Canyon Country, Newhall, and Saugus. SCWD supplies water from local groundwater and CLWA imported water.

LACWWD #36's service area includes the Hasley Canyon area in the unincorporated community of Val Verde. During most years, the District obtains its water supply from CLWA.

NCWD's service area includes portions of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Newhall, Canyon Country, Saugus, and Castaic. The District supplies water from local groundwater and CLWA imported water.

VWC's service area includes a portion of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Castaic, Stevenson Ranch, and Valencia. VWC supplies water from local groundwater, CLWA imported water, and recycled water.

The service area for CLWA and the retail water purveyors is shown on Figure 1-1.

[1] CLWA's contract rights to SWP water total 95,200 acre feet per year ('afy"), including a water transfer of 41,000 afy approved in 1999 from Wheeler Ridge-Maricopa Water Storage District, a member unit of the Kern County Water Agency. CLWA's Environmental Impact Report ("EIR") prepared in connection with the 41,000 afy water transfer was challenged in *Friends of the Santa Clara River v. Castaic Lake Water Agency* (Los Angeles County Superior Court, Case Number BS056954) ("*Friends*"). That action was dismissed with prejudice (permanently) in February 2005. New challenges to CLWA's environmental review of the transfer were filed in January 2005 (*i.e., Planning and Conservation League v. Castaic Lake Water Agency*, Los Angeles County Superior Court Case Number BS098724). A more detailed discussion of these new challenges and the reasons the challenges will have no impact on the amount of water available to CLWA can be found at Section 3.2.2.

Castaic Lake Water Agency Service Area

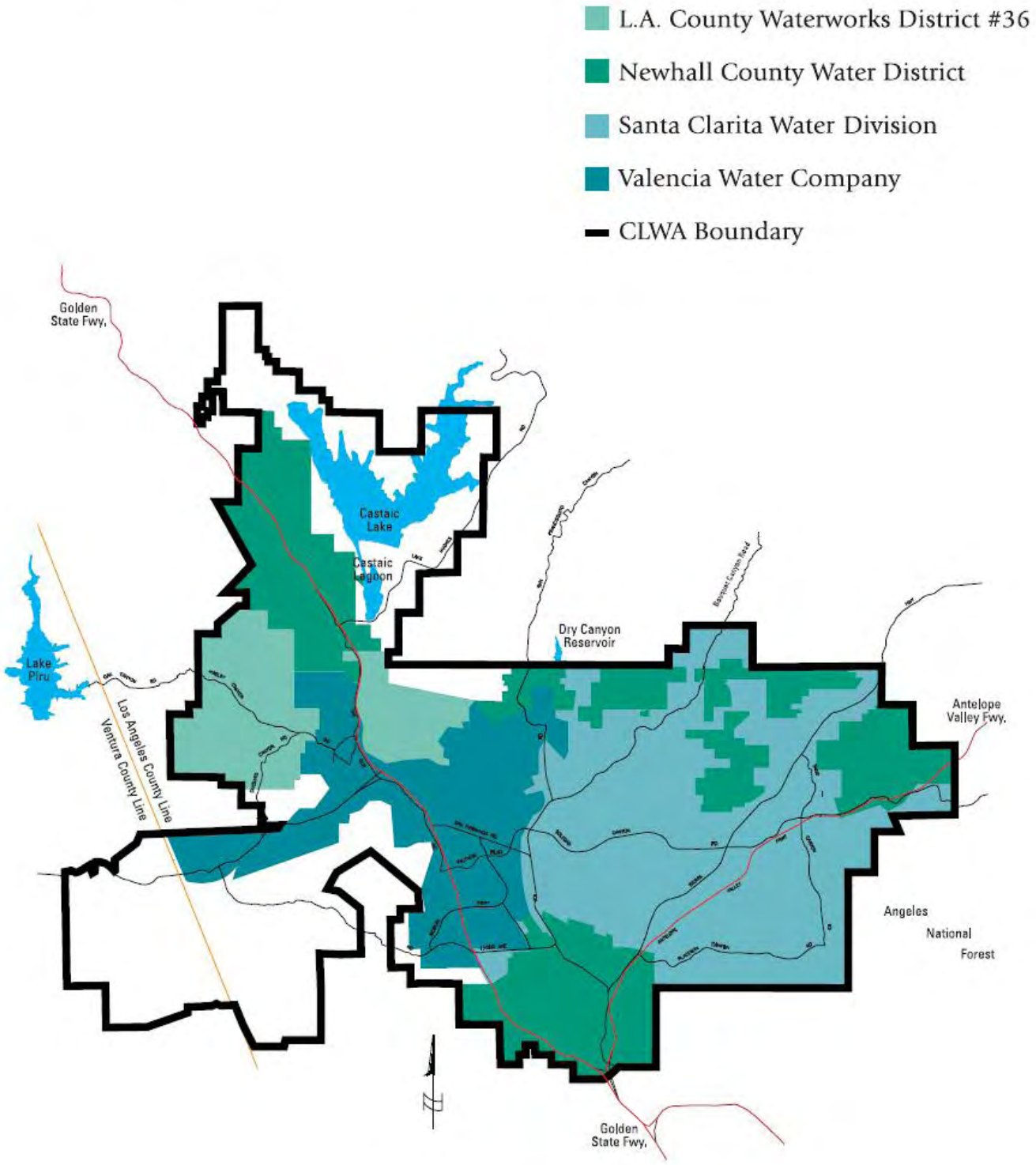


Figure 1-1
Castaic Lake Water Agency Service Area

As of mid-2005, the retail water purveyors served about 65,800 connections, as presented in Table 1-3.

Table 1-3
Retail Water Service Connections

Retail Water Purveyor	Connections
CLWA Santa Clarita Water Division (SCWD)	26,784
Los Angeles County Waterworks District No. 36 (LACWWD # 36)	1,311
Newhall County Water District (NCWD)	9,112
Valencia Water Company (VWC)	28,602
Total Connections	**65,809**

1.5 CLIMATE

The climate in CLWA's service area is generally semi-arid and warm. Summers are dry with temperatures as high as 110°F. Winters are somewhat cool with temperatures as low as 20°F. Average rainfall is about 17.64 inches per year in the flat areas and about 27 inches in the mountains. The region is subject to wide variations in annual precipitation and also experiences periodic wildfires. Table 1-4 presents the region's annual average climate data. Standard Monthly Average data was generated from 1996-2005 data. Average Monthly Rainfall data is provided for 1980-2004, and Average Maximum Temperature data is provided for 1971-2000.

Table 1-4
Climate Data for the Santa Clarita Valley

	Jan	Feb	Mar	Apr	May	Jun
Standard Monthly Average ETo[(1)]	2.20	2.45	3.64	4.74	5.31	6.06
Average Rainfall (inches) [(2)]	3.52	4.88	3.13	0.88	0.28	0.06
Average Max. Temperature (Fahrenheit) [(3)]	64.2	66.0	68.7	73.1	79.9	88.0

	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Standard Monthly Average ETo[(1)]	6.75	6.66	5.01	3.95	2.73	2.31	51.81
Average Rainfall (inches)[(2)]	0.03	0.05	0.15	0.88	1.29	2.49	17.64
Average Max. Temperature (Fahrenheit) [(3)]	94.9	94.9	89.4	81.3	69.1	65.2	78.1

Notes:
(1) ETo (evapotranspiration) data provided for Glendale region, http://wwwcimis.water.ca.gov/cimis/welcome.jsp
(2) Average Monthly Rainfall data gathered from long-term average precipitation records from Newhall-Soledad 32c gage during period 1980-2004.
(3) Temperature data provided for Dry Canyon Reservoir region, http://www.wrcc.dri.edu/CLIMATEDATA.html

1.6 Potential Effects of Global Warming

A topic of growing concern for water planners and managers is global warming and the potential impacts it could have on California's future water supplies. DWR's Draft California Water Plan Update 2005 contains the first-ever assessment of such potential impacts in a California Water Plan.

Volume 1, Chapter 4 of the California Water Plan, "Preparing for an Uncertain Future," lists some potential impacts of global warming, based on more than a decade of scientific studies on the subject:

- Could produce hydrologic conditions, variability, and extremes that are different from what current water systems were designed to manage
- May occur too rapidly to allow sufficient time and information to permit managers to respond appropriately
- May require special efforts or plans to protect against surprises or uncertainties

Should global warming increase over time, it may cause a number of changes impacting future water supplies, including changes in Sierra snowpack patterns (the source of the SWP's water supply in Lake Oroville), hydrologic patterns, sea level, rainfall intensity, and statewide water demand. Computer models (such as CALVIN) have been developed to show water planners how California water management might adapt to climate change. DWR has committed to continue to update and refine these models based on ongoing scientific data collection and to incorporate this information into future California Water Plans. As DWR develops more specific assessments of the potential effects of climate change on SWP delivery reliability and water demands, CLWA and the purveyors can update their plans accordingly.

1.7 OTHER DEMOGRAPHIC FACTORS

Water service is provided to residential, commercial, industrial, institutional, recreational, and agricultural customers and for environmental and other uses, such as fire protection and pipeline cleaning.

Recently, the Valley area (along with most of California) has experienced significant increases in both single family and multi-family residential construction, as well as in commercial and industrial construction. As the local population has increased, the demand for water has also increased.

1.8 LIST OF ABBREVIATIONS AND ACRONYMS

The following abbreviations and acronyms are used in this report.

AB	Assembly Bill
ACOE	U.S. Army Corps of Engineers
Act	California Urban Water Management Planning Act
af	acre-feet
afy	acre-feet per year
Agency	Castaic Lake Water Agency
AWWARF	American Water Works Association Research Foundation
Basin	Santa Clara River Valley Groundwater Basin, East Subbasin
BMPs	Best Management Practices

CCF	One Hundred Cubic Feet
CCR	Consumer Confidence Report
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CLWA	Castaic Lake Water Agency
CUWCC	California Urban Water Conservation Council
CVP	Central Valley Project
DBP	Disinfection by-products
Delta	Sacramento-San Joaquin Delta
DHS	California Department of Health Services
DMM	Demand Management Measures
DOF	Department of Finance
DTSC	Department of Toxic Substances Control
DWR	California Department of Water Resources
EC	Electrical conductivity
Edison	Southern California Edison
EIR	Environmental Impact Report
EPA	Environmental Protection Agency
gpcd	gallons per capita per day
gpd	gallons per day
gpm	gallons per minute
GWMP	Groundwater Management Plan
KCWA	Kern County Water Agency
LACDRP	Los Angeles County Department of Regional Planning
LACSD	Sanitation Districts of Los Angeles County
LACWWD #36	Los Angeles County Waterworks District # 36
M&I	Municipal and Industrial
Metropolitan	Metropolitan Water District of Southern California
mgd	million gallons per day
mg/L	milligrams per liter
MOU	Memorandum of Understanding
NCWD	Newhall County Water District
NPDES	National Pollutant Discharge Elimination System
OVOV	One Valley One Vision
Plan	Urban Water Management Plan 2005
PUC	California Public Utilities Commission
RAP	Remedial Action Plan
RO	Reverse Osmosis
RTP	Regional Transportation Plan
RWQCB	Regional Water Quality Control Board
SCAG	Southern California Association of Governments

SCLLC	Santa Clarita LLC
SCOPE	Santa Clarita Organization for Planning the Environment
SCWC	Santa Clarita Water Company
SCWD	Santa Clarita Water Division
Semitropic	Semitropic Water Storage District
SWP	State Water Project
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
umhos/cm	Micromhos per centimeter
UWCD	United Water Conservation District
UWMP	Urban Water Management Plan
Valley	Santa Clarita Valley
VWC	Valencia Water Company
WRP	Waste Water Reclamation Plant

Chapter 2
WATER USE

Chapter 2.0
WATER USE

2.1 OVERVIEW

This chapter describes historic and current water usage and the methodology used to project future demands within CLWA's service area. Water usage is divided into sectors such as residential, industrial, institutional, landscape, agricultural, and other purposes. To undertake this evaluation, existing land use data and new housing construction information were compiled from each of the retail water purveyors and projections prepared by "One Valley One Vision" (OVOV), a joint planning effort by the City of Santa Clarita and Los Angeles County Department of Regional Planning (LACDRP). This information was then compared to historical trends for new water service connections and customer water usage information. In addition, weather and water conservation effects on historical water usage were factored into the evaluation.

The methodology used to project future demands within CLWA's service area included three steps: (1) obtain projected demands to 2030 from each water purveyor, (2) compare projections based on historical records to the totals developed by the purveyors, and (3) compare these results with the OVOV Plan for consistency with the General Plan.

This approach allowed the comparison of three different sources of data and projections to be evaluated. Several factors can affect demand projections, including:

- Land use revisions
- New regulations
- Consumer choice
- Economic conditions
- Transportation needs
- Highway construction
- Environmental factors
- Conservation programs
- Plumbing codes

The foregoing factors affect the amount of water needed, as well as the timing of when it is needed. Past experience in the Valley has indicated that the economy is the biggest factor in determining water demand projections. During an economic recession, there is a major downturn in development and a subsequent slowing of the projected demand for water. The projections in this Plan do not attempt to forecast recessions or droughts. Likewise, no speculation is made about future plumbing codes or other regulatory changes. However, the projections do include water conservation, which is projected to reduce overall water demand by 10 percent. There have been, and continue to be, major efforts statewide to conserve water, which have been successful.

2.2 HISTORIC WATER USE

Predicting future water supply requires accurate historic water use patterns and water usage records. Both the economy and entitlement process (compliance with the California Environmental Quality Act [CEQA]) are key factors impacting growth in population and demand. Figure 2-1 illustrates the steady increase in Valley water demand since 1980.

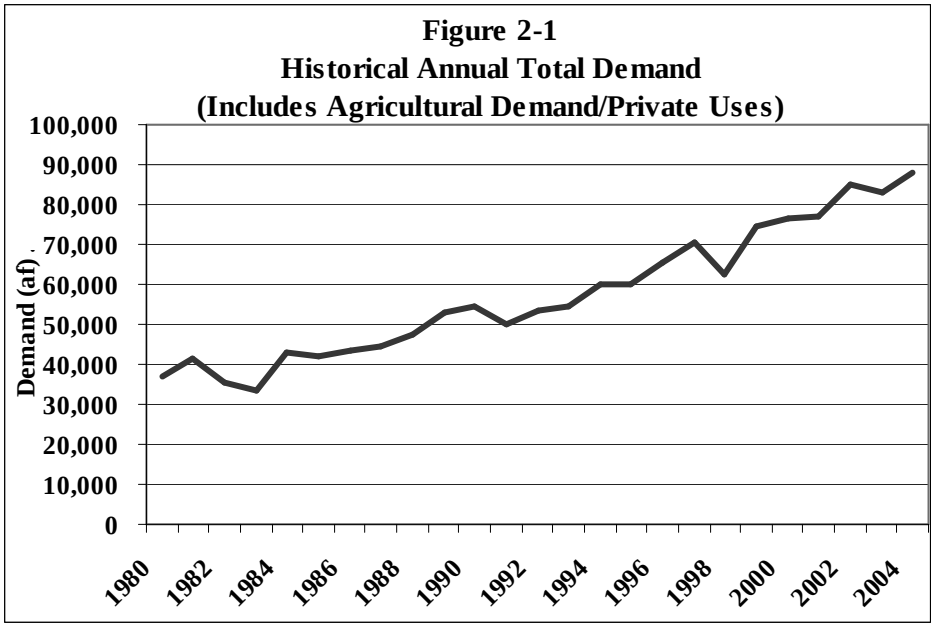


Table 2-1 presents the historical accounts and deliveries by retail purveyor since 1990. The type of customer accounts included in the table are single family homes, multi-family homes, commercial, industrial, institutional/government, and landscape.

Table 2-1
Historical Accounts and Deliveries by Retail Purveyor

Purveyor		1990	1992	1994	1996	1998	2000	2002	2004
CLWA	No. Accounts	18,550	19,000	19,400	19,650	20,300	21,970	24,175	26,161
SCWD	Deliveries (af)	18,503	17,551	19,911	22,006	20,319	25,280	28,434	29,191
LACWWD	No. Accounts	706	736	752	768	774	972	1,200	1,300
#36	Deliveries (af)	513	456	500	533	578	758	1,071	1,302
NCWD	No. Accounts	6,039	6,230	6,373	6,475	6,726	7,434	7,941	8,970
	Deliveries (af)	7,813	7,973	7,754	8,916	8,782	9,623	9,869	10,555
VWC	No. Accounts	13,965	14,520	15,359	17,009	19,389	21,661	24,453	27,238
	Deliveries (af)	16,572	15,338	17,390	19,721	19,874	25,190	28,360	30,682
Total	No. Accounts	39,260	40,486	41,884	43,902	47,189	52,037	57,769	63,669
	Deliveries (af)	43,401	41,318	45,555	51,176	49,553	60,851	67,734	71,730
	af/Account	1.11	1.02	1.09	1.17	1.05	1.17	1.17	1.13

2.3 PROJECTED WATER USE

2.3.1 Purveyor Projections

Each of the four retail water purveyors provided projected water demands based on the projects that are under evaluation, are in the planning process, or the result of its own water planning efforts for its service area. The purveyors maintain historical data, as well as work closely with property owners and developers in their service areas, to ensure they have an adequate water supply and the necessary infrastructure to provide water service.

Since there are only four purveyors in the service area, there is close coordination and exchange of data. SCWD's engineering department continually updates expected demands and infrastructure needs. NCWD prepared a "Water Supply Assessment" in 2004 that is the basis for NCWD's projected demand. VWC is a California Public Utilities Commission (PUC)-regulated water supplier and is required to regularly provide its service plan for rate increases and service area changes. Table 2-2 summarizes the purveyors' projected water demands through 2030.

Table 2-2
Projected Water Demands

Purveyor	Demand (af)						Annual Increase
	2005	2010	2015	2020	2025	2030	
CLWA SCWD	30,400	35,000	39,100	43,100	47,100	51,100	2.1%
LACWWD #36	1,300	1,600	1,800	2,000	2,400	2,800	3.1%
NCWD	11,800	14,400	16,000	17,700	19,300	21,000	2.4%
VWC	30,200	35,100	40,200	43,700	50,600	54,400	2.4%
Total Purveyor	**73,700**	**86,100**	**97,100**	**106,500**	**119,400**	**129,300**	2.2%
Agricultural/Private Uses	15,600	13,950	12,300	10,650	9,000	9,000	--
Total (w/o conservation)	**89,300**	**100,050**	**109,400**	**117,150**	**128,400**	**138,300**	**--**
Conservation (1)	(7,370)	(8,610)	(9,710)	(10,650)	(11,940)	(12,930)	--
Total (w/conservation)	81,930	91,440	99,690	106,500	116,460	125,370	1.3%

Notes:
(1) Assumes 10 percent reduction on urban portion of demand resulting from conservation best management practices (see Chapter 7).

Tables 2-3 through 2-6 present the past, current, and projected water deliveries by customer type for the CLWA SCWD, LACWWD #36, NCWD, and VWC, respectively.

Table 2-3
Past, Current, and Projected Water Deliveries (by customer type)
CLWA Santa Clarita Water Division

Year		Water Use Sectors	Single Family	Multi-Family	Comm-ercial	Industrial	Institutional/ Government	Landscape	Total
2000	metered	No. of accounts	16,906	3,784	537	48	83	612	21,970
		Deliveries (af)	15,966	2,669	930	1,096	893	3,726	25,280
2005	metered	No. of accounts	20,550	4,800	650	50	125	700	26,875
		Deliveries (af)	19,139	3,386	1,126	1,142	1,345	4,262	30,400
2010	metered	No. of accounts	23,575	5,800	750	60	175	800	31,160
		Deliveries (af)	21,486	4,091	1,299	1,370	1,883	4,871	35,000
2015	metered	No. of accounts	25,715	6,800	850	70	225	900	34,560
		Deliveries (af)	23,333	4,796	1,472	1,598	2,421	5,480	39,100
2020	metered	No. of accounts	27,855	7,800	950	80	275	1,000	37,960
		Deliveries (af)	25,080	5,501	1,645	1,826	2,959	6,089	43,100
2025	metered	No. of accounts	29,995	8,800	1,050	90	325	1,100	41,360
		Deliveries (af)	26,827	6,206	1,818	2,054	3,497	6,698	47,100
2030	metered	No. of accounts	32,135	9,800	1,150	100	375	1,200	44,760
		Deliveries (af)	28,574	6,911	1,991	2,282	4,035	7,307	51,100

Table 2-4
Past, Current, and Projected Water Deliveries (by customer type)
Los Angeles County Waterworks District No. 36

Year		Water Use Sectors	Single Family	Multi-Family	Comm-ercial	Const/ Industrial	Institutional/ Government	Landscape	Total
2000	metered	No. of accounts	948	5	0	10	5	4	972
		Deliveries (af)	643	29	0	54	20	12	758
2005	metered	No. of accounts	1,275	5	0	10	5	5	1,300
		Deliveries (af)	1,185	29	0	54	20	12	1,300
2010	metered	No. of accounts	1,575	5	0	10	5	4	1,600
		Deliveries (af)	1,480	30	0	56	21	12	1,600
2015	metered	No. of accounts	1,774	5	0	11	5	4	1,800
		Deliveries (af)	1,676	31	0	58	22	13	1,800
2020	metered	No. of accounts	1,973	6	0	11	6	4	2,000
		Deliveries (af)	1,872	32	0	60	22	13	2,000
2025	metered	No. of accounts	2,372	6	0	11	6	5	2,400
		Deliveries (af)	2,268	33	0	62	23	14	2,400
2030	metered	No. of accounts	2,772	6	0	12	6	5	2,800
		Deliveries (af)	2,665	34	0	63	23	14	2,800

Table 2-5
Past, Current, and Projected Water Deliveries (by customer type)
Newhall County Water District

Year		Water Use Sectors	Single Family	Multi-Family	Commercial	Construction/ Industrial	Institutional/ Government	Landscape	Total
2000	metered	No. of accounts	6,608	293	377	11	18	127	7,434
		Deliveries (af)	5,556	1,537	872	411	119	1,128	9,623
2005	metered	No. of accounts	8,047	293	399	35	59	232	9,065
		Deliveries (af)	7,243	1,969	891	207	133	1,357	11,800
2010	metered	No. of accounts	9,735	425	425	60	75	300	11,020
		Deliveries (af)	8,750	2,485	999	250	176	1,740	14,400
2015	metered	No. of accounts	10,730	450	450	85	90	425	12,230
		Deliveries (af)	9,475	2,595	1,038	315	212	2,365	16,000
2020	metered	No. of accounts	11,865	475	475	110	105	550	13,580
		Deliveries (af)	10,385	2,750	1,066	375	234	2,890	17,700
2025	metered	No. of accounts	12,620	500	500	135	120	675	14,550
		Deliveries (af)	11,000	2,900	1,114	425	261	3,600	19,300
2030	metered	No. of accounts	14,050	525	525	160	135	800	16,195
		Deliveries (af)	12,275	3,000	1,140	500	285	3,800	21,000

Table 2-6
Past, Current, and Projected Water Deliveries (by customer type)
Valencia Water Company

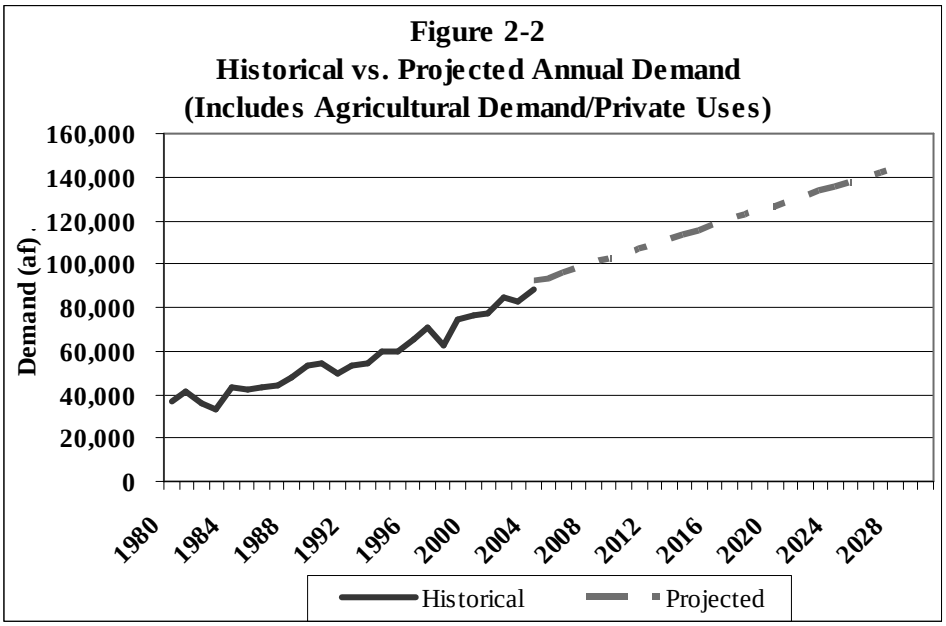
Year		Water Use Sectors	Single Family	Multi-Family	Comm-ercial	Industrial	Institutional/ Government	Landscape	Total
2000	metered	No. of accounts	19,805	191	876	382	406	1	21,661
		Deliveries (af)	12,112	1,373	5,798	1,759	3,711	437	25,190
2005	metered	No. of accounts	25,067	364	1,307	452	505	3	27,698
		Deliveries (af)	14,526	1,646	6,949	2,108	4,448	523	30,200
2010	metered	No. of accounts	29,405	2,035	1,615	558	624	3	34,240
		Deliveries (af)	17,147	2,186	8,611	2,399	4,465	292	35,100
2015	metered	No. of accounts	30,724	8,176	1,998	690	772	3	42,363
		Deliveries (af)	17,998	4,151	9,882	2,753	5,124	292	40,200
2020	metered	No. of accounts	31,234	13,203	2,282	788	882	3	48,392
		Deliveries (af)	18,326	5,760	10,752	2,995	5,575	292	43,700
2025	metered	No. of accounts	36,384	14,341	2,605	900	1,007	3	55,240
		Deliveries (af)	21,803	6,124	12,454	3,469	6,458	292	50,600
2030	metered	No. of accounts	39,484	14,391	2,767	956	1,069	3	58,670
		Deliveries (af)	23,909	6,140	13,388	3,729	6,942	292	54,400

2.3.2 Projections Based On Historical Use

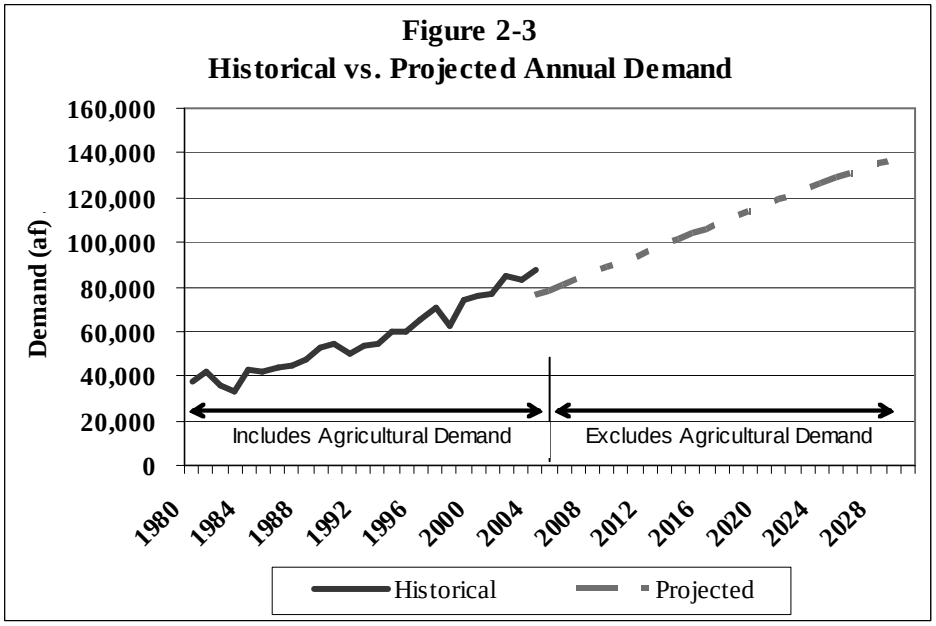
Another methodology to forecast demand involves projecting historical water use into the future. Mathematical methods are used to perform this projection. A correlation factor to the historical data of 1.0 would be considered the most exact. The ideal method results in a correlation of 0.9 or greater. For this Plan, a Linear Regression method was used to project demands, which resulted in a coefficient of correlation of 0.95.

2.3.2.1 Linear Regression Method

The Linear Regression method examines the historical growth in water demand and projects forward using linear regression. Figure 2-2 displays the growth in water demand since 1980 for the CLWA service area with a linear progression through the year 2030. Growth in demand has been relatively constant with some downturns that reflect either weather patterns or economic trends. The demand includes agricultural as well and municipal and industrial (M&I) uses.



On Figure 2-3, agricultural demand is removed to show M&I use only. As shown on Figure 2-3, results from the linear regression (after extracting the projected agricultural demands provided in Table 2-2) indicate a total 2030 demand of 137,100 af. This demand figure is comparable to the 129,300 af submitted by the purveyors (a six percent difference), as shown in Table 2-2.



2.3.2.2 Comparison to City and County Planning

The next step involved comparison of the purveyor-projected growth in water demand with the growth projections provided by local land use planning agencies. Table 2-7 is the result of the joint OVOV planning effort by the City of Santa Clarita and LACDRP.

Table 2-7
Adjusted Santa Clarita Valleywide General Plan [(1)(2)]
(SCAG 2004 RTP, Projections: Years 2000 to 2030)

Jurisdiction	2000 [(3)]	2005	2010	2015	2020	2025	2030	Change	Average Annual Growth
City of Santa Clarita									
Population	151,088	171,290	196,680	210,280	222,290	232,830	242,620	91,532	1.6%
Households	50,787	55,614	62,837	67,832	72,883	77,868	82,806	32,019	1.6%
Employment	51,380	59,640	68,820	73,240	77,490	81,460	85,190	33,810	1.7%
Jobs/Household ratio	*1.01*	*1.07*	*1.10*	*1.08*	*1.06*	*1.05*	*1.03*	0.02	
Persons per Household	*2.97*	*3.08*	*3.13*	*3.10*	*3.05*	*2.99*	*2.93*	(0.04)	
SCV Unincorporated Area									
Population	61,523	78,053	105,094	125,850	146,401	166,557	185,589	124,066	3.7%
Households	17,973	20,645	28,108	34,609	41,154	47,941	54,630	36,657	3.8%
Employment (estimated)	10,790	13,900	18,830	23,190	27,980	33,080	38,240	27,450	4.3%
Jobs/Household ratio	*0.60*	*0.67*	*0.67*	*0.67*	*0.68*	*0.69*	*0.70*	0.10	
Persons per Household	*3.42*	*3.78*	*3.74*	*3.64*	*3.56*	*3.47*	*3.40*	(0.03)	
SCV Planning Area[(4)]									
Population	212,611	249,343	301,774	336,130	368,691	399,387	428,209	215,598	2.4%
Households	68,760	76,259	90,945	102,441	114,037	125,809	137,436	68,676	2.3%
Employment	62,170	73,540	87,650	96,430	105,470	114,540	123,430	61,260	2.3%
Jobs/Household ratio	*0.90*	*0.96*	*0.96*	*0.94*	*0.92*	*0.91*	*0.90*	(0.01)	
Persons per Household	*3.09*	*3.27*	*3.32*	*3.28*	*3.23*	*3.17*	*3.12*	0.02	

Notes:
(1) Source: Stanley R. Hoffman Associates, Inc.; Southern California Association of Governments, 2004 Regional Transportation Plan (RTP).
(2) The SCAG population and household projections are used as control totals for the entire "One Valley One Vision" (OVOV) planning area while the allocation between the City and unincorporated areas is based on 2000-2003 Department of Finance (DOF) population and household trend data. The 1998-2003 Employment Development Department data is used to calibrate the 2005 base year for employment. However, the employment totals for the unincorporated area are allowed to exceed the SCAG RTP 2004 forecast based on local information from the County of Los Angeles Planning staff.
(3) 2000 Population and Household data is based on DOF estimates benchmarked to the 2000 U.S. Census Figures.
(4) The Santa Clarita Valley Planning Area estimates are the sum of the City and unincorporated area.
(5) On May 11, 2005, the OVOV Team agreed to use these adjusted RTP data for the OVOV General Plan Update.

The OVOV task force used the data provided by Southern California Association of Governments' (SCAG's) Regional Transportation Plan (RTP), the State Department of Finance (DOF), and the Employment Development Department. This joint effort was undertaken to ensure compatibility of planning efforts since the Valley is considered a realistic planning area with both City and County jurisdictions.

The annual rate of growth was examined to determine if the projected water demand was in accordance with the purveyors' projected growth shown in Table 2-2.

In Table 2-7, the OVOV projections indicate a 1.6 percent annual growth rate of population and households for the City of Santa Clarita, and 3.7 to 3.8 percent annual growth rates for the Valley Unincorporated Area. This results in a combined growth rate of 2.3 to 2.4 percent, which is

comparable to the purveyors' projected annual growth rate in water demand of 2.2 percent shown in Table 2-2.

Table 2-8 summarizes the projected Valley water use per household in af and in gallons per capita per day (gpcd). The data developed in this table is derived from the total annual demand projections provided in Table 2-2 divided by the projected annual populations and by the projected annual households provided in Table 2-7. Since the forecasted growth is based on households and population, it is not possible to obtain a direct match to number of service connections and water use per connection. However, based on 2005 population and water demand, the current estimated water use is 264 gpcd. The projected water use in 2030 of 270 gpcd remains very close to the 2005 water use of 264 gpcd, thus demonstrating that water demand and projected growth track closely. The term "household" is a term used by OVOV and does not equate to a single family residence.

Table 2-8
Projected Household Water Use

Projected Water Use	2005	2010	2015	2020	2025	2030
Water Use (af/household) (1)	0.97	0.95	0.95	0.93	0.95	0.94
Water Use (gpcd) (2)	264	255	258	258	267	270

Notes:

(1) Based on dividing the total annual demand projections provided in Table 2-2 by the projected annual households provided in Table 2-7.

(2) Based on dividing the total annual demand projections (converted from af to gpd) provided in Table 2-2 by the projected annual populations provided in Table 2-7.

An additional analysis was conducted by using actual 2004 water use (in gpcd) and multiplying that by the projected population from the OVOV population forecast (Table 2-7). 2004 actual water use was determined by taking the "2004 Santa Clarita Valley Water Report" M&I water use for 2004 and dividing that by the 2004 population. This resulted in an actual water use of 269 gpcd, which compares closely to the values presented in Table 2-8. Table 2-9 presents a summary of the comparison between the purveyors and OVOV demand projections. The projected demand by the purveyors varies from -0.20 percent to 5.62 percent of the water demand determined based on the OVOV population projections. This demonstrates that the purveyors' projections track closely with the anticipated growth projected by OVOV.

Table 2-9
Comparison of Purveyor and OVOV Demand Projections

Projection	Demand (af)					
	2005	2010	2015	2020	2025	2030
Purveyor (1)	73,700	86,100	97,100	106,500	119,400	129,300
OVOV (2)	75,136	90,936	101,288	111,100	120,350	129,035
Difference	1,436	4,836	4,188	4,600	950	(264)
Percent Difference	1.95%	5.62%	4.31%	4.32%	0.80%	-0.20%

Notes:

(1) Demand projections based on total puveyor projections provided in Table 2-2.

(2) Demand projections based on 269 gpcd multiplied by OVOV population projections provided in Table 2-7.

The data provided in Tables 2-3 through 2-6 indicates total estimated 2005 Valley water use to be (in af/connection) 1.13 for all connection types and 0.77 for a single family connection. These findings were compared with a study conducted by the American Water Works Association Research Foundation (AWWARF), Residential End Uses of Water (1999). This study compared residential water demand for several cities in the western United States. For comparison, the average annual water use (in af/connection) for a single family connection in Las Virgenes Municipal Water District and the City of San Diego are 0.87 and 0.47, respectively, which compare with the Valley water use of 0.77.

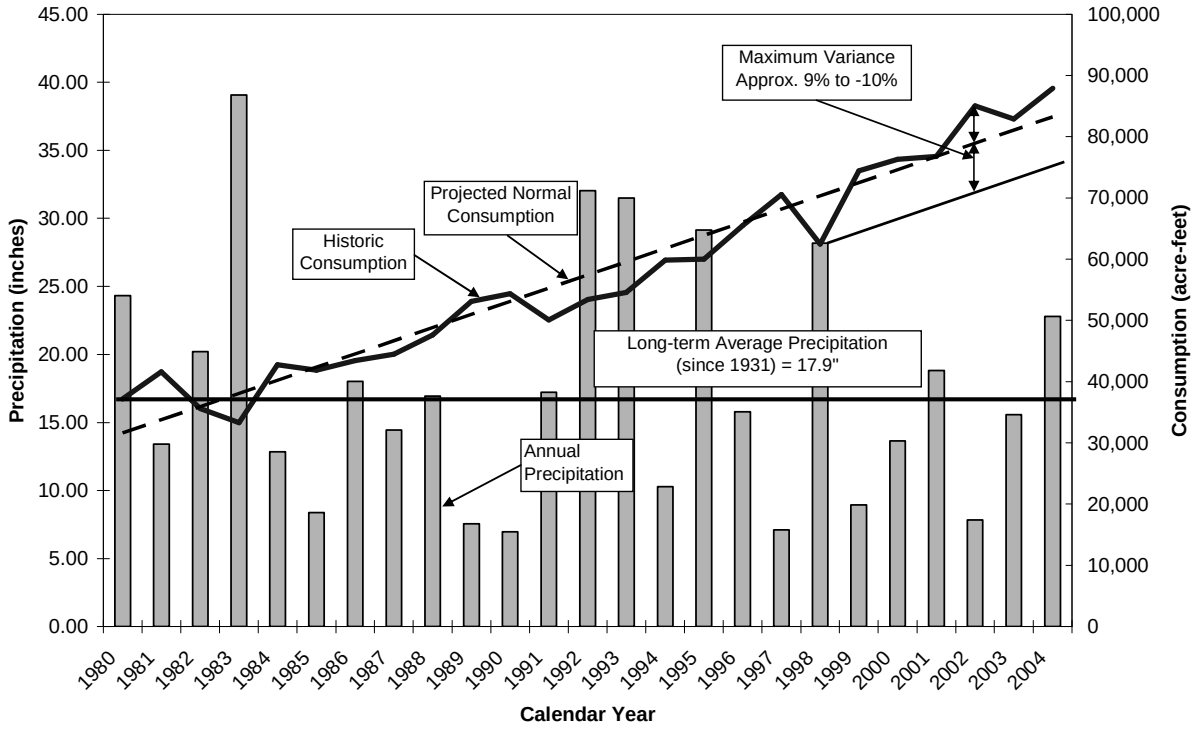
2.4 OTHER FACTORS AFFECTING WATER USAGE

Two major factors that affect water usage are weather and water conservation. Historically, when the weather is hot and dry, water usage increases. The amount of increase varies according to the number of consecutive years of hot, dry weather and the conservation activities imposed. During cool-wet years, historical water usage has decreased to reflect less water usage for external landscaping. Water conservation measures employed within the CLWA's and purveyors' service areas have a direct long-term effect on water usage. Both of these factors are discussed below in detail.

2.4.1 Weather Effects on Water Usage

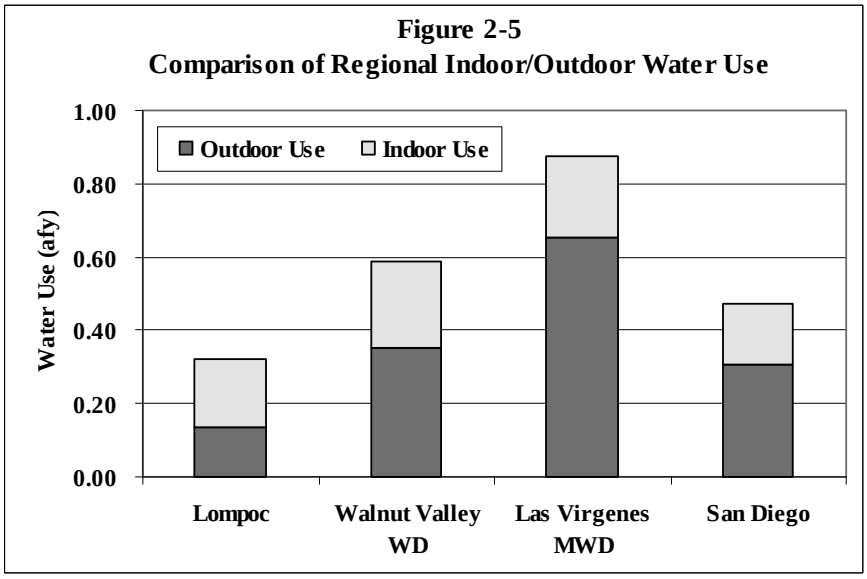
Historically, about 605 to 1,110 gallons of water are consumed daily for urban uses for every household in the CLWA's and purveyors' service areas. Most of this range in water use is due to seasonal weather variations. As presented on Figure 2-4, the historical water use from 1980 to 2004 fluctuated principally due to weather, with the maximum variance around the projected normal of approximately 9 percent higher use in hot, dry years to approximately 10 percent lower use in cool, wet years.

Figure 2-4
Weather Effects on Water Usage



The same AWWARF study described in Section 2.3.2.2 compared residential indoor and outdoor water use for several cities in the western United States. A comparison of the water use for four California locations is presented on Figure 2-5. As shown on the figure, indoor water use tracks closely among each of the four locations. However, outdoor use (landscaping), varies significantly among the locations. CLWA and the retail purveyors' water use correlates most closely with the data provided for Las Virgenes MWD.

Figure 2-5
Comparison of Regional Indoor/Outdoor Water Use



2.4.2 Conservation Effects on Water Usage

In recent years, water conservation has become an increasingly important factor in water supply planning in California. The California plumbing code has instituted requirements for new construction that mandate the installation of ultra low-flow toilets and low-flow showerheads. CLWA and the purveyors have developed water conservation measures that include public information and education programs. CLWA funds a toilet replacement program and, through its connection fee program, has provided financial incentives to developers for good water management practices.

During the 1987-1992 drought period, overall water requirements due to the effects of hot, dry weather were projected to increase by approximately 10 percent. As a result of extraordinary conservation measures enacted during the period, the overall water requirements actually decreased by more than 10 percent.

Residential, commercial, and industrial usage can be expected to decrease as a result of the implementation of more aggressive water conservation practices. As previously discussed, the greatest opportunity for conservation is in developing greater efficiency and reduction in landscape irrigation. The irrigation demand can represent as much as 50 percent of the water demand for residential customers depending upon lot size and amount of irrigated turf and plants. It is assumed that conservation will result in a long-term 10 percent reduction of demand.

Chapter 3
WATER RESOURCES

Chapter 3.0
WATER RESOURCES

3.1 OVERVIEW

This section describes the water resources available to CLWA and the purveyors for the 25-year period covered by the Plan. These are summarized in Table 3-1 and discussed in more detail below. Both currently available and planned supplies are discussed.

Table 3-1
Summary of Current and Planned Water Supplies and Banking Programs[1]

Water Supply Sources	Supply (af)					
	2005	2010	2015	2020	2025	2030
Existing Supplies						
Wholesale (Imported)	*70,380*	*73,660*	*75,560*	*76,080*	*77,980*	*77,980*
SWP Table A Supply (2)	65,700	67,600	69,500	71,400	73,300	73,300
Flexible Storage Account (CLWA) (3)	4,680	4,680	4,680	4,680	4,680	4,680
Flexible Storage Account (Ventura County) (3) (4)	0	1,380	1,380	0	0	0
Local Supplies						
Groundwater	*40,000*	*46,000*	*46,000*	*46,000*	*46,000*	*46,000*
Alluvial Aquifer	35,000	35,000	35,000	35,000	35,000	35,000
Saugus Formation	5,000	11,000	11,000	11,000	11,000	11,000
Recycled Water	1,700	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	112,080	121,360	123,260	123,780	125,680	125,680
Existing Banking Programs (3)						
Semitropic Water Bank (5)	50,870	50,870	0	0	0	0
Total Existing Banking Programs	50,870	50,870	0	0	0	0
Planned Supplies						
Local Supplies						
Groundwater	*0*	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*
Restored wells (Saugus Formation)	0	10,000	10,000	10,000	10,000	10,000
New Wells (Saugus Formation)	0	0	0	10,000	10,000	10,000
Recycled Water (6)	0	0	1,600	6,300	11,000	15,700
Transfers						
Buena Vista-Rosedale (7)	0	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	0	21,000	22,600	37,300	42,000	46,700
Planned Banking Programs (3)						
Rosedale-Rio Bravo	0	20,000	20,000	20,000	20,000	20,000
Additional Planned Banking	0	0	20,000	20,000	20,000	20,000
Total Planned Banking Programs	0	20,000	40,000	40,000	40,000	40,000

Notes:

(1) The values shown under "Existing Supplies" and "Planned Supplies" are supplies projected to be available in average/normal years. The values shown under "Existing Banking Programs" and "Planned Banking Programs" are either total amounts currently in storage, or the maximum capacity of program withdrawals.

(2) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available, taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005).

(3) Supplies shown are total amounts that can be withdrawn, and would typically be used only during dry years.

(4) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(5) Supplies shown are the total amount currently in storage, and would typically be used only during dry years. Once the current storage amount is withdrawn, this supply would no longer be available and in any event, is not available after 2013.

(6) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.

(7) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

The term "dry" is used throughout this chapter and in subsequent chapters concerning water resources and reliability as a measure of supply availability. As used in this Plan, dry years are those years when supplies are the lowest, which occurs primarily when precipitation is lower than the long-term average precipitation. The impact of low precipitation in a given year on a particular supply may differ based on how low the precipitation is, or whether the year follows a high-precipitation year or another low-precipitation year. For the SWP, a low-precipitation year may or may not affect supplies, depending on how much water is in SWP storage at the beginning of the year. Also, dry conditions can differ geographically. For example, a dry year can be local to the Valley area (thereby affecting local groundwater replenishment and production), local to northern California (thereby affecting SWP water deliveries), or statewide (thereby affecting both local groundwater and the SWP). When the term "dry" is used in this Plan, statewide drought conditions are assumed, affecting both local groundwater and SWP supplies at the same time.

3.2 WHOLESALE (IMPORTED) WATER SUPPLIES

3.2.1 Imported Water Supplies

Imported water supplies consist primarily of SWP supplies, which were first delivered to CLWA in 1980. In addition, CLWA has access to water from Flexible Storage Accounts in Castaic Lake, which are planned for dry-year use, but are not strictly limited as such. CLWA wholesales these imported supplies to each of the local retail water purveyors.

The SWP is the largest state-built, multi-purpose water project in the country. It was authorized by the California State Legislature in 1959, with the construction of most initial facilities completed by 1973. Today, the SWP includes 28 dams and reservoirs, 26 pumping and generating plants, and approximately 660 miles of aqueducts. The primary water source for the SWP is the Feather River, a tributary of the Sacramento River. Storage released from Oroville Dam on the Feather River flows down natural river channels to the Sacramento-San Joaquin River Delta (Delta). While some SWP supplies are pumped from the northern Delta into the North Bay Aqueduct, the vast majority of SWP supplies are pumped from the southern Delta into the 444-mile-long California Aqueduct. The California Aqueduct conveys water along the west side of the San Joaquin Valley to Edmonston Pumping Plant, where water is pumped over the Tehachapi Mountains and the aqueduct then divides into the East and West Branches. CLWA takes delivery of its SWP water at Castaic Lake, a terminal reservoir of the West Branch. From Castaic Lake, CLWA delivers its SWP supplies to the local retail water purveyors through an extensive transmission pipeline system.

In the early 1960s, DWR began entering into individual SWP Water Supply Contracts with urban and agricultural public water supply agencies located throughout northern, central, and southern California for SWP water supplies. CLWA is one of 29 water agencies (commonly referred to as “contractors”) that have an SWP Water Supply Contract with DWR. Each SWP contractor’s SWP Water Supply Contract contains a “Table A,” which lists the maximum amount of water an agency may request each year throughout the life of the contract. Table A is used in determining each contractor’s proportionate share, or “allocation,” of the total SWP water supply DWR determines to be available each year. The total planned annual delivery capability of the SWP and the sum of all contractors’ maximum Table A amounts was originally

4.23 million af. The initial SWP storage facilities were designed to meet contractors' water demands in the early years of the SWP, with the construction of additional storage facilities planned as demands increased. However, essentially no additional SWP storage facilities have been constructed since the early 1970s. SWP conveyance facilities were generally designed and have been constructed to deliver maximum Table A amounts to all contractors. After the permanent retirement of some Table A amount by two agricultural contractors in 1996, the maximum Table A amounts of all SWP contractors now totals about 4.17 million af. Currently, CLWA's annual Table A Amount is 95,200 af.[1,2]

While Table A identifies the maximum annual amount of water an SWP contractor may request, the amount of SWP water actually available and allocated to SWP contractors each year is dependent on a number of factors and can vary significantly from year to year. The primary factors affecting SWP supply availability include hydrology, the amount of water in SWP storage at the beginning of the year, regulatory and operational constraints, and the total amount of water requested by SWP contractors. Urban SWP contractors' requests for SWP water, which were low in the early years of the SWP, have been steadily increasing over time, which increases the competition for limited SWP dry-year supplies.

Consistent with other urban SWP contractors, SWP deliveries to CLWA have increased as its requests for SWP water have increased. Tables 3-2 and 3-3 present historical total SWP deliveries to CLWA municipal purveyors and CLWA SWP demand projections provided to DWR (CLWA's wholesale supplier), respectively.

Table 3-2
Historical Total SWP Deliveries to Purveyors(1)

Year	Deliveries (af)	Year	Deliveries (af)
1980	1,125	1993	13,393
1981	5,816	1994	14,389
1982	9,659	1995	16,996
1983	9,185	1996	18,093
1984	10,996	1997	22,148
1985	11,823	1998	20,254
1986	13,759	1999	27,282
1987	16,285	2000	32,579
1988	19,033	2001	35,369
1989	21,618	2002	41,768
1990	21,613	2003	44,419
1991	7,968	2004	47,205
1992	13,911		

Notes:
(1) Includes CLWA SCWD, LACWWD 36, NCWD, and VWC.

[1] CLWA's original SWP Water Supply Contract with DWR was amended in 1966 for a maximum annual Table A Amount of 41,500 af. In 1991, CLWA purchased 12,700 af of annual Table A Amount from a Kern County water district, and in 1999 purchased an additional 41,000 af of annual Table A Amount from another Kern County water district, for a current total annual Table A Amount of 95,200 af.
[2] See Section 3.2.2.

Table 3-3
CLWA Demand Projections Provided to Wholesale Supplier (DWR) (af)

Wholesaler (Supply Source)	2010	2015	2020	2025	2030
DWR (SWP)	95,200	95,200	95,200	95,200	95,200

In an effort to assess the impacts of these varying conditions on SWP supply reliability, DWR issued its "State Water Project Delivery Reliability Report" in May 2003. The report assists SWP contractors in assessing the reliability of the SWP component of their overall supplies. DWR is in the process of updating this report and, on May 25, 2005, provided updated delivery reliability estimates to the SWP contractors in its "Excerpts from the Working Draft of 2005 State Water Project Delivery Reliability." In this update, DWR provided a recommended set of analyses for SWP contractors to use in preparing their 2005 UWMPs.[3] These updated analyses indicate that the SWP, using existing facilities operated under current regulatory and operational constraints, and with all contractors requesting delivery of their full Table A Amounts in most years, could deliver 77 percent of total Table A Amounts on a long-term average basis. These most recent analyses also project that SWP deliveries during multiple-year dry periods could average about 25 to 40 percent of total Table A Amounts and could possibly be as low as 5 percent during an unusually dry single year. During wetter years, or more than 25 percent of the time, 100 percent of full Table A Amounts is projected to be available.

The SWP supplies projected to be available for delivery to CLWA were determined based on the total SWP delivery percentages identified by DWR in its updated analyses. Table 3-4 shows SWP supplies projected to be available to CLWA in average/normal years (based on the average delivery over the study's historic hydrologic period from 1922-1994), i.e., long-term average basis. Table 3-5 summarizes estimated SWP supply availability in a single dry year (based on a repeat of the worst-case historic hydrologic conditions of 1977) and over a multiple dry year period (based on a repeat of the worst-case historic four-year drought of 1931-1934). Reliability and dry-year planning of water supplies are further described in Chapter 6, Reliability Planning.

[3]As part of the Monterey Settlement Agreement, DWR is to prepare an assessment every two years of SWP delivery reliability, which SWP contractors are to use in their water planning efforts. DWR has completed an update of its analysis of SWP delivery reliability and is currently updating this report. While DWR continues its drafting of the remainder of the report, it issued this updated reliability data to the SWP contractors early, so that they could use the most up-to-date SWP reliability data in preparation of their UWMPs. For this reason, DWR issued, in a Notice to Contractors, excerpts from its working draft of this report (available at www.swpao.water.ca.gov/pdfs/05-08.pdf). It is unlikely that the reliability data in DWR's final version of this updated report will differ from the draft.

Table 3-4
Wholesaler Identified and Quantified Existing and Planned Sources of Water Available to CLWA for Average/Normal Years (1)

Wholesaler (Supply Source)	2010	2015	2020	2025	2030
DWR (SWP)					
Table A Supply (af)	67,600	69,500	71,400	73,300	73,300
% of Table A Amount	71%	73%	75%	77%	77%

Notes:

(1) The percentages of Table A Amount projected to be available are taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005). Supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by these percentages.

Table 3-5
Wholesale Supply Reliability (1)

Wholesaler	Single Dry Year (2)	Multiple Dry Years (3)
DWR (SWP Supply)		
2005		
Table A Supply (af)	3,800	30,500
% of Table A Amount	4%	32%
2025/2030		
Table A Supply (af)	4,800	31,400
% of Table A Amount	5%	33%

Notes:

(1) The percentages of Table A Amount projected to be available are taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005). Supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by these percentages.

(2) Based on the worst case historic single dry year of 1977.

(3) Supplies shown are annual averages over four consecutive dry years, based on the worst case historic four-year dry period of 1931-1934.

As part of its Water Supply Contract with DWR, CLWA has access to a portion of the storage capacity of Castaic Lake. This Flexible Storage Account allows CLWA to borrow up to 4,684 af of the storage in Castaic Lake. Any of this amount that CLWA borrows must be replaced by CLWA within five years of its withdrawal. CLWA manages this storage by keeping the account full in normal and wet years and then delivering that stored amount (or a portion of it) during dry periods. The account is refilled during the next year that adequate SWP supplies are available to CLWA to do so. CLWA has recently negotiated with Ventura County water agencies to obtain the use of their Flexible Storage Account. This will allow CLWA access to another 1,376 af of storage in Castaic Lake. CLWA access to this additional storage will be available on a year-to-year basis for ten years, beginning in 2006.

While the primary supply of water available from the SWP is allocated Table A supply, SWP supplies in addition to Table A water may periodically be available, including “Article 21” water, Turnback Pool water, and DWR dry-year purchases. Article 21 water (which refers to the SWP contract provision defining this supply) is water that may be made available by DWR when

excess flows are available in the Delta (i.e., when Delta outflow requirements have been met, SWP storage south of the Delta is full, and conveyance capacity is available beyond that being used for SWP operations and delivery of allocated and scheduled Table A supplies). Article 21 water is made available on an unscheduled and interruptible basis and is typically available only in average to wet years, generally only for a limited time in the late winter. The Turnback Pool is a program where contractors with allocated Table A supplies in excess of their needs in a given year may turn back that excess supply for purchase by other contractors who need additional supplies that year. The Turnback Pool can make water available in all types of hydrologic years, although generally less excess water is turned back in dry years. As urban contractor demands increase in the future, the amount of water turned back and available for purchase will likely diminish. In critical dry years, DWR has formed Dry Year Water Purchase Programs for contractors needing additional supplies. Through these programs, water is purchased by DWR from willing sellers in areas that have available supplies and is then sold by DWR to contractors willing to purchase those supplies. Because the availability of these supplies is somewhat uncertain, they are not included as supplies in this UWMP. However, CLWA's access to these supplies when they are available may enable it to improve the reliability of its SWP supplies beyond the values used throughout this report.

3.2.2 Litigation Effects on Availability of Imported Water

Of CLWA's 95,2000 af annual Table A Amount, 41,000 afy was permanently transferred to CLWA in 1999 by Wheeler Ridge-Maricopa Water Storage District, a member unit of the Kern County Water Agency. CLWA's Environmental Impact Report ("EIR") prepared in connection with the 41,000 afy water transfer was challenged in Friends of the Santa Clara River v. Castaic Lake Water Agency (Los Angeles County Superior Court, Case Number BS056954) ("Friends"). On appeal, the Court of Appeal, Second Appellate District held that since the 41,000 afy EIR tiered off the Monterey Agreement EIR that was later decertified, CLWA would also have to decertify its EIR as well and prepare a revised EIR. As amplified in detail in the following sentences, Friends was dismissed with prejudice (permanently) in February 2005. CLWA has not been enjoined from using any water that is part of the 41,000 afy transfer.

Under the jurisdiction of the Los Angeles County Superior Court in Friends, CLWA prepared and circulated a revised Draft EIR for the transfer, received and responded to public comments regarding the revised Draft EIR, and held two separate public hearings concerning the revised Draft EIR. CLWA approved the revised EIR for the transfer on December 22, 2004 and lodged the revised EIR with the Los Angeles Superior Court as part of its Return to the Preemptory Writ of Mandate in Friends. Thereafter, Friends was dismissed with prejudice (permanently). In January 2005, two new challenges to CLWA's environmental review for the transfer were filed in the Ventura County Superior Court by the Planning and Conservation League and by the California Water Impact Network; these cases have been consolidated and transferred to Los Angeles County Superior Court.

These pending challenges to the EIR for the transfer do not affect the reliability of the transfer amount, and it is still appropriate to include the transfer amount as part of CLWA's 95,200 AFY Table A amount, for the following reasons. First, the transfer was completed in 1999, and DWR has allocated and annually delivered the water in accordance with the completed transfer. Second, the Court of Appeal held that the only defect in the 1999 EIR was that it tiered off the

Monterey Agreement EIR, which was later decertified. This defect has now been remedied by the preparation of a revised EIR that did not tier off the Monterey Agreement EIR. Third, the Monterey Amendments settlement agreement expressly authorizes the operation of the SWP in accordance with the Monterey Amendments, which authorized the transfer. Fourth, the Court of Appeal refused to enjoin the transfer, and instead required preparation of a revised EIR. Fifth, the transfer contracts remain in full force and effect, and no court has ever questioned their validity or enjoined the use of this portion of CLWA's Table A amount. It is, therefore, reasonable to conclude that if a court finds the revised EIR legally deficient, that court, like all others before it, will again refuse to enjoin the transfer, and will instead require further revisions to the EIR. Therefore, the pending challenges litigation should have no impact upon the amount of water available to CLWA as a result of the transfer.

3.3 GROUNDWATER

This section presents information about CLWA's and the purveyor's groundwater supplies, including a summary of the adopted GWMP.

3.3.1 Santa Clara River Groundwater Basin – East Subbasin

The sole source of local groundwater for urban water supply in the Valley is the groundwater Basin identified in the DWR Bulletin 118, 2003 Update as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin) (Basin No. 4-4.07). The Basin is comprised of two aquifer systems, the Alluvium and the Saugus Formation. The Alluvium generally underlies the Santa Clara River and its several tributaries, and the Saugus Formation underlies practically the entire Upper Santa Clara River area. There are also some scattered outcrops of Terrace deposits in the Basin that likely contain limited amounts of groundwater. Since these deposits are located in limited areas situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and consequently have not been developed for any significant water supply. Figure 3-1 illustrates the mapped extent of the Santa Clara River Valley East Subbasin in DWR Bulletin 118 (2003), which approximately coincides with the outer extent of the Alluvium and Saugus Formation. The service area for CLWA and the purveyors is also shown on Figure 3-1.

3.3.2 Adopted Groundwater Management Plan

As part of legislation authorizing CLWA to provide retail water service to individual municipal customers, Assembly Bill (AB) 134 (2001) included a requirement that CLWA prepare a groundwater management plan in accordance with the provisions of Water Code Section 10753, which was originally enacted by AB 3030. The general contents of CLWA's groundwater management plan were outlined in 2002, and a detailed plan was drafted and adopted in 2003 to satisfy the requirements of AB 134. The plan both complements and formalizes a number of existing water supply and water resource planning and management activities in CLWA's service area, which effectively encompasses the East Subbasin of the Santa Clara River Valley Groundwater Basin.

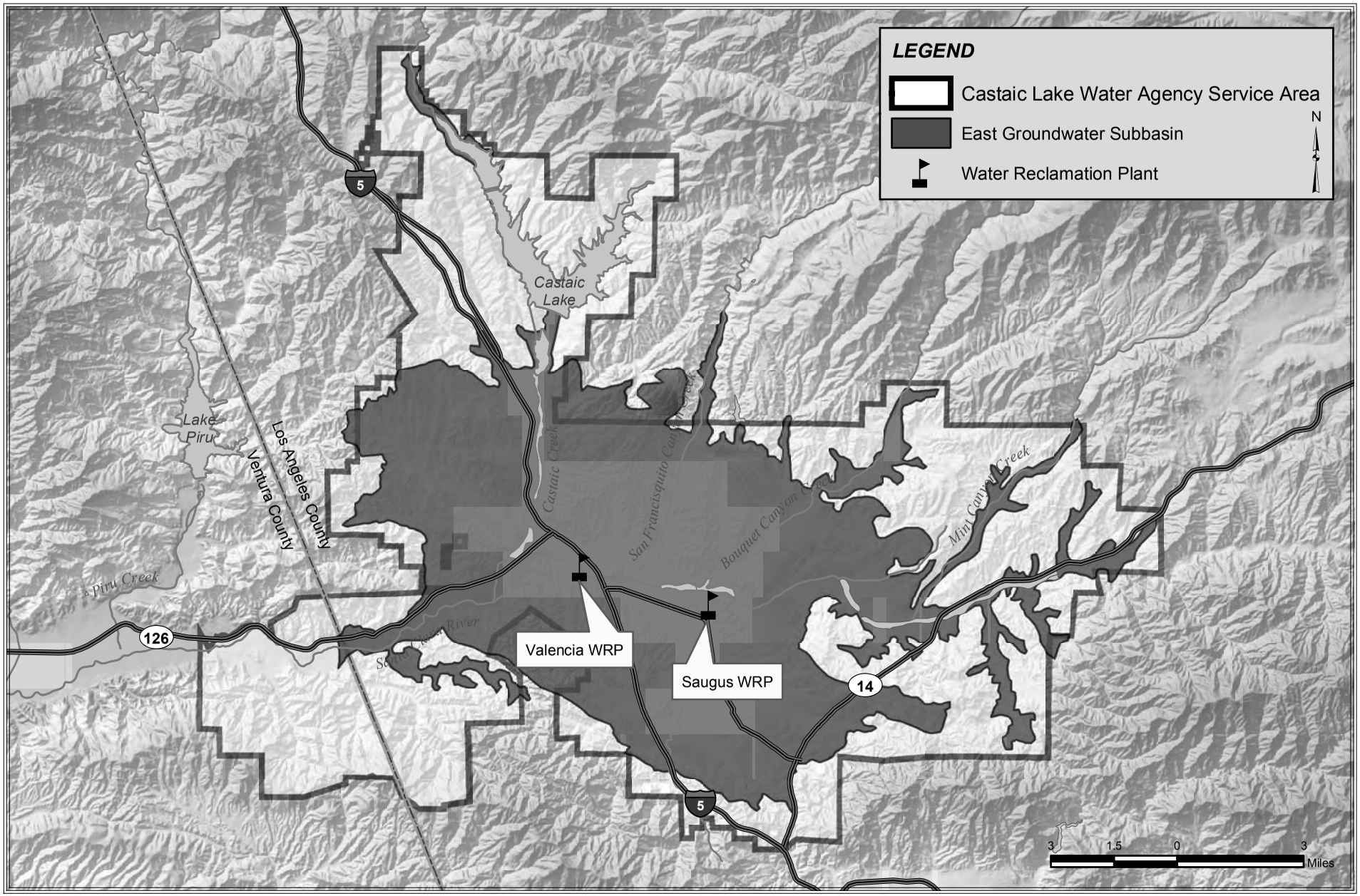


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Figure 3-1
Santa Clara River Valley
East Groundwater Subbasin

CLWA adopted the GWMP on December 10, 2003. The GWMP contains four management objectives, or goals, for the Basin including (1) development of an integrated surface water, groundwater, and recycled water supply to meet existing and projected demands for municipal, agricultural, and other water uses; (2) assessment of groundwater basin conditions to determine a range of operational yield values that use local groundwater conjunctively with supplemental SWP supplies and recycled water to avoid groundwater overdraft; (3) preservation of groundwater quality, including active characterization and resolution of any groundwater contamination problems; and (4) preservation of interrelated surface water resources, which includes managing groundwater to not adversely impact surface and groundwater discharges or quality to downstream basin(s).

Prior to preparation and adoption of the GWMP, a local Memorandum of Understanding (MOU) process among CLWA, the purveyors, and United Water Conservation District (UWCD) in neighboring Ventura County had produced the beginning of local groundwater management, now embodied in the GWMP. In 2001, out of a willingness to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, those agencies prepared and executed the MOU. The agreement is a collaborative and integrated approach to several of the aspects of water resource management included in the GWMP. UWCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the East Subbasin of the Santa Clara River Valley (Basin). UWCD is a partner in cooperative management efforts to accomplish the objectives (goals) for the Basin, particularly as they relate to preservation of surface water resources that flow through the respective basins. As a result of the MOU, the cooperating agencies have undertaken the following measures: integrated their database management efforts, developed and utilized a numerical groundwater flow model for analysis of groundwater basin yield and containment of groundwater contamination, and continued to monitor and report on the status of Basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

The adopted GWMP includes 14 elements intended to accomplish the Basin management objectives listed above. In summary, the plan elements include:

- Monitoring of groundwater levels, quality, production and subsidence
- Monitoring and management of surface water flows and quality
- Determination of Basin yield and avoidance of overdraft
- Development of regular and dry-year emergency water supply
- Continuation of conjunctive use operations
- Long-term salinity management
- Integration of recycled water
- Identification and mitigation of soil and groundwater contamination, including involvement with other local agencies in investigation, cleanup, and closure
- Development and continuation of local, state and federal agency relationships
- Groundwater management reports

- Continuation of public education and water conservation programs
- Identification and management of recharge areas and wellhead protection areas
- Identification of well construction, abandonment, and destruction policies
- Provisions to update the groundwater management plan

Work on a number of the GWMP elements had been ongoing for some time prior to the formal adoption of the GWMP and continues on an ongoing basis. The results of some of that work are reflected in this Plan.

3.3.2.1 Available Groundwater Supplies

The groundwater component of overall water supply in the Valley derives from a groundwater operating plan developed over the last 20 years to meet water requirements (municipal, agricultural, small domestic) while maintaining the Basin in a sustainable condition (i.e., no long-term depletion of groundwater or interrelated surface water). This operating plan also addresses groundwater contamination issues in the Basin, all consistent with both the MOU and the GWMP described above. The groundwater operating plan is based on the concept that pumping can vary from year to year to allow increased groundwater use in dry periods and increased recharge during wet periods and to collectively assure that the groundwater Basin is adequately replenished through various wet/dry cycles. As described in the MOU and subsequently formalized in the GWMP, the operating yield concept has been quantified as ranges of annual pumping volumes.

The ongoing work of the MOU has produced two formal reports. The first report, dated April 2004, documents the construction and calibration of the groundwater flow model for the Valley. The second report, dated August 2005, presents the modeling analysis of the purveyors' groundwater operating plan, described below. The primary conclusion of the modeling analysis is that the groundwater operating plan will not cause detrimental short or long term effects to the groundwater and surface water resources in the Valley and is therefore, sustainable[4]. The analysis of sustainability for groundwater and interrelated surface water is described in Appendix C.

The groundwater operating plan, summarized in Table 3-6, is as follows:

> **Alluvium** – Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 afy during normal and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the Basin, pumping is reduced to between 30,000 and 35,000 afy during locally dry years.
>
> **Saugus Formation** – Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 afy. Planned dry-year pumping from the Saugus Formation ranges between

[4] From "Analysis of Groundwater Basin Yield, Upper Santa Clara River Basin, Eastern Subbasin, Los Angeles County, California," prepared by CH2M Hill and Luhdorff and Scalmanini Consulting Engineers, August 2005.

15,000 and 25,000 afy during a drought year and can increase to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.

Table 3-6
Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (af)			
	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

Within the groundwater operating plan, three factors affect the availability of groundwater supplies: sufficient source capacity (wells and pumps); sustainability of the groundwater resource to meet pumping demand on a renewable basis; and protection of groundwater sources (wells) from known contamination, or provisions for treatment in the event of contamination. The first two factors are briefly discussed as follows, and more completely addressed in Appendix C. Protection of groundwater sources and provisions for treatment in the event of contamination are developed further in Chapter 5.

For reference to the Groundwater Operating Plan, recent historical and projected groundwater pumping by the retail water purveyors is summarized in Tables 3-7 and 3-8, respectively.

Table 3-7
Historical Groundwater Production by the Retail Water Purveyors[1]

Basin Name	Groundwater Pumped (af) [2]				
	2000	2001	2002	2003	2004
Santa Clara River Valley East Subbasin					
CLWA Santa Clarita Water Division	*11,529*	*9,896*	*9,513*	*6,424*	*7,146*
Alluvium	11,529	9,896	9,513	6,424	7,146
Saugus Formation	0	0	0	0	0
LA County Waterworks District 36	*0*	*0*	*0*	*0*	*380*
Alluvium	0	0	0	0	380
Saugus Formation	0	0	0	0	0
Newhall County Water District	*3,694*	*4,073*	*4,376*	*3,779*	*5,321*
Alluvium	1,508	1,641	981	1,266	1,582
Saugus Formation	2,186	2,432	3,395	2,513	3,739
Valencia Water Company	*13,186*	*11,353*	*12,568*	*12,775*	*11,824*
Alluvium	12,179	10,518	11,603	11,707	9,862
Saugus Formation	1,007	835	965	1,068	1,962
Total	*28,409*	*25,322*	*26,457*	*22,978*	*24,671*
Alluvium	25,216	22,055	22,097	19,397	18,970
Saugus Formation	3,193	3,267	4,360	3,581	5,701
% of Total Municipal Water Supply	**47%**	**42%**	**39%**	**34%**	**34%**

Notes:

(1) From 2004 Santa Clarita Valley Water Report (May 2005).

(2) Pumping for municipal and industrial uses only. Does not include pumping for agricultural and miscellaneous uses.

Table 3-8
Projected Groundwater Production (Normal Year)

Basin Name	Range of Groundwater Pumping (af) [1][2][3]				
	2010	2015	2020	2025	2030
Santa Clara River Valley East Subbasin					
CLWA Santa Clarita Water Division					
Alluvium	6,000-14,000	6,000-14,000	6,000-14,000	6,000-14,000	6,000-14,000
Saugus Formation	3,000	3,000	3,000	3,000	3,000
LA County Waterworks District 36					
Alluvium	0	0	0	0	0
Saugus Formation	500-1,000	500-1,000	500-1,000	500-1,000	500-1,000
Newhall County Water District					
Alluvium	1,500-3,000	1,500-3,000	1,500-3,000	1,500-3,000	1,500-3,000
Saugus Formation	3,000-6,000	3,000-6,000	3,000-6,000	3,000-6,000	3,000-6,000
Valencia Water Company					
Alluvium	12,000-20,000	12,000-20,000	12,000-20,000	12,000-20,000	12,000-20,000
Saugus Formation	2,500-5,000	2,500-5,000	2,500-5,000	2,500-5,000	2,500-5,000

Notes:

(1) The range of groundwater production capability for each purveyor varies based on a number of factors which include each purveyor's capacity to produce groundwater, the location of its wells within the Alluvium and Saugus Formation, local hydrology, availability of imported water supplies and water demands.

(2) To ensure sustainability, the purveyors have committed that the annual use of groundwater pumped collectively in any given year will not exceed the purveyors' operating plan as described in the Basin Yield Study and reported annually in the SCV Water Report. As noted in the discussion of the purveyors' operating plan for groundwater in Table 3-6 of this Plan, the "normal" year quantities of groundwater pumped from the Alluvium and Saugus Formation are 30,000 to 40,000 afy and 7,500 to 15,000 afy, respectively.

(3) Groundwater pumping shown for purveyor municipal and industrial uses only.

The groundwater operating plan recognizes ongoing Alluvial pumping for both municipal and agricultural water supply, as well as other small private domestic and related pumping. During preparation of this Plan, the Santa Clarita Valley Well Owners' Association submitted some limited information about the nature and magnitude of private well pumping. This included a detailed estimate of private well pumping in the San Francisquito Canyon portion of the Basin: a total of 85 afy by 73 individual private pumpers, or nearly 1.2 afy per private well pumper. As a result of that input, it is now better recognized that total private pumping is likely well within the 500 afy estimates of small private well pumping in recent annual Water Reports, or about 1 percent of typical Alluvial Aquifer pumping by the purveyors and other known private well owners, e.g. agricultural pumpers, combined. Thus, while the small private wells are not explicitly modeled in the Basin yield analysis described herein because their locations and operations are not known, their operation creates a pumping stress that is essentially negligible at the scale of the regional model. Ultimately, the intent to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (purveyor), agricultural, and small private groundwater use on an ongoing basis.

3.3.2.1.1 Alluvium

Based on a combination of historical operating experience and recent groundwater modeling analysis, the Alluvial Aquifer can supply groundwater on a long-term sustainable basis in the overall range of 30,000 to 40,000 afy, with a probable reduction in dry years to a range of 30,000 to 35,000 afy. Both of those ranges include about 15,000 afy of Alluvial pumping for current agricultural water uses and an estimated pumping of up to about 500 afy by small private pumpers. The dry year reduction is a result of practical constraints in the eastern part of the Basin, where lowered groundwater levels in dry periods have the effect of reducing pumping capacities in that shallower portion of the aquifer.

Adequacy of Supply

For municipal water supply, with existing wells and pumps, the three retail water purveyors with Alluvial wells (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells (not contaminated by perchlorate) of 36,120 gpm, which translates into a current full-time Alluvial source capacity of approximately 58,000 afy. Alluvial pumping capacity from all the active municipal supply wells is summarized in Table 3-9. The locations of the various municipal Alluvial wells throughout the Basin are illustrated on Figure 3-2. These capacities do not include one Alluvial Aquifer well that has been temporarily inactivated due to perchlorate contamination: the SCWD Stadium well, which represents another 800 gpm of pumping capacity, or full-time source capacity of about 1,290 afy.

In terms of adequacy and availability, the combined active Alluvial groundwater source capacity of municipal wells is approximatley 58,000 afy. This is more than sufficient to meet the municipal, or urban, component of groundwater supply from the Alluvium, which is currently 20,000 to 25,000 afy of the total planned Alluvial pumping of 30,000 to 40,000 afy. (The balance of Alluvial pumping in the operating plan is for agricultural and other, including small private, pumping.)

Sustainability

Until recently, the long-term renewability of Alluvial groundwater was empirically determined from approximately 60 years of recorded experience. Generally, it consists of long-term stability in groundwater levels and storage, with some dry period fluctuations in the eastern part of the Basin, over a historical range of total Alluvial pumpage from as low as about 20,000 afy to as high as about 43,000 afy. Those empirical observations have now been complemented by the development and application of a numerical groundwater flow model, which has been used to predict aquifer response to the planned operating ranges of pumping. The numerical groundwater flow model has also been used to analyze the control of perchlorate contaminant migration under selected pumping conditions that would restore, with treatment, pumping capacity inactivated due to perchlorate contamination detected in some wells in the Basin. The latter use of the model is described in Chapter 5, which addresses the Saugus Formation and the overall approach to the perchlorate contamination issue.

Table 3-9
Active Municipal Groundwater Source Capacity—Alluvial Aquifer Wells

Wells	Pump Capacity (gpm)	Max Annual Capacity (af)	Normal Year Production [1] (af)	Dry-Year Production (af)
Newhall CWD				
Castaic 1	600	960	385	345
Castaic 2	425	680	166	125
Castaic 4	270	430	100	45
Pinetree 1	300	480	164	N/A
Pinetree 3	550	880	545	525
Pinetree 4	500	800	300	N/A
NCWD Subtotal	2,645	4,230	1,660	1,040
Santa Clarita WD				
Clark	600	960	782	700
Guida	1,000	1,610	1,320	1,230
Honby	950	1,530	696	870
Lost Canyon 2	850	1,370	741	640
Lost Canyon 2A	825	1,330	1,034	590
Mitchell 5B	700	1,120	557	N/A
N. Oaks Central	1,000	1,610	822	1,640
N. Oaks East	950	1,530	1,234	485
N. Oaks West	1,400	2,250	898	N/A
Sand Canyon	750	1,200	930	195
Sierra	1,500	2,410	846	N/A
SCWD Subtotal	10,525	16,920	9,860	6,350
Valencia WC				
Well D	1,050	1,690	690	690
Well E-15	1,400	2,260	N/A	N/A
Well N	1,250	2,010	620	620
Well N7	2,500	4,030	1,160	1,160
Well N8	2,500	4,030	1,160	1,160
Well Q2	1,200	1,930	985	985
Well S6	2,000	3,220	865	865
Well S7	2,000	3,220	865	865
Well S8	2,000	3,220	865	865
Well T2	800	1,290	460	460
Well T4	700	1,120	460	460
Well U4	1,000	1,610	935	935
Well U6	1,250	2,010	825	825
Well W9	800	1,290	600	600
Well W10	1,500	2,410	865	865
Well W11	1,000	1,610	350	350
VWC Subtotal	22,950	36,950	11,705	11,705
Total Purveyors	**36,120**	**58,100** [2]	**23,225** [2]	**19,095** [2]

Notes:
(1) Based on recent annual pumping.
(2) Currently active wells only; capacity will slightly increase by restoration of contaminated wells.

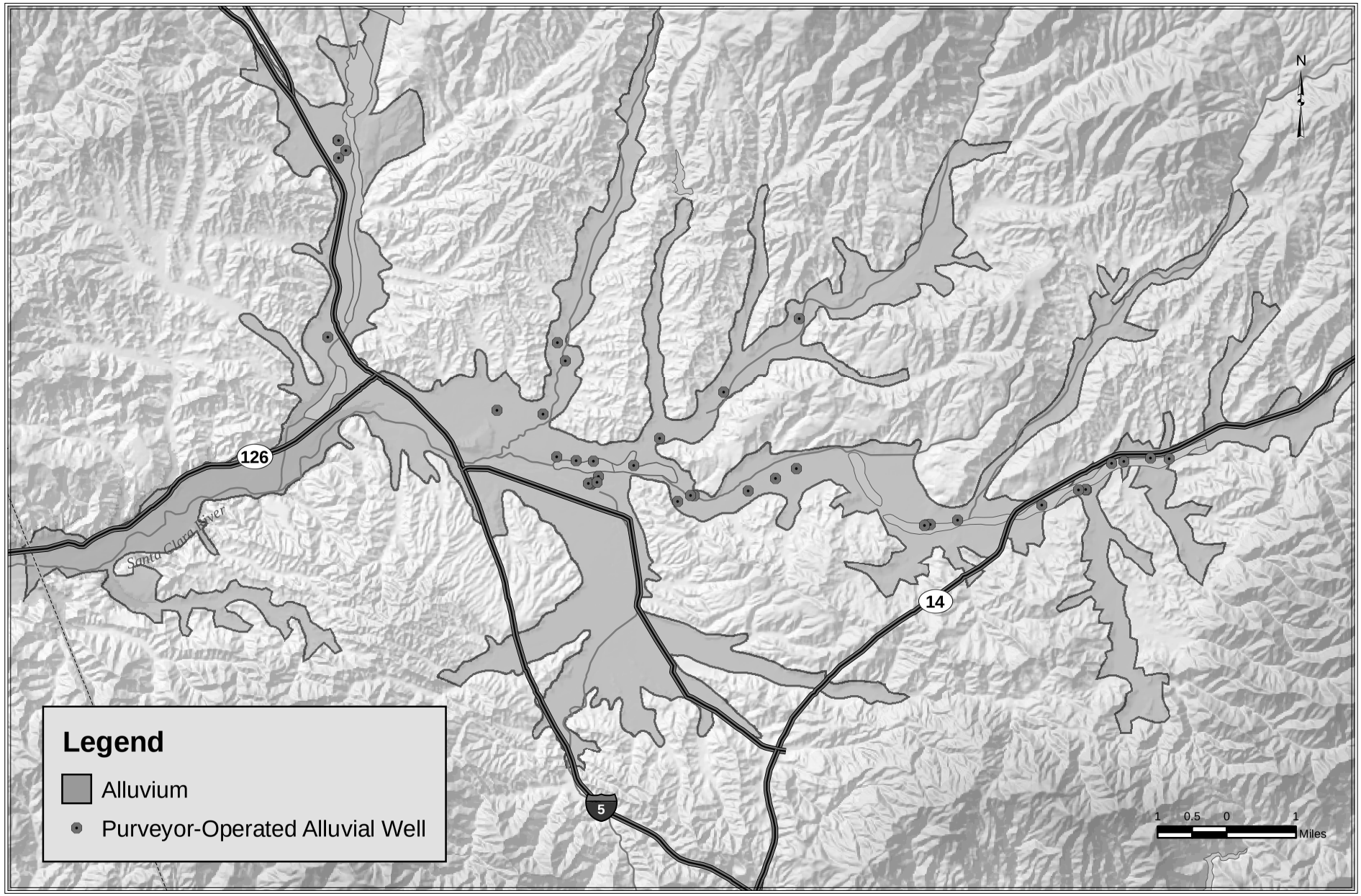

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Figure 3-2
Municipal Alluvial Well Locations
Santa Clara River Valley, East Groundwater Subbasin

To examine the yield of the Alluvium or, the sustainability of the Alluvium on a renewable basis, the groundwater flow model was used to examine the long-term projected response of the aquifer to pumping for municipal and agricultural uses in the 30,000 to 40,000 afy range under average/normal and wet conditions, and in the 30,000 to 35,000 afy range under locally dry conditions. To examine the response of the entire aquifer system, the model also incorporated pumping from the Saugus Formation in accordance with the normal (7,500-15,000 afy) and dry year (15,000-35,000 afy) operating plan for that aquifer. The model was run over a 78-year hydrologic period, which was selected from actual historical precipitation to examine a number of hydrologic conditions expected to affect both groundwater pumping and groundwater recharge. The selected 78-year simulation period was assembled from an assumed recurrence of 1980 to 2003 conditions, followed by an assumed recurrence of 1950 to 2003 conditions. The 78-year period was analyzed to define both local hydrologic conditions (normal and dry), which affect the rate of pumping from the Alluvium, and hydrologic conditions that affect SWP operations, which in turn affect the rate of pumping from the Saugus. The resultant simulated pumping cycles included the distribution of pumping for each of the existing Alluvial Aquifer wells, for normal and dry years respectively, as shown in Table 3-9.

Simulated Alluvial Aquifer response to the range of hydrologic conditions and pumping stresses is essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades. The resultant response consists of: (1) generally constant groundwater levels in the middle to western portion of the Alluvium and fluctuating groundwater levels in the eastern portion as a function of wet and dry hydrologic conditions, (2) variations in recharge that directly correlate with wet and dry hydrologic conditions, and (3) no long-term decline in groundwater levels or storage. The Alluvial Aquifer is considered a sustainable water supply source to meet the Alluvial portion of the operating plan for the groundwater Basin. This is based on the combination of actual experience with Alluvial Aquifer pumping at capacities similar to those planned for the future and the resultant sustainability (recharge) of groundwater levels and storage, and further based on modeled projections of aquifer response to planned pumping rates that also show no depletion of groundwater.

3.3.2.1.2 Saugus Formation

Based on historical operating experience and extensive recent testing and groundwater modeling analysis, the Saugus Formation can supply water on a long-term sustainable basis in a normal range of 7,500 to 15,000 afy, with intermittent increases to 25,000 to 35,000 af in dry years. The dry-year increases, based on limited historical observation and modeled projections, demonstrate that a small amount of the large groundwater storage in the Saugus Formation can be pumped over a relatively short (dry) period. This would be followed by recharge (replenishment) of that storage during a subsequent normal-to-wet period when pumping would be reduced.

Adequacy of Supply

For municipal water supply with existing wells, the three retail water purveyors with Saugus wells (NCWD, SCWD, and VWC) have a combined pumping capacity from active wells (not contaminated by perchlorate) of 14,900 gpm, which translates into a full-time Saugus source capacity of 24,000 afy. Saugus pumping capacity from all the active municipal supply wells is summarized in Table 3-10; the locations of the various active municipal Saugus wells are illustrated on Figure 3-3. These capacities do not include the four Saugus wells contaminated by

perchlorate, although they indirectly reflect the capacity of one of the contaminated wells, VWC's Well 157, which has been sealed and abandoned, and replaced by VWC's Well 206 in a non-impacted part of the Basin. The four contaminated wells, one owned by NCWD and two owned by SCWD, in addition to the VWC well, represent a total of 7,900 gpm of pumping capacity (or full-time source capacity of about 12,700 afy) inactivated due to perchlorate contamination.

Table 3-10
Active Municipal Groundwater Source Capacity—Saugus Formation Wells

Wells	Pump Capacity (gpm)	Max Annual Capacity (af)	Normal Year Production [(1)] (af)	Dry-Year Production (af)
Newhall CWD				
12	2,300	3,700	1,315	2,044
13	2,500	4,030	1,315	2,044
NCWD Subtotal	4,800	7,730	2,630	4,088
Valencia WC				
159	500	800	50	50
160	2,000	3,220	1,000	1,330
201	2,400	3,870	100	3,577
205	2,700	4,350	1,000	3,827
206	2,500	4,030	1,175	3,500
VWC Subtotal	10,100	16,270	3,325	12,284
Total Purveyors	**14,900**	**24,000** [(2)]	**5,955** [(2)]	**16,372** [(2)]

Notes:
(1) Based on recent annual pumping.
(2) Currently active wells only; additional capacity to meet dry-year operating plan would be met by restoration of contaminated wells and new well construction.

In terms of adequacy and availability, the combined active Saugus groundwater source capacity of municipal wells of 24,000 afy, is more than sufficient to meet the planned use of Saugus groundwater in normal years of 7,500 to 15,000 afy. During the currently scheduled two-year time frame for restoration of impacted Saugus capacity (as discussed further in Chapter 5), this currently active capacity is more than sufficient to meet water demands, in combination with other sources, if both of the next two years are dry. At that time, the combination of currently active capacity and restored impacted capacity, through a combination of treatment at two of the impacted wells and replacement well construction, will provide sufficient total Saugus capacity to meet the planned use of Saugus groundwater during multiple dry-years of 35,000 af, if that third year is also a dry year.

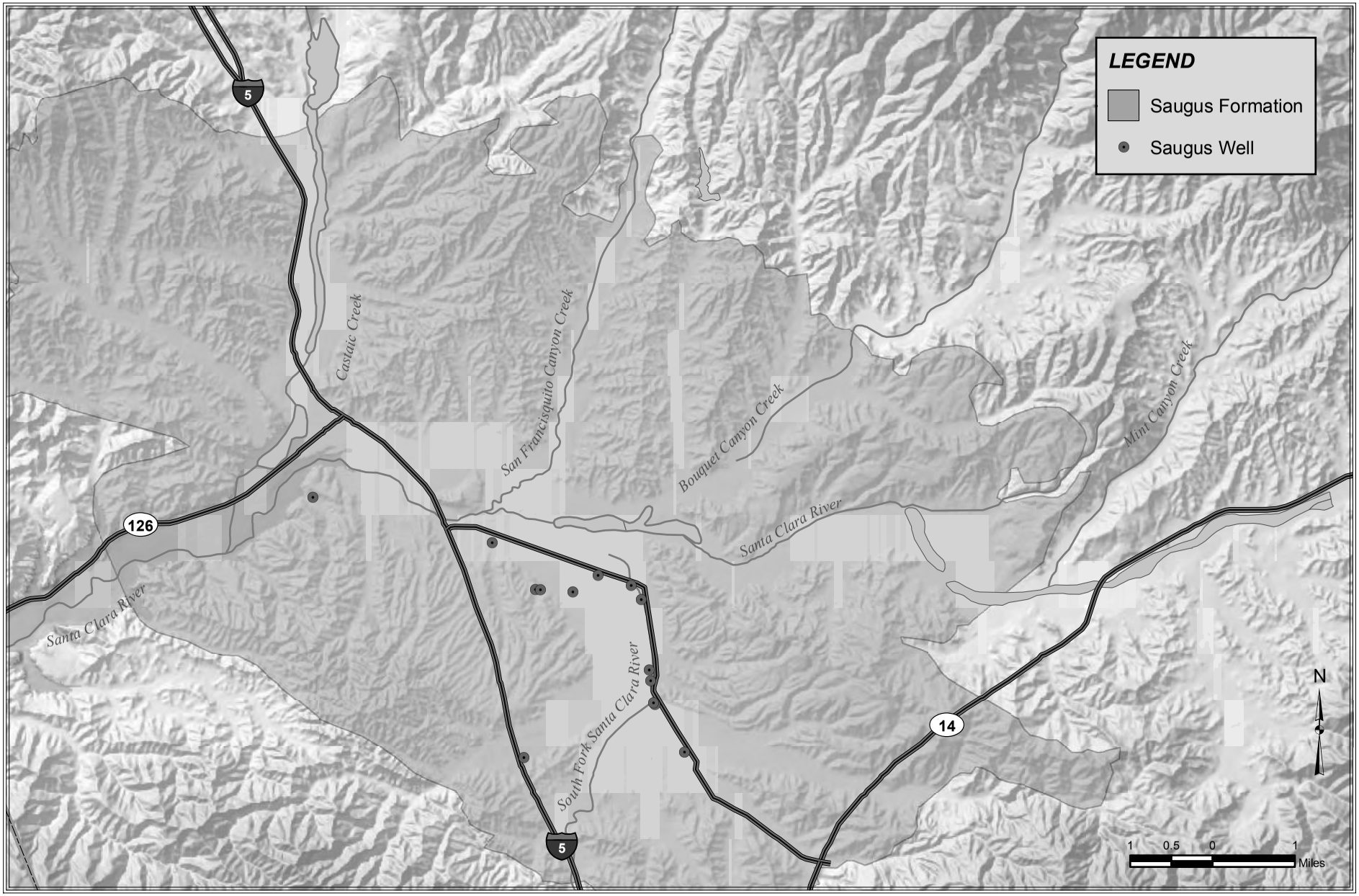

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Figure 3-3
Saugus Well Locations
Santa Clara River Valley, East Groundwater Subbasin

Sustainability

Until recently, the long-term sustainability of Saugus groundwater was empirically determined from limited historical experience. The historical record shows fairly low annual pumping in most years, with one four-year period of increased pumping up to about 15,000 afy that produced no long-term depletion of the substantial groundwater storage in the Saugus. Those empirical observations have now been complemented by the development and application of the numerical groundwater flow model, which has been used to examine aquifer response to the operating plan for pumping from both the Alluvium and the Saugus and also to examine the effectiveness of pumping for both contaminant extraction and control of contaminant migration within the Saugus Formation. The latter aspects of Saugus pumping are discussed in Chapter 5.

To examine the yield of the Saugus Formation or, its sustainability on a renewable basis, the groundwater flow model was used to examine long-term projected response to pumping from both the Alluvium and the Saugus over the 78-year period of hydrologic conditions using alternating wet and dry periods as have historically occurred. The pumping simulated in the model was in accordance with the operating plan for the Basin. For the Saugus, simulated pumpage included the planned restoration of recent historic pumping from the perchlorate-impacted wells. In addition to assessing the overall recharge of the Saugus, that pumping was analyzed to assess the effectiveness of controlling the migration of perchlorate by extracting and treating contaminated water close to the source of contamination.

Simulated Saugus Formation response to the ranges of pumping under assumed recurrent historical hydrologic conditions is consistent with actual experience under smaller pumping rates. The response consists of (1) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping, (2) rapid recovery of groundwater levels and storage after cessation of dry-period pumping, and (3) no long-term decreases or depletion of groundwater levels or storage. The combination of actual experience with Saugus pumping and recharge up to about 15,000 afy, now complemented by modeled projections of aquifer response that show long-term utility of the Saugus at 7,500 to 15,000 afy in normal years and rapid recovery from higher pumping rates during intermittent dry periods, shows that the Saugus Formation can be considered a sustainable water supply source to meet the Saugus portion of the operating plan for the groundwater Basin.

3.3.3 Potential Supply Inconsistency

A small group of wells that have been impacted by perchlorate represent a temporary loss of well capacity within CLWA's service area. Of the six wells that were initially removed from active water supply service upon the detection of perchlorate, four wells with a combined capacity of 10,000 af remain out of service, as discussed further in Chapter 5. However, CLWA and the purveyors have developed an implementation plan that would restore this well capacity. The implementation plan includes a combination of treatment facilities and replacement wells. Treatment facilities for several of the impacted wells will be operational in 2006 and the production restoration (replacement) wells will be operational by 2010. Additional information on the treatment technology and schedule for restoration of the impacted wells is provided in Chapter 5. Additional information concerning water quality issues and replacement capacity is also provided in Chapter 5.

3.4 TRANSFERS, EXCHANGES, AND GROUNDWATER BANKING PROGRAMS

Additional water supplies can be purchased from other water agencies and sources, and CLWA is currently exploring opportunities. An important element to enhancing the long-term reliability of the total mix of supplies currently available to meet the needs of the Valley is the use of transfers, exchanges, and groundwater banking programs, such as those described below.

3.4.1 Transfers and Exchanges

An opportunity available to CLWA to increase water supplies is to participate in voluntary water transfer programs. Since the drought of 1987-1992, the concept of water transfer has evolved into a viable supplemental source to improve supply reliability. The initial concept for water transfers was codified into law in 1986 when the California Legislature adopted the "Katz" Law (California Water Code, Sections 1810-1814) and the Costa-Isenberg Water Transfer Law of 1986 (California Water Code, Sections 470, 475, 480-483). These laws help define parameters for water transfers and set up a variety of approaches through which water or water rights can be transferred among individuals or agencies.

Up to 27 million af of water are delivered for agricultural use every year. Over half of this water use is in the Central Valley, and much of it is delivered by, or adjacent to, SWP and Central Valley Project (CVP) conveyance facilities. This proximity to existing water conveyance facilities could allow for the voluntary transfer of water to many urban areas, including CLWA, via the SWP. Such water transfers can involve water sales, conjunctive use and groundwater substitution, and water sharing and usually occur as a form of spot, option, or core transfers agreement. The costs of a water transfer would vary depending on the type, term, and location of the transfer. The most likely voluntary water transfer programs would probably involve the Sacramento or southern San Joaquin Valley areas.

One of the most important aspects of any resource planning process is flexibility. A flexible strategy minimizes unnecessary or redundant investments (or stranded costs). The voluntary purchase of water between willing sellers and buyers can be an effective means of achieving flexibility. However, not all water transfers have the same effectiveness in meeting resource needs. Through the resource planning process and ultimate implementation, several different types of water transfers could be undertaken.

3.4.1.1 Core Transfers

Core transfers are agreements to purchase a defined quantity of water every year. These transfers have the benefit of more certainty in costs and supply, but in some years can be surplus to imported water (available in most years) that is already paid for.

3.4.1.2 Spot Market Transfers

Spot market transfers involve water purchased only during the time of need (usually a drought). Payments for these transfers occur only when water is actually requested and delivered, but there is usually greater uncertainty in terms of costs and availability of supply. Examples of such transfers were the Governor's Drought Water Banks of 1991 and 1992. An additional risk of spot

market transfers is that the purchases may be subject to institutional limits or restricted access (e.g., requiring the purchasing agency to institute rationing before it is eligible to participate in the program).

3.4.1.3 Option Contracts

Option contracts are agreements that specify the amount of water needed and the frequency or probability that the supply will be called upon (an option). Typically, a relatively low up-front option payment is required and, if the option is actually called upon, a subsequent payment would be made for the amount called. These transfers have the best characteristics of both core and spot transfers. With option contracts, the potential for redundant supply is minimized, as are the risks associated with cost and supply availability.

3.4.1.4 Future Market Transfers

The most viable types of water transfers are core and option transfers and, as such, represent CLWA's long-term strategy. The costs for these types of transfers have been estimated to be about $60 to $110 per af (equivalent to $1,100 to $2,000 per af for Table A Amount) for core transfers and $250 per af for option transfers. Although the option transfer costs might seem high, the equivalent average annual cost is much less - about $65 to $112 per af. Average annual option transfer costs are much lower due to the variable likelihood that the transfers will be needed. Currently, CLWA is proceeding with environmental compliance to acquire a core transfer of an additional 11,000 afy of surface water from the Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District, both located in Kern County.

3.4.2 Groundwater Banking Programs

With recent developments in conjunctive use and groundwater banking, significant opportunities exist to improve water supply reliability for CLWA. Conjunctive use is the coordinated operation of multiple water supplies to achieve improved supply reliability. Most conjunctive use concepts are based on storing groundwater supplies in times of surplus for use during dry periods and drought when surface water supplies would likely be reduced.

Groundwater banking programs involve storing available SWP surface water supplies during wet years in groundwater basins in, for example, the San Joaquin Valley. Water would be stored either directly by surface spreading or injection, or indirectly by supplying surface water to farmers for their use in lieu of their intended groundwater pumping. During water shortages, the stored water could be pumped out and conveyed through the California Aqueduct to CLWA as the banking partner, or used by the farmers in exchange for their surface water allocations, which would be delivered to CLWA as the banking partner through the California Aqueduct. Several conjunctive use and groundwater banking opportunities are available to CLWA.

In 2003, CLWA produced a Draft Water Supply Reliability Plan. The plan outlines primary elements that CLWA should include in its water supply mix to obtain maximum overall supply reliability enhancement. These elements include both conjunctive use and groundwater banking programs, as well as water acquisitions. The Plan also contains a recommended implementation plan and schedule.

The reliability plan recommends that CLWA obtain total banking storage capacity of 50,000 af, with pumpback capacity of 20,000 af per year, by 2005. For the long-term, CLWA should obtain a total of 183,000 af of storage capacity, with total pumpback capacity of 70,000 af per year by 2050. Table 3-11, taken from the 2003 Draft Water Supply Reliability Report, presents an implementation schedule recommended for both storage and pumpback capacity beginning in 2005 and incrementally increasing through 2050.

Table 3-11
Recommended Schedule for Water Banking Capacity(1)

Year	Total Pumpback (afy)	Total Storage (afy)
2005	20,000	50,000
2010	20,000	50,000
2020	40,000	100,000
2030	60,000	150,000
2040	70,000	183,000
2050	70,000	183,000

Notes:
(1) Reference "Draft Report – CLWA Water Supply Reliability Plan", Kennedy/Jenks Consultants, 2003.

3.4.2.1 Semitropic Water Banking

Semitropic Water Storage District (Semitropic) provides SWP water to farmers for irrigation. Semitropic is located in the San Joaquin Valley in the northern part of Kern County immediately east of the California Aqueduct. Using its available groundwater storage capacity (approximately one million af), Semitropic has developed a groundwater banking program, which it operates by taking available SWP supplies in wet years and returning the water in dry years. As part of this dry-year return, Semitropic can leave its SWP water in the Aqueduct for delivery to a banking partner and increase its groundwater production for its farmers. Semitropic constructed facilities so that groundwater can be pumped into a Semitropic canal and, through reverse pumping plants, be delivered to the California Aqueduct. Semitropic currently has six banking partners: the Metropolitan Water District of Southern California (Metropolitan), Santa Clara Valley Water District, Alameda County Water District, Alameda County Flood Control and Water Conservation District Zone 7, Vidler Water Company, and The Newhall Land and Farming Company. The total amount of storage under contract is approximately 1 million af.

In 2002, CLWA stored an available portion of its Table A Amount (24,000 af) in an account in Semitropic's program.[5] In 2004, 32,522 af of available 2003 Table A Amount water was stored in a second Semitropic account.[6] In accordance with the terms of CLWA's storage agreements with Semitropic, 90 percent of the banked amount, or a total of 50,870 af, is recoverable through 2013 to meet CLWA water demands when needed. Each account has a term of ten years for the

[5] CLWA's approval of this project and of its negative declaration was challenged under the California Environmental Quality Act ("CEQA") in the Ventura County Superior Court (i.e., California Water Network v. Castaic Lake Water Agency [Ventura County Superior Court Case No. CIV 215327]). Finding that CLWA's approval of this project and of its negative declaration did not violate CEQA, the trial entered judgment in favor of CLWA. Petitioners have, however, filed an appeal with the California Court of Appeal, Second Appellate District, Division 6 Court of Appeal Case No. B177978.
[6] No legal challenge was made to CLWA's approval of this project or to the negative declaration for this project.

water to be withdrawn and delivered to CLWA.[7] Current operational planning includes use of the water stored in Semitropic for dry-year supply. Accordingly, it is reflected in the available supplies delineated in this section, and it is also reflected in contributing to short-term (prior to 2013) reliability in Chapter 6.

3.4.2.2 Rosedale-Rio Bravo Water Storage District Water Banking

Also located in Kern County, immediately adjacent to the Kern Water Bank, Rosedale-Rio Bravo Water Storage District has completed environmental documentation for a Water Banking and Exchange Program. The initial offering from the program is storage and pumpback capacity of 20,000 afy, with up to 100,000 af of storage capacity. This banking program would meet the total pumpback and exceed the total storage capacity in 2010 recommended in the implementation schedule provided in the 2003 Draft Water Supply Reliability Report. This program is available for subscription and, in 2004, CLWA signed an MOU with Rosedale-Rio Bravo to begin preliminary non-binding negotiations on the possible terms for participation in the program. Such terms would define a project that would then be subject to subsequent environmental analysis. In April 2005, CLWA and Rosedale-Rio Bravo executed a deposit agreement for the exclusive right to negotiate, and CLWA approved an EIR in October 2005. This project is a water management program to improve the reliability of CLWA's existing dry-year supplies; it is not, and should not be considered, an annual supply that could support growth. CLWA anticipates that, upon completion of CEQA documentation, this program will be operational by 2006.

3.4.2.3 Other Opportunities

The Draft Water Supply Reliability Plan recommends water banking storage and pumpback capacity both north and south of CLWA's service area, the latter of which would provide an emergency supply in case of catastrophic outage along the California Aqueduct. With short-term storage now existing in the Semitropic program and negotiations underway with Rosedale-Rio Bravo, CLWA is assessing southern water banking opportunities. These include potential programs with the Chino Basin Watermaster (with whom CLWA signed an MOU in 2003), Calleguas Municipal Water District, and San Gorgonio Pass Water Agency.

Groundwater banking and conjunctive-use programs enhance the reliability of both the existing and future supplies. Table 3-12 summarizes CLWA's future reliability enhancement programs.

Table 3-12
Future Reliability Enhancement Programs

Project Name	Year Available	Proposed Quantities (af)		
		Average/ Normal Year	Single Dry Year	Multiple Dry Years (1)
Rosedale-Rio Bravo Water Banking Program	2006	0	20,000	20,000
Additional Planned Banking Programs	2014	0	20,000	20,000

Notes:
(1) Supplies shown are maximum withdrawal capacity for each of four consecutive dry years.

[7] Thereafter, the remaining amount of project water is forfeited from the account.

3.5 PLANNED WATER SUPPLY PROJECTS AND PROGRAMS

The 2003 Draft Water Supply Reliability Plan also discusses the potential for acquiring additional water supplies to meet future demands (the plan refers to these as "water transfer opportunities"). Table 3-13 summarizes CLWA's transfer and exchange opportunities.

Table 3-13
Transfer and Exchange Opportunities

Source Transfer Agency	Transfer/ Exchange	Year Available	Short/Long Term	Proposed Quantity (afy)
Buena Vista-Rosedale (1)	Transfer	2006	Long Term	11,000

Notes:
(1) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

Buena Vista Water Storage District/Rosedale-Rio Bravo Water Storage District Water Storage and Recovery Program

These two districts, both located in Kern County, have joined together to develop a program that provides both a firm water supply and a water banking component. Both districts are member agencies of the Kern County Water Agency (KCWA), an SWP contractor, and both districts have contracts with KCWA for SWP Table A Amounts. Environmental documentation has been completed for this program, which envisions a single partner purchasing a firm annual water supply, which can then be banked in years when it is not needed for withdrawal and delivery in later years. The supply is based on existing long-standing Kern River water rights, which would be delivered by exchange of SWP Table A Amount. In 2004, CLWA signed an MOU with both districts to begin preliminary non-binding negotiations on the possible terms for participation in the program. Such terms would define a project subject to subsequent environmental analysis. The initial offering from the program is up to 11,000 afy of firm supply. In December 2004, CLWA, Buena Vista, and Rosedale-Rio Bravo executed a deposit agreement for the exclusive right to negotiate, and CLWA started preparing an EIR. CLWA anticipates that, upon completion of CEQA documentation, this program will be operational during 2006.

3.6 DEVELOPMENT OF DESALINATION

The California UWMP Act requires a discussion of potential opportunities for use of desalinated water (Water Code Section 10631[i]). CLWA has explored such opportunities, and they are described in the following section, including opportunities for desalination of brackish water, groundwater, and seawater. However, at this time, none of these opportunities is practical or economically feasible for CLWA, and CLWA has no current plans to pursue them. Therefore, desalinated supplies are not included in the supply summaries in this Plan (e.g., Tables 3-1, 6-2, 6-3, and 6-4).

3.6.1 Opportunities for Brackish Water and/or Groundwater Desalination

As discussed in Chapter 5, the two sources of groundwater in the Valley are water drawn from the Alluvial Aquifer and from the Saugus Formation. Neither of these supplies can be considered brackish in nature, and desalination is not required.

However, CLWA and the retail water purveyors could team up with other SWP contractors and provide financial assistance in construction of other regional groundwater desalination facilities in exchange for SWP supplies. The desalinated water would be supplied to users in communities near the desalination plant, and a similar amount of SWP supplies would be exchanged and allocated to CLWA from the SWP contractor. A list summarizing the groundwater desalination plans of other SWP contractors is not available; however, CLWA would begin this planning effort should the need arise.

In addition, should an opportunity emerge with a local agency other than an SWP contractor, an exchange of SWP deliveries would most likely involve a third party, such as Metropolitan. Most local groundwater desalination facilities would be projects implemented by retailers of SWP contractors and, if an exchange program was implemented, would involve coordination and wheeling of water through the contractor's facilities to CLWA.

3.6.2 Opportunities for Seawater Desalination

Because the Valley is not in a coastal area, it is neither practical nor economically feasible for CLWA and its purveyors to implement a seawater desalination program. However, similar to the brackish water and groundwater desalination opportunities described above, CLWA and the purveyors could provide financial assistance to other SWP contractors in the construction of their seawater desalination facilities in exchange for SWP supplies.

CLWA and the purveyors have been following the existing and proposed seawater desalination projects along California's coast. In March 2004, the California Coastal Commission released the "Seawater Desalination and the California Coastal Act." This Act provides a summary and status of the existing and proposed seawater desalination plants along California's coast. Tables 3-14 and 3-15 provide a summary of several of California's existing and proposed municipal/domestic seawater desalination facilities, respectively.

As shown in the tables, most of the existing and proposed seawater desalination facilities are/would be operated by agencies that are not SWP contractors. However, in these cases as described above, an exchange for SWP deliveries would most likely involve a third party (SWP contractor), the local water agency (retailer), and CLWA.

Table 3-14
Existing Seawater Desalination Facilities Along the California Coast[1]

Operator/Location	Maximum Capacity (gpd/afy[2])	Status
City of Morro Bay	830,000/930	Intermittent Use
City of Santa Barbara	N/A	Inactive
Marina Coast Water District	300,000/335	Active

Notes:
(1) Reference "Seawater Desalination and the California Coastal Act," California Coastal Commission, March 2004.
(2) gpd = gallons per day; afy = acre-feet per year

Although not listed in Table 3-15, the Bay Area Regional Desalination Partnership, made up of four agencies collaborating on a Regional Desalination Project in the San Francisco Bay Area, is working to develop desalination as a water supply for the region. This partnership, comprised of San Francisco Public Utilities Commission, Santa Clara Valley Water District, East Bay Municipal Utilities District, and Contra Costa Water District, is in the process of planning regional seawater/brackish water desalination facilities. This regional desalination project is an example of the type of project that CLWA could participate in on an exchange basis.

Table 3-15
Proposed Seawater Desalination Facilities Along the California Coast[1]

Operator/Location	Maximum Capacity (gpd/afy[2])	Status
Cambria Community Services District	500,000/560	Planning
City of Santa Cruz	2,500,000/2,800	Planning
Marina Coast Water District/Fort Ord	2,680,000/3,000	Planning
Long Beach	10,000,000/11,000	Planning
Los Angeles Dept. of Water & Power	10,000,000/11,000	Planning
Monterey Peninsula Water Mgmt. District/Sand City	7,500,000/8,400	Planning
Cal-Am/Moss Landing Power Plant	9,000,000/10,000	Planning
Municipal Water District of Orange County/Dana Point	27,000,000/30,000	Planning
Poseidon Resources/Huntington Beach	50,000,000/55,000	Draft EIR Complete
San Diego County Water Authority/San Onofre	TBD	Planning
San Diego County Water Authority/South County	50,000,000/55,000	Planning
San Diego County Water authority/Poseidon/Carlsbad	50,000,000/55,000	Planning
West Basin Municipal Water District	20,000,000/22,000	Planning

Notes:
(1) Reference "Seawater Desalination and the California Coastal Act," California Coastal Commission, March 2004.
(2) gpd = gallons per day; afy = acre-feet per year

Chapter 4
WATER RECYCLING

Chapter 4.0
RECYCLED WATER

4.1 OVERVIEW

This section of the Plan describes the existing and future recycled water opportunities available to the CLWA service area. The description includes estimates of potential supply and demand for 2005 to 2030 in five year increments, as well as CLWA's proposed incentives and optimization plan.

4.2 RECYCLED WATER MASTER PLAN

The four retail water purveyors provide water to M&I customers. In normal years, approximately 60 percent of the M&I demand within CLWA's service area is met with imported water. However, the reliability of the imported SWP supply is variable (due to its dependence on current year hydrology in northern California and prior year storage in SWP reservoirs). When sufficient imported water is not available, the balance is met with local groundwater provided by the purveyors.

It is anticipated that water demands will continue to increase. Accordingly, additional reliable sources of water are necessary to meet projected water demands. CLWA recognizes that recycled water is an important and reliable source of additional water. Recycled water would enhance reliability in that it would provide an additional source of supply and allow for more effective utilization of CLWA's water supplies. A Draft Reclaimed Water System Master Plan for the CLWA service area was completed in 1993, and a Draft Recycled Water Master Plan update was completed in 2002. Table 4-1 provides a list of the agencies that participated in the Recycled Water Master Plan update.

Table 4-1
Participating Agencies

Participating Agencies	Role in Plan Development
Castaic Lake Water Agency	Wholesale water provider
Newhall County Water District	Retail water purveyor
Santa Clarita Water Division	Retail water purveyor
Valencia Water Company	Retail water purveyor
Los Angeles County Waterworks District 36	Retail water purveyor
Los Angeles County Sanitation District 26	Recycled water supplier
Los Angeles County Sanitation District 32	Recycled water supplier
Berry Petroleum	Potential recycled water supplier

The Sanitation Districts of Los Angeles County (LACSD) own and operate two water reclamation plants (WRPs): Saugus WRP and Valencia WRP, within the CLWA service area. The water is treated to tertiary levels and discharged to the Santa Clara River. The Newhall Ranch development is also planning to construct a water recycling facility, and non-potable

water from this source may be incorporated into the CLWA's recycled water system. Additionally, Berry Petroleum has expressed interest in treating oilfield produced water from the Placerita Oilfield for sale to CLWA for non-potable uses. Oilfield produced water is a by-product of petroleum extraction, however, and would only be available on a short-term basis. By utilizing the effluent from the WRPs and oilfield produced water for irrigation and other non-potable purposes, CLWA can more efficiently allocate its potable water and increase the overall reliability of water supplies in the Valley.

4.3 POTENTIAL SOURCES OF RECYCLED WASTEWATER

LACSD provides wastewater collection, treatment, and disposal services to residents of two sanitation districts in the Valley: District Nos. 26 and 32, which serve the eastern and western portions of the Valley, respectively. The majority of the two districts' service areas lies within the City of Santa Clarita.

4.3.1 Existing and Planned Wastewater Treatment Facilities

4.3.1.1 Existing Facilities

LACSD's Saugus and Valencia WRPs operated independently until 1980, at which time the two plants were linked by a bypass interceptor. The interceptor was installed to transfer a portion of flows received at the Saugus WRP to the Valencia WRP. In order to improve operating efficiencies and because a shortage of space at the Saugus WRP limits future expansion of wastewater facilities in District No. 26, a joint powers agreement was enacted in 1984, creating the Santa Clarita Valley Joint Sewerage System. Through use of wastewater and sludge connecting lines, future expansions of treatment works, including sludge handling and disposal operations, will be provided at the larger Valencia WRP.

The primary sources of wastewater to the Saugus and Valencia WRPs are domestic. Both plants are tertiary treatment facilities and produce high quality effluent. Historically, the effluent from the two WRPs has been discharged to the Santa Clara River. The Saugus WRP effluent outfall is located approximately 400 feet downstream (west) of Bouquet Canyon Road. Effluent from the Valencia WRP is discharged to the Santa Clara River at a point approximately 2,000 feet downstream (west) of The Old Road Bridge.

Together, the Valencia and Saugus WRPs have a design capacity of 28.1 million gallons per day (mgd). In fiscal year 2002-2003 (FY 02/03), they produced an average of 18.33 mgd, none of which was used for recycled water purposes.

Located within District No. 26, the Saugus WRP, completed in 1962, is southeast of the intersection of Bouquet Canyon Road and Soledad Canyon Road. Two subsequent expansions and flow equalization facilities brought its current design capacity to 6.5 mgd. The treatment process was brought up to a tertiary level with the addition of dual-media pressure filters in 1987. However, no future expansions are possible due to space limitations at the site. In FY 02/03, the Saugus WRP produced an average effluent flow of 5.28 mgd (5,914 afy). Use of recycled water from this facility is permitted under Regional Water Quality Control Board (RWQCB) Order No. 87-49; however, LACSD staff has expressed concern about diverting these discharges due to potential impacts to downstream habitat. Until more detailed habitat

investigations are conducted, it is assumed that only recycled water from the Valencia WRP will be used.

The Valencia WRP is located within District No. 32 and is on The Old Road near Magic Mountain Amusement Park. The Valencia WRP was completed in 1967. The existing capacity is 21.6 mgd following three subsequent expansions: construction of a 4.4 million gallon flow equalization tank in February 1995, the Stage 4 expansion completed in June 1996, and the Joint Sewerage System Phase I expansion of 9 mgd in 2002. In FY 02/03, the Valencia WRP produced an average effluent flow of 13.05 mgd (14,628 afy). Use of recycled water from the Valencia WRP is permitted under RWQCB Order No. 87-48. On July 24, 1996, CLWA executed an agreement with LACSD to purchase up to 1,700 afy of recycled water from the Valencia WRP. In 2002, CLWA constructed the facilities to utilize this supply and initiated deliveries in 2003 to the Westridge Golf Course.

Recycled water from Valencia WRP has been used in the past by the City of Santa Clarita for landscape irrigation and by Pacific Pipeline and Oberg Construction for construction applications, delivered via tanker truck. In April 2000, a contract was signed with TransCoast Financial for use of up to 20,000 gallons per day (gpd) for dust control at a nearby composting facility. When recycled water is requested, it is transported via tanker truck.

4.3.2 Planned Improvements and Expansions

To accommodate anticipated growth in the Valley and to ensure compliance with discharge requirements from the RWQCB, LACSD has begun an expansion of the Valencia WRP as part of the 2015 Joint Sewerage System Facilities Plan. The ultimate capacity of the WRP is planned to be 27.6 mgd. The Phase I expansion (9 mgd increase) was completed in 2002. Phase 2 is expected to be completed in 2010 and involves an additional 6 mgd increase. No expansion is planned at the Saugus WRP. Thus, the ultimate total capacity for both WRPs is 34.1 mgd (38,200 afy). Table 4-2 provides the projected wastewater flow for the combined Valencia and Saugus WRP planning area.

Table 4-2
Wastewater Collection and Capacity

Type of Wastewater	Capacity (af)						
	2002	2005	2010	2015	2020	2025	2030
Wastewater Collected and Treated in Service Area	20,542	31,500	38,200	38,200	38,200	38,200	38,200
Quantity that Meets Recycled Water Standard	20,542	31,500	38,200	38,200	38,200	38,200	38,200

Note:
(1) Information collected from LACSD and Draft 2002 Recycled Water Master Plan.

4.3.3 Water Rights

The ability of CLWA to use recycled water is constrained by its rights to use the water available. While there are few regulatory limitations on the use of oilfield produced water, the use of wastewater effluent is limited by various state water laws, codes, and court decisions. These

regulatory limitations are described in greater detail in the 2002 Draft Recycled Water Master Plan.

CLWA has been approved to use 1,700 afy, but the ultimate recycled water use is governed by the availability of native versus foreign water as shown in Table 4-3. According to the Water Code Section 1211, downstream water rights holders are protected if the source of return flow is "native water." Native water is water that under natural conditions would contribute to a given stream or other body of water (i.e., surface water or percolating groundwater). Thus, if the source of water is "foreign" (e.g., imported or SWP water), downstream water rights holders are not protected under the code. Groundwater extracted from and used in the Valley and then discharged to the Santa Clara River as wastewater effluent may be considered a "native water" to the river; whereas, SWP water imported into and used in the Valley and then discharged to the Santa Clara River as wastewater effluent may be considered a "foreign water." Furthermore, while existing discharges may have a permanent public use (i.e., habitat), only the "foreign water" percentage within the effluent flows can be diverted for recycling purposes.

In 2005, the Valley's potable water supply is projected to consist of approximately 36 percent groundwater (native water) and 64 percent imported water (foreign water). Projected potable water demand for the year 2030 is approximately 112,500 af, 65 percent derived from foreign water and 35 percent derived from native sources. The projected recycled water component would consist of approximately 65 percent (72,800 af foreign / 112,500 total) of projected wastewater generation. Therefore, CLWA's future recycled water system is limited to the foreign water portion of wastewater. This volume is determined by multiplying the percentage of foreign water by the wastewater flow. As shown in Table 4-3, the future foreign water portion of wastewater is 24,830 afy (65 percent times 38,200 afy). It is important to note that these percentages are of potable water demand (i.e., they do not include the use of recycled water in the calculation) and as such are not percentages of total water demand. Although the foreign water percentage of potable water demand only increases by one percent from 2005 to 2030, actual use of foreign water increases by approximately 58 percent.

Table 4-3
Use of Native Water vs. Foreign Water

	Native Water Demand (afy)	Foreign Water Demand (afy)[(1)]	Recycled Water Demand (afy)	Potable Water Demand Total (afy)	Wastewater Flow[(2)] (afy)	Foreign Water Percentage of Potable Water Demand	Foreign Water Portion of Wastewater (afy)
Projected (2005)	25,500	46,100	800	71,600	31,500	64%	20,100
Future (2030)	39,700	72,800	17,391	112,500	38,200	65%	24,830

Note:
(1) Foreign water includes SWP water, water transfers, and desalination.
(2) From Table 4-2.

In order to maintain native water rights, and assuming the ultimate capacities and recycled water demand (as discussed in Section 4.3), the existing and planned methods of wastewater effluent discharge and use are as summarized in Table 4-4.

Table 4-4
Disposal of Wastewater (non-recycled)

Method of Disposal	Treatment Level	Wastewater Discharge and Use (af)					
		2005	2010	2015	2020	2025	2030
Discharge to Santa Clara River	Disinfected, tertiary	30,700	36,600	34,900	30,200	25,500	20,800
Recycled Water Users	Disinfected Tertiary	800	1,600	3,300	8,000	12,700	17,400
Total		**31,500**	**38,200**	**38,200**	**38,200**	**38,200**	**38,200**

4.3.4 Other Potential Sources of Recycled Water

4.3.4.1 Newhall Ranch Water Reclamation Plant

A third Valley reclamation plant is proposed as part of the Newhall Ranch project. This proposed facility would be located near the western edge of the development project along the south side of State Route 126. The plant will be constructed in stages, with an ultimate capacity of 7.7 mgd. Effluent from the proposed water reclamation plant would be used to meet non-potable water demand within the development area. According to the Newhall Ranch Draft Additional Analyses, this plant is projected to produce 5,344 afy on average. During the dry months, all of the recycled water would be used for non-potable uses within Newhall Ranch, supplemented by additional recycled water from CLWA. During the wet winter months when demands are low, the Newhall Ranch WRP would on average have approximately 286 afy excess recycled water. In order for the WRP to be non-discharging (i.e., have production equal demand), this recycled water would be transferred into CLWA's recycled water system for use and/or storage. Any excess demand would need a National Pollutant Discharge Elimination System (NPDES) permit prior to discharge. NPDES permits could place stricter regulatory limitation on the effluent, which may increase treatment costs. Furthermore, the discharge could be subject to additional environmental review prior to approval.

4.3.4.2 Oilfield Produced Water

Oilfield produced water is a by-product of oil production generated when oil is extracted from the oil reservoir. It is generally of poor quality and unsuitable for potable, industrial, or irrigation use without treatment. Because of the poor water quality, reinjection has often been the most cost-effective disposal option.

Treatment processes can produce potable quality water; yet, because of the poor initial water quality and the organic constituents, it is often more appropriate for treated oilfield produced water to be used for irrigation or industrial purposes to offset potable water demand. Pilot studies performed at the Placerita Oilfield have indicated that, even with reverse osmosis (RO) treatment, some organic compounds such as naphthalene, 2-butanone, and ethylbenzene, can be detected in the RO effluent.

The economics of oil production are market-driven and are different from those of drinking water supplies. As oil prices rise or drop, oilfields go into and out of production depending on the costs of production. Also, oilfields are eventually depleted of supply and abandoned. Therefore, while oilfield produced water should be considered as long-term, it is not a completely firm supply and is not permanent.

Studies of the potential reuse of treated oilfield produced water from the Placerita Oilfield have indicated that approximately 44,000 barrels per day (1.8 mgd) of treated oilfield produced water may be available. For irrigation reuse, the produced water would need to be cooled and treated to remove hardness, silica, total dissolved solids (TDS), boron, ammonia, and total organic carbon (TOC).

4.3.5 Summary of Available Source Water Flows

As discussed previously, the non-potable water system has four potential sources of water. The flows projected to be available are shown in Table 4-5. For planning purposes, only recycled water from LACSD is considered available to meet the projected recycled water demands due to the level of evaluation still needed on the alternative sources.

Table 4-5
Summary of Available Source Water Flows

Source	Current Capacity (mgd)	Projected Capacity (mgd)	Projected to be Available for Non-Potable Use (afy)
LACSD Total	28.1	34.1	19,995
Valencia WRP	*21.6*	*27.6*	*19,995*
Saugus WRP	*6.5*	*6.5*	*0*
Oilfield Produced Water	0	1.8	1,980
Newhall Ranch WRP	0	7.7	5,344
Total			**27,319**

4.4 RECYCLED WATER DEMAND

In this section, current recycled water use is discussed, and potential recycled water users within CLWA's service area are identified as determined from the 2002 Draft Recycled Water Master Plan. For each potential user, estimates are provided for annual demand, peak monthly demand, peak daily demand, and the hourly distribution of water demand during peak months. The requirements for potential users to convert their existing water potable systems to recycled water are also discussed.

4.4.1 Current Use

Currently, Recycled water is served to landscape irrigation customers, including the Westridge Golf Course. Table 4-6 provides a summary of existing recycled water use.

Table 4-6
Actual Recycled Water Uses

Type of Use	Treatment Level	Actual 2004 Use (af)
Landscape	Disinfected tertiary	448
Total		**448**

4.4.2 Potential Users

Potential recycled water users were identified through a number of sources including:

- 1993 Recycled Water Master Plan
- Water consumption records for LACWD No. 36, NCWD, SCWD, and VWC
- Land use maps
- General Plans and Specific Plans for the City of Santa Clarita and County of Los Angeles
- Discussions with City, County, water purveyor, and land developer staff
- "Windshield" survey of CLWA service area
- Draft 2002 Recycled Water Master Plan

In order to be considered as a potential recycled water user, the user had to be located within CLWA's service area and have a potential non-potable water demand of at least 4 afy. A total potential demand for existing and future recycled water users is 34,500 afy as identified in the Draft 2002 Recycled Water Master Plan for 2015. As this volume is already greater than the anticipated source of recycled water supply, additional future recycled users were not identified at this time. However, CLWA may reevaluate the list of recycled users after 2015 to consider future users not included in the Draft Master Plan. Table 4-7 provides a summary of the demands by user type.

Table 4-7
Potential Recycled Water Uses

Type of Use	Treatment Level	Potential Use (af)				
		2010	2015	2020	2025	2030
Landscape	Disinfected tertiary	34,500	34,500	34,500	34,500	34,500
Total		**34,500**	**34,500**	**34,500**	**34,500**	**34,500**

The initial list of potential recycled water users was reduced by evaluating the potential users that would be most expensive to serve until potential uses were approximately 17,000 afy. The unit cost to serve each user was calculated using the capital costs for pipelines, reservoirs, and pump stations as well as operational costs for pumping. The areas retained for recycled water service have costs per af ranging from $120 to $5,000. Areas eliminated from service had costs as high as $13,000/af. However, only two of the proposed phases in the Draft Master Plan had costs above $1,000 per af. The resulting proposed recycled water service area encompasses a large portion of CLWA's western service area.

4.4.3 Potential Recycled Water Demand

Potential annual recycled water demands were estimated from historical water use records for existing users and the proposed irrigated area and expected water use per acre for future users. Demands for recycled water are seasonal, with the highest demands occurring during the hot, dry summer months when irrigation requirements are greatest.

The total potential annual recycled water demand that is cost effective to serve is approximately 17,400 afy. Implementation of the recycled water system is expected to occur over the next 25 years. Table 4-8 summarizes the projected future use by user type.

Table 4-8
Projected Potential Future Use of Recycled Water in Service Area

Type of Use	Projected Use (af)				
	2010	2015	2020	2025	2030
Landscape	1,600	3,300	8,000	12,700	17,400
Total	1,600	3,300	8,000	12,700	17,400

4.4.4 Recycled Water Comparison

CLWA's 2000 UWMP projected a total recycled water demand of 19,612 afy by the year 2010. Although it did not specifically state a projected 2005 demand, CLWA had approval for 1,700 afy of recycled water use and was in the process of constructing the necessary facilities to deliver this amount at the time the 2000 UWMP was written. Approximately 448 afy was served in 2004 to landscape irrigation customers, including the Westridge Golf Course. Current demand is lower than originally predicted due to delays in the necessary environmental documentation and funding availability to expand the recycled water distribution system. Table 4-9 provides a comparison of the 2000 projected demand versus the actual 2004 demand.

Table 4-9
Recycled Water Uses - 2000 Projection Compared with 2004 Actual

User Type	2000 Projection for 2005 (af)	2004 Actual Use (af)
Landscape	1,700	448
Total	**1,700**	**448**

4.5 METHODS TO ENCOURAGE RECYCLED WATER USE

In order to provide an incentive to recycled water users, it was recommended in the Draft 2002 Recycled Water Master Plan that the CLWA issue a monthly rebate directly to each recycled water user. However, CLWA is currently considering utilizing a two-fold approach to encourage recycled water use. CLWA plans on making recycled water available at a reduced rate and to work with the City of Santa Clarita and Los Angeles County to adopt a Recycled Water Ordinance, mandating recycled use for certain applications. A Draft Ordinance is currently

being developed and is anticipated to be ready for review in late 2005. The recycled water incentives are summarized in Table 4-10.

Table 4-10
Methods To Encourage Recycled Water Use

Actions	Use Projected to Result From This Action [(1)] (af)				
	2010	2015	2020	2025	2030
Reduced Rate/Recycled Water Ordinance	800	1,600	3,980	6,340	8,700
Total	800	1,600	3,980	6,340	8,700

Note:
(1) Estimated as the projected use due to future customers and assuming future customer use is half of projected recycled water demand for the given years.

CLWA may consider providing financial assistance to retail water providers to offset the costs of extending the recycled water conveyance system or to existing customers to cover a portion of or all of the costs to convert their potable water system to receive recycled water.

4.6 OPTIMIZATION PLAN

Production from the WRPs is not anticipated to be adequate to meet the total demands of the system. However, as potable water demands increase and, consequently, recycled water production increases, the water available to meet system demands would also increase. Therefore, it is recommended that construction of the recycled water system be phased to utilize the increases in plant production.

Oilfield produced water would also not be available immediately, nor would it be available as a permanent source of supply. Instead, this alternative water source would be used as an interim supply when the field is in operation and inadequate recycled water is available from Valencia WRP. Oilfield produced water is anticipated to be available as a long-term supply, available for approximately the next 20 years. The phasing considers when this water source would be available. A detailed discussion of the recommended phasing plan is provided in the Draft Master Plan.

Phasing implementation of the recycled water system is recommended for the following reasons:

- A number of the potential recycled water users are future users that do not yet need recycled water.
- The current flow of the Valencia WRP is not adequate to meet the total demands of the recycled water users.
- Capital requirements would be spread over CLWA's current planning period through 2030.
- Oilfield produced water is not immediately (nor permanently) available.
- Demand is increasing due to development of Newhall Ranch

The recycled water system is divided into implementation phases based primarily on service zone boundaries.

In general, the following factors were considered in developing a phasing plan:

- Ease or willingness of customers to connect to recycled water
- Retrofit costs
- Regulatory requirements
- Community impacts and development requirements
- Water utility involvement/cooperation
- Funding availability
- Reliability and operational costs considerations
- System flexibility

The implementation phases are prioritized based on the status of the users (existing or future), the anticipated construction schedule of future users, and the proximity of the users to the non-potable water source (e.g., Valencia WRP, Placerita Oilfield).

Chapter 5
WATER QUALITY

Chapter 5.0
WATER QUALITY

5.1 OVERVIEW

The quality of any natural water is dynamic in nature. This is true for the SWP and the local groundwater of the Basin. During periods of intense rainfall or snowmelt, routes of surface water movement are changed; new constituents are mobilized and enter the water while other constituents are diluted or eliminated. The quality of water changes over the course of a year. These same basic principles apply to groundwater. Depending on water depth, groundwater will pass through different layers of rock and sediment and leach different materials from those strata. Water depth is a function of local rainfall and snowmelt. During periods of drought, the mineral content of groundwater increases. Water quality is not a static feature of water, and these dynamic variables must be recognized.

Water quality regulations also change. This is the result of the discovery of new contaminants, changing understanding of the health effects of previously known as well as new contaminants, development of new analytical technology, and the introduction of new treatment technology. All water purveyors are subject to drinking water standards set by the Federal Environmental Protection Agency (EPA) and the California Department of Health Services (DHS). Additionally, investor-owned water utilities, such as VWC, are also subject to water quality regulation by the PUC. CLWA provides surface water from the SWP while local retail water purveyors combine local groundwater with treated SWP water from CLWA for delivery to their customers. (LACWWD #36 is an exception and during most years receives water from SWP.) An annual Consumer Confidence Report (CCR) is provided to all Valley residents who receive water from CLWA and one of the four retail water purveyors. That report includes detailed information about the results of quality testing of the water supplied during the preceding year (CCR, 2005).

The quality of water received by individual customers will vary depending on whether they receive SWP water, groundwater, or a blend. Some will receive only SWP water at all times, while others will receive only groundwater. Others may receive water from one well at one time, water from another well at a different time, different blends of well and SWP water at other times, and only SWP water at yet other times. These times may vary over the course of a day, a week, or a year.

This section provides a general description of the water quality of both imported water and groundwater supplies. A discussion of potential water quality impacts on the reliability of these supplies is also provided.

5.2 IMPORTED WATER QUALITY

CLWA provides SWP water to the Valley. The source of SWP water is rain and snow of the Sierra Nevada, Cascade, and Coastal mountain ranges. This water travels to the Delta through a series of rivers and various SWP structures. There it is pumped into a series of canals and reservoirs, which provides water to urban and agricultural users throughout the San Francisco

Bay Area and central and southern California. The most southern reservoir on the West Branch of the SWP California Aqueduct is Castaic Lake. CLWA receives water from Castaic Lake and distributes it to the purveyors following treatment.

Perhaps the most important difference in quality between surface water and groundwater is the presence of microbes in surface water. Surface water is exposed to a variety of microbial contaminants while groundwater in general is not. As a result, there are considerably more water quality regulations for surface water providers. CLWA has two surface water treatment plants, the Rio Vista Water Treatment Plant and the Earl Schmidt Water Filtration Plant, whose function is to ensure the safety of the water by eliminating microbial contaminants. Both of these plants have a multi-barrier strategy. The first barrier is the application of ozone, a powerful disinfectant, which has the ability to kill a broad range of microbes. The second barrier is the addition of chemicals to remove particles from the water, which can hide and protect microbes. Removing particles improves the anti-microbial action of the disinfectants. The water is then passed through two sets of filters, and chloramines are then added to the water. Chloramines are similar to chlorine and prevent the growth of bacteria in the distribution system, which delivers water from the treatment plants to the retail water purveyors.

An important property of SWP water is the chemical make up caused by its passage through the Delta. The Delta is basically a very large marsh (or estuary) with large masses of plants and peat soils. These contribute organic materials (TOC) to the water. Salt water can also move into the Delta from San Francisco Bay and the Pacific Ocean. This brings in salts, notably bromide and chloride. None of these chemicals are harmful in and of themselves; however, when bromide and TOC react with disinfectants such as ozone, chlorine, or chloramines, a reaction occurs forming substances known as disinfection by-products (DBPs). A variety of health-based concerns are associated with DBPs (CCR, 2005).

Another important property of SWP water is the mineral content. SWP water is generally low in dissolved minerals, such as calcium, magnesium, sodium, potassium, iron, manganese, nitrate, and sulfate. Most of these minerals do not have health based concerns, but “hard” water (water high in calcium, magnesium, and iron) can cause a number of problems for consumers, such as the formation of white crusts in plumbing fixtures, water spots, damage to water heaters, and excess use of soaps. Nitrate is the main exception, as it has significant health effects for infants; however, the nitrate content of SWP water is very low. Also of significance is the chloride content. Although not a human health risk, chloride can have a negative impact on agricultural activities and regulatory compliance for local sanitation agencies. The chloride content of SWP water varies widely from well over 100 milligrams per liter (mg/L) to below 40 mg/L, depending on Delta conditions.

All surface waters can have taste and odor problems caused by the growth of algae in reservoirs, such as Castaic Lake. Under certain conditions, algae can grow in large mats, which then die, releasing foul smelling chemicals. Although harmless, the taste and odor causing chemicals can generally be very unpleasant for consumers.

5.3 GROUNDWATER QUALITY

The Basin has two sources of groundwater. Most local wells draw water from the Alluvial Aquifer. A smaller portion of the Valley's water supply is drawn from the Saugus Formation, a much deeper aquifer than the Alluvial Aquifer. The quality components of these aquifers differ with changing rainfall conditions. The two aquifers' water quality changes at different rates and much more slowly than surface water.

Local groundwater generally does not have microbial water quality problems. Parasites, bacteria, and viruses are filtered out as the water percolates through the soil, sand, and rock on its way to the aquifer. Even so, disinfectants are added to local groundwater when it is pumped by wells to protect public health. Local groundwater has very little TOC and generally has very low concentrations of bromide, minimizing potential for DPB formation. Taste and odor problems from algae are not an issue with groundwater.

The mineral content of local groundwater is very different from SWP water. The groundwater is very "hard," that is, it has high concentrations of calcium and magnesium (approximately 250-600 mg/L, as developed in the CLWA et al 2005 Annual Water Quality Report). Groundwater may also contain higher concentrations of nitrates and chlorides when compared to SWP water. However, all groundwater meets or exceeds drinking water standards.

The following sections describe the groundwater quality of the Alluvium and Saugus Formation.

5.3.1 Groundwater Quality – Alluvium

Groundwater quality is a key factor in assessing the Alluvial Aquifer as a municipal and agricultural water supply. In terms of the aquifer system, there is no convenient long-term record of water quality, i.e., water quality data in one or more single wells that spans several decades and continues to the present. Thus, in order to examine a long-term record of water quality in the Alluvium, individual records have been integrated from several wells completed in the same aquifer materials and in close proximity to each other to examine historical trends in general mineral groundwater quality throughout the Basin. Based on these records of groundwater quality, wells within the Alluvium have experienced historical fluctuations in general mineral content, as indicated by specific conductance (or electrical conductivity [EC]), which correlates with fluctuations of individual constituents that contribute to EC. The historic water quality data indicates that, on a long-term basis, there has not been a notable trend and, specifically, there has not been a decline in water quality within the Alluvium.

Specific conductance within the Alluvium exhibits a westward gradient, corresponding with the direction of groundwater flow in the Alluvium. EC is lowest in the easternmost portion of the Basin and highest in the west. Water quality in the Alluvium generally exhibits an inverse correlation with precipitation and streamflow, with a stronger correlation in the easternmost portion of the Basin, where groundwater levels fluctuate the most. Wet periods have produced substantial recharge of higher quality (low EC) water, and dry periods have resulted in declines in groundwater levels, with a corresponding increase in EC (and individual contributing constituents) in the deeper parts of the Alluvium.

Specific conductance throughout the Alluvium is currently below the Secondary (aesthetic) Upper Maximum Contaminant Level of 1,600 micromhos per centimeter (umhos/cm). The presence of long-term consistent water quality patterns, although intermittently affected by wet and dry cycles, supports the conclusion that the Alluvial aquifer is a viable ongoing water supply source in terms of groundwater quality.

The most notable groundwater quality issue in the Alluvium is perchlorate contamination. In 2002, one Alluvial well located near the former Whittaker-Bermite facility was inactivated for municipal water supply due to detection of perchlorate slightly below the Notification Level. In early 2005, perchlorate was detected in a second Alluvial well, VWC's Well Q2. In response, VWC removed the well from active service and commissioned an analysis and report assessing the impact of, and response to, the perchlorate contamination of that well. Sections 5.4 and 5.5 present additional information on the results of the Q2 analysis and report and VWC's response plan for Well Q2 to pursue permitting and installation of wellhead treatment, which resulted in returning the well to water supply service in October 2005.

5.3.2 Groundwater Quality – Saugus Formation

Similar to the Alluvium, groundwater quality in the Saugus Formation is a key factor in assessing that aquifer as a municipal and agricultural water supply. As with groundwater level data, long-term Saugus groundwater quality data is not sufficiently extensive (few wells) to permit any basin-wide analysis or assessment of pumping-related impacts on quality. As with the Alluvium, EC has been chosen as an indicator of overall water quality, and records have been combined to produce a long-term depiction of water quality. Water quality in the Saugus Formation has not historically exhibited the precipitation-related fluctuations seen in the Alluvium. Based on the historical record over the last 50 years, groundwater quality in the Saugus has exhibited a slight overall increase in EC. More recently, several wells within the Saugus Formation have exhibited an additional increase in EC similar to that seen in the Alluvium. In 2004, monthly data collected by VWC for two Saugus wells shows that the overall level of EC remained fairly stable during the year. Levels of EC in the Saugus Formation remain below the Secondary (aesthetic) Upper Maximum Contaminant Level for EC. Groundwater quality within the Saugus will continue to be monitored to ensure that degradation that presents concern relative to the long-term viability of the Saugus as an agricultural or municipal water supply does not occur.

As with the Alluvium, the most notable groundwater quality issue in the Saugus Formation is prechlorate contamination. Perchlorate was originally detected in four Saugus wells operated by the retail water purveyors in the eastern part of the Saugus Formation in 1997, near the former Whittaker-Bermite facility. Since then, the four Saugus municipal supply wells have been out of water supply service due to the presence of perchlorate. While the inactivation of those wells does not limit the ability of the purveyors to meet water requirements, there is an ongoing effort to restore impacted pumping capacity and contain potential perchlorate migration in the Saugus Formation by 2006 as discussed in Sections 5.4 and 5.5.

The local retail water purveyors continue to test for perchlorate in active water supply wells near the Whittaker-Bermite site, and there has been no additional detection of perchlorate in any other municipal Saugus well. Details are provided below on the various aspects of ongoing

perchlorate-related work, including investigation of the extent of contamination, development of an interrelated program for control and extraction of perchlorate by restoring impacted capacity (wells), treatment technology and its planned application for restoration of impacted wells, regulatory aspects of utilizing impacted wells with treatment for domestic water supply, and the current state of planning and implementation of perchlorate control and clean-up, including restoration of contaminated municipal water supply as part of that control and clean-up.

5.4 AQUIFER PROTECTION

As introduced in Chapter 3, three factors affect the availability of groundwater: sufficient source capacity (wells and pumps); sustainability of the groundwater resource to meet pumping demand on a renewable basis; and protection of groundwater sources (wells) from known contamination, or provisions for treatment in the event of contamination. The first two of those factors are addressed in Chapter 3. The third factor, the impact and resolution of contamination, is being addressed in the Valley's two aquifers as follows.

5.4.1 Alluvium

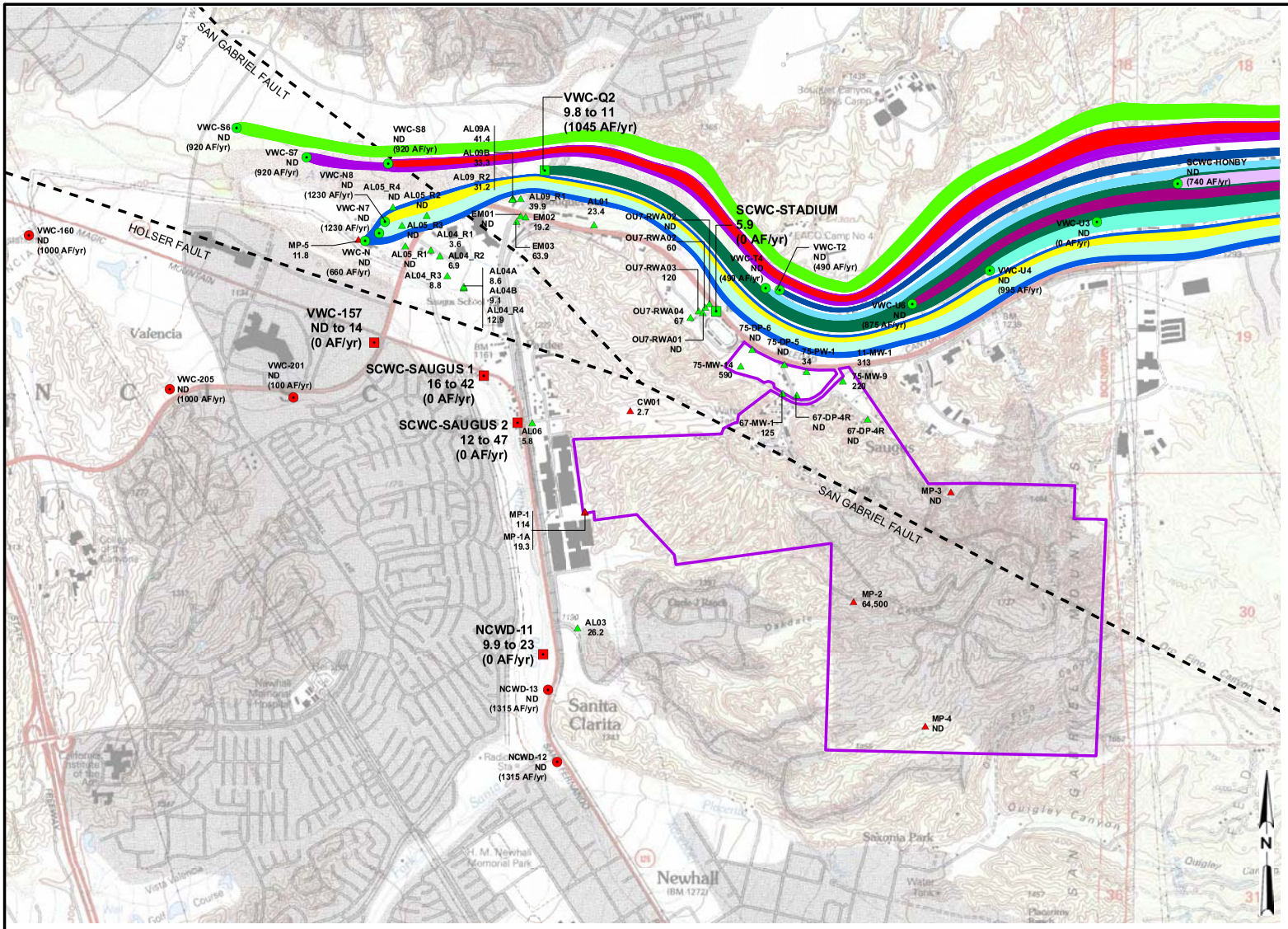
Details of the overall perchlorate contamination issue, which has had a larger impact on the Saugus Formation (four impacted wells with a total pumping capacity of 7,900 gpm) than on the Alluvium (one impacted well with a total pumping capacity of 800 gpm), are discussed in Appendix D of this Plan. As detailed in that Appendix, there has been extensive investigation of the extent of perchlorate contamination which, in combination with the groundwater modeling previously described, has led to the current plan for integrated control of contamination migration and restoration of impacted pumping (well) capacity in 2006. While most of the perchlorate contamination control and restoration plan is focused on the Saugus Formation, part of that plan includes potential capture of contaminated groundwater in the Alluvium by pumping of selected Saugus wells. Specific long-term resolution of perchlorate contamination in the Alluvium, which impacted two water supply wells, is focused on a combination of wellhead treatment at one well, the VWC's Well Q2, and several source control methods such as on-site pumping and treatment in the northern Alluvium (at the northerly portion of the former Whittaker-Bermite site) and subsequent restoration of the impacted Stadium well. In the interim, i.e., through 2006, a key challenge is protection of active Alluvial wells that could be impacted, including what effect that might have on adequacy of Alluvial groundwater pumping capacity and what response will be taken.

In April 2005, perchlorate was detected in VWC's Well Q2. VWC's response was to remove the well from active water supply service and to rapidly seek approval for installation of wellhead treatment and return of the well to service. As part of outlining its plan for treatment and return of the well to service, VWC analyzed the impact of the temporary inactivation of the well on its water supply capability; the analysis determined that VWC's other sources are sufficient to meet demand and that the inactivation of Well Q2 thus had no impact on VWC's water supply capability (LSCE, 2005). VWC proceeded through mid-2005 to gain approval for installation of wellhead treatment (ion-exchange as described below), including environmental review, and completed the installation of the wellhead treatment facilities in September 2005. Well Q2 was returned to active water supply service in October 2005.

Ongoing monitoring of all active municipal wells near the Whittaker-Bermite site has shown no detections of perchlorate in any active Alluvial wells. However, based on a combination of proximity to the Whittaker-Bermite site and prevailing groundwater flow directions, complemented by findings in the ongoing on-site and off-site investigations by Whittaker-Bermite and the Army Corps of Engineers (ACOE) (See Appendix D), there is logical concern that perchlorate could impact nearby, downgradient Alluvial wells. As a result, provisions are in place to respond to perchlorate contamination if it should occur. The groundwater model was used to examine capture zones around Alluvial wells under planned operating conditions (pumping capacities and volumes) for the time period through currently scheduled restoration of impacted wells in 2006 (Technical Memorandum "Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property (Santa Clarita, California)", CH2M Hill, November 2004). The capture zone analysis of Alluvial wells generally near the Whittaker-Bermite site, shown on Figure 5-1, suggests that inflow to those wells will either be upgradient of the contamination site, or will be from the Alluvium beyond where perchlorate is most likely to be transported, with the possible exception of the VWC's Pardee wellfield, which includes Wells N, N7, and N8. Although the capture zone analysis does not show the Pardee wells to be impacted, they are considered to be at some potential risk due to the proximity of their capture zone to the Whittaker-Bermite site.

The combined pumping capacity of VWC's Pardee wells is 6,200 gpm, which equates to about 10,000 af of maximum annual capacity. However, in the operating plan for both normal and dry-year Alluvial pumping, the planned use of those wells represents 2,940 afy of the total 30,000 to 40,000 afy Alluvial groundwater supply. Thus, if the wells were to become contaminated with perchlorate, they would represent an amount of the total Alluvial supply that could be readily replaced, on a short-term interim basis, by utilizing an equivalent amount of imported water from CLWA or by utilizing existing capacity from other Alluvial wells (see Table 3-9 in Chapter 3.0). However, if the Pardee wells were to become contaminated by perchlorate contamination, VWC has made site provisions at its Pardee wellfield for installation of wellhead treatment. Such treatment would be the same methodology as installed at its Well Q2.

In addition to the preceding, on-site investigation by Whittaker-Bermite since late 2003 has resulted in the completion, in June 2005, of a Workplan for a Pilot Remediation Pumping Program in the Northern Alluvium and certain on-site sub-areas east/southeast, or generally upgradient, of the impacted Stadium well. That program basically involves the establishment of containment, generally along the northern boundary of the Whittaker-Bermite site, upgradient of the Stadium well, by continuous pumping of a former Whittaker-Bermite facility well, at a continuous low capacity, complemented by pumping at several groundwater "hot spots" also generally upgradient of the Stadium well. Due to the low conductivity nature of the aquifer materials at the various "hot spots," pumping for containment at those locations would be from several wells at low pumping capacities. Extracted water would be treated at Whittaker-Bermite's existing on-site treatment system. Generally consistent with the Saugus restoration concept, the Northern Alluvium pumping program would have the concurrent objectives of preventing site-related contaminants from leaving the site and removing some contamination from groundwater such that it can be removed in the on-site treatment process prior to discharge of the water back to the groundwater Basin.



LEGEND

CONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

MONITORING WELL
- ALLUVIUM
- SAUGUS

TWO-YEAR GROUNDWATER CAPTURE ZONE
- SCWC-HONBY
- VWC-N
- VWC-N7
- VWC-N8
- VWC-Q2
- VWC-S6
- VWC-S7
- VWC-S8
- VWC-T2
- VWC-T4
- VWC-U4
- VWC-U6
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. PUMPING VALUES IN PARENTHESES ARE ANNUAL PUMPING VOLUMES
3. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
4. µg/L = MICROGRAMS PER LITER; AF/yr = acre feet per year
5. FLOWPATHS ARE DELINEATED USING AN EFFECTIVE POROSITY OF 0.10 IN THE ALLUVIAL AQUIFER AND 0.05 IN THE SAUGUS FORMATION.

FIGURE 5-1
FORECASTED TWO-YEAR GROUNDWATER CAPTURE ZONES FOR ACTIVE ALLUVIAL PRODUCTION WELLS LOCATED CLOSEST TO THE WHITTAKER-BERMITE PROPERTY
SANTA CLARITA, CALIFORNIA

CH2MHILL

5.4.2 Saugus Formation

Details of the overall nature and extent of perchlorate contamination are discussed in Appendix D. The program and schedule involves the ultimate installation of treatment facilities to both extract contaminated water and control migration in the aquifer, such that the impacted capacity is restored and perchlorate migration is controlled in 2006.

In the interim, the question of whether existing active Saugus wells are likely to be contaminated by perchlorate migration prior to the installation of treatment and pumping for perchlorate contamination control has been evaluated by using the groundwater flow model to analyze capture zones of existing active wells through 2006, the scheduled period for permitting, installation of treatment, and restoration of impacted capacity. For that analysis, recognizing current hydrologic conditions and available supplemental SWP supplies, the rate of Saugus pumping was conservatively projected to be in the normal range (7,500 to 15,000 afy) for the near-term. The results of the capture zone analysis, illustrated on Figure 5-2, were that the two nearest downgradient Saugus wells, VWC's Wells 201 and 205, would draw water from very localized areas around the wells and would not draw water from locations where perchlorate has been detected in the Saugus. As shown on the figure, the capture zone analysis projected Well 201 would potentially draw Saugus groundwater from areas located up to 450 feet east of the well, but was unlikely to draw water from areas farther to the east through that time period. During the same time, Well 205 would potentially draw Saugus groundwater from areas as much as 650 feet to the east and northeast of this well.

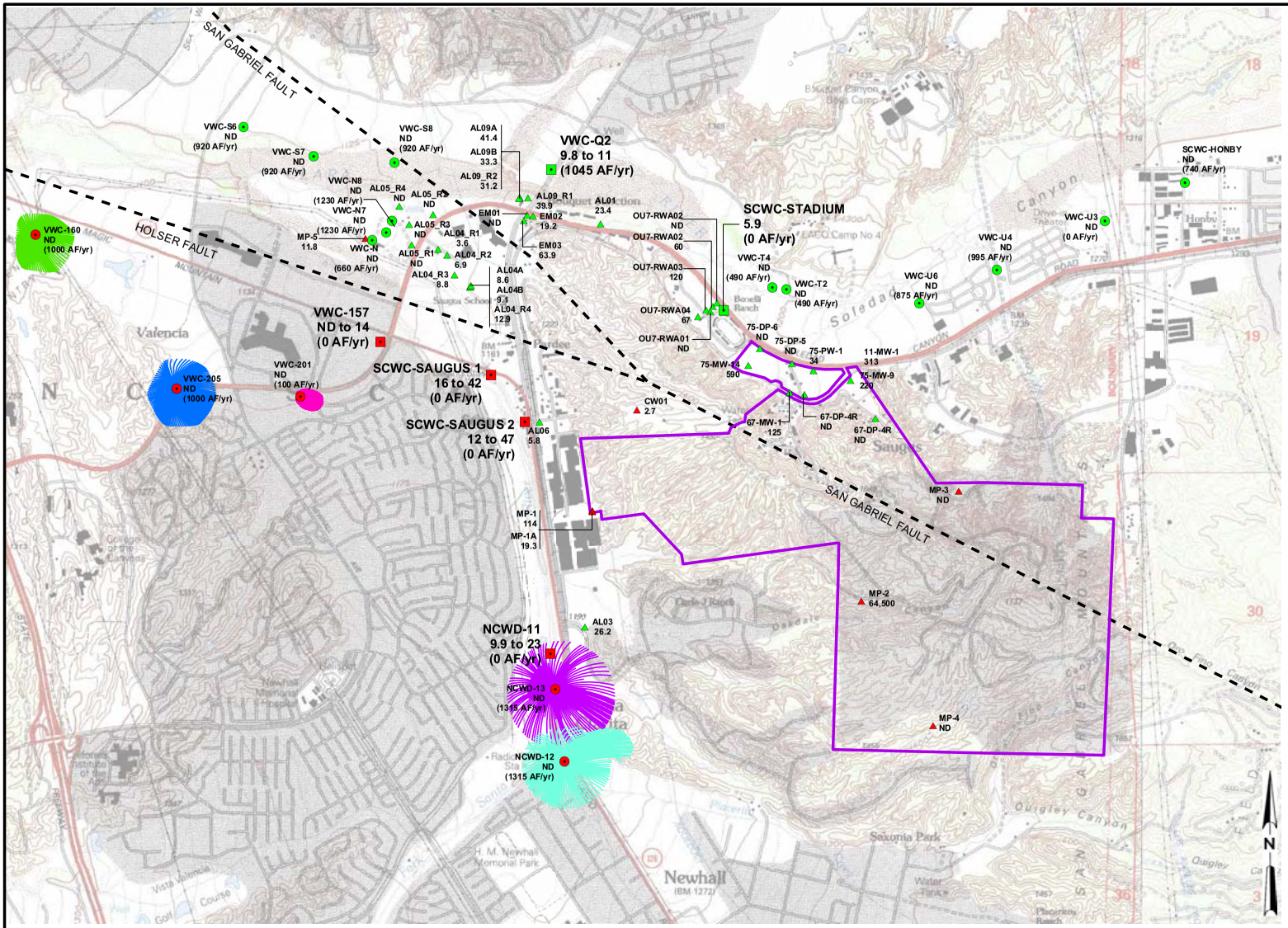
As a result, the currently active downgradient Saugus wells are expected to remain active as sources of water supply in accordance with the overall operating plan for the Saugus Formation, given the generally low planned pumping from the nearest downgradient Saugus wells in the operating plan through 2006, after which restored capacity and resultant aquifer hydraulic control are scheduled to be in place.

5.5 WATER QUALITY IMPACTS ON RELIABILITY

5.5.1 Groundwater Contamination (Perchlorate)

The detection of perchlorate in Valley groundwater supplies has raised concerns over the reliability of those supplies, in particular the Saugus Formation, where four wells have been removed from active service as a result of perchlorate. As discussed below and in Appendix D, planning for remediation of the perchlorate and restoration of the impacted well capacity is substantially underway. While that work is being completed, non-impacted production facilities can be relied upon for the quantities of water projected to be available from the Alluvial Aquifer and Saugus Formation during the time necessary to restore perchlorate-impacted wells. CLWA, the local retail water purveyors, the California Department of Toxic Substances Control (DTSC), and the ACOE continue to work closely on the perchlorate contamination issue.

The following is a summary of the status of perchlorate remediation and restoration of perchlorate-impacted groundwater supply. A more detailed discussion of pertinent events related



LEGEND

CONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

MONITORING WELL
- ALLUVIUM
- SAUGUS

TWO-YEAR GROUNDWATER CAPTURE ZONE
- NC-12
- NC-13
- VWC-160
- VWC-201
- VWC-205
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. PUMPING VALUES IN PARENTHESES ARE ANNUAL PUMPING VOLUMES.
3. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
4. µg/L = MICROGRAMS PER LITER; AF/yr = acre feet per year
5. FLOWPATHS ARE DELINEATED USING AN EFFECTIVE POROSITY OF 0.10 IN THE ALLUVIAL AQUIFER AND 0.05 IN THE SAUGUS FORMATION.

FIGURE 5-2
FORECASTED TWO-YEAR GROUNDWATER CAPTURE ZONES FOR ACTIVE SAUGUS PRODUCTION WELLS LOCATED CLOSEST TO THE WHITTAKER-BERMITE PROPERTY
SANTA CLARITA, CALIFORNIA

CH2MHILL

to perchlorate contamination, containment, remediation, and water supply restoration is included in Appendix D. These discussions are provided to illustrate that work toward the ultimate remediation of the perchlorate contamination, including the reactivation of impacted groundwater supply wells, has progressed on several integrated fronts over the last five years.

5.5.2 Perchlorate Impacted Water Purveyor Wells

As introduced above, perchlorate was detected in four Saugus Formation production wells near the former Whittaker-Bermite site in 1997. As a result, these wells (SCWD's Wells Saugus 1 and Saugus 2, NCWD's Well NC-11, and VWC's Well V-157) were removed from service. In 2002, perchlorate was detected in the SCWD Stadium well located directly adjacent to the Whittaker-Bermite site. This Alluvial well also has been removed from service.

Since the detection of perchlorate and resultant inactivation of impacted wells, the purveyors have been conducting regular monitoring of active wells near the Whittaker-Bermite site. In April 2005, that monitoring detected the presence of perchlorate in VWC's Well Q2, an Alluvial well located immediately northwest of the confluent of Bouquet Creek and the Santa Clara River. The location of this well is also shown on Figures 5-1 and 5-2. As a result of the detection and confirmation of perchlorate in its Well Q2, VWC removed the well from active service and pursued rapid permitting and installation of wellhead treatment in order to return the well to water supply service as described in Section 5.4.1.

In January 2005, VWC permanently closed well V-157 and in September 2005 completed the construction of new Saugus well V-206 located in an area of the Saugus Formation not impacted by perchlorate. VWC's V-206 is operational and replaces the pumping capacity temporarily impacted by the detection of perchlorate at V-157. In October 2005, VWC restored the pumping capacity of well Q2 with the start-up of wellhead treatment designed to effectively remove perchlorate. In summary, four wells (Saugus 1 and 2, NC-11, and Stadium well) remain temporarily offline due to perchlorate contamination.

Locations of the impacted wells, and other nearby non-impacted wells, relative to the Whittaker-Bermite site are shown on Figures 5-1 and 5-2.

5.5.3 Restoration of Perchlorate Impacted Water Supply

Since the detection of perchlorate in the four Saugus wells in 1997, CLWA and the retail water purveyors have recognized that one element of an overall remediation program would most likely include pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. Thus, CLWA and the retail water purveyors expect that the overall perchlorate remediation program could include dedicated pumping from some or all of the impacted wells, with appropriate treatment, such that two objectives could be achieved. The first objective is control of subsurface flow and protection of downgradient wells, and the second is restoration of some or all of the contaminated water supply. Not all impacted capacity is required for control of groundwater flow. The remaining capacity would be replaced by construction of replacement wells at non-impacted locations.

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, CLWA and the local retail water purveyors developed an off-site plan that focuses on the concepts of groundwater flow control and restored pumping capacity and is compatible with on-site and possibly other off-site remediation activities. Specifically relating to water supply, the plan includes the following:

- Constructing and operating a water treatment process that removes perchlorate from two impacted wells such that the produced water can be used for municipal supply.
- Hydraulically containing the perchlorate contamination that is moving from the Whittaker-Bermite site toward the impacted wells by pumping the wells at rates that will capture water from all directions around them.
- Protecting the downgradient non-impacted wells through the same hydraulic containment that results from pumping two of the impacted wells.
- Restoring the annual volumes of water pumped from the impacted wells before they were inactivated and also restoring the wells' total capacity to produce water in a manner consistent with the retail water purveyors' operating plan for groundwater supply described above.

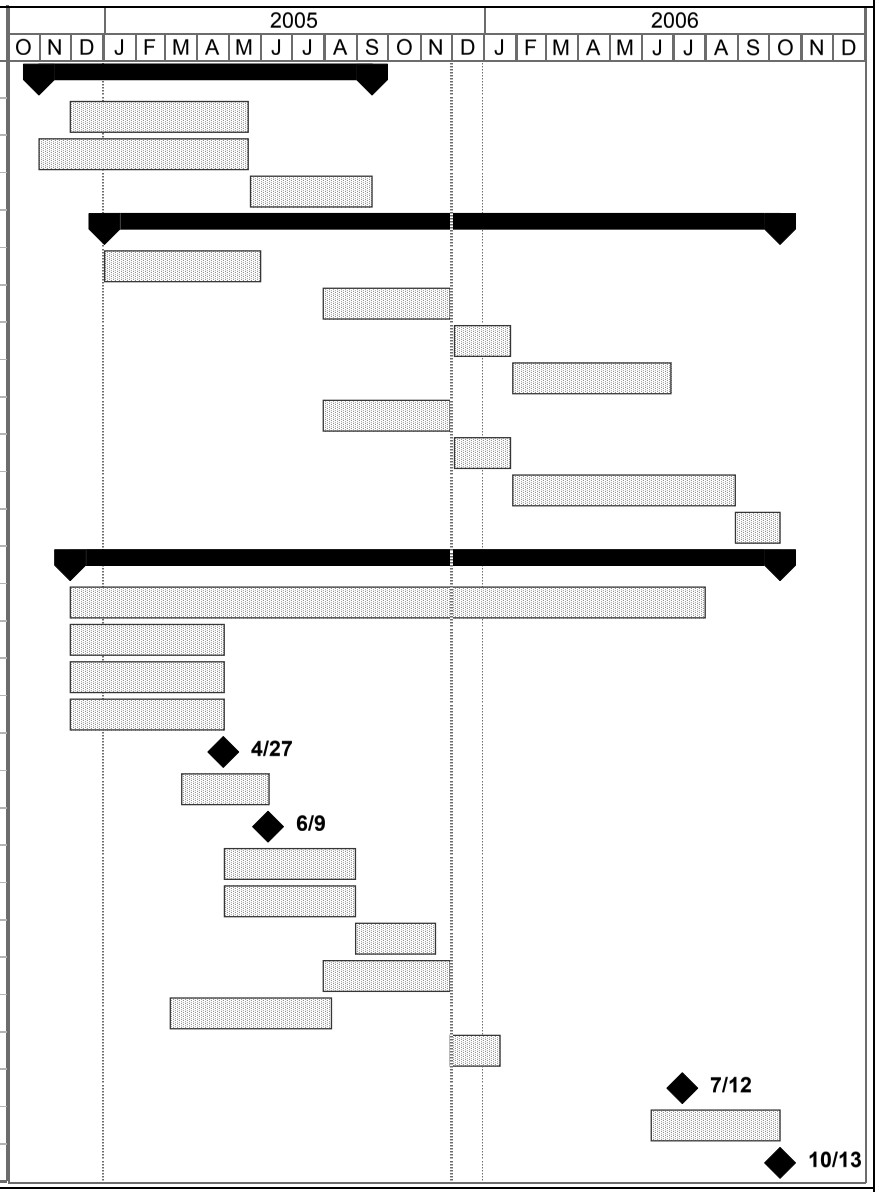
The current schedule for implementation of the plan to restore contaminated water supply (wells) is illustrated on Figure 5-3. Included in the schedule is a planned extended test of the wells that will be returned to service as part of restoring contaminated water supply and that will also be operated to extract contaminated water and control the migration of contamination in the aquifer. Concurrent with the testing of the wells, several specific ion exchange resins will also be tested to evaluate their performance and longevity. The two key activities that comprise the majority of effort required for implementation of the plan are general facilities-related work (design and construction of well facilities, treatment equipment, pipelines, etc.) and permitting work. Both activities are planned and scheduled concurrently, resulting in planned completion (i.e., restoration of all impacted capacity) in 2006. Notable recent accomplishments toward implementation include completion of the Final Draft Interim Remedial Action Plan (RAP) in August 2005 and completion of environmental review with the adoption of a Mitigated Negative Declaration in September 2005.

In light of the preceding, with regard to the adequacy of groundwater as the local component of water supply in this Plan, the impacted capacity will remain unavailable through early to mid-2006, during which time the non-impacted groundwater supply will be sufficient to meet near-term water requirements as described in Chapter 3, Water Resources. Afterwards, the total groundwater capacity will be sufficient to meet the full range of normal and dry-year conditions as provided in the operating plan for groundwater supply.

Returning the contaminated Saugus wells to municipal water supply service by installing treatment requires issuance of permits from DHS before the water can be considered potable and safe for delivery to customers. The permit requirements are contained in DHS Policy Memo 97-005 for direct domestic use of impaired water sources.

Figure 5-3
Preliminary 97-005 Implementation Schedule
Castaic Lake Water Agency

ID	Task Name	Duration	Start	Finish
1	**DTSC Approval Activities**	**230 days**	**Mon 11/1/04**	**Fri 9/16/05**
2	Feasibility Study	6.15 mons	Wed 12/1/04	Fri 5/20/05
3	Draft RAP	29 wks	Mon 11/1/04	Fri 5/20/05
4	Final RAP	4.25 mons	Mon 5/23/05	Fri 9/16/05
5	**Implementation Activities**	**465 days**	**Mon 1/3/05**	**Fri 10/13/06**
6	Easements and ROW	5.4 mons	Mon 1/3/05	Wed 6/1/05
7	Treatment Design	4.4 mons	Mon 8/1/05	Wed 11/30/05
8	Treatment Bidding & Contracting	2 mons	Mon 12/5/05	Fri 1/27/06
9	Treatment Construction	5.5 mons	Mon 1/30/06	Fri 6/30/06
10	Pipeline Design	4.4 mons	Mon 8/1/05	Wed 11/30/05
11	Pipeline Bidding & Contracting	2 mons	Mon 12/5/05	Fri 1/27/06
12	Pipeline Construction	7.7 mons	Mon 1/30/06	Thu 8/31/06
13	System Startup	1.55 mons	Fri 9/1/06	Fri 10/13/06
14	**DHS Approval Activities (97-005)**	**488 days**	**Wed 12/1/04**	**Fri 10/13/06**
15	DHS Coordination	21.8 mons	Wed 12/1/04	Wed 8/2/06
16	TM1: Source Water Assessment	5.3 mons	Wed 12/1/04	Wed 4/27/05
17	TM2: Raw Water Quality Characterization	5.3 mons	Wed 12/1/04	Wed 4/27/05
18	TM3: Source Water Protection	5.3 mons	Wed 12/1/04	Wed 4/27/05
19	DHS Workshop No. 1	0 days	Wed 4/27/05	Wed 4/27/05
20	TM4: Effective Monitoring & Treatment	3 mons	Fri 3/18/05	Thu 6/9/05
21	DHS Workshop No. 2	0 days	Thu 6/9/05	Thu 6/9/05
22	TM5: Human Health Risk Assessment	4.5 mons	Thu 4/28/05	Wed 8/31/05
23	TM6: Alternative Source Assessment	4.5 mons	Thu 4/28/05	Wed 8/31/05
24	DHS Review of TMs 5 & 6	2.75 mons	Thu 9/1/05	Wed 11/16/05
25	Prepare 97-005 Engineer's Report	4.4 mons	Mon 8/1/05	Wed 11/30/05
26	CEQA Initial Study and Draft MND	5.55 mons	Mon 3/7/05	Mon 8/8/05
27	Permit Application	1.7 mons	Thu 12/1/05	Tue 1/17/06
28	Public Hearing	0 days	Wed 7/12/06	Wed 7/12/06
29	DHS Evaluation	4.5 mons	Mon 6/12/06	Fri 10/13/06
30	Obtain DHS Permit	0 days	Fri 10/13/06	Fri 10/13/06



Project: CLWA 97-005_r2
Date: Thu 12/1/05

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

Before issuing a permit to a water utility for use of an impaired source as part of the utility's overall water supply permit, DHS requires that studies and engineering work be performed to demonstrate that pumping the wells and treating the water will be protective of public health for users of the water. The 97-005 Policy Memo requires that DHS review the local retail water purveyor's plan, establish appropriate permit conditions for the wells and treatment system, and provide overall approval of returning the impacted wells to service for potable use. Ultimately, CLWA's and the local retail water purveyor's plan and the DHS requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

The DHS 97-005 Policy Memo requires, among other things, the completion of a source water assessment for the impacted wells intended to be returned to service. The purpose of the assessment is to determine the extent to which the aquifer is vulnerable to continued migration of perchlorate and other contaminants of interest from the Whittaker-Bermite site. The assessment includes the following:

- Delineation of the groundwater capture zone caused by operating the impacted wells
- Identification of contaminants found in the groundwater at or near the impacted wells
- Identification of chemicals or contaminants used or generated at the Whittaker-Bermite facility
- Determination of the vulnerability of pumping the impacted wells to these contaminant sources

CLWA is currently working directly with the retail water purveyors and its consultants on development of the DHS 97-005 Policy Memo permit application. Two coordination workshops have already been held with DHS. Drafts of all six elements of the 97-005 Policy Memo have been submitted to DHS and the retail purveyors for review, including: the Source Water Assessment, Raw Water Quality Characterization, Source Protection Plan, Effective Monitoring and Treatment Evaluation, Human Health Risk Assessment, and the Alternatives Sources Evaluation. The Engineer's Report, which summarizes these six elements for the 97-005 process, is anticipated to be complete by the end of November 2005.

The CEQA process for the "CLWA Groundwater Containment, Treatment, and Restoration Project," for which the 97-005 process is being conducted, was completed in August 2005. The Project Description from the project's CEQA Initial Study is included in Appendix E.

As listed above, DHS 97-005 Policy Memo requires an analysis to demonstrate contaminant capture and protection of other nearby water supply wells. The development and calibration of a numerical groundwater flow model of the entire basin had been initiated as a result of a 2001 MOU among the Upper Basin Water Purveyors (CLWA, CLWA SCWD, LACWWD #36, NCWD, and VWC) and the United Water Conservation District in Ventura County.

The groundwater model was initially intended for use in analyzing the operating yield and sustainability of groundwater in the Basin. Use of the model for that analysis is described in Chapter 3. However, the model was adaptable to analyze both the sustainability of groundwater under an operational scenario that includes full restoration of perchlorate-contaminated supply

and the containment of perchlorate near the Whittaker-Bermite property (i.e., by pumping some of the contaminated wells). In 2004, DTSC reviewed and approved the construction and calibration of the regional model as described in the final model report, "Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration" (CH2M Hill, April 2004).

After DTSC approval, the model was used to simulate the capture and control of perchlorate by restoring impacted wells, with treatment. The results of that work are summarized in a second report, "Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California" (CH2M Hill, December 2004). The modeling analysis indicates that the pumping of impacted wells SCWD-Saugus 1 and SCWD-Saugus 2 on a nearly continual basis will effectively contain perchlorate migrating westward in the Saugus Formation from the Whittaker-Bermite property. The analysis also indicates that (1) no new production wells are needed in the Saugus Formation to meet the perchlorate containment objective, (2) impacted well NCWD-11 is not a required component of the containment program, and (3) pumping at SCWD-Saugus 1 and SCWD-Saugus 2 is necessary to prevent migration of perchlorate to other portions of the Saugus Formation.

The perchlorate containment report also includes the general design of a sentinel groundwater monitoring network and program required by DHS as part of its 97-005 Policy Memo permitting. The perchlorate containment report was approved by DTSC in November 2004. With that approval, the model is now being used to support the source water assessment and the balance of the permitting process required by DHS under its 97-005 Policy Memo.

Chapter 6
RELIABILITY PLANNING

Chapter 6.0
RELIABILITY PLANNING

6.1 OVERVIEW

The Act requires urban water suppliers to assess water supply reliability that compares total projected water used with the expected water supply over the next twenty years in five year increments. The Act also requires an assessment for a single dry year and multiple dry years. This chapter presents the reliability assessment for CLWA's service area.

It is the stated goal of CLWA and the retail water purveyors to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions over the next 25 years in combination with conservation of non-essential demand during certain dry years, the Plan successfully achieves this goal.

6.2 RELIABILITY OF WATER SUPPLIES

Each water supply source has its own reliability characteristics. In any given year, the variability in weather patterns around the state may affect the availability of supplies to the Valley differently. For example, from 2000 through 2002, southern California experienced dry conditions in all three years. During the same period, northern California experienced one dry year and two normal years. The Valley is typical in terms of water management in southern California; local groundwater supplies are used to a greater extent when imported supplies are less available due to dry conditions in the north, and larger amounts of imported water supplies are used during periods when northern California has wetter conditions. This pattern of "conjunctive use" has been in effect since SWP supplies first came to the Valley in 1980. SWP supplies have supplemented the overall supply of the Valley, which previously depended solely on local groundwater supplies.

To supplement these local groundwater supplies, CLWA contracted with DWR for delivery of SWP water, providing an imported water supply to the Valley. However, the variability in SWP supplies affects the ability of the agencies to meet the overall water supply needs for the service area. While each of the Valley's available supply sources has some variability, the variability in SWP supplies has the largest effect on overall supply reliability.

As discussed in Section 3.2 of Chapter 3, each SWP contractor's Water Supply Contract contains a Table A Amount that identifies the maximum amount of water that contractor may request. However, the amount of SWP water actually allocated to contractors each year is dependent on a number of factors than can vary significantly from year to year. The primary factors affecting SWP supply availability include hydrologic conditions in northern California, the amount of water in SWP storage reservoirs at the beginning of the year, regulatory and operational constraints, and the total amount of water requested by the contractors. The availability of SWP supplies to CLWA and the other SWP contractors is generally less than their full Table A amounts in many years and can be significantly less in very dry years.

DWR's SWP Delivery Reliability Report, issued in May 2003, assists SWP contractors in assessing the reliability of the SWP component of their overall supplies. DWR is currently in the process of updating this report and, on May 25, 2005, provided excerpts from this update that includes updated reliability analyses and a recommendation for which set of analyses to use in preparation of 2005 UWMPs. DWR provided these updated delivery reliability estimates to the SWP contractors in its "Excerpts from the Working Draft of 2005 State Water Project Delivery Reliability."

The amount of SWP water projected to be available to CLWA in this Plan is based on DWR's draft reliability report update. In its report, DWR presents the results of its analysis of the reliability of SWP supplies, based on model studies of SWP operations. In general, DWR model studies show the anticipated amount of SWP supply that would be available for a given SWP water demand, given an assumed set of physical facilities and operating constraints, based on 73 years of historic hydrology. The results are interpreted as the capability of the SWP to meet the assumed SWP demand, over a range of hydrologic conditions, for that assumed set of physical facilities and operating constraints.

DWR's draft report presents the results of model studies for years 2005 and 2025. In these model studies, DWR assumed existing SWP facilities and operating constraints for both the 2005 and 2025 studies. The primary differences between the two studies are an increase in projected SWP contractor demands and an increase in projected upstream demands (which affects SWP supplies by reducing the amount of inflows available for the SWP). In the report, DWR presents the SWP delivery capability resulting from these studies as a percent of full contractor Table A Amounts. To estimate supply capability in intermediate years between 2005 and 2025, DWR interpolates between the results of those studies.

6.3 NORMAL, SINGLE-DRY, AND MULTIPLE-DRY YEAR PLANNING

CLWA has various water supplies available to meet demands during normal, single-dry, and multiple-dry years. The following sections elaborate on the different supplies available to CLWA including groundwater, recycled water, and SWP supplies.

6.3.1 Groundwater

Supplies from the Alluvial Aquifer are projected to be 30,000 to 40,000 afy in average years and 30,000 to 35,000 afy in dry years; supplies from the Saugus Formation are projected to be 7,500 to 15,000 afy in average years and 15,000 to 35,000 afy in dry years. Groundwater modeling of the aquifers has shown that short-term, dry-year supply from the Saugus Formation could increase to up to 35,000 afy. This amount of Saugus Formation pumping can be achieved through pumping from a combination of existing wells at about 15,000 afy, restored capacity from perchlorate-impacted wells of about 10,000 afy, and new wells at 10,000 afy.

The projected groundwater supplies used in this Plan are generally the midpoints of the ranges mentioned above, with the exception of dry-period pumping from the Saugus Formation. Given the large amount of groundwater storage within the Saugus Formation, it was assumed that single-dry year pumping on an intermittent basis would be limited primarily by well capacity, to 35,000 afy. For the multiple-dry year period, it was assumed that pumping from the Saugus

Formation would be governed by the groundwater operating plan summarized in Table 3-6, with average pumping over the 4-year dry period of about 21,500 afy.

6.3.2 Recycled Water

Recycled water is available from two existing water reclamation plants operated by LACSD. CLWA has completed environmental review on the construction of Phase I of its Reclaimed Water System Master Plan, a multi-phased program to deliver recycled water in the Valley. As described in Chapter 4, the ability of CLWA to use recycled water is constrained by its rights to use the water available. CLWA currently has rights to use 1,700 afy of recycled water, and Phase I provides for the delivery of this amount. While actual use of recycled water currently totals approximately 500 afy, the amount of this supply currently available is 1,700 afy. In this Plan, the existing supply of recycled water assumed to be available is 1,700 afy in an average year, a single-dry year, and in each year of a multiple-dry year period. CLWA projects an increase of 15,700 afy in the supply of recycled water by 2030, for a total of 17,400 afy. Similar to the existing recycled water supply, the 15,700 afy of planned recycled water supply is assumed to be available in an average year, a single-dry year, and in each year of a multiple-dry year period.

6.3.3 State Water Project Table A Supply

For this Plan, the availability of SWP supplies to CLWA was estimated by multiplying CLWA's 95,200 afy of Table A Amount by the delivery percentages from DWR's draft report.[1] For the three hydrologic conditions evaluated, the delivery percentages used were taken from DWR's report based on the 73-year average, 1977, and the 1931-1934 average, for the average year, single-dry year, and multiple-dry year conditions, respectively.

In DWR's 73-year model studies, the lowest single-year SWP delivery results from 1977 hydrologic conditions, and the lowest delivery over any four-year period results from the hydrologic conditions from 1931 to 1934. Thus, the estimates of SWP dry-year supply availability used in this assessment were based on the worst case hydrologic conditions in DWR's report.

6.3.3.1 Flexible Storage Account

Under the Water Supply Contracts with DWR for SWP water, the contractors that share in the repayment of Castaic Lake may access a portion of the storage in that reservoir. This accessible storage is referred to as "flexible storage." The contractors may withdraw water from flexible storage, in addition to their allocated Table A supplies, on an as-needed basis. A contractor must replace any water it withdraws from this storage within five years. As one of the three contractors sharing in the repayment of Castaic Lake, CLWA has access to this flexible storage. Its share of the total flexible storage is currently 4,684 af. After recent negotiations with Ventura

[1] Of CLWA's 95,2000 af annual Table A Amount, 41,000 afy was permanently transferred to CLWA in 1999 by Wheeler Ridge-Maricopa Water Storage District, a member unit of the Kern County Water Agency. CLWA's Environmental Impact Report ("EIR") prepared in connection with the 41,000 afy water transfer was challenged in *Friends of the Santa Clara River v. Castaic Lake Water Agency* (Los Angeles County Superior Court, Case Number BS056954) ("*Friends*"). A more detailed discussion of these new challenges and the reasons the challenges will have no impact on the amount of water available to CLWA can be found at Section 3.2.2.

County water agencies, CLWA has gained access to an additional 1,376 af of flexible storage for ten years beginning in 2006.

CLWA plans to use this supply only in dry years. For the single-dry year condition, it was assumed the entire amount would be used. For the multiple-dry year condition, it was assumed that the entire amount would be used sometime during the four-year period, so the average annual supply during that period would be one fourth of the total. Any water withdrawn was assumed to be replaced in intervening average and wet years and would be available again for use in the next dry year.

6.3.3.2 Semitropic Water Bank

In 2002, CLWA stored 24,000 af of its allocated SWP Table A supply through a groundwater banking agreement with Semitropic. In 2004, CLWA stored 32,522 af of its 2003 allocated SWP Table A supply in a second Semitropic storage account. Under the terms of these agreements, and after consideration for losses within the groundwater basin, CLWA may withdraw up to 50,870 af when needed within ten years of when the water was stored. In addition to this short-term storage for CLWA, Semitropic has a long-term groundwater banking program with several other partners. The facilities that Semitropic may use in the return of CLWA's banked water supply are the same facilities that Semitropic may use to return banked water to its long-term banking program partners. As a result, there may be competition for use of those facilities in a particularly dry year, which could limit CLWA's ability to access the water in that year.

CLWA plans to use this supply only in dry years. For the single dry year, it was assumed that competition among Semitropic's banking partners for use of return facilities would limit CLWA's supply to about one third of the storage available, or about 17,000 af. For the multiple-dry year period, it was assumed that the entire amount would be accessible and used sometime during the four-year period, so the average annual supply during that period would be one fourth of the total available, or about 12,700 af. Since the stored water must be withdrawn within ten years of when it was stored, it was assumed that this supply is available only through 2013.

6.3.4 Buena Vista-Rosedale

The Buena Vista Water Storage District and the Rosedale-Rio Bravo Water Storage District, both member districts of KCWA, have jointly developed a program that provides both a firm water supply and a water banking component. This planned supply program would provide a firm annual water supply based on existing and long-standing Kern River water rights, which would be delivered by exchange of their SWP Table A supplies. In years when this supply is not needed, it can be banked for withdrawal and delivery in later years. The supply from this program is up to 11,000 afy of firm supply, which will be available in every year.

6.3.5 Rosedale-Rio Bravo Bank

Rosedale-Rio Bravo Water Storage District has also developed a water banking and exchange program. The initial offering from the program is for storage and withdrawal capacity of 20,000 afy, with up to 100,000 af of storage capacity. Withdrawals from the program can be made by exchange of Rosedale's Table A supply, or by pumpback into the California Aqueduct. CLWA issued a draft EIR on its participation in this program in August 2005, and plans to use this

supply only in dry years. For the single-dry year, supplies were assumed at the program's maximum withdrawal capacity of 20,000 af. For the multiple-dry year period, it was assumed in the first five-year increment the program is available that supplies would be limited to an average of 5,000 afy and that 20,000 af of water would be stored in one wet year prior to the dry period. In later years, it was assumed that supplies would average at least 15,000 afy over the dry period and that additional supplies would be banked during wetter years to allow withdrawal of at least this amount.

6.3.6 Additional Planned Banking

CLWA's Draft Water Supply Reliability Plan identifies a need for additional banking programs to firm up the dry-year reliability of service area supplies. While a specific banking program has not yet been identified, the amount of the additional dry-year supply needed was estimated as equivalent to the storage and withdrawal capacity of the Rosedale-Rio Bravo Bank. The supply amounts needed from this additional banking program were assumed to be the same as for the Rosedale-Rio Bravo Bank, with the exception that the program was not assumed to be available until 2015.

6.4 SUPPLY AND DEMAND COMPARISONS

The available supplies and water demands for CLWA's service area were analyzed to access the region's ability to satisfy demands during three scenarios: a normal water year, single-dry year, and multiple-dry years. The tables in this section present the supplies and demands for the various drought scenarios for the projected planning period of 2010-2030 in five year increments. Table 6-1 presents the base years for the development of water year data. Tables 6-2, 6-3, and 64 at the end of this section summarize, respectively, Normal Water Year, Single-Dry Water Year, and Multiple-Dry Year supplies.

Table 6-1
Basis of Water Year Data

Water Year Type	Base Years	Historical Sequence
Normal Water Year	Average	1922-1994
Single-Dry Water Year	1977	--
Multiple-Dry Water Years	1931-1934	--

6.4.1 Normal Water Year

Table 6-2 summarizes CLWA's water supplies available to meet demands over the 20-year planning period during an average/normal year. As presented in the table, CLWA's water supply is broken down into existing and planned water supply sources, including wholesale (imported) water, local supplies, transfers, and banking programs. Demands are shown with and without the effects of an assumed 10 percent urban demand reduction resulting from conservation best management practices.

6.4.2 Single-Dry Year

The water supplies and demands for CLWA's service area over the 20-year planning period were analyzed in the event that a single-dry year occurs, similar to the drought that occurred in California in 1977. Table 6-3 summarizes the existing and planned supplies available to meet demands during a single-dry year. Demand during dry years was assumed to increase by 10 percent.

6.4.3 Multiple-Dry Year

The water supplies and demands for CLWA's service area over the 20-year planning period were analyzed in the event that a four-year multiple-dry year event occurs, similar to the drought that occurred during the years 1931 to 1934. Table 6-4 summarizes the existing and planned supplies available to meet demands during multiple-dry years. Demand during dry years was assumed to increase by 10 percent.

6.4.4 Summary of Comparisons

As shown in the analyses above, CLWA and the retail purveyors have adequate supplies to meet demands during normal, single-dry, and multiple-dry years throughout the 20-year planning period.

Table 6-2
Projected Average/Normal Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*67,600*	*69,500*	*71,400*	*73,300*	*73,300*
SWP Table A Supply (1)	67,600	69,500	71,400	73,300	73,300
Flexible Storage Account (CLWA) (2)	0	0	0	0	0
Flexible Storage Account (Ventura County) (2)	0	0	0	0	0
Local Supplies					
Groundwater	*46,000*	*46,000*	*46,000*	*46,000*	*46,000*
Alluvial Aquifer	35,000	35,000	35,000	35,000	35,000
Saugus Formation	11,000	11,000	11,000	11,000	11,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	115,300	117,200	119,100	121,000	121,000
Existing Banking Programs					
Semitropic Water Bank (2)	0	0	0	0	0
Total Existing Banking Programs	0	0	0	0	0
Planned Supplies					
Local Supplies					
Groundwater	*0*	*0*	*0*	*0*	*0*
Restored wells (Saugus Formation) (2)	0	0	0	0	0
New Wells (Saugus Formation) (2)	0	0	0	0	0
Recycled Water (3)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (4)	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	11,000	12,600	17,300	22,000	26,700
Planned Banking Programs					
Rosedale-Rio Bravo (2)	0	0	0	0	0
Additional Planned Banking (2)	0	0	0	0	0
Total Planned Banking Programs	0	0	0	0	0
Total Existing and Planned Supplies and Banking	126,300	129,800	136,400	143,000	147,700
Total Estimated Demand (w/o conservation) (5)	100,050	109,400	117,150	128,400	138,300
Conservation (6)	(8,600)	(9,700)	(10,700)	(11,900)	(12,900)
Total Adjusted Demand	91,450	99,700	106,450	116,500	125,400

Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of average deliveries projected to be available (71% in 2010 and 77% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005).

(2) Not needed during average/normal years.

(3) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.

(4) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

(5) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 4).

(6) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in Chapter 7.

Table 6-3
Projected Single-Dry Year Supplies and Demands

Water Supply Sources	Supply (af)				
	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*9,860*	*9,860*	*8,480*	*9,480*	*9,480*
SWP Table A Supply (1)	3,800	3,800	3,800	4,800	4,800
Flexible Storage Account (CLWA)	4,680	4,680	4,680	4,680	4,680
Flexible Storage Account (Ventura County) (2)	1,380	1,380	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	59,060	59,060	57,680	58,680	58,680
Existing Banking Programs					
Semitropic Water Bank (3)	17,000	0	0	0	0
Total Existing Banking Programs	17,000	0	0	0	0
Planned Supplies					
Local Supplies					
Groundwater	*10,000*	*10,000*	*20,000*	*20,000*	*20,000*
Restored wells (Saugus Formation)	10,000	10,000	10,000	10,000	10,000
New Wells (Saugus Formation)	0	0	10,000	10,000	10,000
Recycled Water (4)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (5)	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	21,000	22,600	37,300	42,000	46,700
Planned Banking Programs					
Rosedale-Rio Bravo (6)	20,000	20,000	20,000	20,000	20,000
Additional Planned Banking (7)	0	20,000	20,000	20,000	20,000
Total Planned Banking Programs	20,000	40,000	40,000	40,000	40,000
Total Existing and Planned Supplies and Banking	117,060	121,660	134,980	140,680	145,380
Total Estimated Demand (w/o conservation) (8) (9)	110,100	120,300	128,900	141,200	152,100
Conservation (10)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of single dry deliveries projected to be available for the worst case single dry year of 1977 (4% in 2010 and 5% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005).

(2) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(3) The total amount of water currently in storage is 50,870 af, available through 2013. Withdrawals of up to this amount are potentially available in a dry year, but given possible competition for withdrawal capacity with other Semitropic banking partners in extremely dry years, it is assumed here that about one third of the total amount stored could be withdrawn.

(4) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.

(5) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

(6) Rosedale-Rio Bravo Water Banking and Recovery Program online in 2006, based on completing CEQA and subsequent adoption by CLWA Board of Directors.

(7) Assumes additional planned banking supplies available by 2014.

(8) Assumes increase in total demand of 10 percent during dry years.

(9) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 5).

(10) Assumes 10 percent reduction on urban portion of total normal year demand resulting from conservation best management practices ([urban portion of total normal year demand x 1.10] * 0.10), as discussed in Chapter 7.

Table 6-4
Projected Multiple-Dry Year Supplies and Demands [1]

Water Supply Sources	2010	2015	2020	2025	2030
Existing Supplies					
Wholesale (Imported)	*32,010*	*32,910*	*32,570*	*32,570*	*32,570*
SWP Table A Supply (2)	30,500	31,400	31,400	31,400	31,400
Flexible Storage Account (CLWA) (3)	1,170	1,170	1,170	1,170	1,170
Flexible Storage Account (Ventura County) (3)	340	340	0	0	0
Local Supplies					
Groundwater	*47,500*	*47,500*	*47,500*	*47,500*	*47,500*
Alluvial Aquifer	32,500	32,500	32,500	32,500	32,500
Saugus Formation (4)	15,000	15,000	15,000	15,000	15,000
Recycled Water	1,700	1,700	1,700	1,700	1,700
Total Existing Supplies	81,210	82,110	81,770	81,770	81,770
Existing Banking Programs					
Semitropic Water Bank (3)	12,700	0	0	0	0
Total Existing Banking Programs	12,700	0	0	0	0
Planned Supplies					
Local Supplies					
Groundwater	*6,500*	*6,500*	*6,500*	*6,500*	*6,500*
Restored wells (Saugus Formation) (4)	6,500	6,500	5,000	5,000	5,000
New Wells (Saugus Formation) (4)	0	0	1,500	1,500	1,500
Recycled Water (5)	0	1,600	6,300	11,000	15,700
Transfers					
Buena Vista-Rosedale (6)	11,000	11,000	11,000	11,000	11,000
Total Planned Supplies	17,500	19,100	23,800	28,500	33,200
Planned Banking Programs					
Rosedale-Rio Bravo (7) (8)	5,000	15,000	15,000	15,000	15,000
Additional Planned Banking (8) (9)	0	5,000	15,000	15,000	15,000
Total Planned Banking Programs	5,000	20,000	30,000	30,000	30,000
Total Existing and Planned Supplies and Banking	116,410	121,210	135,570	140,270	144,970
Total Estimated Demand (w/o conservation) (10) (11)	110,100	120,300	128,900	141,200	152,100
Conservation (12)	(9,500)	(10,700)	(11,700)	(13,100)	(14,200)
Total Adjusted Demand	100,600	109,600	117,200	128,100	137,900

Notes:

(1) Supplies shown are annual averages over four consecutive dry years (unless otherwise noted).

(2) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of deliveries projected to be available for the worst case four-year drought of 1931-1934 (32% in 2010 and 33% in 2025/2030), taken from Table 6-5 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005).

(3) Based on total amount of storage available divided by 4 (4-year dry period). Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(4) Total Saugus pumping is the average annual amount that would be pumped under the groundwater operating plan, as summarized in Table 3-6 ([11,000+15,000+25,000+35,000]/4).

(5) Recycled water supplies based on projections provided in Chapter 4, Recycled Water.

(6) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

(7) Rosedale-Rio Bravo Water Banking and Recovery Program online in 2006, assuming CEQA complete and adoption by CLWA Board of Directors.

(8) Average dry year period supplies could be up to 20,000 af for each program depending on storage amounts at the beginning of the dry period.

(9) Assumes additional planned banking supplies available by 2014.

(10) Assumes increase in total demand of 10 percent during dry years.

(11) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. Currently proposed annexations have a demand for about 4,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 7,000 afy could eventually be approved (see Footnote 6).

(12) Assumes 10 percent reduction on urban portion of total normal year demand resulting from conservation best management practices ([urban portion of total normal year demand x 1.10] * 0.10), as discussed in Chapter 7.

Chapter 7
DEMAND MANAGEMENT MEASURES

Chapter 7.0
WATER DEMAND MANAGEMENT MEASURES

7.1 OVERVIEW

This section describes the water Demand Management Measures (DMMs) and the Best Management Practices (BMPs) implemented by CLWA as a part of water conservation programs to result in quantifiable water savings for the Valley.

7.2 WATER DEMAND MANAGEMENT MEASURES AND BEST MANAGEMENT PRACTICES

Establishing goals and choosing water conservation measures is a continuing planning process. Goals are developed, adopted, and then evaluated periodically. Specific conservation measures are phased in and then evaluated for their effectiveness, achievement of desired results, and customer satisfaction. Water conservation can achieve a number of goals such as:

- Meeting legal mandates
- Reducing average annual potable water demands
- Reducing wastewater flows
- Reducing urban runoff
- Reducing demands during peak seasons
- Meeting drought restrictions

The Act specifies 14 DMMs. The Act was revised in 2000 to relate the DMMs to the 14 BMPs of the California Urban Water Conservation Council (CUWCC).

The CUWCC was formed in 1991 through the "Memorandum of Understanding Regarding Urban Water Conservation in California." The urban water conservation BMPs included in the MOU are intended to reduce California's long-term urban water demands. The BMPs are currently implemented by the signatories to the MOU on a voluntary basis. However, the CALFED Bay-Delta Program (now the California Bay-Delta Authority) included mandatory implementation of the BMPs and certification of water use efficiency programs in its final Environmental Impact Statement/Report and Record of Decision. Work toward this certification requirement has taken place during the five year planning period since 2000, but to date a final decision on such a requirement has not been made by the Bay-Delta Authority. Therefore, implementation of the BMPs/DMMs continues to be voluntary.

After adoption of the 2000 UWMP, CLWA signed the urban MOU in February 2001 on its own behalf as a water wholesaler and on behalf of the local retail water purveyors, thus meeting one of the recommendations of the 2000 UWMP. NCWD signed the MOU separately on its own behalf in September 2002. Los Angeles County signed the MOU prior to the 2000 UWMP on

behalf of all its Waterworks Districts. The retail purveyors have voluntarily complied with those BMPs considered locally cost-effective, as discussed in Section 7.3.

7.3 IMPLEMENTATION LEVELS OF DMMs/BMPs

The CUWCC is composed of over 150 urban water suppliers and 30 environmental organizations, as well as other interested companies and organizations. It has spent much of its existence determining the methodology by which savings from various water conservation measures (BMPs) can be quantified. The CUWCC has published "Guidelines to Preparing Cost-effectiveness Analysis" and a "BMP Cost and Savings Study," which assigns the water savings that can be ascribed to specific devices and activities when making cost-effectiveness evaluations for specific BMPs.

The BMP Cost and Savings Study recognizes two categories of BMPs: device-based and activity-based. Device-based BMPs, such as showerhead and toilet replacement programs, are intended to alter water use patterns through the actual installation of water-saving appliances. Activity-based BMPs, such as school education and public information programs, are intended to modify social behaviors to encourage people to save water. The savings from device-based BMPs can be directly quantified and attributed, whereas savings from activity-based BMPs are usually not possible to quantify. Device-based BMPs will result in quantifiable water savings for the Valley.

CLWA has been implementing the following BMPs, which pertain to wholesalers and retailers (with the exception of BMP 10), for the past several years (both prior to and after signing the urban MOU):

BMP 3	System Water Audits, Leak Detection and Repair
BMP 7	Public Information
BMP 8	School Education
BMP 10	Wholesale Agency Assistance
BMP 11	Conservation Pricing
BMP 12	Conservation Coordinator

CLWA implements BMP 8 on behalf of all the retailers.

In addition, since signing the urban MOU, CLWA has been assisting the purveyors by implementing BMPs 2 (Residential Plumbing Retrofit) and 14 (Residential Ultra Low Flush Toilet Replacement Programs). CLWA and VWC also undertook a pilot program to assess the cost-effectiveness of BMP 5 (Large Landscape Conservation Programs and Incentives) and BMP 9 (Conservation Programs for Commercial, Industrial, and Institutional Accounts). These two BMPs will see increased focus during the next five year planning period of this Plan. NCWD has been implementing all cost-effective BMPs since it signed the MOU.

Three BMPs are undergoing revision by the CUWCC and their implementation will be re-assessed during this planning period.

Signatories to the urban MOU are allowed by Water Code Section 10631(j) to include their biennial CUWCC BMP reports in an UWMP to meet the requirements of the DMMs sections of the UWMP Act. As a wholesaler MOU signatory, CLWA assists with BMP implementation and reporting for two retail purveyors: SCWD and VWC. NCWD, as a separate MOU signatory, is responsible for BMP implementation and reporting for its own retail service area. LACWWD #36 BMP implementation and reporting is done by the County of Los Angeles on behalf of all its Waterworks Districts. For the purposes of this Plan, the most recent BMP reports (2003 and 2004) as required by the urban MOU are attached as Appendix F. This appendix includes the reports for CLWA (wholesale), SCWD, and VWC. NCWD's separate report is also included in Appendix F.

7.4 SUMMARY OF CONSERVATION

CLWA will continue to implement the BMPs applicable to a wholesale water agency (BMPs 3, 7, 8, 10, 11, and 12), as well as other BMPs found to be locally cost-effective. NCWD will continue to implement all locally cost-effective BMPs for its service area. VWC, while not a signatory, will also continue to implement all cost-effective BMPs in its service territory.

CLWA, in cooperation with the retail purveyors, continues development and implementation of a comprehensive water conservation program. The program will expand existing water conservation activities and BMP implementation. These efforts will be tied to water conservation programs in adjoining urban areas making appropriate improvements to meet the unique conditions of the Valley.

Chapter 8
WATER SHORTAGE CONTINGENCY PLANNING

Chapter 8.0
WATER SHORTAGE CONTINGENCY PLANNING

8.1 OVERVIEW

Water supplies may be interrupted or reduced significantly in a number of ways, such as a drought which limits supplies, an earthquake which damages water delivery or storage facilities, a regional power outage, or a toxic spill that affects water quality. This chapter of the Plan describes how CLWA and the retail water purveyors plan to respond to such emergencies so that emergency needs are met promptly and equitably.

To date, both a Water Shortage Contingency Plan and a Drought Emergency Water Sharing Agreement have been prepared by CLWA and the retail purveyors. Prohibitions, penalties and financial impacts of shortages have recently been developed by CLWA SCWD, NCWD, and VWC and are summarized in this chapter.

8.2 COORDINATED PLANNING

CLWA and the purveyors have coordinated efforts in the past to meet water shortages. During 1991 (the fifth year of a six-year drought), the purveyors and CLWA prepared a Water Shortage Contingency Plan. Since this plan was first prepared, the Valley has experienced two water shortages: in 1991-1992 due to the continuation of the 1987-1992 drought and in 1994 due to the January 17, 1994, Northridge earthquake. The plan worked extremely well in both instances, and minor updates were made to incorporate what was actually experienced during these two periods. It is envisioned that the Water Shortage Contingency Plan will be implemented whenever needed on a contingency basis.

8.2.1 CLWA and the Water Purveyors

During times of normal supply, the water agencies meet periodically to review total water supply and demand in the Valley and any new regulations affecting the water industry.

During 1991, the local agencies met about once per month. Monthly water production and demand reports were produced and shared with the City of Santa Clarita Drought Committee. Also, after the 1987-1992 drought, CLWA and the retail purveyors cooperated in sharing available water from all sources without regard to contractual or other water rights for the duration of the emergency, and to facilitate among themselves water transfers, exchanges, and arrangements to use each others distribution facilities. Should water shortage conditions similar to the 1987-1992 drought occur again, it is expected that similar coordinated planning between the local agencies would be conducted.

8.2.2 City of Santa Clarita Drought Committee

The City of Santa Clarita Drought Committee was created by the City's Ordinance No. 91-16, adopted on March 13, 1991. The committee was made up of five appointees representing the

public, a representative of the City Staff, purveyor representatives, and a representative from CLWA. The function was to:

- Review all available data on water consumption, water supply and groundwater conditions
- Evaluate the level of compliance with the terms of the ordinance
- Evaluate the level of achievement of the stated water consumption reductions
- Make recommendations to the City Council concerning the timing of and need for implementation of future additional water restrictions as may be developed
- Make recommendations to the water purveyors serving the City of Santa Clarita concerning additional measures to encourage water conservation

From its inception and through the crucial summer months of 1991, the group met twice monthly. In the event of another drought or water shortage crisis, such a committee could be reinstituted. The 1991 ordinances, resolutions and agreements in Appendix G will be used as the model for the water shortage contingency resolution/ordinance package.

8.3 STAGES OF ACTION TO RESPOND TO WATER SHORTAGES

The Saugus Formation has underground storage of approximately 1.65 million acre-feet. In times of continued drought, the Saugus Formation can be pumped for temporary periods above its normal-year production. During an extended drought, the purveyors would consider upgrading the pumping capacity of their wells in the Saugus Formation and possibly drill additional wells to enable temporary pumping above the normal-year production of 7,500 to 15,000 afy. As developed in the Valley's groundwater operating plan and presented in Table 3-6, production in the Saugus Formation can be as high as 25,000-35,000 afy during multiple-dry year periods.

The Alluvium would be most affected by a continued local drought. As developed in the Valley's groundwater operating plan and further presented in Table 3-6, sustainable production during normal years can range from 30,000 to 40,000 afy. However, due to operational constraints in the eastern part of the Basin, production would be reduced to approximately 30,000 to 35,000 afy during locally dry years.

Table 8-1 presents the four-stage rationing and demand reduction goals for the Valley.

Table 8-1
Rationing and Reduction Goals

Deficiency	Stage	Demand Reduction Goal	Type of Program
Up to 15%	1	15% reduction	Voluntary
15-25%	2	25% reduction	Mandatory
25-35%	3	35% reduction	Mandatory
35-50%	4	50+% reduction	Mandatory

Priorities for use of available water, based on Chapter 3 of the California Water Code, are:

- Health and Safety—Interior residential, sanitation and fire protection
- Commercial, Industrial, and Governmental—Maintain jobs and economic base
- Existing Landscaping—Especially trees and shrubs
- New Demand—Projects with permits when shortage declared

Water quantity calculations used to determine the interior household gpcd requirements for health and safety are provided in Table 8-2. As developed in Table 8-2, the California Water Code Stage 2, 3, and 4 health and safety allotments are 68 gpcd, or 33 ccf (100 cubic feet) per person per year. When considering this allotment and the 2005 Valley Planning Area population of 249,343, as presented in Table 2-7, the total annual water supply required to meet the first priority use during a water shortage is approximately 19,000 afy.

Table 8-2
Per Capita Health and Safety Water Quantity Calculations

	Non-Conserving Fixtures		Habit Changes		Conserving Fixtures	
Toilets	5 flushes x 5.5 gpf =	27.5	3 flushes x 5.5 gpf =	16.5	5 flushes x 1.6 gpf =	8.0
Showers	5 min x 4.0 gpm =	20.0	4 min x 3.0 gpm =	12.0	5 min x 2.0 gpm =	10.0
Washers	12.5 gpcd (1/3 load) =	12.5	11.5 gpcd (1/3 load) =	11.5	11.5 gpcd (1/3 load) =	11.5
Kitchens	4 gpcd =	4.0	4 gpcd =	4.0	4 gpcd =	4.0
Other	4 gpcd =	4.0	4 gpcd =	4.0	4 gpcd =	4.0
Total gpcd		68.0		48.0		37.5
CCF per capita per year		33.0		23.0		18.0

8.4 MINIMUM WATER SUPPLY AVAILABLE DURING NEXT THREE YEARS

The minimum water supply available during the next three years would occur during a three-year multiple-dry year event between the years 2006 and 2008. As shown in Table 8-3, the total supplies and banking range from approximately 103,500 afy to 120,500 afy during the next three years. When comparing these supplies to the demand projections provided in Chapters 2 and 6 of this Plan, CLWA and the purveyors have adequate supplies available to meet projected demands should a multiple-dry year period occur during the next three years.

Table 8-3
Estimate of Minimum Supply for the Next Three Years

Source	Supply (af)		
	2006	2007	2008
Wholesale Imported	*29,620*	*29,620*	*29,620*
SWP Table A Supply (1)	27,600	27,600	27,600
Flexible Storage Account (CLWA) (2)	1,560	1,560	1,560
Flexible Storage Account (Ventura County) (2)	460	460	460
Local Supply			
Groundwater	*37,500*	*54,500*	*54,500*
Alluvial Aquifer	32,500	32,500	32,500
Saugus Formation	5,000	22,000	22,000
Recycled Water	1,700	1,700	1,700
Transfers			
Buena Vista-Rosedale (3)	11,000	11,000	11,000
Banking Programs	*23,600*	*23,600*	*23,600*
Semitropic Water Bank (4)	16,900	16,900	16,900
Rosedale-Rio Bravo (5) (6)	6,700	6,700	6,700
Total Supplies	**103,420**	**120,420**	**120,420**

Notes:

(1) SWP supplies are calculated by multiplying CLWA's Table A Amount of 95,200 af by percentages of total deliveries projected to be available for the worst case three-year drought of 1990-1992, calculated from data in Table B-8 of DWR's "Excerpts from Working Draft of 2005 State Water Project Delivery Reliability Report" (May 2005). The average of total SWP deliveries over this three year period was 29 percent of total Table A Amounts.

(2) Based on total amount of storage available divided by 3 (3-year dry period).

(3) CLWA is in the process of acquiring this supply, primarily to meet the potential demands of future annexations to the CLWA service area. This acquisition is consistent with CLWA's annexation policy under which it will not approve potential annexations unless additional water supplies are acquired. Currently proposed annexations have a demand for about 4,000 afy of this supply which, if approved, would leave the remaining 7,000 afy available for potential future annexations. Unless and until any such annexations are actually approved, this supply will be available to meet demands within the existing CLWA service area.

(4) Based on total amount of storage available (50,870 af) divided by 3 (3-year dry period) and rounded down to the nearest 100.

(5) Assumes Rosedale-Rio Bravo Water Banking and Recovery Program on line in 2006, based on completion of CEQA and subsequent adoption by CLWA Board of Directors.

(6) Based on total amount of storage available (20,000 af) divided by 3 (3-year dry period).

8.5 ACTIONS TO PREPARE FOR CATASTROPHIC INTERRUPTION

8.5.1 General

The Valley is located approximately 20 miles southwest of the San Andreas Fault. A major earthquake along the southern portion of the San Andreas Fault would affect the Valley. The California Division of Mines and Geology has stated two of the aqueduct systems that import

water to southern California could be ruptured by displacement on the San Andreas Fault, and supply may not be restored for a three to six week period. The situation would be further complicated by physical damage to pumping equipment and local loss of electrical power.

DWR has a contingency aqueduct outage plan for restoring the California Aqueduct to service should a major break occur, which it estimates would take approximately four months to repair.

Experts agree it may be at least three days after the earthquake before outside help could get to the Valley. Extended supply shortages of both groundwater and imported water, due to power outages and/or equipment damage, would be severe until the water supply could be restored.

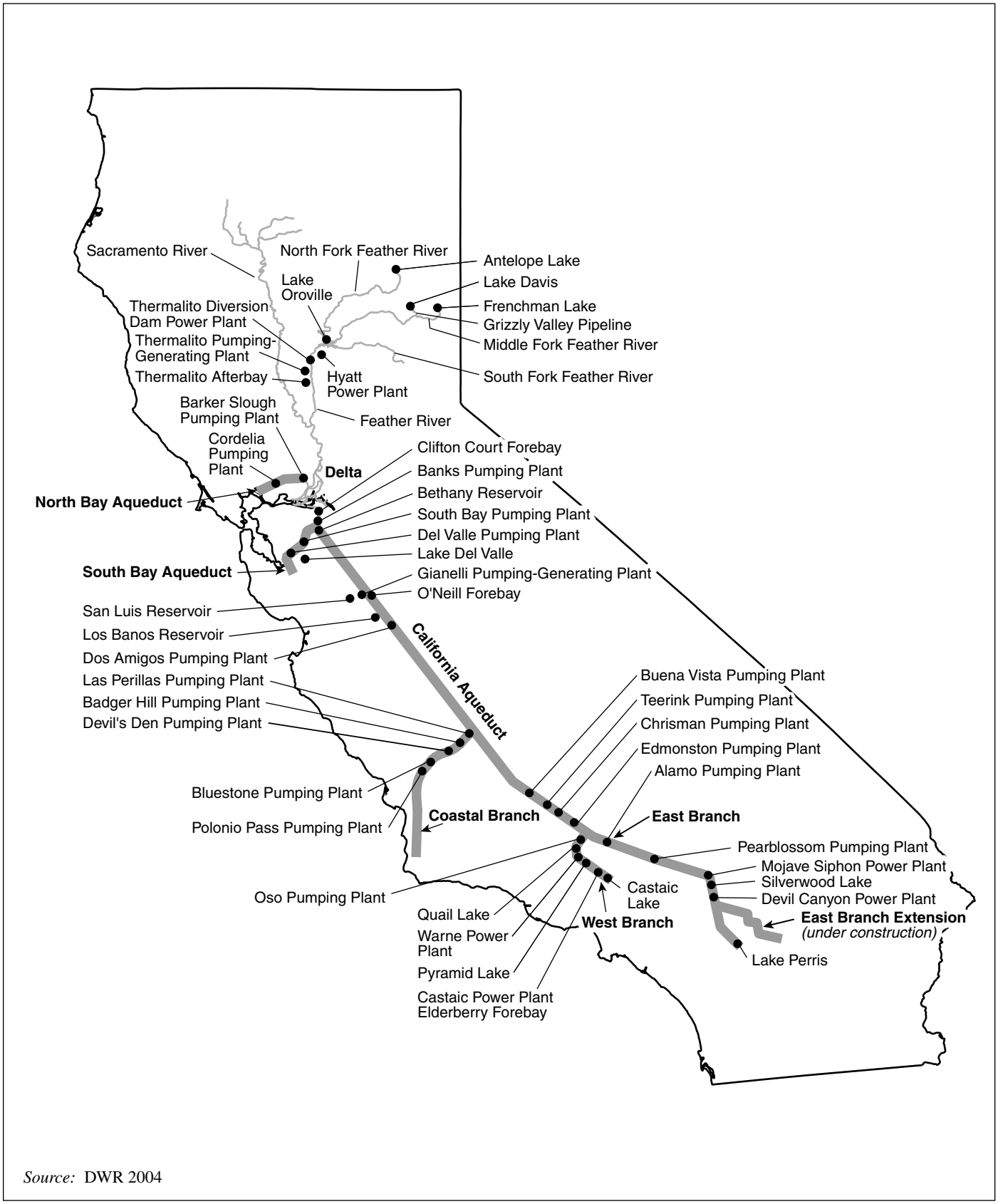
Combined water storage of the local agencies totals approximately 190 million gallons of water in storage tanks, which can be gravity fed to Valley residences, even if there is a power outage. In addition, since the 1994 Northridge earthquake, storage tanks have been fitted with flexible couplings, which should reduce damage to local storage facilities. The public would be asked to reduce consumption to minimum health and safety levels, extending the supply to seven days. This would provide sufficient time to restore a significant amount of groundwater production. After the groundwater supply is restored, the pumping capacity of the four retail purveyors, along with CLWA's proportionate share of storage from Pyramid and Castaic Lakes, could meet the reduced demand until such time that the imported water supply was reestablished. Updates on the water situation would be made as often as necessary.

The Valley's water sources are generally of good quality, and no insurmountable problems resulting from industrial or agricultural contamination are foreseen. If contamination did result from a toxic spill or similar accident, the contamination would be isolated and should not significantly impact the total water supply. In addition, such an event would be covered by the purveyors' emergency response plan. The recent detection of perchlorate in the Saugus Formation and Alluvial Aquifer is an example of prior contamination due to industrial chemical processes. The few affected wells have been shut down; design of the treatment process to remove the perchlorate is near completion; and the wells are expected to return to service in 2006.

8.5.2 SWP Emergency Outage Scenarios

In addition to earthquakes, the SWP could experience other emergency outage scenarios. Past examples include slippage of aqueduct side panels into the California Aqueduct near Patterson in the mid-1990s, the Arroyo Pasajero flood event in 1995 (which also destroyed part of Interstate 5 near Los Banos), and various subsidence repairs needed along the East Branch of the Aqueduct since the 1980s. All these outages were short-term in nature (on the order of weeks), and DWR's Operations and Maintenance Division worked diligently to devise methods to keep the Aqueduct in operation while repairs were made. Thus, the SWP contractors experienced no interruption in deliveries.

One of the SWP's important design engineering features is the ability to isolate parts of the system. The Aqueduct is divided into "pools." Thus, if one reservoir or portion of the California Aqueduct is damaged in some way, other portions of the system can still remain in operation. The Primary SWP facilities are shown on Figure 8-1.



Source: DWR 2004

Figure 8-1. Primary SWP Facilities

Other events could result in significant outages and potential interruption of service. Examples of possible nature-caused events include a levee breach in the Delta near the Harvey O. Banks Pumping Plant, a flood or earthquake event that severely damaged the Aqueduct along its San Joaquin Valley traverse, or an earthquake event along either the West or East Branches. Such events could impact some or all SWP contractors south of the Delta.

The response of DWR, CLWA, and other SWP contractors to such events would be highly dependent on the type and location of any such event. In typical SWP operations, water flowing through the Delta is diverted at the SWP's main pumping facility, located in the southern Delta, and is pumped into the California Aqueduct. During the relatively heavier runoff period in the winter and early spring, Delta diversions generally exceed SWP contractor demands, and the excess is stored in San Luis Reservoir. Storage in SWP aqueduct terminal reservoirs, such as Pyramid and Castaic Lakes, is also refilled during this period. During the summer and fall, when diversions from the Delta are generally more limited and less than contractor demands, releases from San Luis Reservoir are used to make up the difference in deliveries to contractors. The SWP share of maximum storage capacity at San Luis Reservoir is 1,062,000 af.

CLWA receives its SWP deliveries through the West Branch of the California Aqueduct at Castaic Lake. The only other contractors receiving deliveries from the West Branch are Metropolitan and Ventura County Watershed Protection District (formerly known as the Ventura County Flood Control District). The West Branch has two terminal reservoirs, Pyramid Lake and Castaic Lake, which were designed to provide emergency storage and regulatory storage (i.e., storage to help meet peak summer deliveries) for CLWA and the other two West Branch contractors. Maximum operating capacity at Pyramid and Castaic lakes is 169,900 af and 323,700 af, respectively.

In addition to SWP storage south of the Delta in San Luis and the terminal reservoirs, a number of contractors have stored water in groundwater banking programs in the San Joaquin Valley, and many also have surface and groundwater storage within their own service areas.

Three scenarios that could impact the delivery to CLWA of its SWP supply, previously banked supplies, or other supplies delivered to it through the California Aqueduct are described below. For each of these scenarios, it was assumed that an outage of six months could occur. CLWA's ability to meet demands during the worst of these scenarios is presented following the scenario descriptions.

Scenario 1: Levee Breach Near Banks Pumping Plant

As demonstrated by the June 2004 Jones Tract levee breach and previous levee breaks, the Delta's levee system is fragile. The SWP's main pumping facility, Banks Pumping Plant, is located in the southern Delta. Should a major levee in the Delta near these facilities fail catastrophically, salt water from the eastern portions of San Francisco Bay would flow into the Delta, displacing the fresh water runoff that supplies the SWP. All pumping from the Delta would be disrupted until water quality conditions stabilized and returned to pre-breach conditions. The re-freshening of Delta water quality would require large amounts of additional Delta inflows, which might not be immediately available, depending on the timing of the levee

breach. The Jones Tract repairs took several weeks to accomplish and months to complete; a more severe breach could take much longer, during which time pumping from the Delta might not be available on a regular basis.

Assuming that the Banks Pumping Plant would be out of service for six months, DWR could continue making at least some SWP deliveries to all southern California contractors from water stored in San Luis Reservoir. The water available for such deliveries would be dependent on the storage in San Luis Reservoir at the time the outage occurred and could be minimal if it occurred in the late summer or early fall when San Luis Reservoir storage is typically low. In addition to supplies from San Luis Reservoir, water from the West Branch terminal reservoirs would also be available to the three West Branch contractors, including CLWA. CLWA water stored in groundwater banking programs in the San Joaquin Valley may also be available for withdrawal and delivery to CLWA.

Scenario 2: Complete Disruption of the California Aqueduct in the San Joaquin Valley

The 1995 flood event at Arroyo Pasajero demonstrated vulnerabilities of the California Aqueduct (the portion that traverses the San Joaquin Valley from San Luis Reservoir to Edmonston Pumping Plant). Should a similar flood event or an earthquake damage this portion of the aqueduct, deliveries from San Luis Reservoir could be interrupted for a period of time. DWR has informed the SWP contractors that a four-month outage could be expected in such an event. CLWA's assumption is a six-month outage.

Arroyo Pasajero is located downstream of San Luis Reservoir and upstream of the primary groundwater banking programs in the San Joaquin Valley. Assuming an outage at a location near Arroyo Pasajero that resulted in the California Aqueduct being out of service for six months, supplies from San Luis Reservoir would not be available to those SWP contractors located downstream of that point. However, CLWA water stored in groundwater banking programs in the San Joaquin Valley could be withdrawn and delivered to CLWA, and water from the West Branch terminal reservoirs would also be available to the three West Branch contractors, including CLWA. Assuming an outage at a location on the California Aqueduct south of the groundwater banking programs in the San Joaquin Valley, these supplies would not be available to CLWA, but water from the West Branch terminal reservoirs would be available to the three West Branch contractors, including CLWA.

Scenario 3: Complete Disruption of the West Branch of the California Aqueduct

The West Branch of the California Aqueduct begins at a bifurcation of the Aqueduct south of Edmonston Pumping Plant, which pumps SWP water through and across the Tehachapi Mountains. From the point of bifurcation, the West Branch is an open canal through Quail Lake, a small flow regulation reservoir, to the Peace Valley Pipeline, which carries water into Pyramid Lake. From Pyramid Lake, water is released into the Angeles Tunnel, through Castaic Powerplant into Elderberry Forebay, and then into Castaic Lake.

If a major earthquake (an event similar to or greater than the 1994 Northridge earthquake) were to damage a portion of the West Branch, deliveries could be interrupted. The exact location of

such damage along the West Branch would be key to determining emergency operations by DWR and the three West Branch SWP contractors. For this scenario, it was assumed that the West Branch would suffer a single-location break and deliveries of SWP water from north of the Tehachapi Mountains or of CLWA water stored in groundwater banking programs in the San Joaquin Valley would not be available. It was also assumed that Pyramid and Castaic dams would not be damaged by the event and that water in Pyramid and Castaic Lakes would be available to the three West Branch SWP contractors, including CLWA.

In any of these three SWP emergency outage scenarios, DWR and the SWP contractors would coordinate operations to minimize supply disruptions. Depending on the particular outage scenario or outage location, some or all of the SWP contractors south of the Delta might be affected. But even among those contractors, potential impacts would differ given each contractor's specific mix of other supplies and available storage. During past SWP outages, the SWP contractors have worked cooperatively to minimize supply impacts among all contractors. Past examples of such cooperation have included certain SWP contractors agreeing to rely more heavily on alternate supplies, allowing more of the outage-limited SWP supply to be delivered to other contractors; and exchanges among SWP contractors, allowing delivery of one contractor's SWP or other water to another contractor, with that water being returned after the outage was over.

Of these three SWP outage scenarios, the West Branch outage scenario presents the worst-case scenario for CLWA. In this scenario, CLWA would rely on local supplies and water available from Pyramid and Castaic Lakes. An assessment of the supplies available to meet demands in CLWA's service area during a six-month West Branch outage and the additional levels of conservation projected to be needed are presented in Table 8-4 for 2005 through 2030.

During an outage, the local supplies available would consist of groundwater from the Alluvial Aquifer and the Saugus Formation, as well as recycled water. It was assumed that local well production would be unimpaired by the outage and that the outage would occur during a year when average/normal supplies would be available from the Alluvial Aquifer. Pumping from the Saugus was assumed to be one-half of the annual supplies available in a single dry year. Note that adequate well and aquifer capacity exists to pump at levels higher than those assumed in this assessment, particularly during a temporary period such as an outage. However, to be conservative, groundwater production was assumed to be one-half of annual supplies. Based on the assumption that additional voluntary conservation could reduce the amount of waste discharge, and therefore the amount of recycled water available, the amount of recycled water assumed to be available would be reduced by 25 percent.

The water available to CLWA from Pyramid and Castaic Lakes includes flexible storage available to CLWA at Castaic Lake and emergency and potentially regulatory storage available in both Pyramid and Castaic Lakes. Regulatory storage, which is used to help meet high peak summer deliveries, may or may not be available depending on what time of year an outage occurs. For this assessment, regulatory storage was assumed to be unavailable. The amount of emergency storage assumed to be available to CLWA was based on CLWA's proportionate share of usable storage in each reservoir, where usable storage is maximum operating storage, less regulatory and dead pool storage. At Castaic Lake, this usable storage determination also

excludes the three West Branch contractors' total flexible storage. CLWA's proportionate share of usable storage was assumed to be slightly less than three percent, based on its share of capital cost repayment at each reservoir. On this cost repayment basis, the proportionate shares of the Metropolitan and Ventura County Flood Control District are about 96 percent and one percent, respectively.

Table 8-4 shows that, for a six-month emergency outage, additional conservation beyond the conservation BMPs described in Chapter 7 would be required, with the additional demand reductions ranging from three to 16 percent of the urban portion of total demand. It is likely that potential cooperation among SWP contractors and/or temporarily increased purveyor groundwater production during such an outage could increase supplies so that lower amounts, or even no amount, of additional conservation would be needed. However, even without such supply increases, these levels of additional conservation would be readily achievable. In an emergency such as this, these levels of additional conservation would likely be achieved through voluntary conservation, but mandatory measures would be enacted if needed.

Table 8-4
Projected Supplies and Demands During
Six-Month Disruption of Imported Supply System [1]

	Supply / Demand (af)					
	2005	**2010**	**2015**	**2020**	**2025**	**2030**
Local Supplies						
Existing Supplies						
Groundwater						
Alluvial Aquifer (2)	17,500	17,500	17,500	17,500	17,500	17,500
Saugus Formation (3)	5,000	7,500	7,500	7,500	7,500	7,500
Recycled Water (4) (5)	190	600	640	640	640	640
Planned Supplies						
Groundwater (3)						
Restored wells (Saugus Formation)	0	5,000	5,000	5,000	5,000	5,000
New Wells (Saugus Formation)	0	0	0	5,000	5,000	5,000
Recycled Water (5)	0	0	600	2,360	4,130	5,890
Total Existing and Planned Local Supplies	22,690	30,600	31,240	38,000	39,770	41,530
SWP West Branch Storage Available						
Flexible Storage (at Castaic Lake)						
Existing (CLWA)	4,680	4,680	4,680	4,680	4,680	4,680
Existing (Ventura County) (6)	0	1,380	1,380	0	0	0
Emergency Storage						
Pyramid Lake (7)	4,370	4,370	4,370	4,370	4,370	4,370
Castaic Lake (8)	3,370	3,370	3,370	3,370	3,370	3,370
Total West Branch Storage	12,420	13,800	13,800	12,420	12,420	12,420
Total Local Supplies and West Branch Storage	35,110	44,400	45,040	50,420	52,190	53,950
Demands (9)						
Total Estimated Demand (w/o Conservation) (10)	44,700	50,000	54,700	58,600	64,200	69,100
Conservation (11)	(3,700)	(4,300)	(4,900)	(5,300)	(6,000)	(6,500)
Total Demand (w/ Conservation)	41,000	45,700	49,800	53,300	58,200	62,600
Additional Conservation Required	5,900	1,300	4,800	2,900	6,000	8,700
Additional Conservation as Percent of Demand (12)	16%	3%	10%	5%	10%	13%

Notes:

(1) Assumes complete disruption in SWP supplies and in deliveries through the California Aqueduct for six months.

(2) Pumping from the Alluvial Aquifer is assumed to be one-half of average/normal year supplies (see Table 6-2).

(3) Pumping from the Saugus Formation is assumed to be one-half of single dry year supplies (see Table 6-3).

(4) Existing recycled water supply is based on one-half of current actual use of about 500 af for 2005, projected demand of 1,600 af for 2010, and existing supply of 1,700 af from 2015 on, as adjusted for the reduction described in Footnote 5.

(5) Assumes 25 percent reduction in waste discharge, and therefore in recycled water availability, due to additional voluntary conservation.

(6) Initial term of the Ventura County entities' flexible storage account is ten years (from 2006 to 2015).

(7) CLWA's share of usable storage at Pyramid Lake, based on its 2.817 percent proportionate share of capital cost repayment of the reservoir. Usable storage is assumed to be 165,100 af (maximum operating storage of 169,900 af, less regulatory storage of 10,000 af for making peak summer deliveries and dead pool storage of 4,800 af).

(8) CLWA's share of usable storage at Castaic Lake, based on its 2.927 percent proportionate share of capital cost repayment of the reservoir. Usable storage is assumed to be 115,100 af (maximum operating storage of 323,700 af, less regulatory storage of 30,000 af for making peak summer deliveries, total SWP contractor flexible storage of 160,000 af, and dead pool storage of 18,600 af).

(9) Demands are assumed to be one-half of average/normal year demands (see Table 2-2).

(10) Demands are for uses within the existing CLWA service area. Demands for any annexations to the CLWA service area will be added if and when such annexations are approved. During a six-month outage, currently proposed annexations would have a demand for about 2,000 afy and, given supplies CLWA is in the process of acquiring, potential future annexations with demands up to an additional 3,500 afy could eventually be approved.

(11) Assumes 10 percent reduction on urban portion of total demand resulting from conservation best management practices, as discussed in Chapter 7.

(12) Additional Conservation is expressed as percent of urban portion of total demand, since an outage would result in shortfall only to purveyors' customers (i.e., urban users).

8.5.3 Regional Power Outage Scenarios

For a major emergency such as an earthquake, Southern California Edison (Edison) has declared that in the event of an outage, power would be restored within a 24 hour period. Following the Northridge earthquake, Edison was able to restore power within 19 hours. Edison experienced extensive damage to several key power stations, yet was still able to recover within a 24 hour timeframe.

CLWA

To specifically address the concern of water outages due to loss of power, CLWA has equipped its two treatment plants with generators to produce power for treating water to comply with the State of California Safe Drinking Water Act and the Health and Safety Code. The Rio Vista Water Treatment Plant and Intake Pump Station emergency generator system provides electrical power to treat 30 mgd for 72 hours without fuel replacement. The Earl Schmidt Filtration Plant emergency generator system provides electrical power to treat 33 mgd for 72 hours without fuel replacement.

CLWA SCWD

SCWD is committed to providing regular service and meeting the needs of the community during any emergency situation. SCWD is obligated to respond to emergencies by using all available resources in the most effective way possible. SCWD has prepared an Emergency Response Plan that provides emergency operations procedures for the effective use of resources during various emergency situations. Emergency situations include but are not limited to: earthquakes, major fire emergencies, water outages due to loss of power, localized flooding, water contamination, and acts of sabotage.

To specifically address the concerns of water outages due to loss of power, SCWD has purchased and maintains one mobile generator and has the ability to obtain emergency access to others. The current generator is trailer mounted and has the capability of supplying 180 Kilovolt-Amperes (KVA). This capacity provides the capability to run any facility within the service area of SCWD. Most primary pumping facilities are equipped with emergency transfer switches, and SCWD employees are trained regularly to install and operate the generators in the most efficient and safe manner. The generator's run time is only limited by the amount of available diesel fuel. SCWD has an above ground diesel fuel storage tank with a capacity of 1,000 gallons located at its Warehouse at 21110 West Golden Triangle Road in the City of Santa Clarita. SCWD maintains one carrier truck, which is equipped with the capability of dispensing 100 gallons of diesel as necessary in refilling the generators. In addition, SCWD maintains a trailer-mounted 100 gallon diesel tank that will be deployed as required to preserve services. SCWD will respond to power outages on a prioritized basis and will continue its response to the power emergency as long as necessary. In addition to the generators, SCWD has a gas driven pump capable of delivering a maximum 2,000 gallons per minute (gpm). This pump can be installed at select facilities and run as required.

NCWD

NCWD fully understands its role in providing a vital service to the community. NCWD is obligated to respond to emergencies by using all available resources in the most effective way possible. NCWD has prepared an Emergency Response Plan that provides emergency operations procedures for the effective use of NCWD resources during various emergency situations. Emergency situations meant to be addressed by this plan are: earthquakes, major fire emergencies, water outages due to loss of power, localized flooding, water contamination, and acts of sabotage. To specifically address the concerns of water outages due to loss of power, NCWD has purchased and maintains three mobile generators. The generators are trailer mounted and have the following capacities: 600 KVA; 300 KVA; and 180 KVA.

These capacities provide the capability to run any facility within NCWD's service area. All primary pumping facilities are equipped with emergency transfer switches, and NCWD employees are trained regularly to maximize the speed to install and operate the generators. The generator run time is only limited by the amount of available diesel fuel. NCWD has an above ground diesel fuel storage tank with a capacity of 1,000 gallons located at its main office at 23780 N. Pine Street in the City of Santa Clarita. Multiple crew trucks are equipped with 100 gallon diesel tanks and the necessary fueling equipment to refill the generators. NCWD would respond to power outages on a prioritized basis and would continue its response to the power emergency as long as necessary. In addition to the generators, NCWD has a gas driven pump capable of delivering 600 gpm. This pump can be installed at select facilities as needed.

The NCWD Emergency Response Plan should be referenced for a more detailed description of specific actions NCWD plans to take in the event of a major power failure.

VWC

In the event that a power outage occurs, VWC has one mobile generator capable of powering either one of VWC's Saugus wells or two Alluvial wells that are in close proximity to one another. VWC would use the generator as a back-up to ensure water service remained until Edison was able to restore power. For regional power outages, VWC would rely on Edison's reliability criteria for restoring service with the longest outage assumed not to exceed 24 hours. This length of outage would not have a significant impact on water service.

The VWC Emergency Response Plan should be referenced for a more detailed description of specific actions VWC plans to take in the event of a major power failure.

8.6 MANDATORY PROHIBITIONS DURING SHORTAGES

All Valley residents live within the boundaries of the City of Santa Clarita or Los Angeles County. Several ordinances were passed in 1991, during the last long-term drought, by the various governmental entities in the Santa Clarita Valley outlawing wasteful water practices. It is expected that, if the Valley experienced another dry-year period, the same ordinances would be reactivated.

On February 11, 1991, the CLWA Board of Directors adopted Resolution No. 804 mandating a program of water conservation in the Santa Clarita Valley.

On February 14, 1991, the NCWD Board of Directors adopted Resolution No. 101 outlawing wasteful water practices. The ordinance was amended on October 15, 1991, with the adoption of Ordinance No. 102 and further amended on July 14, 2005, with the adoption of Ordinance No. 112.

On March 13, 1991, the City of Santa Clarita adopted Ordinance No. 91-16 outlawing wasteful water practices and calling for voluntary water conservation. The ordinance was amended on October 8, 1991 by the adoption of Ordinance No. 91-48.

On March 21, 1991, the Los Angeles County Board of Supervisors adopted Ordinance No. 91-0046U, which prohibits wasteful water practices.

Most of the ordinances mentioned above had sunset provisions that were effective January 1, 1992; however, these ordinances could be reinstituted as needed.

8.7 CONSUMPTIVE REDUCTION METHODS DURING RESTRICTIONS

8.7.1 Supply Shortage Triggering Levels

The agencies will manage water supplies to minimize the social and economic impact of water shortages. The Plan is designed to provide a minimum 50 percent of normal supply during a severe or extended water shortage.

Demand reduction stages may be triggered by a shortage in any one of the water sources in the Valley or by shortages in a combination of supplies. The guidelines for triggering the stages are listed in Table 8-5. However, circumstances may arise where the purveyors may deviate from these guidelines, such as in a case where the Governor declares a water shortage emergency and/or institutes a statewide rationing program.

Table 8-5
Water Deficiency Triggering Levels

Stage	Percent Shortage
1	Up to 15 percent water deficiency
2	15 to 25 percent water deficiency
3	25 to 35 percent water deficiency
4	35 to 50+ percent water deficiency

8.7.2 Consumption Limits

The Valley-wide consumption allocation method for each customer type is as follows:

Single Family	Hybrid of Per-capita and Percentage Reduction
Multi Family	Hybrid of Per-capita and Percentage Reduction

Commercial	Percentage Reduction
Industrial	Percentage Reduction
Governmental	Percentage Reduction
Recreational	Percentage Reduction
Irrigation	Percentage Reduction

The percentage reductions at each stage and for each customer type correspond to the figures listed in Table 8-4. In a drought situation (multiple-dry year period), individual customer allotments will be based on a normal year consumption table. The water agencies will classify each customer and calculate each customer's allotment according to Table 8-4. Each customer will be notified of its classification and allotment by mail before the implementation of a mandatory program. New customers and connections will be notified at the time service commences if a mandatory program is in effect. Any customer may appeal its classification on the basis of use or the allotment on the basis of incorrect calculation.

In a disaster, prior notice of allotment may not be possible. Notice will be provided by the most efficient means available, if necessary, through the terms of the CLWA's Emergency Response Plan.

8.7.3 New Demand

During any declared water shortage emergency requiring mandatory rationing, the retail purveyors recommend that the City and County building departments continue to process applications for grading and building permits, but not issue the actual permits until mandatory rationing is rescinded. In Stages 3 and 4, it may be necessary to discontinue all use of grading water, even if permits have been issued, and consider banning all use of water for non-essential uses, such as new landscaping and pools.

8.8 PENALTIES FOR EXCESSIVE USE

The following section provides a summary of the penalties, if any, that are implemented for excessive water use for CLWA SCWD, NCWD, and VWC.

8.8.1 CLWA Santa Clarita Water Division

The SCWD has one commodity rate for all customer classes, so no excessive use penalties are in place.

8.8.2 Newhall County Water District

In July 2005, NCWD's Board of Directors adopted Ordinance No. 112, which addresses water conservation, shortage, drought, and emergency response procedures. NCWD's Water Conservation Action Plan states that no water user shall waste water or make, cause, or permit the use of water for any purpose contrary to any provision of Ordinance No. 112, or in quantities in excess of the use permitted by the conservation stage in effect. If excessive use (water leaks and/or waste) is detected from any water user, the following enforcement plan will be followed:

Efficient Water Use and Stage 1 Enforcement:

- Any sign of water leaks and/or waste will be documented.
- NCWD will then determine the appropriate level of action to inform the water user of the guidelines in Ordinance No. 112 and will encourage more efficient water use.

Stages 2, 3, and 4 Enforcement:

- First Violation: NCWD shall issue a verbal warning to the water user and recommend corrective action.
- Second Violation: NCWD shall issue a written warning to the water user, and a fine of $40 shall be added to the water user's bill if the corrective action is not taken within 30 days after receiving the written warning.
- Third Violation: A fine of $100 shall be added to the water user's bill if the corrective action is not taken within 30 days after receiving the written warning. In addition, the NCWD Board or General Manager may require installation of a flow-restricting device on the water user's service connection.
- Fourth Violation: For the fourth and any additional violations, a fine of $250 shall be added to the water user's bill at the property where the violation occurred. NCWD may also discontinue the water user's water service at the property where the violation occurred. Reconnection shall be permitted only when there is reasonable protection against future violations, such as a flow-restricting device on the customer's service connection, as determined at NCWD's discretion.

NCWD Enforcement Costs: NCWD shall be reimbursed for its costs and expenses in enforcing the provisions of Ordinance No. 112, including costs incurred for staff to investigate and monitor the water user's compliance with the terms of the Ordinance. Charges for installation of flow-restricting devices or for discontinuing or restoring water service, as NCWD incurs those charges, shall be added to the water user's bill at the property where the enforcement costs were incurred.

8.8.3 Valencia Water Company

VWC is regulated by the PUC. During times of threatened or actual water shortage, the PUC will require that VWC apportion its available water supply among its customers. In the absence of direction from the PUC, VWC will apportion the supply in the manner that appears most equitable under circumstances then prevailing and with the cooperation of the Valley water purveyors with due regard to public health and safety.

The PUC's methodology for water utilities to implement Water Conservation Plans is documented in Standard Practice U-40-W, "Instructions for Water Conservation, Rationing, and Service Connection Moratoria." Water shortage contingency plans must be approved by the PUC prior to implementation by VWC. As stated in the Standard Practice U-40-W, the PUC shall

authorize mandatory conservation and rationing by approving Schedule No. 14.1, Mandatory Water Conservation and Rationing. Schedule No. 14.1 sets forth water use violation fines, charges for removal of flow restrictors, and the period during which mandatory conservation and rationing measures will be in effect.

8.9 FINANCIAL IMPACTS OF ACTIONS DURING SHORTAGES

The following section addresses the financial impacts of actions during water shortages for CLWA SCWD, NCWD, and VWC.

8.9.1 CLWA Santa Clarita Water Division

Approximately 45 percent of SCWD's expenses are variable and will be reduced proportionately with any reduction in sales due to voluntary or mandatory conservation. The remaining 55 percent of expenses are fixed and will not decrease as a result of reduced sales. Also, only 50 percent of the fixed expenses are included in the meter charge, and 70 percent of SCWD's revenues are generated by the commodity and energy charge.

As a result of the 1987-1992 drought, the Valley's retail water purveyors asked their retail customers to voluntarily reduce water use in 1992. The customers temporarily achieved a 25 percent reduction in usage. Approximately 70 percent of SCWD's revenues are derived from the commodity charge. A reduction of 25 percent could dramatically affect the financial stability of SCWD and impact its ability to meet its payment obligations and fund its capital program. Rather than being faced with the necessity of raising rates during a drought period, the Board directed staff to establish and maintain a Water Conservation Rate Stabilization Fund to be used in years when actual consumption drops 10 percent or more below average consumption. The Rate Stabilization Fund, established to address the financial impacts of water shortages, was approved by the Board in 2004.

8.9.2 Newhall County Water District

NCWD's rates are designed with the intent that NCWD will generate adequate revenues to meet the costs of operating the water system. For the 2005-06 budget year, it is expected that 26 percent of NCWD's total water revenues will come from the service charge and about 74 percent of the total revenues will come from the commodity charge. The service charge is based on meter size and the commodity charge is based on the quantity of water consumed.

The nature of NCWD's operation (as with any water utility) is that the majority of the operating costs are "fixed" in nature and do not increase or decrease in direct proportion with increases or decreases in water use by customers. For example, if water availability issues or shortages cause NCWD to request a voluntary reduction in the customer's water use, two-thirds of the operating costs will remain the same even though less water is sold. This would result in a major revenue shortfall.

In an effort to address this shortfall, NCWD established a reserve policy (Resolution 2005-26), that includes a "rate stabilization" fund to be used in situations where actual consumption of

water is reduced as a direct result of a water shortage situation as defined in Table 8-1 of this Plan.

In the event of a declaration of a water shortage situation, NCWD's Board of Directors will consider options and actions intended to replenish the rate stabilization reserve to its ideal level. These actions may include but are not limited to rate increases or surcharges, per customer assessments, and utilization of other reserve funds.

8.9.3 Valencia Water Company

The PUC allows the investor owned water utilities it regulates to track and seek recovery of lost revenues and expense increases due to mandatory or voluntary water rationing during a drought. PUC regulated utilities' rates are set based on an assumed level of customer water usage during normal weather conditions. Therefore, when a drought occurs and customers conserve water, a utility's revenue declines, and it is difficult for the utility to fund its operating expenses. In order to provide an incentive for utilities to promote water conservation during periods of drought, the PUC developed a mechanism whereby utilities can track lost revenues as well as increases in expenses due to drought. Utilities can then recover a portion of their lost revenues and expense increases via a surcharge to customers. This reduces the financial strain conservation programs place on investor owned utilities while furthering the statewide goal of water conservation during periods of drought.

8.10 WATER SHORTAGE CONTINGENCY RESOLUTION

If a water shortage crisis reoccurs, such as the 1987-1992 drought, the water agencies will call a public hearing to declare a water shortage pursuant to Sections 351 and 352 of the California Water Code.

The Los Angeles County Board of Supervisors (on behalf of LACWWD #36) and NCWD's and CLWA's respective Boards of Directors would adopt ordinances, similar to those adopted in 1991, implementing the Water Shortage Contingency Plan. As stated in Section 8.6, in February 1991, the CLWA Board of Directors adopted Resolution No. 804, which recognized reductions in requested delivery of SWP supply and mandated water conservation in the Valley.

VWC would file an advice letter with the CPUC implementing the Water shortage Contingency Plan.

8.11 MECHANISM TO DETERMINE REDUCTIONS IN WATER USE

Demand

NCWD, SCWD, and VWC bill their customers on a monthly basis. The prior year's consumption is included on most customer bills. This allows comparison of the total consumption from each billing period to the same billing period from the prior year.

Production

Under normal conditions, CLWA, NCWD, SCWD, and VWC prepare monthly production reports, which are reviewed and compared to production reports and pumping statistics from the same period of the prior year. Under water shortage conditions, these production reports could be prepared as often as daily.

Stage 1 and 2 Water Shortages

During Stage 1 and 2 Water Shortages, retail purveyors will review selected production reports on a daily basis, and CLWA will provide each retail purveyor with a copy of its daily production report. The water agencies will meet on a more frequent basis to review water supply and demand in the Valley. Billing reports will be reviewed to identify users who are not abiding by the plan.

Stage 3 and 4 Water Shortages

During Stage 3 and 4 Water Shortages, the retail purveyors will review all production reports and pumping statistics on a daily basis. The water agencies will continue to monitor the supply and demand in the Valley. Water transfers and agreements to use each other's distribution facilities will be implemented as needed. Billing reports will be reviewed to identify users who are not abiding by the plan.

Disaster Shortage

During a disaster shortage, management will continually monitor production figures. The water agencies will work to transfer water and use each other's distribution facilities where feasible.

Appendix A
UWMP Checklist

Appendix A
2005 Urban Water Management Plan Checklist

Yes	No			
Coordination with Appropriate Agencies				**(Water Code §10620 (d)(1)(2))**
✓		Participated in area, regional, watershed or basin wide plan		1-2 Page or Chapter
✓		Describe the coordination of the plan preparation and anticipated benefits.		1-2 thru 1-4 Page or Chapter
Describe resource maximization / import minimization plan				**(Water Code §10620 (f))**
✓		Describe how water management tools / options maximize resources & minimize need to import water		1-5 Page or Chapter
Plan Updated in Years Ending in Five and Zero				**(Water Code § 10621(a))**
✓		Date updated and adopted plan received	*Adopted Nov. 9th, 2005*	1-2 thru 1-4 Page or Chapter
City and County Notification and Participation				**(Water Code § 10621(b))**
✓		Notify any city or county within service area of UWMP of plan review & revision		1-3 thru 1-5 Page or Chapter
✓		Consult and obtain comments from cities and counties within service area		1-3 thru 1-5 Page or Chapter
Service Area Information				**(Water Code § 10631 (a))**
✓		Include current and projected population		2-7 Page or Chapter
✓		Population projections were based on data from state, regional or local agency		2-7 Page or Chapter
✓		Describe climate characteristics that affect water management		1-8; 1-9; 2-9; 2-10 Page or Chapter
✓		Describe other demographic factors affecting water management		1-9 Page or Chapter
Water Sources				**(Water Code § 10631 (b))**
✓		Identify existing and planned water supply sources		3-1; chapter 3 Page or Chapter
✓		Provide current water supply quantities		3-1; chapter 3 Page or Chapter
✓		Provide planned water supply quantities		3-1; chapter 3 Page or Chapter
If Groundwater identified as existing or planned source				**(Water Code §10631 (b)(1-4))**
✓		Has management plan		3-6 thru 3-9 Page or Chapter
✓		Attached management plan (b)(1)		[attached to adopted plan] Page or Chapter
✓		Description of basin(s) (b)(2)		3-6 Page or Chapter
		Basin is adjudicated		-- Page or Chapter
		If adjudicated, attached order or decree (b)(2)		-- Page or Chapter
		Quantified amount of legal pumping right (b)(2)		-- Page or Chapter
✓		Analysis of location, amount & sufficiency, last five years (b)(3)		3-9 thru 3-18 Page or Chapter
✓		Analysis of location & amount projected, 20 years (b)(4)		3-9 thru 3-18 Page or Chapter
Reliability of Supply				**(Water Code §10631 (c) (1-3)**
✓		Describes the reliability of the water supply and vulnerability to seasonal or climatic shortage		Chapter 6 Page or Chapter
Water Sources Not Available on a Consistent Basis				**(Water Code §10631 (c))**
✓		Describe the reliability of the water supply due to seasonal or climatic shortages		3-3, 3-8, Chapter 6 Page or Chapter
✓		Describe the vulnerability of the water supply to seasonal or climatic shortages		1-8; 1-9; Chapter 6 Page or Chapter
✓		Describe plans to supplement/replace inconsistent sources with alternative sources/DMMs		3-17; 5-5; 5-10 Page or Chapter
Transfer or Exchange Opportunities				**(Water Code §10631 (d))**
✓		Describe short term and long term exchange or transfer opportunities		3-19; 3-23 Page or Chapter
Water Use Provisions				**(Water Code §10631 (e) (1-2))**
✓		Quantify past water use by sector		2-4; 2-5 Page or Chapter
✓		Quantify current water use by sector		2-4; 2-5 Page or Chapter
✓		Project future water use by sector		2-4; 2-5 Page or Chapter
✓		Identify and quantify sales to other agencies		3-2, 3-3 Page or Chapter
✓		Identify and quantify additional water uses		Chapter 3 & 4 Page or Chapter
Demand Management Measures				**(Water Code §10631 (f)(g))**
✓		Agency is a CUWCC member		Chapter 7 Page or Chapter
✓		Annual BMP reports provided and considered completed by CUWCC website		Appendix F Page or Chapter
Planned Water Supply Projects and Programs				**(Water Code §10631 (h))**
✓		Detailed description of expected future supply projects & programs		3-22; 3-23 Page or Chapter
✓		Timeline for each proposed project		3-20 thru 3-23 Page or Chapter
✓		Quantification of each projects normal yield (AFY)		3-22; 3-23 Page or Chapter
✓		Quantification of each projects single dry-year yield (AFY)		3-22; 3-23 Page or Chapter
✓		Quantification of each projects multiple dry-year yield (AFY)		3-22; 3-23 Page or Chapter

Appendix A
2005 Urban Water Management Plan Checklist

Yes	No			
Opportunities for development of desalinated water			**(Water Code §10631 (i))**	
✓		Describes opportunities for development of desalinated water, including, but not limited to, ocean water, brackish water, and groundwater, as a long-term supply	3-23 thru 3-25	Page or Chapter
If Supplier receives or projects receiving water from a wholesale supplier			**(Water Code §10631 (k))**	
✓		Agency receives, or projects receiving, wholesale water	3-2 thru 3-6	Page or Chapter
✓		Agency provided written demand projections to wholesaler, 20 years	3-3	Page or Chapter
✓		Wholesaler provided written water availability projections, by source, to agency, 20 years (if agency served by more than one wholesaler, duplicate this table and provide the source availability for each wholesaler)	3-4	Page or Chapter
✓		Reliability of wholesale supply provided in writing by wholesale agency (if agency served by more than one wholesaler, duplicate this table and provide the source availability for each wholesaler)	3-5; chapter 6	Page or Chapter
Water Shortage Contingency Plan Section			**(Water Code § 10632)**	
Stages of Action			**(Water Code § 10632 (a))**	
✓		Provide stages of action	8-2	Page or Chapter
✓		Provide the water supply conditions for each stage	8-2	Page or Chapter
✓		Includes plan for 50 percent supply shortage	8-2	Page or Chapter
Three-Year Minimum Water Supply			**(Water Code §10632 (b))**	
✓		Identifies driest 3-year period	8-3; 8-4	Page or Chapter
✓		Minimum water supply available by source for the next three years	8-3	Page or Chapter
Preparation for catastrophic water supply interruption			**(Water Code §10632 (c))**	
✓		Provided catastrophic supply interruption plan	8-4 thru 8-13	Page or Chapter
Prohibitions			**(Water Code § 10632 (d))**	
✓		List the mandatory prohibitions against specific water use practices during water shortages	8-13; 8-14	Page or Chapter
Consumption Reduction Methods			**(Water Code § 10632 (e))**	
✓		List the consumption reduction methods the water supplier will use to reduce water use in the most restrictive stages with up to a 50% reduction.	8-14; 8-15	Page or Chapter
Penalties			**(Water Code § 10632 (f))**	
✓		List excessive use penalties or charges for excessive use	8-15 thru 8-17	Page or Chapter
Revenue and Expenditure Impacts			**(Water Code § 10632 (g))**	
✓		Describe how actions and conditions impact revenues	8-17; 8-18	Page or Chapter
✓		Describe how actions and conditions impact expenditures	8-17; 8-18	Page or Chapter
✓		Describe measures to overcome the revenue and expenditure impacts	8-17; 8-18	Page or Chapter
Water Shortage Contingency Ordinance/Resolution			**(Water Code § 10632 (h))**	
✓		Attach a copy of the draft water shortage contingency resolution or ordinance.	Appendix G	Page or Chapter
Reduction Measuring Mechanism			**(Water Code § 10632 (i))**	
✓		Provided mechanisms for determining actual reductions	8-18	Page or Chapter
Recycling Plan Agency Coordination			**(Water Code § 10633)**	
✓		Describe the coordination of the recycling plan preparation information to the extent available.	4-1	Page or Chapter
Wastewater System Description			**(Water Code § 10633 (a))**	
✓		Describe the wastewater collection and treatment systems in the supplier's service area	4-2; 4-3	Page or Chapter
✓		Quantify the volume of wastewater collected and treated	4-3	Page or Chapter
Wastewater Disposal and Recycled Water Uses			**(Water Code § 10633 (a - d))**	
✓		Describes methods of wastewater disposal	4-5	Page or Chapter
✓		Describe the current type, place and use of recycled water	4-6; 4-7	Page or Chapter
✓		Describe and quantify potential uses of recycled water	4-7; 4-8	Page or Chapter
✓		Determination of technical and economic feasibility of serving the potential uses	4-7; 4-8	Page or Chapter
Projected Uses of Recycled Water			**(Water Code § 10633 (e))**	
✓		Projected use of recycled water, 20 years	4-8	Page or Chapter
✓		Compare UWMP 2000 projections with UWMP 2005 actual (§ 10633 (e))	4-8	Page or Chapter

Appendix A
2005 Urban Water Management Plan Checklist

Yes	No			
Plan to Optimize Use of Recycled Water			**(Water Code § 10633 (f))**	
✓		Describe actions that might be taken to encourage recycled water uses	4-8, 4-9	Page or Chapter
✓		Describe projected results of these actions in terms of acre-feet of recycled water used per year	4-9	Page or Chapter
✓		Provide a recycled water use optimization plan which includes actions to facilitate the use of recycled water (dual distribution systems, promote recirculating uses)	4-9, 4-10	Page or Chapter
Water quality impacts on availability of supply			**(Water Code §10634)**	
✓		Discusses water quality impacts (by source) upon water management strategies and supply reliability	Chapter 5	Page or Chapter
Supply and Demand Comparison to 20 Years			**(Water Code § 10635 (a))**	
✓		Compare the projected normal water supply to projected normal water use over the next 20 years, in 5-year increments.	6-7	Page or Chapter
Supply and Demand Comparison: Single-dry Year Scenario			**(Water Code § 10635 (a))**	
✓		Compare the projected single-dry year water supply to projected single-dry year water use over the next 20 years, in 5-year increments.	6-8	Page or Chapter
Supply and Demand Comparison: Multiple-dry Year Scenario			**(Water Code § 10635 (a))**	
✓		Project a multiple-dry year period (as identified in Table 9) occurring between 2006-2010 and compare projected supply and demand during those years	6-9	Page or Chapter
✓		Project a multiple-dry year period (as identified in Table 9) occurring between 2011-2015 and compare projected supply and demand during those years	6-9	Page or Chapter
✓		Project a multiple-dry year period (as identified in Table 9) occurring between 2016-2020 and compare projected supply and demand during those years	6-9	Page or Chapter
✓		Project a multiple-dry year period (as identified in Table 9) occurring between 2021-2025 and compare projected supply and demand during those years	6-9	Page or Chapter
Provision of Water Service Reliability section to cities/counties within service area			**(Water Code § 10635(b))**	
✓		Provided Water Service Reliability section of UWMP to cities and counties within which it provides water supplies within 60 days of UWMP submission to DWR	[to be complied w/ adopted Plan]	Page or Chapter
Does the Plan Include Public Participation and Plan Adoption			**(Water Code § 10642)**	
✓		Attach a copy of adoption resolution	[attached to adopted Plan]	Page or Chapter
✓		Encourage involvement of social, cultural & economic community groups	1-3 thru 1-5; Appendix B	Page or Chapter
✓		Plan available for public inspection	1-3 thru 1-5; Appendix B	Page or Chapter
✓		Provide proof of public hearing	1-3 thru 1-5; Appendix B	Page or Chapter
✓		Provided meeting notice to local governments	1-3 thru 1-5; Appendix B	Page or Chapter
Review of implementation of 2000 UWMP			**(Water Code § 10643)**	
✓		Reviewed implementation plan and schedule of 2000 UWMP	Chapter 1	Page or Chapter
✓		Implemented in accordance with the schedule set forth in plan	Chapter 1	Page or Chapter
Provision of 2005 UWMP to local governments			**(Water Code § 10644 (a))**	
✓		Provide 2005 UWMP to DWR, and cities and counties within 30 days of adoption	[to be complied w/ upon adoption of Plan]	Page or Chapter
Does the plan or correspondence accompanying it show where it is available for public review			**(Water Code § 10645)**	
✓		Does UWMP or correspondence accompanying it show where it is available for public review	1-3	Page or Chapter

Appendix B
Public Outreach Materials

UWMP 2005 Workshop and Public Hearing Schedule	
Date	**Meeting**
April 7, 2005	Community Workshop #1
June 29, 2005	Community Workshop #2
August 31, 2005	Community Workshop #3
September 28, 2005	First Joint Public Hearing
October 26, 2005	Second Joint Public Hearing

UWMP 2005 Outreach Meeting Schedule	
Date	**Meeting**
May 17, 2005	City of Santa Clarita Planning and Government Relations Staff
July 13, 2005	Building Industry Association Executive Director
August 3, 2005	Building Industry Association Government Affairs Committee
August 9, 2005	Santa Clarita Valley Government Affairs Committee
September 20, 2005	Santa Clarita Valley Chamber of Commerce Board
September 21, 2005	Castaic Town Council
September 22, 2005	Santa Clarita Valley Chamber of Commerce Environmental Committee

The Signal
3/29/05

SANTA CLARITA VALLEY

URBAN WATER MANAGEMENT PLAN

2005

CASTAIC LAKE WATER AGENCY AND THE SANTA CLARITA VALLEY WATER COMMUNITY ANNOUNCE THE PREPARATION OF THE 2005 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan, mandated by the State of California, presents a picture of the Valley's water situation through the year 2030. It describes the long-range water needs of the community, and the means that will be used to supply the necessary water. We encourage your interest and involvement.

Kick-Off Community Workshop

Date: Thursday, April 7, 2005

Time: 6:00 pm

Location: Castaic Lake Water Agency,
Administration Building,
27234 Bouquet Canyon Road

Purpose: At this Kick-Off Community Workshop we will present an overview of the state requirements and an outline of the contents of the 2005 Urban Water Management Plan. Our team of experts will provide an overview and answer any questions. We will also provide an overview of the many opportunities for public comment during the preparation of the 2005 Urban Water Management Plan.

CASTAIC LAKE WATER AGENCY

Please call (661) 297-1600
for information.

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

Daily News
3/31/05

SANTA CLARITA VALLEY

URBAN WATER MANAGEMENT PLAN

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CASTAIC LAKE WATER AGENCY

Please call (661) 297-1600 for information.

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

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The Signal
Daily News
6/22/05

SANTA CLARITA VALLEY
URBAN WATER MANAGEMENT PLAN
2005

CASTAIC LAKE WATER AGENCY AND
THE SANTA CLARITA VALLEY WATER COMMUNITY
ANNOUNCE THE PREPARATION OF THE
2005 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan, mandated by the State of California, presents a picture of the Valley's water situation through the year 2030. It describes the long-range water needs of the community, and the means that will be used to supply the necessary water. We encourage your interest and involvement.

YOU ARE CORDIALLY INVITED TO ATTEND OUR NEXT WORKSHOP
JUNE 29, 2005
5:30 P.M.

June 2005	Preliminary Draft UWMP release for public comment
June 2005	Community Workshop to review UWMP and seek input
August 2005	Follow up Community Workshop – release Draft UWMP, review contents with the public
September 2005	First CLWA Public Hearing
October 2005	Second CLWA Public Hearing
October 2005	Final UWMP considered for approval by the CLWA Board and NCWD Board (at a joint meeting)

CASTAIC LAKE WATER AGENCY

All meetings will be held at
Castaic Lake Water Agency, Administration Building
27234 Bouquet Canyon Road, at times TBA.
Please call (661) 297-1600 for information.

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

Breakfast, Lunch and Dinner only $175.00.
All Golfers get a chance at the Hole In One contest for a car sponsored by Frontier Toyota as well as many other raffles and prizes.
Musical sendoff provided by Canyon High Marching Band and Happy Hour Jazz, by the Canyon High Jazz Band.
Register online at www.goldstarbrigade.org or call (661) 252-7076.
This is a Non-Profit event. For sponsorship information log onto our website or call the number above.

SANTA CLARITA VALLEY
URBAN WATER MANAGEMENT PLAN
2005

CASTAIC LAKE WATER AGENCY AND
THE SANTA CLARITA VALLEY WATER COMMUNITY
ANNOUNCE THE PREPARATION OF THE
2005 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan, mandated by the State of California, presents a picture of the Valley's water situation through 2030. It describes the long-range water needs of the community, and the means that will be used to supply the necessary water. We encourage your interest and involvement.

YOU ARE CORDIALLY INVITED TO ATTEND
OUR NEXT WORKSHOP
AUGUST 31, 2005
6:30 P.M.

June 2005	Preliminary Draft UWMP release for public comment
June 2005	Community Workshop to review UWMP and seek input
August 2005	Follow up Community Workshop – release Draft UWMP, review contents with the public
September 2005	First CLWA Public Hearing
October 2005	Second CLWA Public Hearing - UWMP considered for approval by the CLWA Board and NCWD Board (at a joint meeting)

CASTAIC LAKE WATER AGENCY

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Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

SANTA CLARITA VALLEY
URBAN WATER MANAGEMENT PLAN
2005

CASTAIC LAKE WATER AGENCY AND
THE SANTA CLARITA VALLEY WATER COMMUNITY
ANNOUNCE THE PREPARATION OF THE
2005 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan, mandated by the State of California, presents a picture of the Valley's water situation through 2030. It describes the long-range water needs of the community, and the means that will be used to supply the necessary water. We encourage your interest and involvement.

YOU ARE CORDIALLY INVITED TO ATTEND OUR NEXT WORKSHOP

AUGUST 31, 2005
6:30 P.M.

June 2005	Preliminary Draft UWMP release for public comment
June 2005	Community Workshop to review UWMP and seek input
August 2005	Follow up Community Workshop – release Draft UWMP, review contents with the public
September 2005	First CLWA Public Hearing
October 2005	Second CLWA Public Hearing - UWMP considered for approval by the CLWA Board and NCWD Board (at a joint meeting)

CASTAIC LAKE WATER AGENCY

All meetings will be held at
Castaic Lake Water Agency, Administration Building
27234 Bouquet Canyon Road, at times TBA.
Please call (661) 297-1600 for information.

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company

The Signal
Monday
10-17-05
3 of 3

SANTA CLARITA VALLEY
URBAN WATER MANAGEMENT PLAN
2005

CASTAIC LAKE WATER AGENCY AND
THE SANTA CLARITA VALLEY WATER COMMUNITY
ANNOUNCE THE PREPARATION OF THE
2005 URBAN WATER MANAGEMENT PLAN

The Urban Water Management Plan, mandated by the State of California, presents a picture of the Valley's water situation through 2030. It describes the long-range water needs of the community, and the means that will be used to supply the necessary water. We encourage your interest and involvement.

YOU ARE CORDIALLY INVITED TO ATTEND OUR NEXT PUBLIC HEARING

OCTOBER 26, 2005

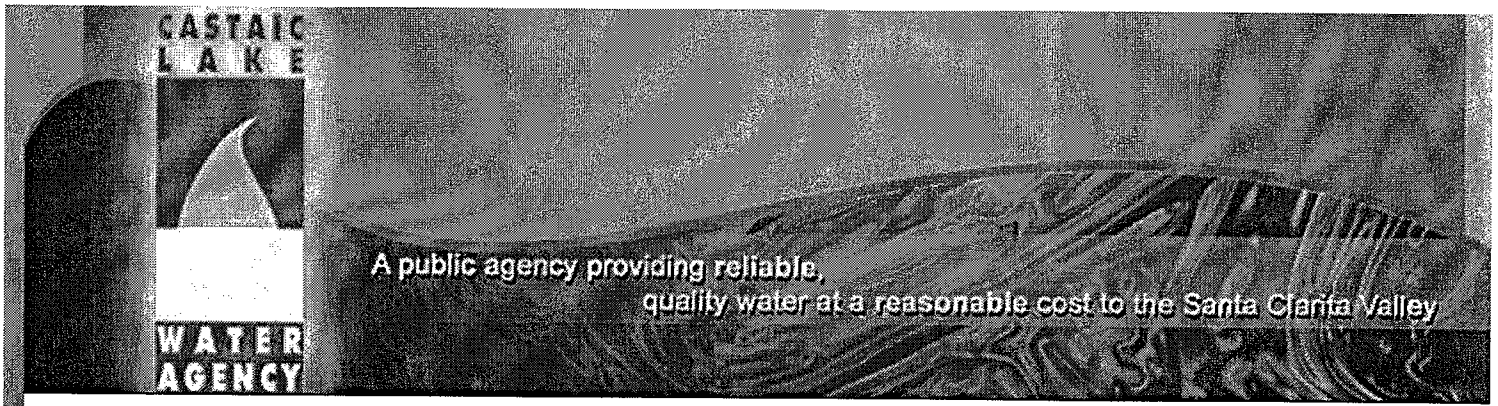
7:00 P.M.

June 2005	Preliminary Draft UWMP release for public comment
June 2005	Community Workshop to review UWMP and seek input
August 2005	Follow up Community Workshop – release Draft UWMP, review contents with the public
September 23, 2005	First CLWA Public Hearing
October 26, 2005	Second CLWA Public Hearing - UWMP considered for approval by the CLWA Board and NCWD Board (at a joint meeting)

CASTAIC LAKE WATER AGENCY

Hearing will be held at
Castaic Lake Water Agency, Administration Building
27234 Bouquet Canyon Road
Please call (661) 297-1600 for information.

Castaic Lake Water Agency
CLWA Santa Clarita Water Division
Newhall County Water District
Valencia Water Company



Publications (Newsletters, etc.)

Important Notices

This is where new items, important notices and information on upcoming events are posted.

IMPORTANT: The Draft 2005 Urban Water Management Plan for the Santa Clarita Valley is available for review. PLEASE SCROLL TO THE BOTTOM OF THIS PAGE FOR MORE INFORMATION.

Draft 2005 Urban Water Management Plan for the Santa Clarita Valley

The Draft 2005 Urban Water Management Plan is prepared in accordance with the requirements of the Urban Water Management Planning Act (Water Code sections 10630 et seq.). Every five years, in years ending in "5" and "0," water suppliers having more th 3,000 service connections or selling at least 3,000 acre-feet of water per year must prepare a plan.

Castaic Lake Water Agency, CLWA Santa Clarita Water Division, Newhall County Water District and Valencia Water Company ha prepared a joint regional plan for the Santa Clarita Valley, as encouraged by the Act. Los Angeles County Waterworks District No. 36 is participating on an ad hoc basis.

Two public hearings will be held to review the plan. Both hearings will he held during joint meetings of the CLWA and NCWD Boar of Directors, and will take place in the CLWA Board Room at the address shown below.

Wednesday, September 28, 2005 7:00 p.m.

Wednesday, October 26, 2005 7:00 p.m.

Written comments should be submitted to CLWA by 5:00 p.m., Wednesday, October 21, 2005. Comments should be directed to:

Mary Lou Cotton
Water Resources Manager
CLWA
27234 Bouquet Canyon Road
Santa Clarita, CA 91350
Fax: 661/297-1611

- Draft 2005 UWMP Introduction and Table of Contents
- Draft 2005 UWMP Chapters 1 through 4
- Draft 2005 UWMP Chapters 5 through 8
- Draft 2005 UWMP Appendix A
- Draft 2005 UWMP Appendix B
- Draft 2005 UWMP Appendix C
- Draft 2005 UWMP Appendix D
- Draft 2005 UWMP Appendix E

CASTAIC LAKE WATER AGENCY

DIRECTORS
E. G. "Jerry" Gladbach
Dean D. Efstathiou
William C. Cooper
Robert [illegible]
William [illegible]
Pete [illegible]
Barbara D[illegible]
Thomas P. Campbell
Edward A. Colley
Jacquelyn H. McMillan
R.J. Kelly

GENERAL MANAGER
Dan Masnada

Vital News About Water Issues in the Santa Clarita Valley Summer 2005

Water Currents

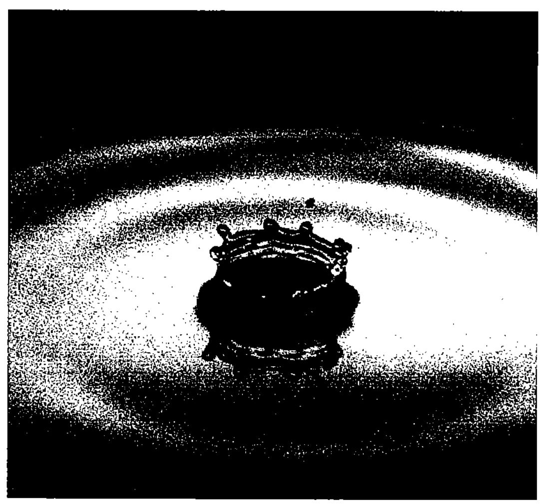
Urban Water Management Plan to Address SCV Water Demand and Supply

CLWA and the local water retailers are preparing a draft of the Santa Clarita Valley 2005 Urban Water Management Plan (UWMP) for review this summer and fall. All California urban water suppliers having more than 3,000 service connections or selling more than 3,000 acre-feet of water annually are required by the California Water Code to prepare a UWMP every five years. About 450 water suppliers statewide are affected. CLWA, CLWA Santa Clarita Water Division, Newhall County Water District (NCWD), and Valencia Water Company are working jointly to prepare a draft of a 2005 plan for the Santa Clarita Valley. Los Angeles County Waterworks District No. 36 is participating on an *ad hoc* basis, as the Los Angeles County Department of Public Works must prepare its own UWMP.

A UWMP must consider projected demands and supplies for a 20-year period, in five-year increments. It must also assess water supply and demand scenarios for average/normal water years (i.e., periods of normal precipitation), a single dry year, and multiple dry years.

The draft 2005 UWMP for the Santa Clarita Valley will identify current local and imported water supply sources, as well as potential future sources. Current sources include the State Water Project, local groundwater and recycled water. Future potential sources include all of these plus water transfers, additional recycled water, groundwater banking, water conservation and desalination.

The plan will identify future demand based on growth projections. By assessing projected demand along with projected supply, the 2005 UWMP will show how the Santa Clarita Valley will meet its water needs through 2030.



CLWA and the retailers published an amended 2000 UWMP this past January, which addresses in detail the issue of perchlorate contamination first detected in 1997 in certain groundwater wells adjacent to the former Whittaker-Bermite site. It describes plans for returning the contaminated wells to service.

Years of negotiations between CLWA, the local water retailers and the current and former owners of the site, in an effort to reach agreement on clean-up, were unproductive. In November 2000 CLWA and the retailers filed suit to compel the

Continued, page 4

CASTAIC LAKE WATER AGENCY

Vital News About Water Issues in the Santa Clarita Valley Fall 2005

Water Currents

CLWA and Retailers Seek Public Comment on 2005 Urban Water Management Plan

The California Urban Water Planning Act requires water utilities to update and submit an Urban Water Management Plan (UWMP) every five years. CLWA is one of California's approximately 450 water suppliers now preparing such a plan. CLWA, CLWA Santa Clarita Water Division, Newhall County Water District (NCWD), and Valencia Water Company have worked together to prepare a draft of a 2005 plan for the Santa Clarita Valley. (Los Angeles County Waterworks District No. 36 is participating on an *ad hoc* basis, as the Los Angeles County Department of Public Works must prepare its own UWMP.)

A UWMP must consider projected demands and supplies for a 20-year period, in five-year increments. It must also assess water supply and demand scenarios for average/normal water years (i.e., periods of normal precipitation), a single dry year, and multiple dry years.

The draft 2005 UWMP for the Santa Clarita Valley is available for public review and comment. The Plan identifies current local and imported water supply sources, as well as potential future sources. Current sources include the State Water Project, local ground- water and recycled water. Future potential sources include all of these sources plus water transfers, additional recycled water, groundwater banking, water conservation and desalination.

The Plan identifies future demand based on growth projections. By assessing projected demand along with projected supply, the 2005 UWMP shows how the Santa Clarita Valley will meet its water needs through 2030.

Two public hearings to discuss the 2005 UWMP have been scheduled, the first of which was held on Wednesday, September 28, 2005, during a joint meeting of the CLWA and NCWD Boards of Directors . A second public hearing is scheduled for 7 p.m. on Wednesday, October 26, 2005. The hearing will be held in the CLWA Boardroom at 27234 Bouquet Canyon Road, Santa Clarita, CA 91350.

DIRECTORS
E. G. "Jerry" Gladbach
Dean D. Efstathiou
William C. Cooper
Robert J. DiPrimio
William [illegible]
Peter [illegible]
Barbara [illegible]
Thomas P. Campbell
Edward A. Colley
Jacquelyn H. McMillan
R.J. Kelly
GENERAL MANAGER
Dan Masnada

JEFFREY LAMBERT, AICP
Planning / Government Relations

March 26, 2005

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

Subject: 2005 Santa Clarita Valley Urban Water Manager Plan

Dear Sand Canyon Well Owners Association:

We have begun to prepare the 2005 Santa Clarita Valley Urban Water Management Plan. In an effort to ensure all interested parties are fully informed and involved in our process, we have scheduled the first of many community workshops.

Date:	Thursday, April 7, 2005
Time:	6:00 pm
Location:	Castaic Lake Water Agency, Administration Building, 27234 Bouquet Canyon Road

The purpose of this Kick-Off Community Workshop is to present an overview of the state requirements and an outline of the contents of the 2005 Santa Clarita Valley Urban Water Management Plan.

I have enclosed a flyer for this workshop and encourage you to attend.

Sincerely,

Jeffrey Lambert, AICP
Public Outreach Manager, 2005 SCV UWMP

4603 Morse Avenue, Sherman Oaks, CA 91423, (818) 907-0294
Jeffrey@Jeffrey-Lambert.com

Ms. Dana Wisehart
United Water Conservation District
106 N. 8th Street
Santa Paula, California 93060

Stephan C. Volker
436 14th Street, Suite 1300
Oakland, California 94612

Sierra Club Angeles Chapter
3435 Wilshire Boulevard, Suite 320
Los Angeles, California 90010-1904

Friends of the Santa Clara River
660 Randy Drive
Newbury Park, California 91320-4323

Mr. Steve Cole
Acting General Manager
Newhall Country Water District
P.O. Box 220970
Newhall, California 91322-0970

Mr. Dennis Slivinski, Assistant County Counsel
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1830

Mr. David Todd
Office of Water Use Efficiency
CA Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Mr. Gerald Johns, Deputy Director
CA Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Jeffrey M. Smith, AICP
Southern CA Association of Governments
818 West Seventh Street, 12th Floor
Los Angeles, CA 90017-3435

McCormick, Kidman & Behrens, LLP
Russ Behrens, Esq.
695 Town Center Drive
Suite 400
Costa Mesa, California 92626-7187

Mr. Chris Stephens, Planning Director
Resource Management Agency
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1600

Mr. James Hartl
Director, Regional Planning
County of Los Angeles
320 West Temple Street
Los Angeles, CA 90012

Mr. Michael Murphy
Inter-Government Relations Officer
City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 91355

Ms. Judy Reinsma, President
Santa Clarita Valley Well Owners Association
P.O. Box 800085
Santa Clarita, CA 91380

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

Paul Fancett
Castaic Area Town Council
P.O. Box 325
Castaic, CA 91310

Paul Ash, President
Westranch Town Council
Hanger, Levine and Steinberg
21031 Ventura Blvd., Suite 800
Woodland Hills, CA 91364

Santa Clarita Sierra Club
21827 Parvin Dr.
Saugus, CA 91350

Santa Clarita Organization for Planning the Environment **SCOPE**
P.O. Box 1182
Canyon Country, CA
91386-1182

NOTE:
Those shaded addresses were sent Return Receipt (only Judy Reinsma was returned without evidence of receipt)

JEFFREY LAMBERT, AICP
Planning / Government Relations

June 21, 2005

Subject: 2005 Santa Clarita Valley Urban Water Management Plan

Dear:

As you know, we are preparing the 2005 Santa Clarita Valley Urban Water Management Plan. In an effort to ensure all interested parties are fully informed and involved in the process, we have scheduled the second community workshop.

Date:	Wednesday, June 29, 2005
Time:	5:30 pm
Location:	Castaic Lake Water Agency, Administration Building, 27234 Bouquet Canyon Road

The purpose of this Community Workshop is to present the Preliminary Draft 2005 UWMP and to seek your feedback. The Draft 2005 UWMP is scheduled to be released in August with public hearings scheduled for September and October.

I encourage you to attend and learn more about the 2005 Santa Clarita Valley Urban Water Management Plan.

Sincerely,

Jeffrey Lambert, AICP
Public Outreach Manager, 2005 SCV UWMP

4603 Morse Avenue, Sherman Oaks, CA 91423, (818) 907-0294
Jeffrey@Jeffrey-Lambert.com

JEFFREY LAMBERT, AICP
Planning / Government Relations
4603 Morse Avenue, Sherman Oaks, CA 91423, (818) 907-0294
Jeffrey@Jeffrey-Lambert.com

August 22, 2005

Subject: 2005 Santa Clarita Valley Urban Water Management Plan

Dear Interested Party:

As you know, the Santa Clarita Valley water suppliers are preparing the 2005 Santa Clarita Valley Urban Water Management Plan. This letter is intended to provide you with advanced information on upcoming public meetings. We have scheduled the third community workshop and have tentatively scheduled two public hearings at joint meetings of the Castaic Lake Water Agency and Newhall County Water District Boards of Directors. These meetings have been scheduled as follows:

What:	**Third Community Workshop**
Date:	Wednesday, August 31, 2005
Time:	6:30 pm
Location:	Castaic Lake Water Agency, Administration Building, 27234 Bouquet Canyon Road

What:	**Joint Public Hearing**
Date:	Wednesday, September 28, 2005 (tentative)
Time:	7:00 pm
Location:	Castaic Lake Water Agency, Administration Building, 27234 Bouquet Canyon Road

What:	**Joint Public Hearing (Second)**
Date:	Wednesday, October 26, 2005 (tentative)
Time:	7:00 pm
Location:	Castaic Lake Water Agency, Administration Building, 27234 Bouquet Canyon Road

The Draft 2005 UWMP is scheduled for release in mid- to late-August. The Draft 2005 UWMP will be available on the CLWA and NCWD web sites.

I encourage you to attend and be involved in the review and adoption of the 2005 Santa Clarita Valley Urban Water Management Plan.

Sincerely,

Jeffrey Lambert, AICP
Public Outreach Manager, 2005 SCV UWMP

Ms. Dana Wisehart
United Water Conservation District
106 N. 8th Street
Santa Paula, California 93060

Stephan C. Volker
436 14th Street, Suite 1300
Oakland, California 94612

Sierra Club Angeles Chapter
3435 Wilshire Boulevard, Suite 320
Los Angeles, California 90010-1904

Friends of the Santa Clara River
660 Randy Drive
Newbury Park, California 91320-4323

Mr. Steve Cole
Acting General Manager
Newhall Country Water District
P.O. Box 220970
Newhall, California 91322-0970

Mr. Dennis Slivinski, Assistant County Counsel
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1830

Mr. David Todd
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P.O. Box 942836
Sacramento, CA 94236-0001

Mr. Gerald Johns, Deputy Director
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Southern CA Association of Governments
818 West Seventh Street, 12th Floor
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McCormick, Kidman & Behrens, LLP
Russ Behrens, Esq.
695 Town Center Drive
Suite 400
Costa Mesa, California 92626-7187

Mr. Chris Stephens, Planning Director
Resource Management Agency
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1600

Mr. James Hartl
Director, Regional Planning
County of Los Angeles
320 West Temple Street
Los Angeles, CA 90012

Mr. Michael Murphy
Inter-Government Relations Officer
City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 91355

Ms. Judy Reinsma, President
Santa Clarita Valley Well Owners Association
P.O. Box 800085
Santa Clarita, CA 91380

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

Paul Fancett
Castaic Area Town Council
P.O. Box 325
Castaic, CA 91310

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Woodland Hills, CA 91364

Santa Clarita Sierra Club
21827 Parvin Dr.
Saugus, CA 91350

Santa Clarita Organization for Planning the Environment SCOPE
P.O. Box 1182
Canyon Country, CA
91386-1182

NOTE:
Those shaded addresses were sent Return Receipt (only Judy Reinsma was returned without evidence of receipt)

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Santa Clarita Organization for Planning the Environment **SCOPE**
P.O. Box 1182
Canyon Country, CA
91386-1182

Dear SCOPE:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Santa Clarita Sierra Club
21827 Parvin Dr.
Saugus, CA 91350

Dear Santa Clarita Sierra Club:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Paul Ash, President
Westranch Town Council
Hanger, Levine and Steinberg
21031 Ventura Blvd., Suite 800
Woodland Hills, CA 91364

Dear Mr. Ash:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Paul Fancett
Castaic Area Town Council
P.O. Box 325
Castaic, CA 91310

Dear Mr. Fancett:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

Dear Sand Canyon Area Well Owners Association:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Ms. Judy Reinsma, President
Santa Clarita Valley Well Owners Association
P.O. Box 800085
Santa Clarita, CA 91380

Dear Ms. Reinsma:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. Michael Murphy
Inter-Government Relations Officer
City of Santa Clarita
23920 Valencia Blvd.
Santa Clarita, CA 91355

Dear Mr. Murphy:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

With this in mind, I am requesting an opportunity to meet with you at your convenience. We would like to present the most recent version of the 2005 UWMP and answer any questions you may have.

I look forward to meeting with you. Please contact me via my cell phone at (818) 605-1506 to arrange a meeting.

Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. James Hartl
Director, Regional Planning
County of Los Angeles
320 West Temple Street
Los Angeles, CA 90012

Dear Mr. Hartl:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. Chris Stephens, Planning Director
Resource Management Agency
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1600

Dear Mr. Stephens:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Jeffrey M. Smith, AICP
Southern CA Association of Governments
818 West Seventh Street, 12th Floor
Los Angeles, CA 90017-3435

Dear Mr. Smith:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. Gerald Johns, Deputy Director
CA Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Dear Mr. Johns:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. David Todd
Office of Water Use Efficiency
CA Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001

Dear Mr. Todd:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Mr. Dennis Slivinski, Assistant County Counsel
County of Ventura
800 South Victoria Avenue
Ventura, California 93009-1830

Dear Mr. Slivinski:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Friends of the Santa Clara River
660 Randy Drive
Newbury Park, California 91320-4323

Dear Friends of the Santa Clara River:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Sierra Club Angeles Chapter
3435 Wilshire Boulevard, Suite 320
Los Angeles, California 90010-1904

Dear Sierra Club:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Stephan C. Volker
436 14th Street, Suite 1300
Oakland, California 94612

Dear Mr. Volker:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Ms. Dana Wisehart
United Water Conservation District
106 N. 8th Street
Santa Paula, California 93060

Dear Ms Wisehart:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Sincerely,

Jeffrey Lambert, AICP

Jeffrey Lambert, AICP
Planning / Government Relations

July 20, 2005

Paul Ash, President
Westranch Town Council
Hanger, Levine & Steinberg
21031 Ventura Blvd, Suite 800
Woodland Hills, CA 91364-6512

Dear Mr. Ash:

As you know, the Santa Clarita Valley water agencies are preparing the 2005 Urban Water Management Plan. I have been asked to manage the public outreach component of this effort. This includes seeking opportunities to talk with interested community groups about the 2005 UWMP. We released the Preliminary Draft 2005 UWMP on June 27, 2005 and are working toward the release of the Draft 2005 UWMP in August.

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Jeffrey Lambert, AICP

Appendix C
Groundwater Resources and Yield In the Santa Clarita Valley

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Groundwater Resources and Yield in the Santa Clarita Valley

Introduction

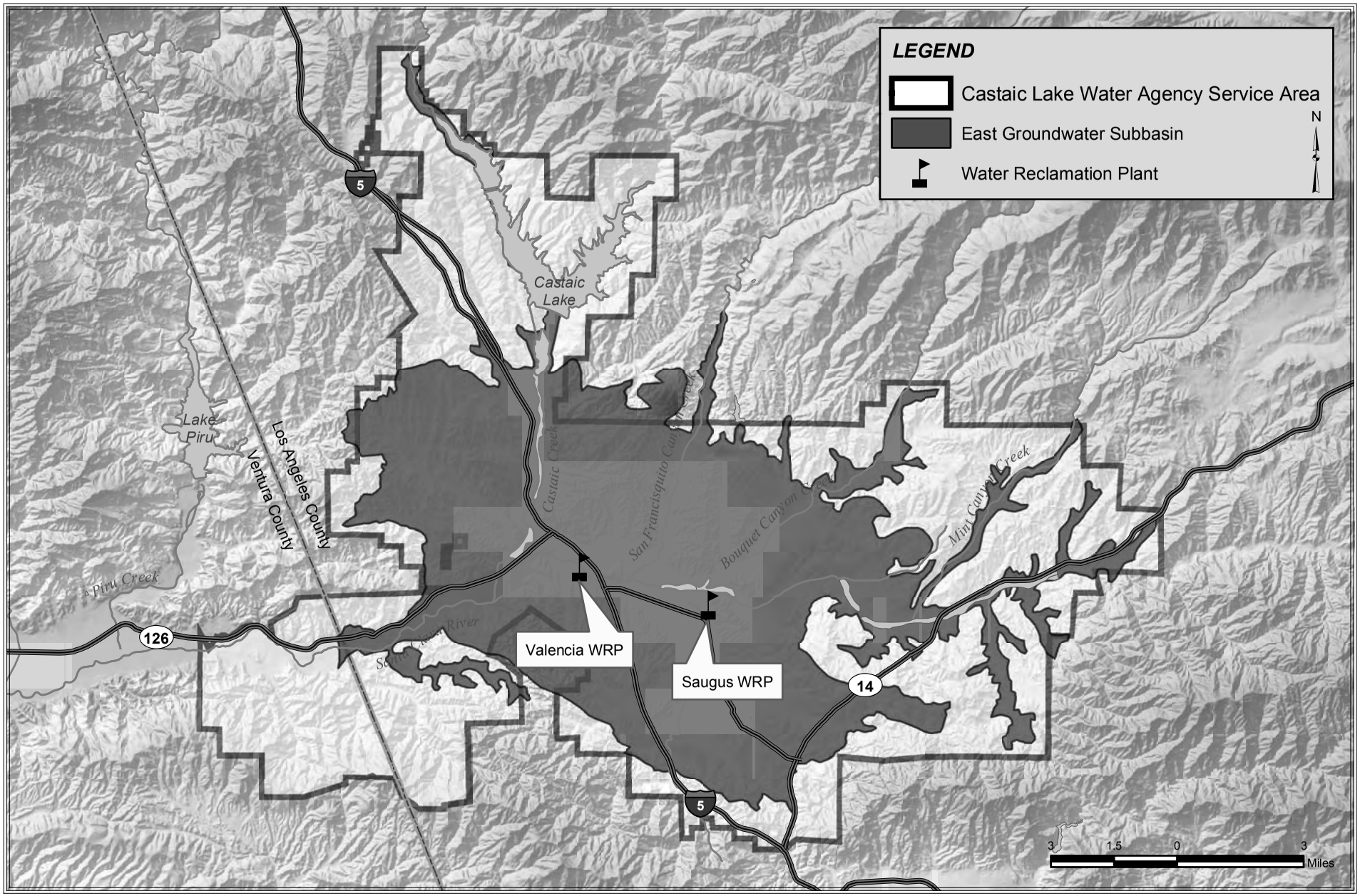
Beginning in the early part of the twentieth century, and continuing through the 1970s, local groundwater extracted from the two aquifers that comprise the local groundwater basin was the Santa Clarita Valley's sole source of water supply. Since 1980, local groundwater supplies have been supplemented with imported surface water from the State Water Project (SWP). In 2003, augmentation of those water supplies began with the initiation of deliveries from Castaic Lake Water Agency's (CLWA) recycled water system, which is anticipated to increase with time.

Santa Clara River Valley Groundwater Basin – East Subbasin

The groundwater basin generally beneath the Santa Clarita Valley, identified in the California Department of Water Resources' (DWR) Bulletin 118, 2003 Update as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin) (Basin No. 4-4.07), is comprised of two aquifer systems. The Alluvium generally underlies the Santa Clara River and its several tributaries and the Saugus Formation underlies practically the entire Upper Santa Clara River area. There are also some scattered outcrops of Terrace deposits in the Basin that likely contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and consequently have not been developed for any significant water supply. Figure C-1 illustrates the mapped extent of the Basin in DWR Bulletin 118 (2003), which approximately coincides with the outer extent of the Alluvium and Saugus Formation, and its relationship to the extent of the CLWA service area.

A 2001 Update Report on both the Alluvium and Saugus Formation Aquifers was completed by Richard C. Slade and Associates, Consulting Groundwater Geologists (Slade, 2002). That report updated the analyses and interpretation of hydrogeologic conditions from earlier reports (Slade, 1986 and 1988), including extensive detail on major aspects of the groundwater Basin. Notable parts of the 2001 Update Report includes:

- Description of the extensive additional data available since the original Alluvium and Saugus Formation reports were prepared in 1986 and 1988, respectively
- Organization of historic data into a Geographic Information System (GIS) database
- Description of the overall groundwater basin in conformance with that being mapped by the Department of Water Resources in Bulletin 118 (2003)



LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure C-1
Santa Clara River Valley
East Groundwater Subbasin

- Analysis of historical groundwater levels and production, and conclusions that there have been no conditions that would be illustrative of groundwater overdraft
- Suggestion that utilization of operational yield (as opposed to perennial yield) as a basis for managing groundwater production would be more applicable in this basin to reflect
- Fluctuating utilization of groundwater in conjunction with utilization of imported SWP water
- Conclusion that operational yield of the Alluvium is 30,000 to 40,000 acre-feet per year (afy) for wet and average/normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 afy in dry years
- Conclusion that operational yield of the Saugus Formation would be in the range of 7,500 to 15,000 afy on a long-term basis, with short-term increases during dry periods into a range of 15,000 to 25,000 afy, and to 35,000 afy if dry year conditions continue

Groundwater Management Plan

As part of legislation authorizing CLWA to provide retail water service to individual municipal customers in addition to its ongoing wholesale water supply, Assembly Bill 134 (2001) included a requirement that CLWA prepare a groundwater management plan in accordance with the provisions of Water Code Section 10753, which was originally enacted by, and is commonly known as, Assembly Bill 3030. The general contents of CLWA's groundwater management plan were outlined in 2002, and a detailed plan was drafted and adopted in 2003 to satisfy the requirements of AB 134. The plan both complements and formalizes a number of existing water supply and water resource planning and management activities in CLWA's service area, which effectively encompasses the East Subbasin of the Santa Clara River Valley Groundwater Basin.

CLWA adopted the Groundwater Management Plan (GWMP) in December 2003. As part of the GWMP, four management objectives, or goals, were established for the Basin including: (1) development of an integrated surface water, groundwater, and recycled water supply to meet existing and projected demands for municipal, agricultural, and other water uses; (2) assessment of groundwater Basin conditions to determine a range of operational yield values that will make use of local groundwater conjunctively with supplemental SWP supplies and recycled water to avoid groundwater overdraft, (3) preservation of groundwater quality, including active characterization and solution of any groundwater contamination problems, and (4) preservation of interrelated surface water resources, which includes managing groundwater to not adversely impact surface and groundwater discharges or quality to downstream basin(s).

The adopted GWMP includes 14 elements that are intended to accomplish the Basin management objectives listed above. In summary, the plan elements include:

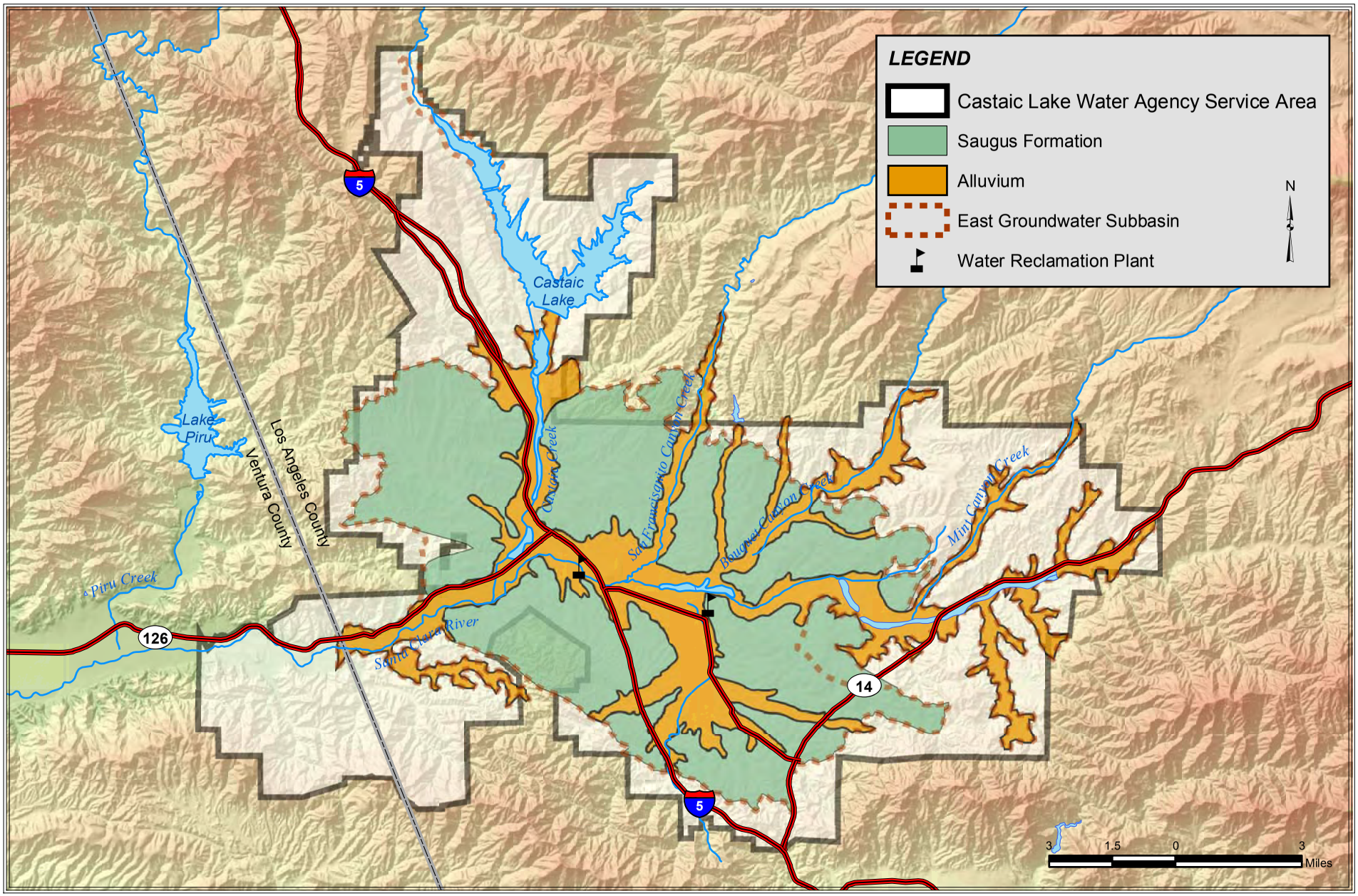
- Monitoring of groundwater levels, quality, production and subsidence
- Monitoring and management of surface water flows and quality
- Determination of Basin yield and avoidance of overdraft

- Development of regular and dry-year emergency water supply
- Continuation of conjunctive use operations
- Long-term salinity management
- Integration of recycled water
- Identification and mitigation of soil and groundwater contamination, including involvement with other local agencies in investigation, cleanup, and closure
- Development and continuation of local, state and federal agency relationships
- Groundwater management reports
- Continuation of public education and water conservation programs
- Identification and management of recharge areas and wellhead protection areas
- Identification of well construction, abandonment, and destruction policies
- Provisions to update the groundwater management plan

Alluvium – General

The Alluvial Aquifer system, of Quaternary to Holocene (recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The Alluvium is deepest along the center of the present river channel, with a maximum thickness of about 200 feet near the Saugus area. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the Basin and, in the tributaries, becomes a mere veneer in their upper reaches. The spatial extent of the Alluvium throughout the Basin is illustrated in Figure C-2.

Groundwater generally moves westward toward the outlet of the Basin, which is also the outlet of the Upper Santa Clara River Hydrologic Area. Thus, groundwater movement in the Alluvium beneath the tributaries is toward their confluence with the Santa Clara River and then westward in the Alluvium. From about Castaic Junction to Blue Cut, the Alluvium thins and narrows. This configuration forces groundwater to rise, keeping the depth to water at or close to the land surface. As discussed in more detail below, the general groundwater flow direction has remained unchanged whether groundwater levels are high or intermittently depressed. The San Gabriel and Holser faults traverse the Basin but neither fault measurably affects groundwater levels or flows in the Alluvium.

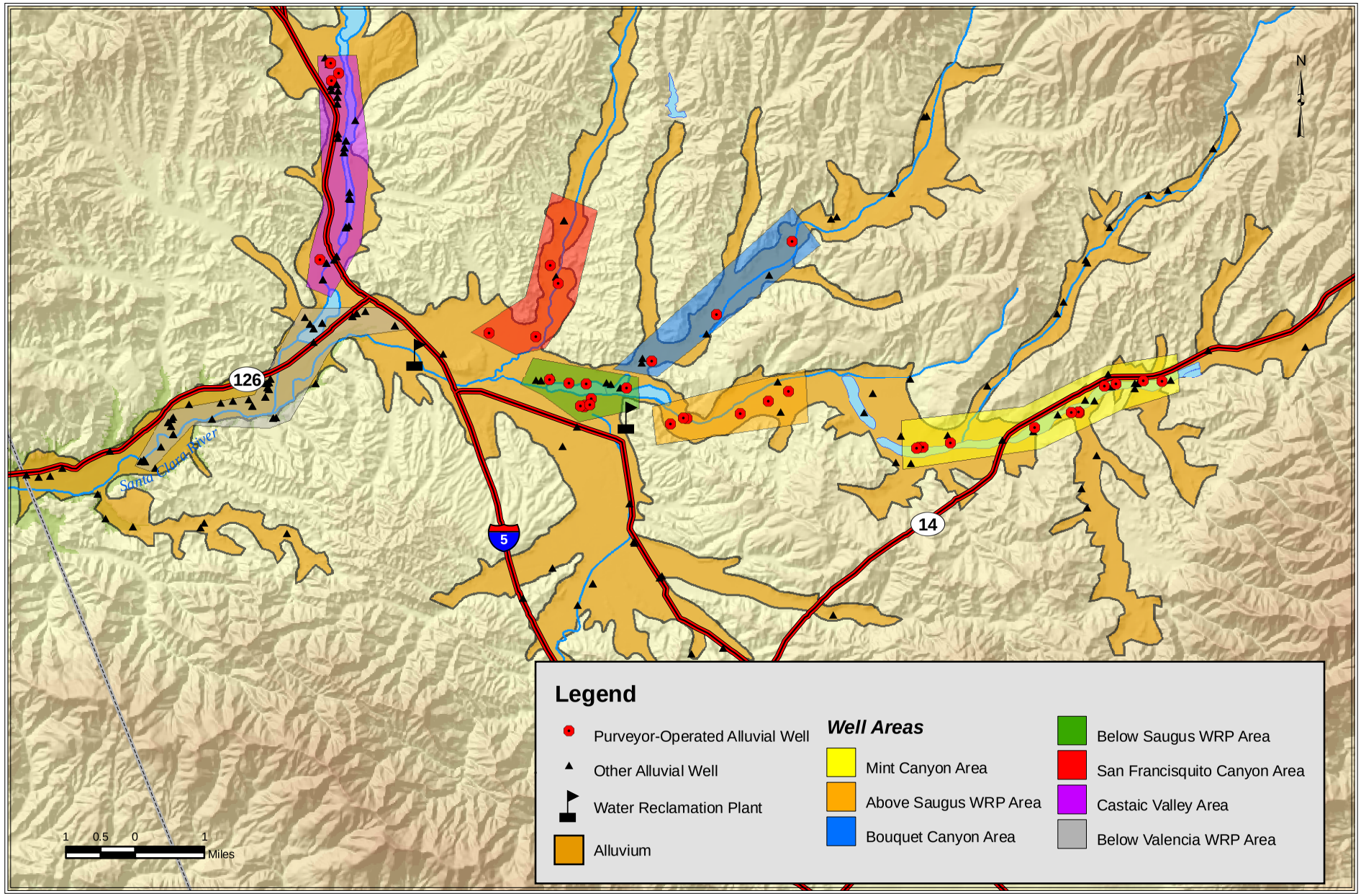


LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure C-2
Alluvial and Saugus Formations
Santa Clara River Valley East Groundwater Subbasin

Alluvial wells are distributed throughout the basin along the Santa Clara River and its southwest draining tributaries. Figure C-3 illustrates the location of the wells operated by retail water purveyors and other known Alluvial wells in the Basin. The Alluvium is the most permeable of the local aquifer units. Based on well yields and aquifer testing, estimated transmissivity values of 50,000 to 500,000 gallons per day per foot have been reported for the Alluvium, with the higher values where the Alluvium is thickest in the center of the Valley and generally west of Bouquet Canyon. The amount of groundwater in storage in the Alluvium can vary because of the effects of recharge, discharge, and pumping from the aquifer. The maximum storage capacity of the Alluvium has been estimated to be 240,000 acre-feet (af).

Consistent with the 2001 Update Report (Slade, 2002), the current management practice of the local retail water purveyors is to continue a groundwater operating plan that generally results in total Alluvial pumping in the range of 30,000 to 40,000 afy, slightly reduced to 30,000 to 35,000 afy in dry periods. This operating plan maximizes use of the Alluvium because of the aquifer's ability to store and produce good quality water on a perennial basis, and because the Alluvium is capable of rapid recovery of water levels and storage in wet periods. As with many groundwater basins, it is possible to intermittently exceed the long-term average yield for one or more years without long-term adverse effects. In the eastern part of the Alluvial Aquifer system, pumping during dry periods results in intermittently lower water levels in that portion of the aquifer. However, management of pumping during dry periods limits the lowering of water levels, and normal-to-wet period recharge results in a rapid return of groundwater levels to historic highs. Historical groundwater data collected from the Alluvium over many hydrologic cycles provides assurance that groundwater elevations return to normal in average or wet years following periods during which the groundwater elevations have declined. In addition, high rainfall totals in only one to two years generally will cause water levels within the Alluvium to rise quickly and by a relatively large amount. Such water level response to rainfall is a significant characteristic of permeable, porous, alluvial aquifer systems that occur within large watersheds.



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CONSULTING ENGINEERS

Figure C-3
Alluvial Well Locations
Santa Clara River Valley, East Groundwater Subbasin

Alluvium – Historical and Current Conditions

Total pumpage from the Alluvium in 2004 was about 33,800 af, of which about 56 percent (19,000 af) was for municipal water supply, and the balance, about 44 percent (14,800 af), was for agriculture and other (minor) miscellaneous uses.

Alluvial pumpage has been recorded intermittently since the mid-1940s, and consistently since 1980. When pumpage records are unavailable (e.g., in the 1970s), data has been approximated to obtain a continuous historic record (Figure C-4). Alluvial pumpage from private wells, estimated to be at most 500 afy, has been included in the total Alluvial pumpage. Since the inception of SWP deliveries to CLWA in 1980, total pumpage from the Alluvium has ranged from a low of about 20,000 afy (in 1983) to slightly more than 43,000 afy (in 1999). Agricultural pumpage remained stable from the mid-1940's through about 1960, generally ranging from 33,000 to 37,000 afy, with annual pumpage as high as 41,000 af. From 1960 through the late 1970's, agricultural pumpage declined in a nearly linear trend, and has fluctuated slightly since then, between approximately 10,000 and 16,000 afy. As agricultural pumpage declined, municipal pumpage from the Alluvium increased from less than 4,000 afy in the 1950s to approximately 17,000 af in 1980. Beginning in 1980 with the importation of SWP water, municipal pumpage from the Alluvium declined to about 12,500 afy and remained stable throughout the 1980's. Municipal pumpage has subsequently increased to the current range of approximately 20,000 to 25,000 afy. Overall, there has been a change in municipal/agricultural pumping distribution since 1980, toward a slightly higher fraction for municipal water supply (from about 50 percent to nearly 60 percent of Alluvial pumpage), which reflects the general land use changes in the Valley.

The most recent analysis of the Alluvium (Slade, 2002) suggested that the operational yield of the Alluvium is 30,000 to 40,000 afy in average/normal and wet years, with a reduction to 30,000 to 35,000 afy in dry years. On a long-term basis since the importation of SWP water, total Alluvial pumpage has been about 30,500 afy (31,300 af in years with less than average precipitation, and 29,400 af in years with greater than average precipitation). These amounts are at the lower end of the range of operational yield of the Alluvium.

Groundwater Production - Alluvium

Santa Clara River Valley, East Groundwater Subbasin

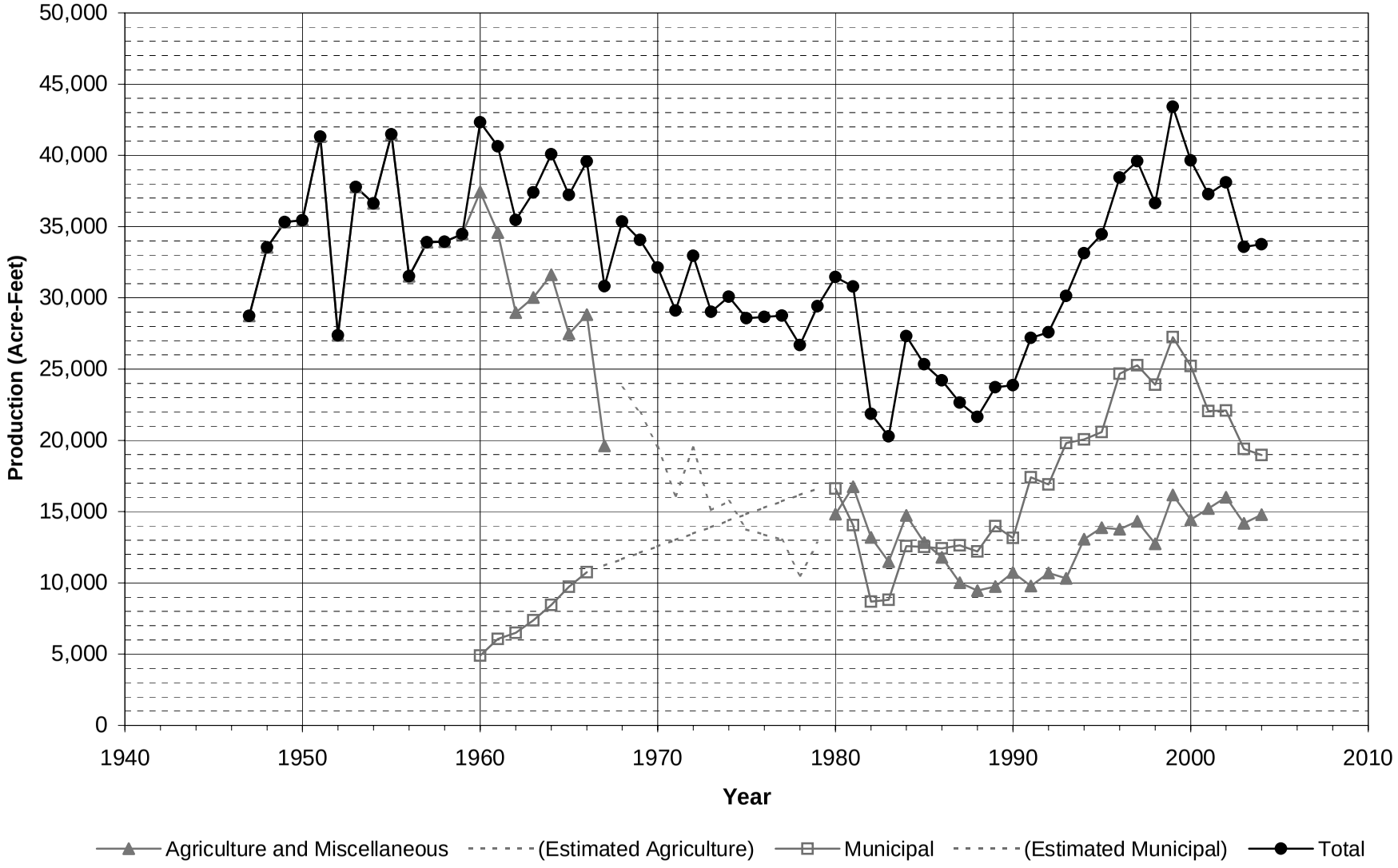


Figure C-4

Groundwater levels in various parts of the Basin have historically exhibited different responses to both pumpage and climatic fluctuations. During the last 20 to 30 years, in essentially all the alluvial portions of the Basin, groundwater levels have fluctuated from near the ground surface when the Basin is full, to as much as 100 feet lower when the Basin is pumped during intermittent dry periods of reduced recharge. Figure C-3 groups the Alluvial wells into areas with similar groundwater level fluctuations. Figures C-5 and C-6 present historical groundwater levels organized into hydrograph form (groundwater elevation vs. time) for four of these areas in the Basin. The other areas shown in Figure C-3 exhibit groundwater level responses similar to those in these four areas.

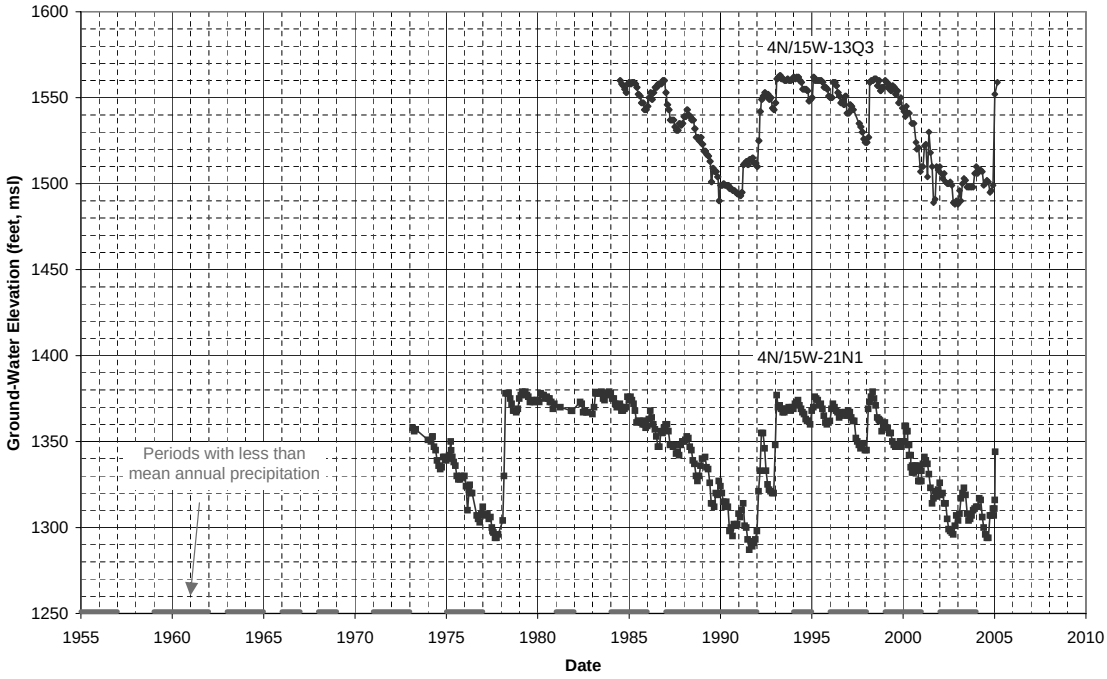
The 'Mint Canyon' area is located at the far eastern end of the Basin along the Santa Clara River. In this area, the Alluvium is shallower than in the western parts of the Basin; consequently, the area has historically exhibited the most dramatic responses to climatic fluctuations. The 'Above Saugus WRP' and 'Bouquet Canyon' areas generally exhibit groundwater level responses that are similar to those in the 'Mint Canyon' area.

The 'Below Saugus WRP' area is located along the Santa Clara River immediately downstream of the Saugus Water Reclamation Plant (WRP). This area has shown a dramatic increase in groundwater levels (30 to 60 feet) since the 1960s. The area now receives recharge from the treated wastewater discharged from the Saugus WRP to the Santa Clara River, and is located in one of the thickest areas of the Alluvium. The 'Below Saugus WRP' area exhibits groundwater level responses to climatic fluctuations, but these responses are much smaller than those further east in the Basin. The 'San Francisquito Canyon' area generally exhibits groundwater level responses that are similar to those in the 'Below Saugus WRP' area.

The 'Castaic Valley' area is located along Castaic Creek below Castaic Lake. Groundwater levels in this area have remained fairly constant, with slight responses to climatic fluctuations, since the 1950s.

The 'Below Valencia' WRP area is located along the Santa Clara River downstream of the Valencia WRP, and receives recharge from the treated wastewater discharged from the Valencia WRP to the Santa Clara River. Groundwater levels in this area exhibit slight, if any, response to climatic fluctuations, and have remained fairly constant since the 1950s.

Groundwater Elevation for 'Mint Canyon' Area Alluvial Wells
(lowest and highest for area shown)



Groundwater Elevation for 'Below Saugus WRP' Area Alluvial Wells
(lowest and highest for area shown)

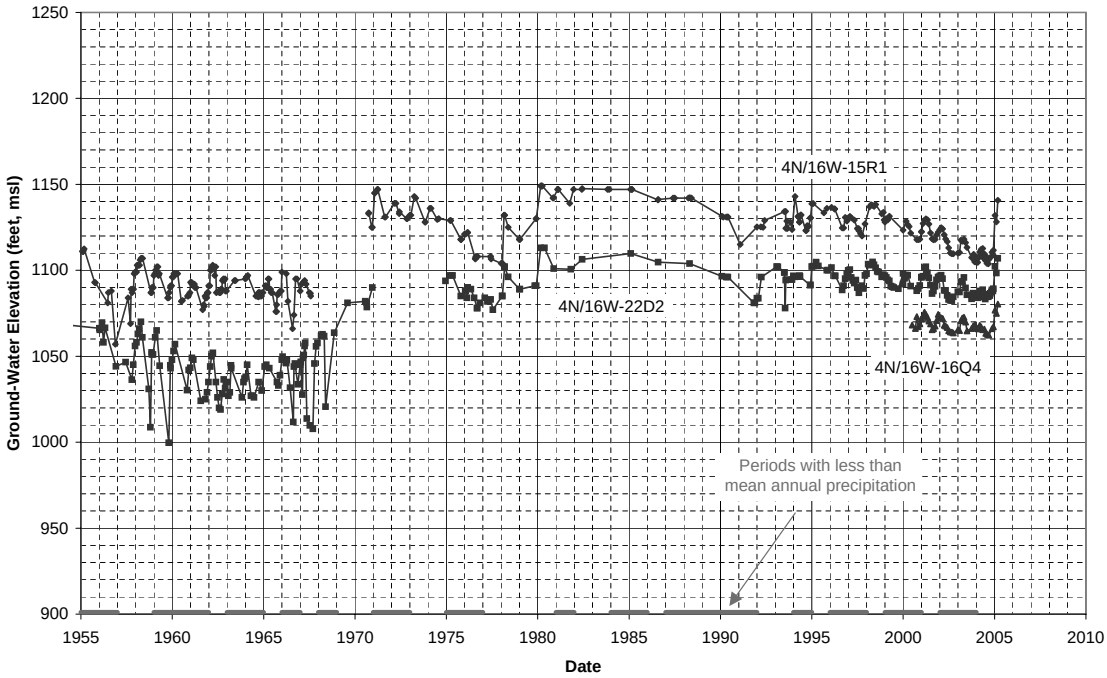
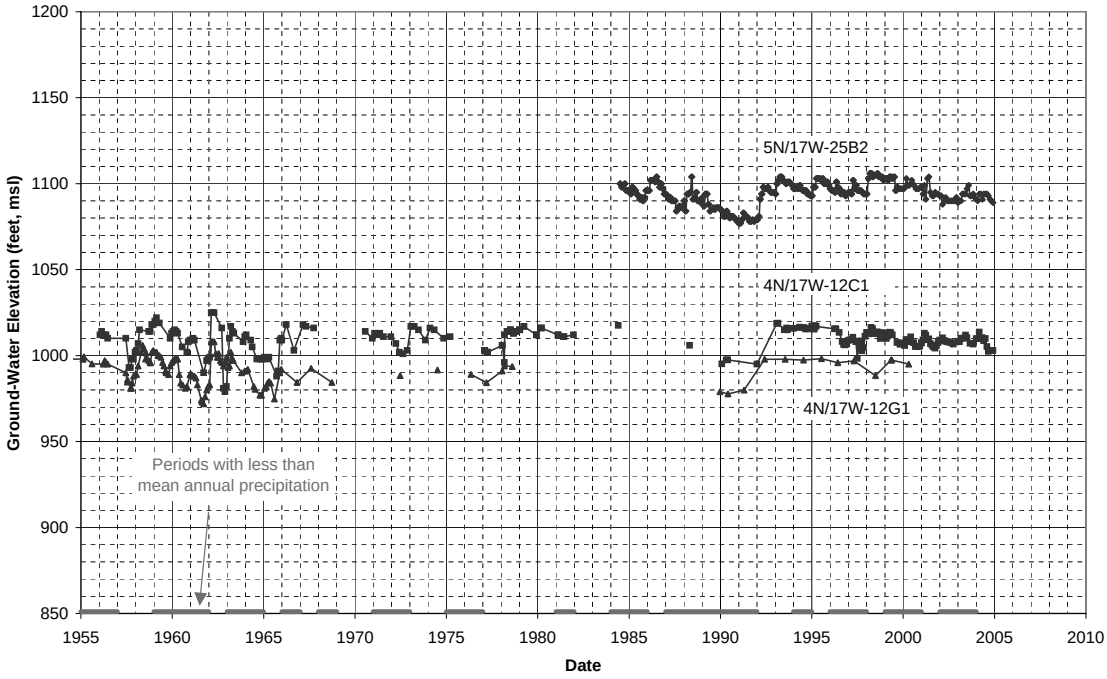


Figure C-5

Groundwater Elevation for 'Castaic Valley' Area Alluvial Wells
(lowest and highest for area shown)



Groundwater Elevation for 'Below Valencia WRP' Area Alluvial Wells
(lowest and highest for area shown)

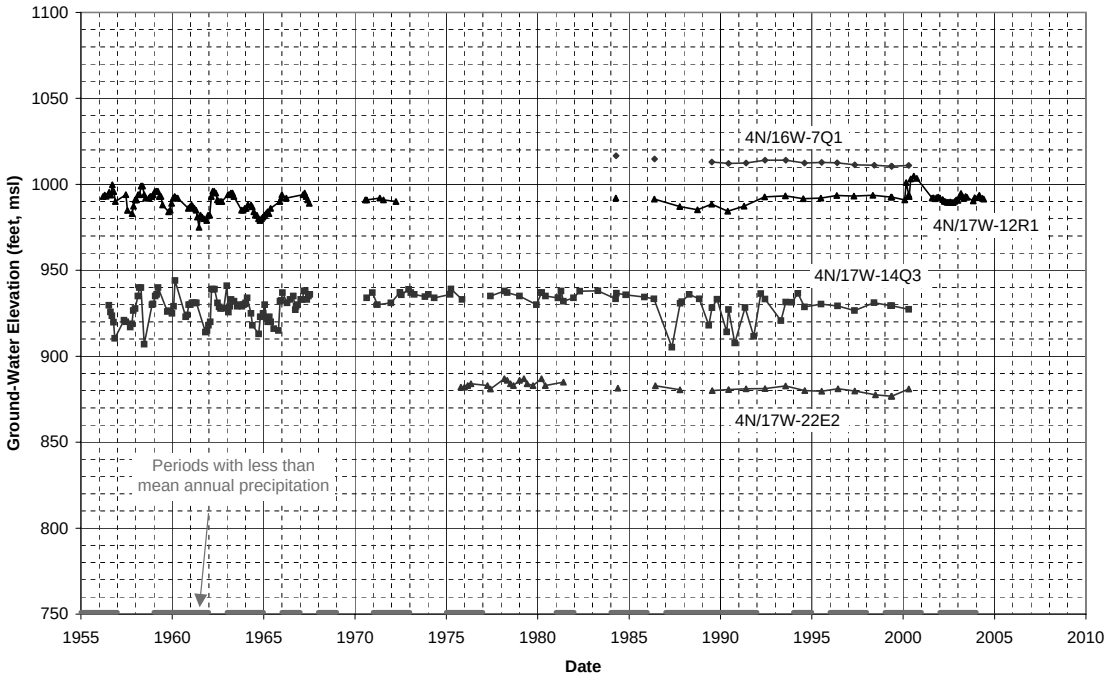


Figure C-6

Groundwater fluctuations in the 'Mint Canyon' area (illustrated in Figure C-5) represent the most substantial intermittent changes in the Basin. As described and discussed above, the Alluvium has historically experienced a number of alternating wet and dry hydrologic conditions during which groundwater level declines are followed by returns to historic highs. Since the Alluvium is thinner to the east, the resulting groundwater fluctuations are most dramatic in this area, up to 75 to 100 feet. When water levels are low, well yields and pumping capacities in this area can be impacted. The affected retail water purveyors respond by decreasing pumping and increasing use of Saugus Formation and imported SWP supplies. The purveyors also shift a fraction of the Alluvial pumpage that would normally be supplied by 'Mint Canyon' area wells to areas further west, where well yields and pumping capacities remain fairly constant because of smaller groundwater level fluctuations. As shown in Figure C-7, the purveyors have decreased the percent of total Alluvial pumpage from the 'Mint Canyon' area steadily beginning in 2000, and have offset these decreases by increasing pumpage in the 'Below Saugus WRP' and 'Below Valencia WRP' areas. This allows the purveyors to maximize the available supply from the Alluvium during dry periods to best meet demand. In spite of the current period of below average precipitation, groundwater levels in the 'Mint Canyon' area have ceased to decline in the last two years. This is illustrative of the purveyors' integrated use of surface water and groundwater to maintain local groundwater resources within their overall yield.

Depending on the period of available data, all the hydrographs of groundwater levels in the Alluvium show the same general picture: recent (last 30 years) groundwater levels have exhibited historic highs; in some locations, there are intermittent dry-period declines (and an associated use of some groundwater from storage) followed by wet-period recoveries (and associated natural refilling of storage space). On a long-term basis, the Alluvium shows no signs of water level-related overdraft (i.e., no trend toward decreasing water levels and storage). Since there is no evidence of any historic or recent trend toward permanent groundwater level or storage decline, pumpage from the Alluvium has been, and continues to be, within the operational yield of that aquifer.

As previously mentioned, it is possible to intermittently pump the aquifer by exceeding its average yield for one or more years without long-term impacts. This utilizes some water from storage in the aquifer, and is evidenced by lowered groundwater levels, which subsequently recover during periods of reduced pumpage or higher than average precipitation. Records of groundwater levels, pumpage and precipitation suggest that declines and subsequent rises in groundwater levels are influenced more by fluctuations in the availability of water for recharge than by pumpage. When less water is available for recharge, during periods of lower than average precipitation and streamflow, groundwater levels decline even when pumpage remains

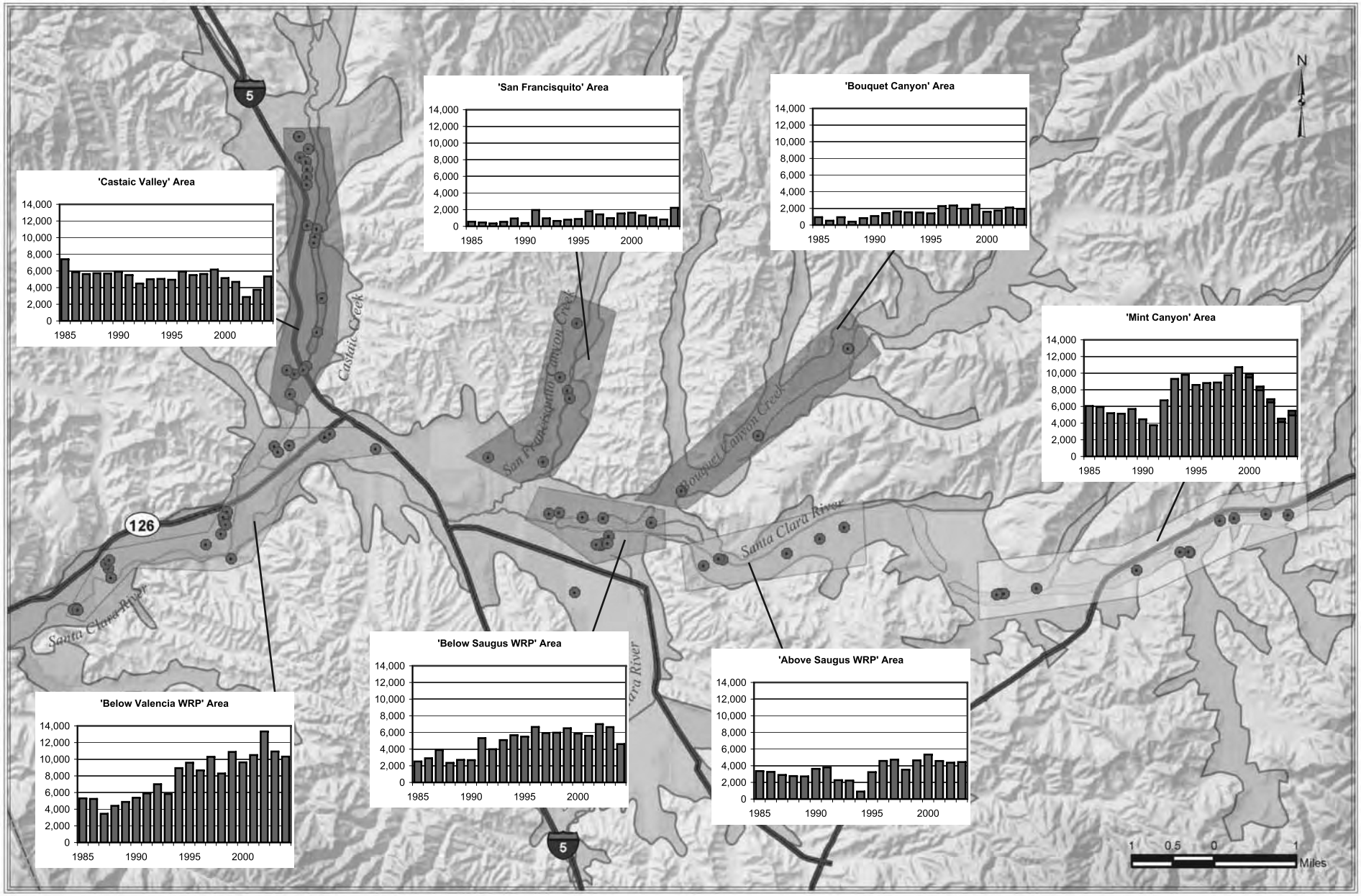


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Figure C-7
Annual Groundwater Production from Alluvium by Area (Acre-feet)
Santa Clara River Valley, East Groundwater Subbasin

constant. Conversely, when an abundance of water is available for recharge because of wet conditions, pumpage can increase significantly without affecting groundwater levels. Overall, long-term experience with Alluvial Aquifer response to pumping in the ranges now considered to be its operational yield shows that such ranges can be considered reliable components of future supply. Recently completed numerical groundwater flow modeling, discussed in detail below, has been used to project Alluvial Aquifer response to the same ranges of pumping over multiple decades of varying hydrologic conditions; groundwater levels are projected to essentially repeat what has historically occurred since the importation of supplemental SWP water.

Saugus Formation – General

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch Member, which is of mixed marine to terrestrial (non-marine) origin; and the overlying, or upper, portion of the Formation which is entirely terrestrial in origin. The Sunshine Ranch Member of the Saugus Formation has a maximum thickness of about 3,000 to 3,500 feet in the central part of the Valley; however, due to its marine origin and fine-grained nature, it is not considered to be a viable source of groundwater for municipal or other water supply. Above the Sunshine Ranch Member, the upper portion of the Saugus Formation is coarser grained, consisting mainly of lenticular beds of sandstone and conglomerate that are interbedded with lesser amounts of sandy mudstone, which were deposited in stream channels, flood plains, and alluvial fans by one or more ancestral drainage systems in the Valley. The sand and gravel units that represent aquifer materials in the upper part of the Saugus Formation are generally located between depths of about 300 and 2,500 feet. The spatial extent of the Saugus Formation throughout the Basin is illustrated on Figure C-8.

The Saugus Formation is much thicker and more spatially extensive throughout the Basin when compared to the Alluvium. It is also significant in terms of groundwater storage and individual well capacity. However, the Saugus Formation has typically lower values of transmissivity, in the range of 80,000 to 160,000 gpd/ft, with the higher values in the upper portions of the Formation. The storage capacity of the Saugus has most recently been estimated to be 1.65 million af between depths of 300 feet and approximately 2,500 feet (to the base of the Saugus, or to the base of fresh water if shallower than 2,500 feet). Groundwater in the Saugus Formation generally moves north along the South Fork of the Santa Clara River, towards the Santa Clara River and the outlet of the Basin. Saugus wells operated by the retail water purveyors (shown in Figure C-8) are located in the southern portion of the Basin, south of the Santa Clara River.

For long-term planning purposes, the operating plan includes pumping from the Saugus in the range of 7,500 to 15,000 afy in average/normal years, a conservative estimate in light of historical estimates of potential recharge to the Saugus complemented by observations of high groundwater levels in the overlying Alluvium over the last 30 years. The operating plan also

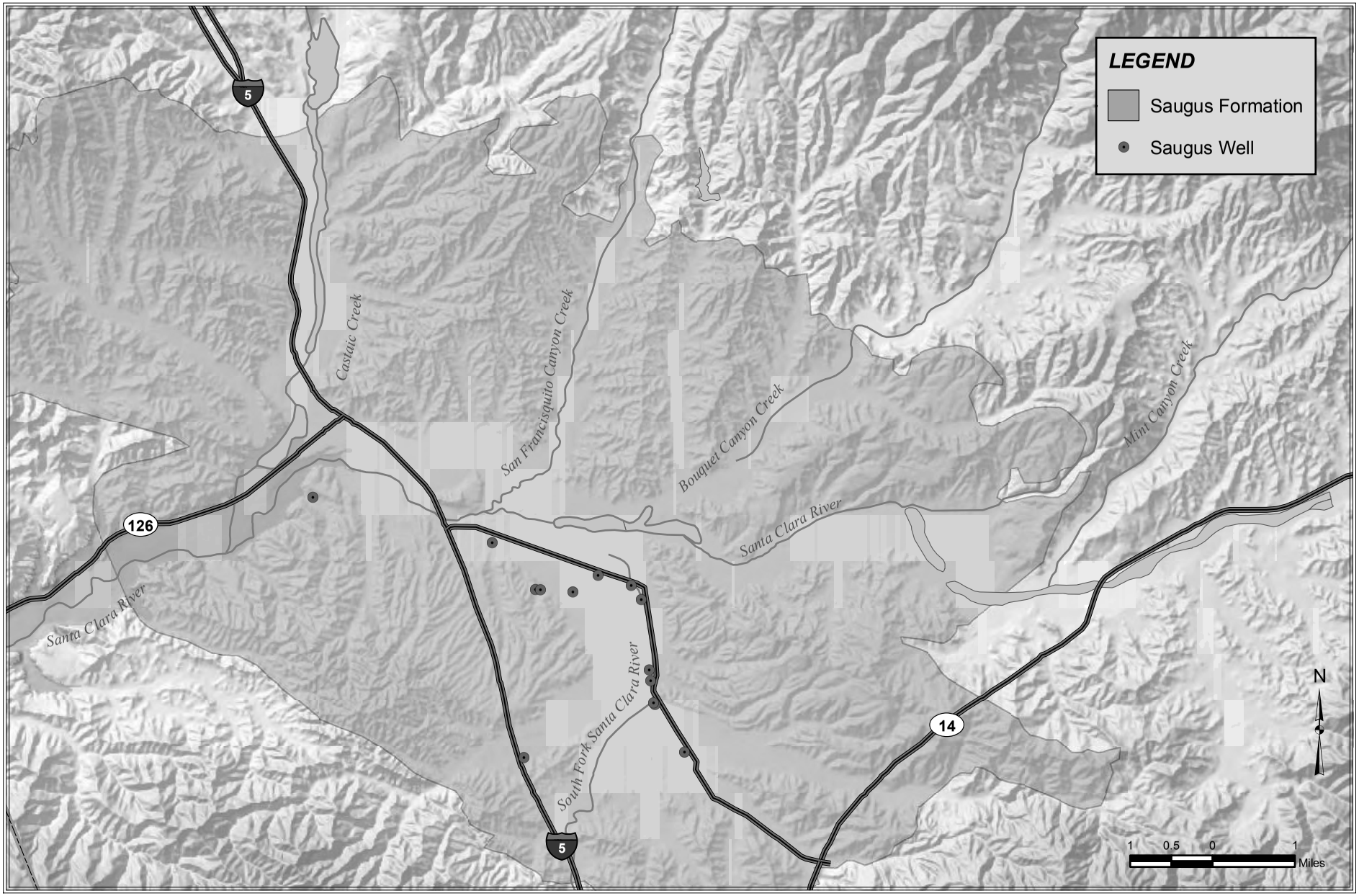

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Figure C-8
Saugus Well Locations
Santa Clara River Valley, East Groundwater Subbasin

includes planned dry-year pumping of 15,000 to 35,000 afy for one to three consecutive dry years, when shortages to other water supplies could occur. Such high pumping would be followed by periods of lower pumpage (7,500 to 15,000 afy in average/normal years as noted above) to allow recharge to recover water levels and storage in the Saugus. Maintaining the substantial volume of water in the Saugus Formation is an important strategy to help provide water supplies in the Valley during dry periods.

Saugus Formation – Historical and Current Conditions

Total pumpage from the Saugus Formation in 2004 was 6,500 af, of which most (5,700 af) was for municipal water supply, and the balance (800 af) was for agricultural and other (minor) uses. Historically, groundwater pumpage from the Saugus peaked in the early 1990s and then declined steadily. Pumpage has remained generally stable, at an average of about 4,600 afy, since 1998.

Historical pumpage records for the Saugus Formation are limited prior to 1980, but suggest that pumpage from the Saugus was minimal at that time. When pumpage records are unavailable, data have been approximated to obtain a continuous historic record (Figure C-9). The records indicate that there was almost no pumping from the Saugus prior to 1960 (about 100 af in most years, beginning in 1948), and that some increased pumping for agricultural water supply (about 900 af) began in about 1962. The largest amount of agricultural pumping from the Saugus was during the mid-1960s, when annual pumpage was about 3,000 af. Agricultural pumping from the Saugus declined to near zero by the late 1970s, but has generally ranged from 500 to 1,000 afy since 1982. Municipal pumping records from the Saugus are incomplete prior to 1980. There was no Saugus pumpage for municipal supply in the early 1960s. Despite the lack of pre-1980 records, post-1980 data suggests that municipal pumping from the Saugus began in the 1970s, and reached nearly 5,000 afy by 1980-81.

The first historical investigation of the Saugus (Slade, 1988) suggested that the recharge potential of the Saugus was in the range of 11,000 to 22,000 afy, depending on precipitation and groundwater levels in the partially overlying Alluvium. Recent updating of that original work (Slade, 2002) suggested that the operational yield of the Saugus Formation is in the range of 7,500 to 15,000 afy in average years, with an increase to as much as 35,000 afy in multiple dry year periods. On a long-term average basis since the importation of SWP water, total pumpage from the Saugus Formation has ranged from a low of about 3,700 afy (in 1999) to a high of nearly 15,000 afy (in 1991); average pumpage from 1980 to present has been about 6,700 afy. These numbers are at the lower end of the estimated range of the operational yield of the Saugus Formation.

Unlike the Alluvium, which has an abundance of wells with extensive water level records, the water level data for the Saugus Formation is limited by the distribution of the wells in this Formation and the periods of record. The wells that do have water level records extending back

Groundwater Production - Saugus Formation
Santa Clara River Valley, East Groundwater Subbasin

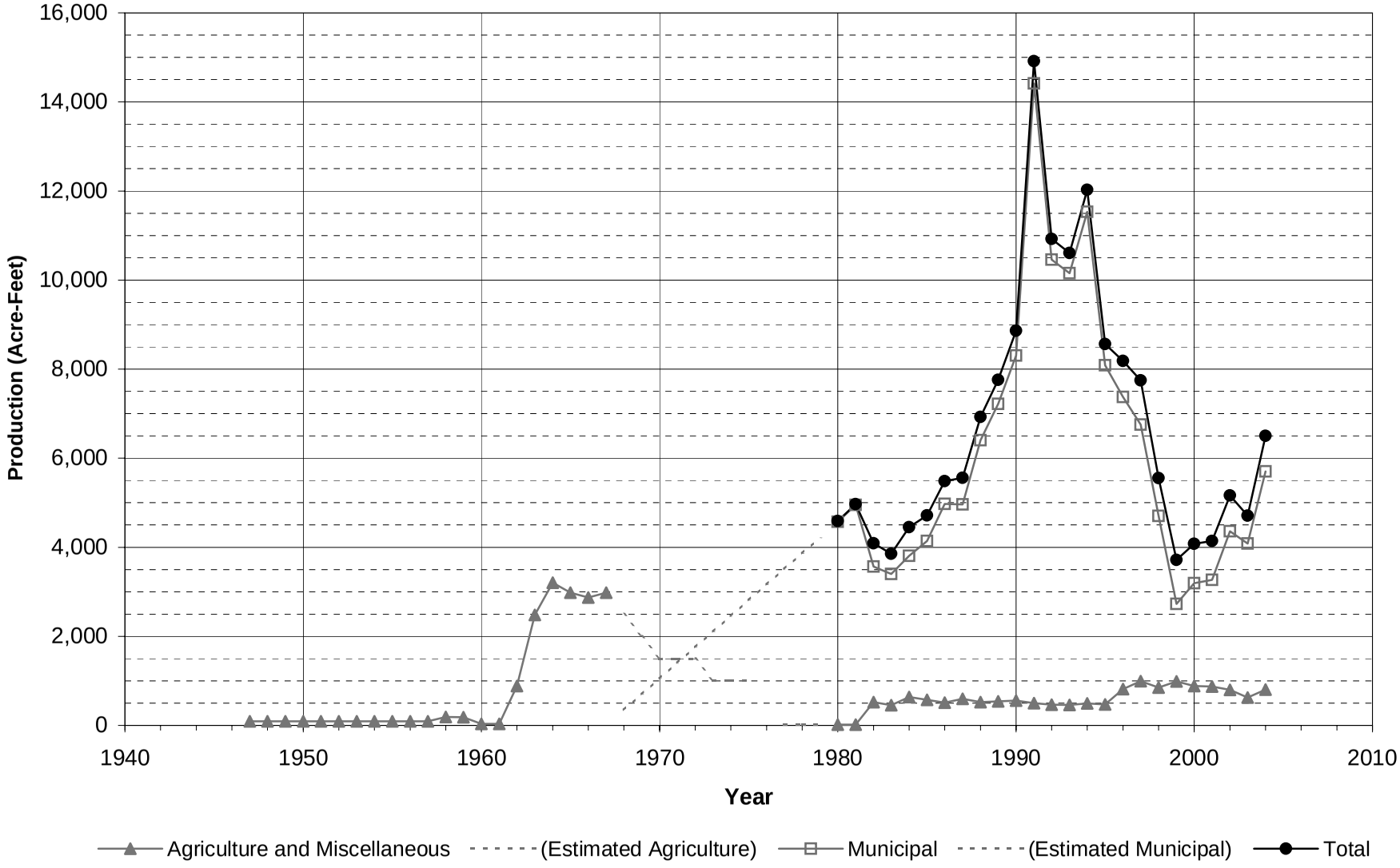


Figure C-9

to the mid-1960s indicate that groundwater levels in the Saugus Formation were highest in the mid-1980s and are currently higher than they were in the mid-1960s (Figure C-10). Based on these data, there is no evidence of any historic or recent trend toward permanent water level or storage decline.

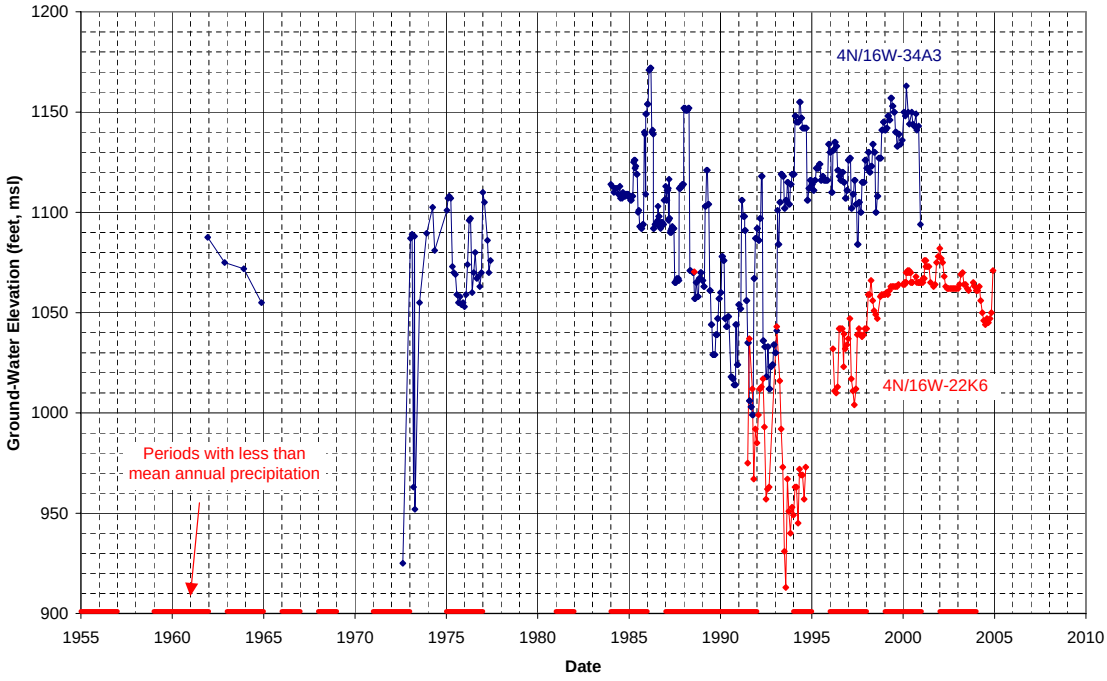
Records of groundwater levels, pumpage and precipitation suggest that declines and subsequent rises in groundwater levels in the Saugus Formation are more influenced by pumpage than by climatic fluctuations. Water levels in wells in the Saugus Formation are highly dependent on pumping in the respective wells. As opposed to the Alluvium, where pumpage is fairly evenly distributed among a number of wells in a given area, there are fewer active wells in the Saugus Formation. Consequently, pumping at one well can create a localized pumping depression that is evident in groundwater level hydrographs. Water levels in the Saugus Formation also exhibit stronger seasonal pumping fluctuations over a year than in the Alluvium (generally more than 20 feet in active Saugus wells, as opposed to generally less than ten feet in Alluvial wells). These responses to pumping are characteristic of the lower transmissivity of the Saugus Formation.

During the period from 1985 through 1991, which experienced consecutive years of lower than average precipitation (with one average year in the middle), pumpage from the Saugus increased from 4,700 afy to nearly 15,000 afy, and groundwater levels declined more than 100 feet in some cases. The subsequent rise in water levels at an individual well depended on pumping at that well. For example (as illustrated on Figure C-10), pumping of Saugus wells declined dramatically beginning between 1993 and 1995, and water levels in individual wells subsequently rose when pumping decreased. Since 1999, water levels in the Saugus have been stable and have exhibited very slight, if any, response to current less-than-average precipitation. A slight pumping depression is evident around active wells. Water levels in the Saugus remain at or above historic levels, and there is no trend toward a sustained decline in Saugus water levels or storage that would be indicative of overdraft.

Consistent with the 2001 Update Report (Slade, 2002), the current management practice of the retail water purveyors is to preserve the Saugus Formation so this supply is available during drought periods, when Alluvial groundwater and SWP supplies are anticipated to decrease. The period of increased pumpage during the late 1980s and early 1990s is a good example of this management strategy. Most notably, in 1991, when SWP deliveries were substantially reduced, increased pumpage from the Saugus made up almost half of the decrease in SWP deliveries. This increased Saugus pumpage resulted in a short-term decline in water levels reflecting the use of stored water. However, the water levels subsequently rose when pumping was reduced, reflecting recovery of groundwater storage in the Saugus Formation.

As with the Alluvial aquifer as introduced above, the response of the Saugus Formation to pumping in the operational yield ranges has been projected by use of a recently completed numerical groundwater flow model. Results of those projections, discussed in detail below,

Groundwater Elevation for Saugus Wells
(lowest and highest shown)



Groundwater Elevation for Saugus Wells
(long-term record)

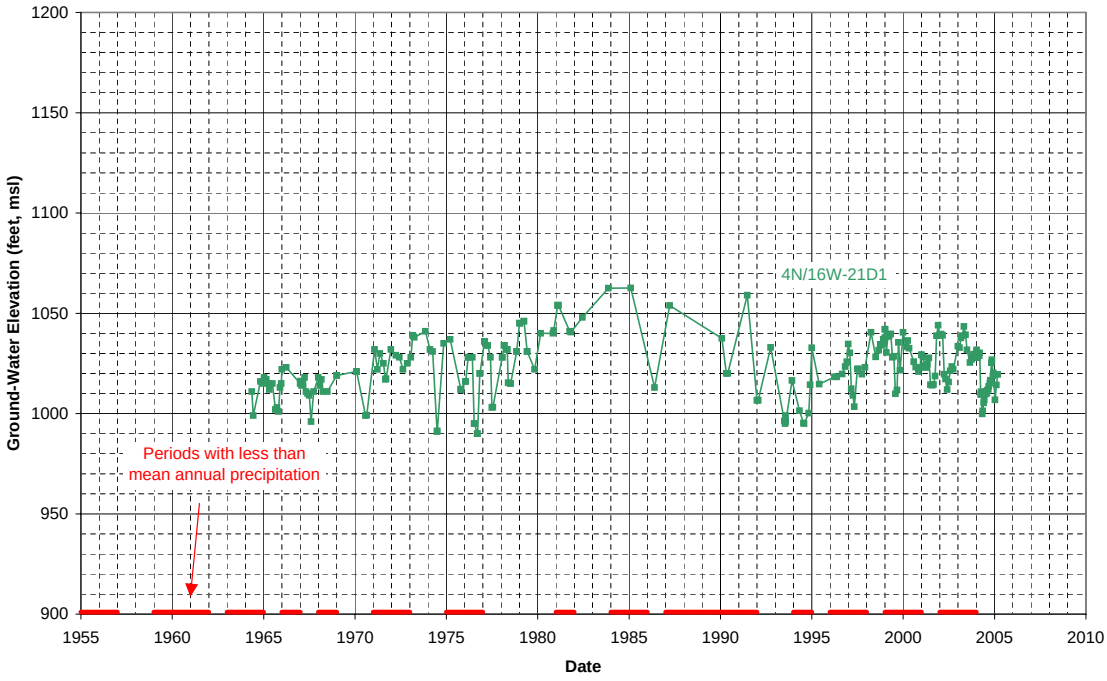


Figure C-10

show that fluctuations in pumping over multiple decades of varying hydrologic conditions will cause fluctuations in groundwater levels similar to what has historically occurred. Short-term declines during dry periods when Saugus pumping is temporarily increased are followed by recovery of water levels when pumping is reduced during wet/normal periods. The lack of any projected permanent decline in Saugus groundwater levels supports the reliability of the Saugus Formation as a long-term water supply at the capacities included in its operational yield.

Sustainability of Groundwater Supplies

Alluvial Aquifer – Based in part on historical operating experience, complemented by recent groundwater modeling work as described herein, it is planned that the Alluvial Aquifer can supply water on a long-term sustainable basis in the overall range of 30,000 to 40,000 afy, with a probable reduction in dry years to a range of 30,000 to 35,000 afy. Both of those ranges include about 15,000 afy of Alluvial pumping for current agricultural water uses and about 500 afy for small private water supply. The dry year reduction is a result of practical constraints in the eastern part of the Basin where lowered groundwater levels in dry periods have the effect of reducing pumping capacities in that shallower portion of the aquifer.

Until recently, the long-term renewability of Alluvial groundwater was empirically determined from approximately 60 years of recorded experience as previously described: long-term stability in groundwater levels and storage, with some dry period fluctuations in the eastern part of the Basin, over a historical range of Alluvial pumpage from as low as about 20,000 afy to as high as about 43,000 afy. Over the last couple of years, those empirical observations have been complemented by the development and application of a numerical groundwater flow model, has been used to predict aquifer response to the planned operating ranges of pumping. The numerical groundwater flow model has also been used to analyze the control of contaminant migration under selected pumping conditions that would restore, with treatment, pumping capacity that has been inactivated due to perchlorate contamination detected in some wells in the Basin.

To examine the yield of the Alluvium or, in other words, the sustainability of Alluvium on a renewable basis, the groundwater flow model was used to examine long-term projected response of the aquifer to pumping for municipal and agricultural uses in the 30,000 to 40,000 afy range under average/normal and wet conditions, and in the 30,000 to 35,000 afy range under locally dry conditions. To examine the response of the entire aquifer system, the model also incorporated pumping from the Saugus Formation in accordance with the normal (7,500-15,000 afy) and dry year (15,000-35,000 afy) operating plan for that aquifer. The model was run over a 78 year hydrologic period which was selected from actual historical hydrology (i.e., precipitation) to examine a number of hydrologic conditions that would be expected to affect both groundwater pumping and groundwater recharge. The selected 78-year simulation period was assembled from an assumed recurrence of 1980 to 2003 conditions, followed by an assumed

recurrence of 1950 to 2003 conditions. The 78-year period was analyzed to define both local hydrologic conditions (normal vs. dry), which affect the rate of pumping from the Alluvium, and hydrologic conditions that affect SWP operations, which in turn affect the rate of pumping from the Saugus. The resultant simulated pumping cycles included the distribution of pumping around the Basin for each of the existing wells, for normal and dry years respectively, shown in Tables C-1 and C-2.

The resultant pumping cycles are summarized as follows:

- Twenty-four years of dry year Alluvial pumping at 30,000 to 35,000 afy
- One drought of four consecutive dry years of Alluvial pumping at 30,000 to 35,000 afy
- Two droughts of three consecutive dry years each, with Alluvial pumping at 30,000 to 35,000 afy
- Three selected years with assigned dry-year Alluvial pumping despite near-normal or above-normal rainfall because each selected year was preceded by a multi-year drought
- Eighteen years of dry-year pumping from the Saugus, or an average of one dry year approximately every four years
- Two droughts lasting three years, plus (in both cases) a dry year that occurs two years before the beginning of each three-year drought and another dry year that begins one year after each three-year drought has ended; Saugus pumping was increased into the 15,000 to 35,000 afy range in all those years
- Two droughts lasting two years; Saugus pumping was increased into the 15,000 to 25,000 afy range in those years
- Sixty years of normal-year Saugus pumping, 7,500 to 15,000 afy

Simulated Alluvial aquifer response to the preceding range of hydrologic conditions and pumping stresses was essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades. The resultant response consisted of (1) generally constant groundwater levels in the middle to western portion of the Alluvium, and fluctuating groundwater levels in the eastern portion of the Alluvium as a function of wet and dry hydrologic conditions, (2) variations in recharge that directly correlate with wet and dry hydrologic conditions, and (3) no long-term decline in groundwater levels or storage. Examples of projected groundwater levels and storage in various parts of the basin are illustrated in Figures C-11 through C-15. Based on the combination of actual experience with Alluvial aquifer pumping at capacities similar to those planned for the future and the resultant sustainability (recharge) of groundwater levels and storage, complemented by modeled projections of aquifer response to planned pumping rates that also show no depletion of groundwater, the Alluvial Aquifer is considered a sustainable water supply source to meet the Alluvial portion of the operating plan for the groundwater Basin.

TABLE C-1

Recent and Simulated Future Annual Groundwater Pumping Volumes from the Alluvial Aquifer

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

		Historical Pumping			UWMP Pumping	
Well Name	**Location[a]**	**2001**	**2002**	**2003**	**Normal Years**	**Dry Years**
NCWD-Castaic 1	Castaic Valley	345	385	561	385	345
NCWD-Castaic 2	Castaic Valley	166	0	123	166	125
NCWD-Castaic 3	Castaic Valley	0	0	0	0	0
NCWD-Castaic 4	Castaic Valley	100	47	56	100	45
NCWD-Pinetree 1	Mint Canyon	164	0	0	164	0
NCWD-Pinetree 2	Mint Canyon	0	0	0	0	0
NCWD-Pinetree 3	Mint Canyon	566	544	525	545	525
NCWD-Pinetree 4	Mint Canyon	300	5	0	300	0
NCWD Total		**1,641**	**981**	**1,265**	**1,660**	**1,040**
NLF-161	Downstream of Valencia WRP	496	485	2,021	485	485
NLF-B10	Downstream of Valencia WRP	1,240	534	344	344	344
NLF-B11	Downstream of Valencia WRP	205	232	271	232	232
NLF-B5	Downstream of Valencia WRP	1,680	2,280	1,582	1,582	1,582
NLF-B6	Downstream of Valencia WRP	1,312	2,175	1,766	1,766	1,766
NLF-B7	Downstream of Valencia WRP	474	584	402	584	584
NLF-C	Downstream of Valencia WRP	1,319	1,720	1,373	1,373	1,373
NLF-C3	Downstream of Valencia WRP	93	192	186	192	192
NLF-C4	Downstream of Valencia WRP	1,028	809	764	809	809
NLF-C5	Downstream of Valencia WRP	680	850	622	850	850
NLF-C6	Downstream of Valencia WRP	231	241	108	241	241
NLF-C7	Downstream of Valencia WRP	741	866	443	866	866
NLF-C8	Downstream of Valencia WRP	293	594	408	594	594
NLF-E	Castaic Valley	1,691	16	28	16	16
NLF-E2	Castaic Valley	141	55	14	55	55
NLF-E4	Downstream of Valencia WRP	0	0	0	0	0
NLF-E5	Downstream of Valencia WRP	172	679	537	679	679
NLF-E9	Downstream of Valencia WRP	238	814	47	814	814
NLF-G45	Downstream of Valencia WRP	291	283	60	283	283
NLF-W4	San Francisquito Canyon[b]	46	1	0	0	0
NLF-W5	San Francisquito Canyon	276	104	23	107	107
NLF-X3	Downstream of Valencia WRP	12	0	0	0	0
NLF Total		**12,659**	**13,514**	**10,999**	**11,872**	**11,872**
SCWD-Clark	Bouquet Canyon	696	782	712	782	700
SCWD-Guida	Bouquet Canyon	1,047	1,320	1,230	1,320	1,230
SCWD-Honby	Above Saugus WRP	721	696	874	696	870
SCWD-Lost Canyon 2	Mint Canyon	741	730	644	741	640
SCWD-Lost Canyon 2A	Mint Canyon	1,034	905	593	1,034	590
SCWD-Mitchell #5A	Mint Canyon	407	143	19	0	0
SCWD-Mitchell #5B	Mint Canyon	0	150	0	557	0
SCWD-N. Oaks Central	Mint Canyon	822	1,646	1,641	822	1,640
SCWD-N. Oaks East	Mint Canyon	1,234	448	485	1,234	485
SCWD-N. Oaks West	Mint Canyon	898	1,123	31	898	0
SCWD-Sand Canyon	Mint Canyon	930	705	195	930	195
SCWD-Sierra	Mint Canyon	846	87	0	846	0
SCWD-Stadium	Above Saugus WRP	565	778	0	800	800
SCWD Total		**9,941**	**9,513**	**6,424**	**10,660**	**7,150**

TABLE C-1

Recent and Simulated Future Annual Groundwater Pumping Volumes from the Alluvial Aquifer

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

		Historical Pumping			UWMP Pumping	
Well Name	**Location[a]**	**2001**	**2002**	**2003**	**Normal Years**	**Dry Years**
VWC-D	Castaic Valley	645	772	687	690	690
VWC-I	San Francisquito Canyon	0	0	0	0	0
VWC-K2	Downstream of Saugus WRP[c]	669	955	364	0	0
VWC-L2	Downstream of Saugus WRP[d]	349	490	71	0	0
VWC-N	Downstream of Saugus WRP	591	700	622	620	620
VWC-N3	Downstream of Saugus WRP[e]	226	857	255	0	0
VWC-N4	Downstream of Saugus WRP[f]	458	909	248	0	0
VWC-N7	Downstream of Saugus WRP				1,160	1,160
VWC-N8	Downstream of Saugus WRP				1,160	1,160
VWC-Q2	Downstream of Saugus WRP	923	1,167	1,451	985	985
VWC-S6	Downstream of Saugus WRP	1,490	1,320	2,134	865	865
VWC-S7	Downstream of Saugus WRP	564	419	1,095	865	865
VWC-S8	Downstream of Saugus WRP	327	190	409	865	865
VWC-T2	Above Saugus WRP	900	696	1,014	460	460
VWC-T4	Above Saugus WRP	690	831	799	460	460
VWC-U3	Above Saugus WRP[g]	956	572	823	0	0
VWC-U4	Above Saugus WRP	942	796	934	935	935
VWC-U6	Above Saugus WRP	0	0	0	825	825
VWC-W10	San Francisquito Canyon	182	0		0	0
VWC-W11	San Francisquito Canyon	806	939	764	600	600
VWC-W6	San Francisquito Canyon[h]	0	0	36	865	865
VWC-W9	San Francisquito Canyon				350	350
VWC Total		**10,718**	**11,613**	**11,706**	**11,705**	**11,705**
Robinson Ranch	Mint Canyon				932	400
WHR (All Wells)	Castaic Valley	1,604	1,602	2,273	1,600	1,600
Total Alluvial Aquifer Pumping		**36,563**	**37,223**	**32,667**	**38,429**	**33,767**

[a]See Figure 2-4 for well locations.

[b]Former well NLF-W4 was located approximately 900 feet west of existing production well VWC-11.

[c]Former well VWC-K2 was located approximately 210 feet south of existing production well VWC-N7.

[d]Former well VWC-L2 was located approximately 150 feet southeast of existing production well VWC-N7.

[e]Former well VWC-N3 was located approximately 440 feet northeast of existing production well VWC-N8.

[f]Former well VWC-N4 was located approximately 430 feet southeast of existing production well VWC-N8.

[g]Former well VWC-U3 was located approximately 2,300 feet northeast of existing production well VWC-U4.

[h]Former well VWC-W6 was located approximately 575 feet northeast of existing production well VWC-11.

Notes:

All pumping volumes are listed in AF/yr. Blank entries for historical pumping indicate that the well did not exist at that time.

Wells that are not listed are assumed to not be pumping in the future.

NLF = Newhall Land & Farming Company

UWMP = Urban Water Management Plan

VWC = Valencia Water Company

WHR = Wayside Honor Rancho, whose wells are owned by the Los Angeles County Waterworks District No. 36

TABLE C-2

Simulated Annual Groundwater Pumping from the Saugus Formation for the 78-year Simulation

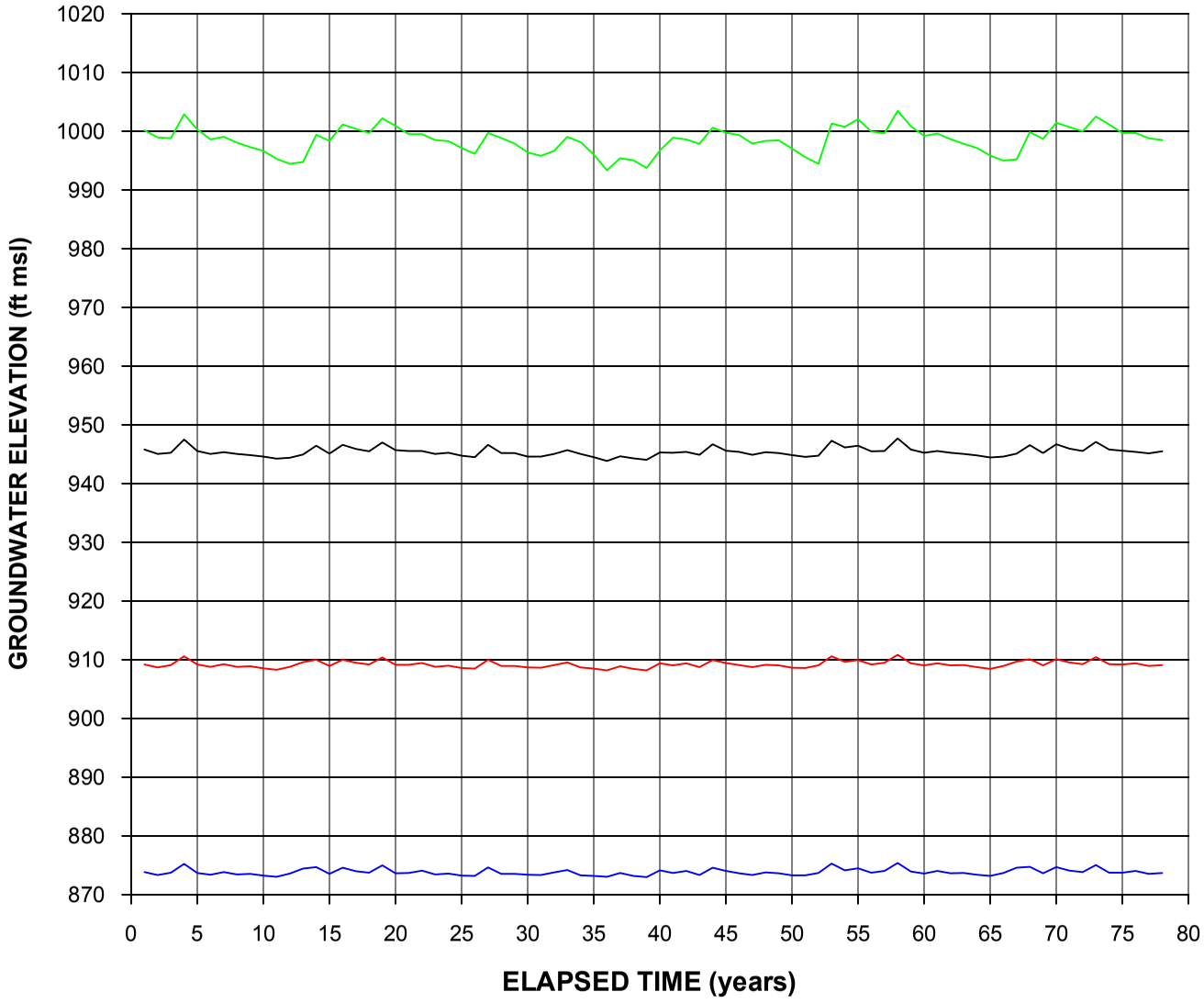
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Owner	Well Name	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
NCWD	11	811	811	811	811
	12	1,315	2,044	2,044	2,044
	13	1,315	2,044	2,044	2,044
Total Pumping (NCWD)		**3,441**	**4,899**	**4,899**	**4,899**
NLF	156	369	369	369	369
Total Pumping (NLF)		**369**	**369**	**369**	**369**
SCWC	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
Total Pumping (SCWC)		**3,544**	**3,544**	**3,544**	**3,544**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Valencia Country Club)	500	500	500	500
	201	100	100	3,577	3,577
	205	1,000	2,734	3,827	3,827
	206	1,175	2,734	3,500	3,500
Total Pumping (VWC)		**3,325**	**6,948**	**12,284**	**12,284**
To Be Determined	Future #1	0	0	3,250	3,250
	Future #2	0	0	0	3,250
	Future #3	0	0	0	3,250
	Future #4	0	0	0	3,250
Total Pumping (Future)		**0**	**0**	**3,250**	**13,000**
Total Saugus Formation Pumping		**10,679**	**15,760**	**24,346**	**34,096**

Notes:

All pumping volumes are listed in acre-feet.

Wells VWC-157 and NCWD-7, 8, 9, and 10 are assumed to no longer operate in the future.



NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. WELL NLF-TOPCO1 IS LOCATED 210 feet SOUTHWEST OF WELL NLF-B11.

FIGURE C-11
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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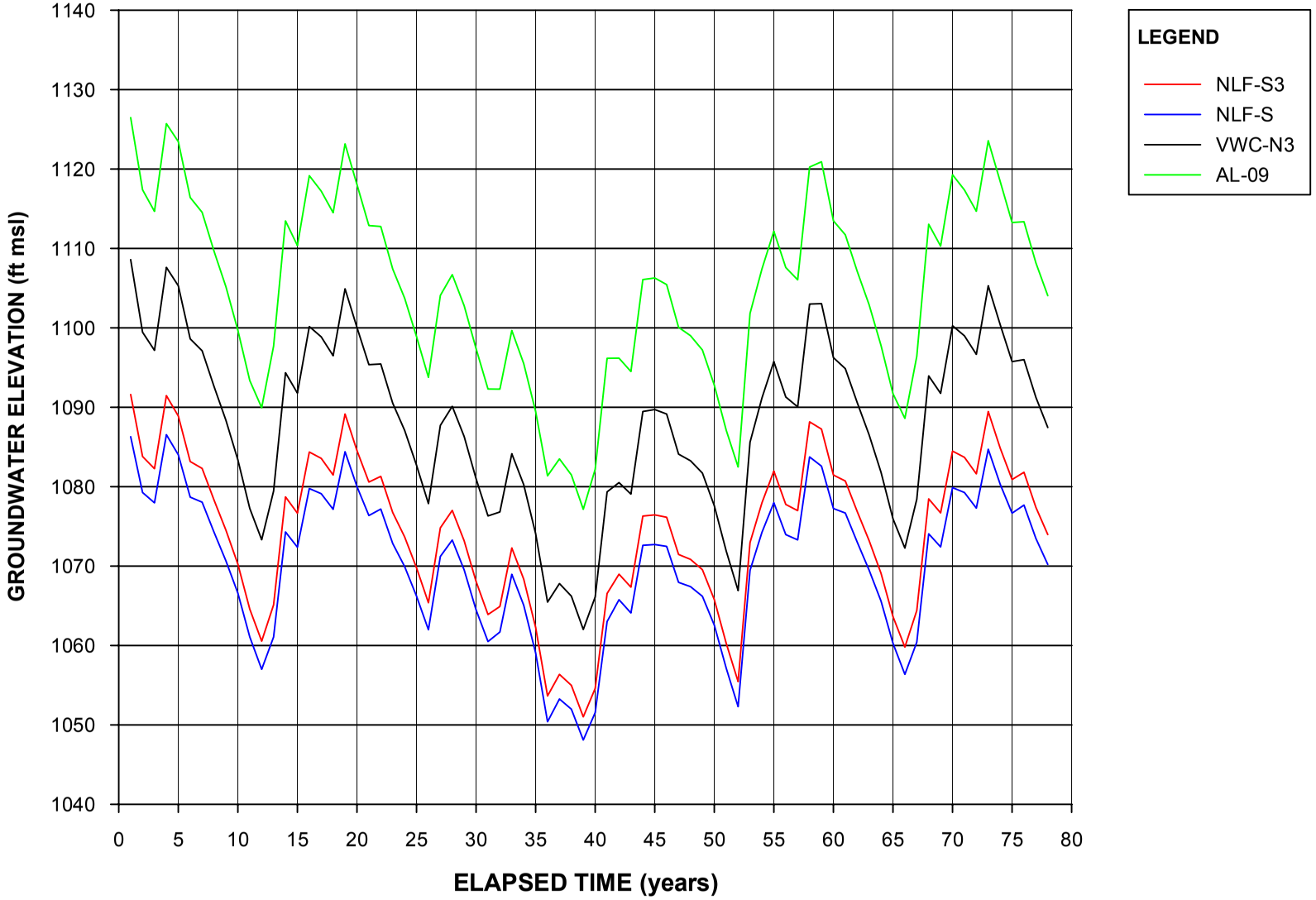

NOTES:

1. AL09 IS A CLUSTER OF OBSERVATION WELLS LOCATED 845 feet SOUTHWEST OF PRODUCTION WELL VWC-Q2.

2. THE REMAINING HYDROGRAPHS REPRESENT FORMER ALLUVIAL AQUIFER WELLS THAT HAVE BEEN ABANDONED AND THEREFORE ARE NOT PUMPED IN THE MODEL SIMULATIONS. RELATIVE TO EXISTING WELLS SHOWN ON FIGURE 2-4, THESE FORMER WELLS WERE LOCATED AS FOLLOWS:

   – WELL NLF-S3 WAS LOCATED 305 feet EAST OF WELL VWC-S6
   – WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6
   – WELL VWC-N3 WAS LOCATED 435 feet NORTHEAST OF WELL VWC-N8

FIGURE C-12
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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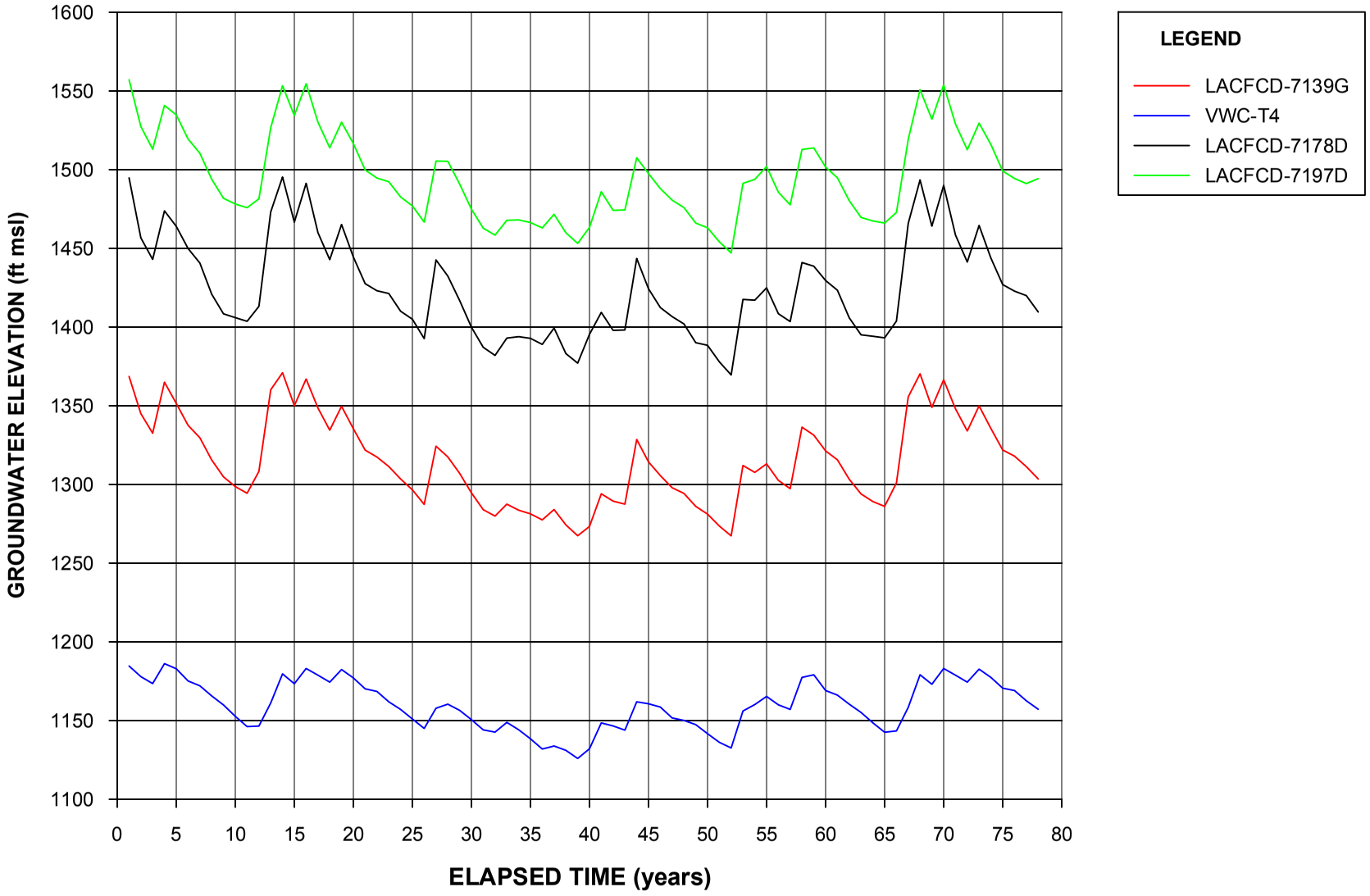

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR VWC- T4 = 1101 ft msl; ALLUVIUM BOTTOM ELEVATION ~1050 TO 1065 ft msl.
3. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7139G = 1289 ft msl; ALLUVIUM BOTTOM ELEVATION ~1256 ft msl OR LOWER.
4. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7178D = 1463 ft msl; ALLUVIUM BOTTOM ELEVATION ~1398 TO 1425 ft msl.
5. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7197D = 1474 ft msl; ALLUVIUM BOTTOM ELEVATION ~1423 TO 1447 ft msl.

FIGURE C-13
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER IN SOLEDAD CANYON
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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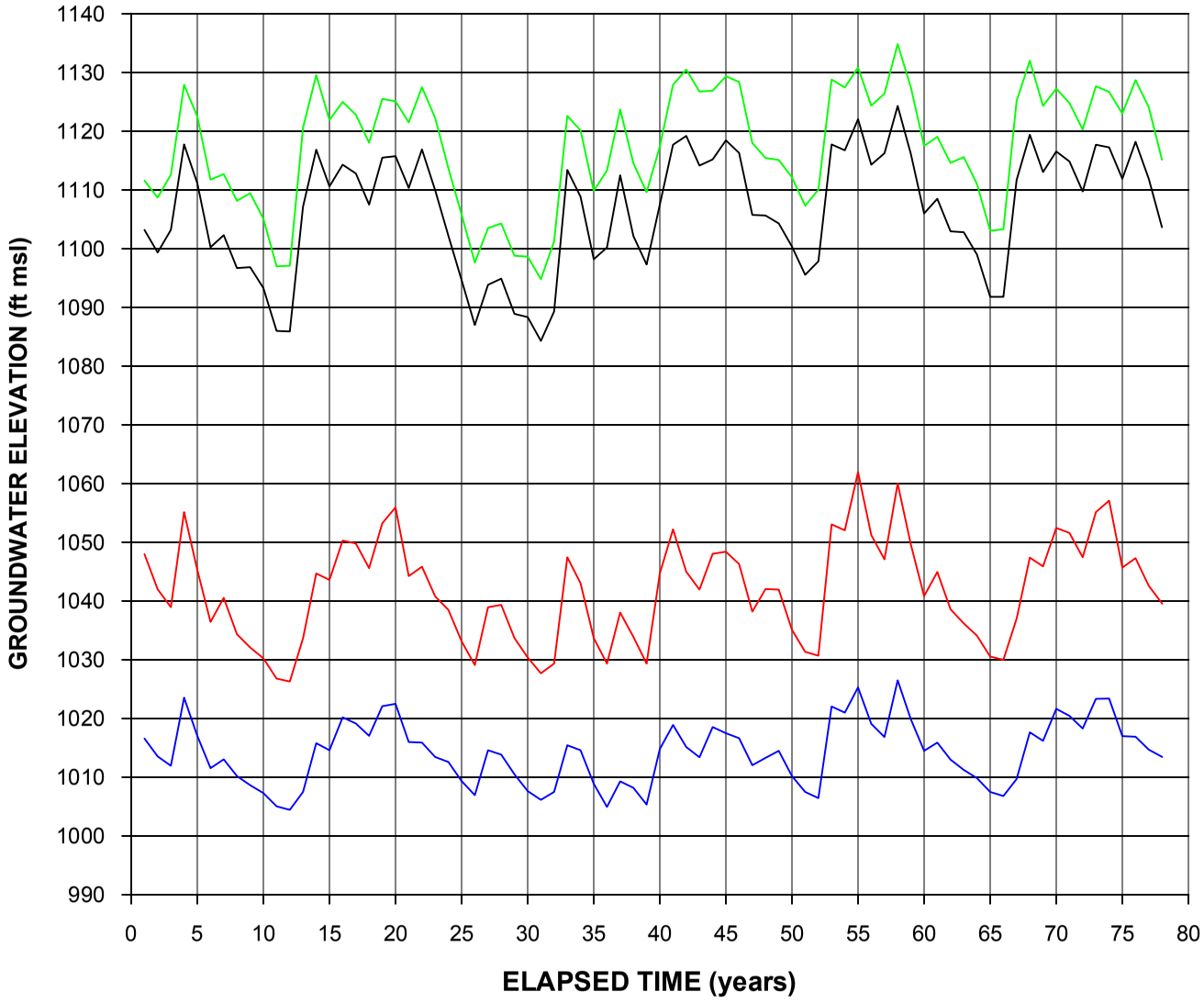

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE C-14
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG CASTAIC CREEK
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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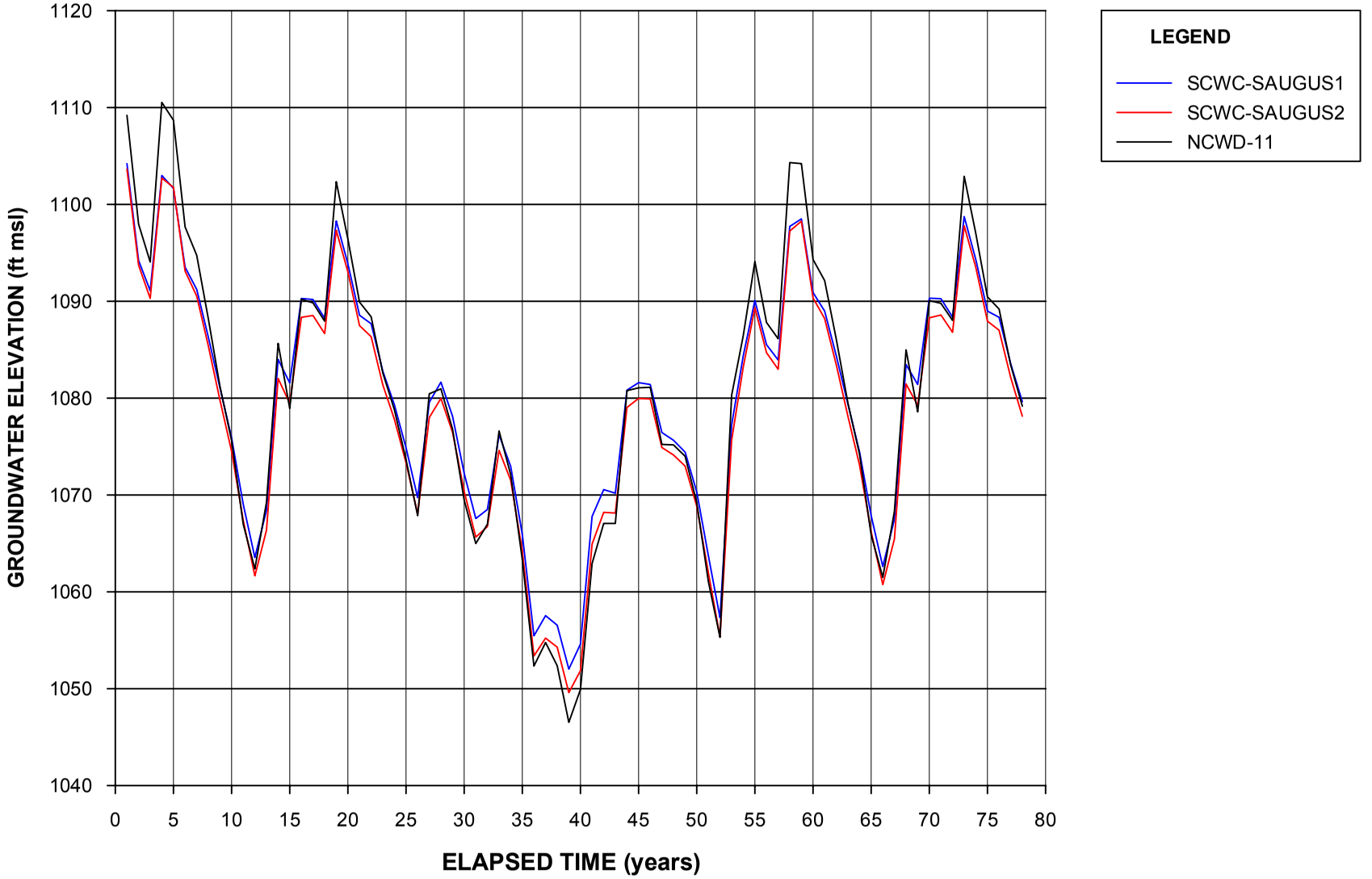

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. THESE WELLS ARE CONSTRUCTED IN THE SAUGUS FORMATION AND ARE NOT OPEN TO THE ALLUVIAL AQUIFER. THE SIMULATED HYDROGRAPHS AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER, ABOVE THE OPEN INTERVALS OF THESE WELLS.

FIGURE C-15
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG THE SOUTH FORK SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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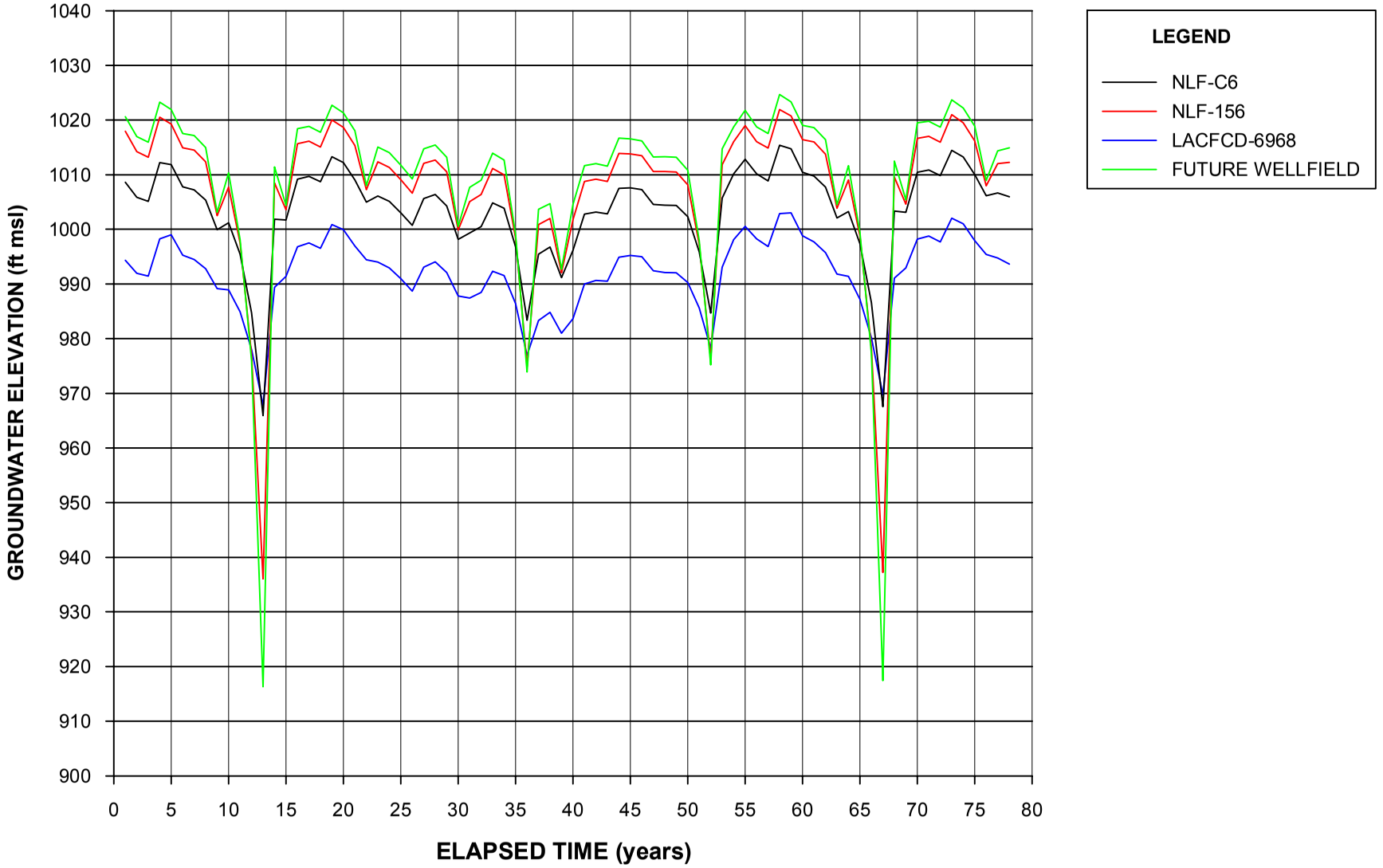
Saugus Formation – Based partially on historical operating experience, complemented by extensive recent testing and groundwater modeling work as described herein, it is planned that the Saugus Formation aquifer can supply water on a long-term sustainable basis in a normal range of 7,500 to 15,000 afy, with intermittent increases to 25,000 to 35,000 af in multiple dry years. The dry-year increases result from limited historical observation, now complemented by modeled projections, that a small amount of the large groundwater storage in the Saugus Formation can be pumped over a relatively short (dry) period, followed by recharge (replenishment) of that storage during a subsequent wet to normal period when pumping would be reduced.

Until recently, the long-term sustainability of Saugus groundwater was empirically determined from limited historical experience. The historical record shows fairly low annual pumping in most years, with one four-year period of increased pumping up to about 15,000 afy, that produced no long-term depletion of the substantial groundwater storage in the Saugus. As with the Alluvium, those empirical observations have now been complemented by the development and application of the numerical groundwater flow model. The model has been used to examine aquifer response to the operating plan for pumping from both the Alluvium and the Saugus, and to examine the effectiveness of pumping for both contaminant extraction and control of contaminant migration within the Saugus Formation.

To examine the yield of the Saugus Formation or, in other words, its sustainability on a renewable basis, the groundwater flow model was used to examine long-term projected response to pumping from both the Alluvium and the Saugus, over the 78-year period of hydrologic conditions to introduce alternating wet and dry periods as have historically occurred. The pumping simulated in the model was in accordance with the operating plan for the Basin. For the Saugus, simulated pumpage included the planned restoration of recent historic pumping from the perchlorate-impacted wells. That pumping was analyzed to assess, in addition to the overall recharge of the Saugus, the effectiveness of controlling the migration of perchlorate by extracting and treating contaminated water close to the source of contamination.

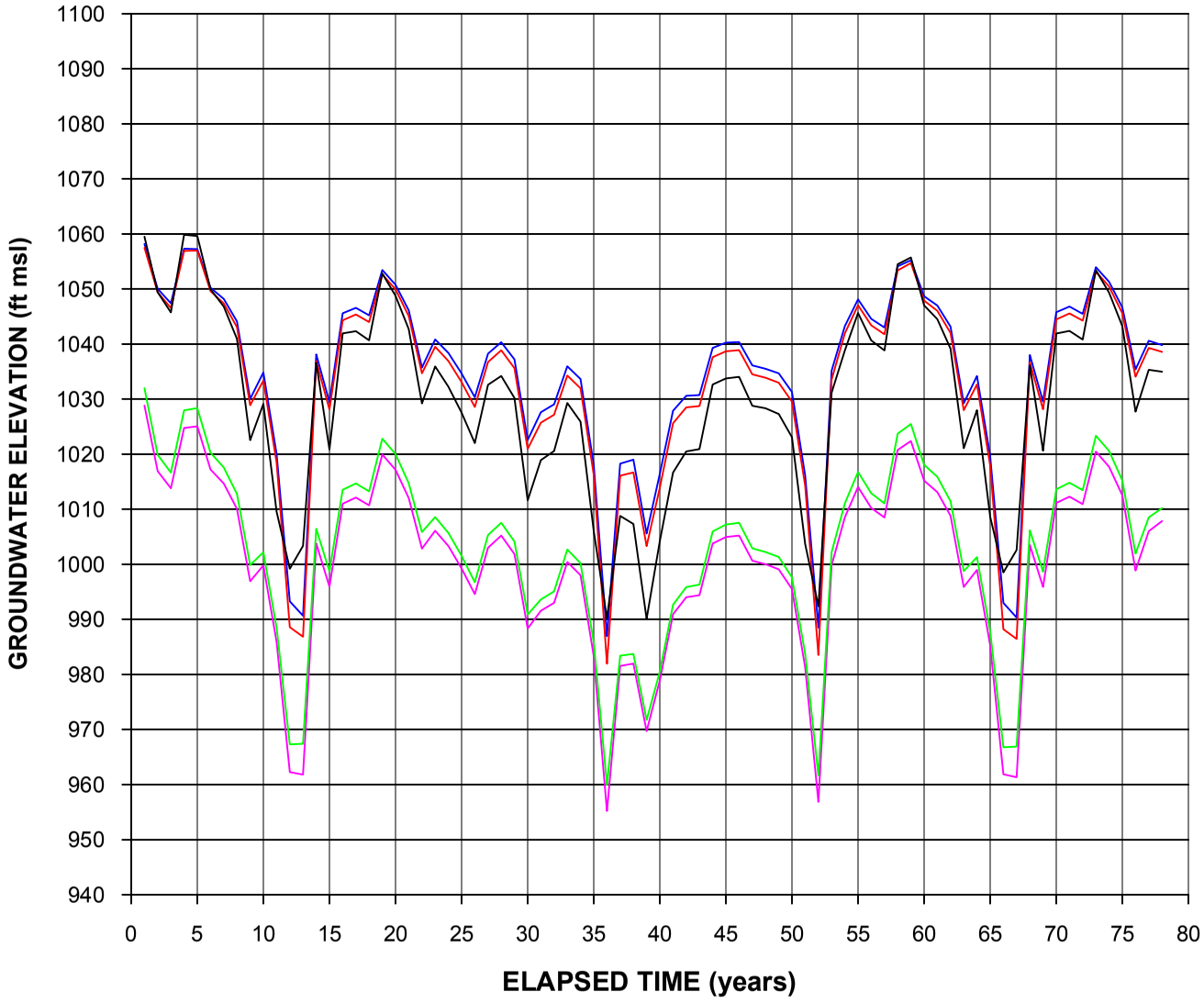
Simulated Saugus Formation response to the ranges of pumping under assumed recurrent historical hydrologic conditions was consistent with actual experience under smaller pumping rates. The response consisted of (1) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping, (2) rapid recovery of groundwater levels and storage after cessation of dry-period pumping, and (3) no long-term decreases or depletion of groundwater levels or storage. Examples of projected groundwater levels and storage around the planned Saugus pumping areas are illustrated in Figures C-16 and C-17. The combination of actual experience with Saugus pumping and recharge up to about 15,000 afy, now complemented by modeled projections of aquifer response that show long-term utility of the Saugus at 7,500 to 15,000 afy in normal years and rapid recovery from higher pumping rates during intermittent dry periods, shows that the Saugus Formation can be considered a sustainable water supply source to meet the Saugus portion of the operating plan for the groundwater Basin.



NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WELLS NLF-C6 AND LACFCD-6968 ARE CONSTRUCTED IN THE ALLUVIAL AQUIFER AND ARE NOT OPEN TO THE SAUGUS FORMATION. THE SIMULATED HYDROGRAPHS SHOWN AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE SAUGUS FORMATION, BELOW THE OPEN INTERVALS OF THESE WELLS.
3. THE SIMULATED HYDROGRAPH FOR THE FUTURE WELLFIELD IS FOR A MODEL NODE WITH NO ASSIGNED PUMPING, LOCATED INSIDE THE WELLFIELD NEAR VWC-206.

FIGURE C-16
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA



NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE C-17
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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Appendix D

Contamination and Impact on Groundwater Supplies in the Santa Clarita Valley

Appendix D

Perchlorate Contamination and Impact on Groundwater Supplies in the Santa Clarita Valley

Introduction

The detection of perchlorate in Santa Clarita Valley groundwater supplies has raised concerns over the reliability of those supplies, in particular the Saugus Formation where four wells have been removed from active service as a result of perchlorate. As discussed below, planning for remediation of the perchlorate and restoration of the impacted well capacity is substantially underway. While that work is being completed, non-impacted production facilities can be relied upon for the quantities of water projected to be available from the Alluvial Aquifer and Saugus Formation during the time necessary to restore perchlorate-impacted wells. CLWA, the local retail water purveyors, the California Department of Toxic Substances Control (DTSC), and the U.S. Army Corps of Engineers (ACOE) continue to work closely on the perchlorate contamination issue, which reasonably ensures a prompt response to any significant changes in conditions.

The following is a discussion of pertinent events related to perchlorate contamination. This discussion is provided to illustrate that work toward the ultimate remediation of the perchlorate contamination, including the reactivation of impacted groundwater supply wells, has progressed on several integrated fronts over the last four years. The following discussion is organized into a section which summarizes the on-site investigations and clean-up activities which are under the regulatory control of DTSC, followed by several sections that focus on various aspects of the off-site impacts of perchlorate on water supply wells, and the ongoing activities to remediate that problem and restore the impacted water supply.

On-Site Investigations and Clean-up

On-site investigation is substantially underway and clean-up is in the planning stages at the former Whittaker-Bermite facility. The on-site investigation and clean-up activities at the source of the contamination are under the regulatory authority and control of DTSC.

Brief History[1]

The Whittaker-Bermite site is located in the center of the Santa Clarita Valley and was operated as an explosives and munitions manufacturing, testing, and storage facility since the late 1930's. It was first owned by the Los Angeles Powder Company and later by Golden State Fireworks, the Halifax Explosives Company, the Bermite Powder Company, and the Whittaker Corporation (Whittaker), which assumed ownership of the site in 1967. Under contracts with the U.S. Department of Defense, Whittaker Corporation used perchlorate in the manufacture of solid propellants for rockets and missiles until operations ceased in 1987. There is a long history of

[1] See, "General Site History," Whittaker Bermite Clean-Up, http://www.whittaker-bermite.com/history.html, pp. 1-3.

perchlorate use and other chemical use at the site, and recent surface and subsurface investigations at the site have revealed the presence of perchlorate and other contaminants in soil and groundwater.

The contaminants found in the soil that require clean-up are perchlorate and volatile organic compounds (VOCs). These chemicals were used in the manufacturing and testing of fireworks, dynamite, oil-field explosives, and munitions. The site consists of about 996 acres, with actual production facilities occupying approximately 50 acres. The property is characterized by chaparral covering the undisturbed portions of the site, fire breaks, dirt roads and remnants of facility foundations and buildings. The surrounding areas include commercial, light industrial, and residential land uses. The facility was closed in 1987 and most of the structures on the property were removed at or about that time.

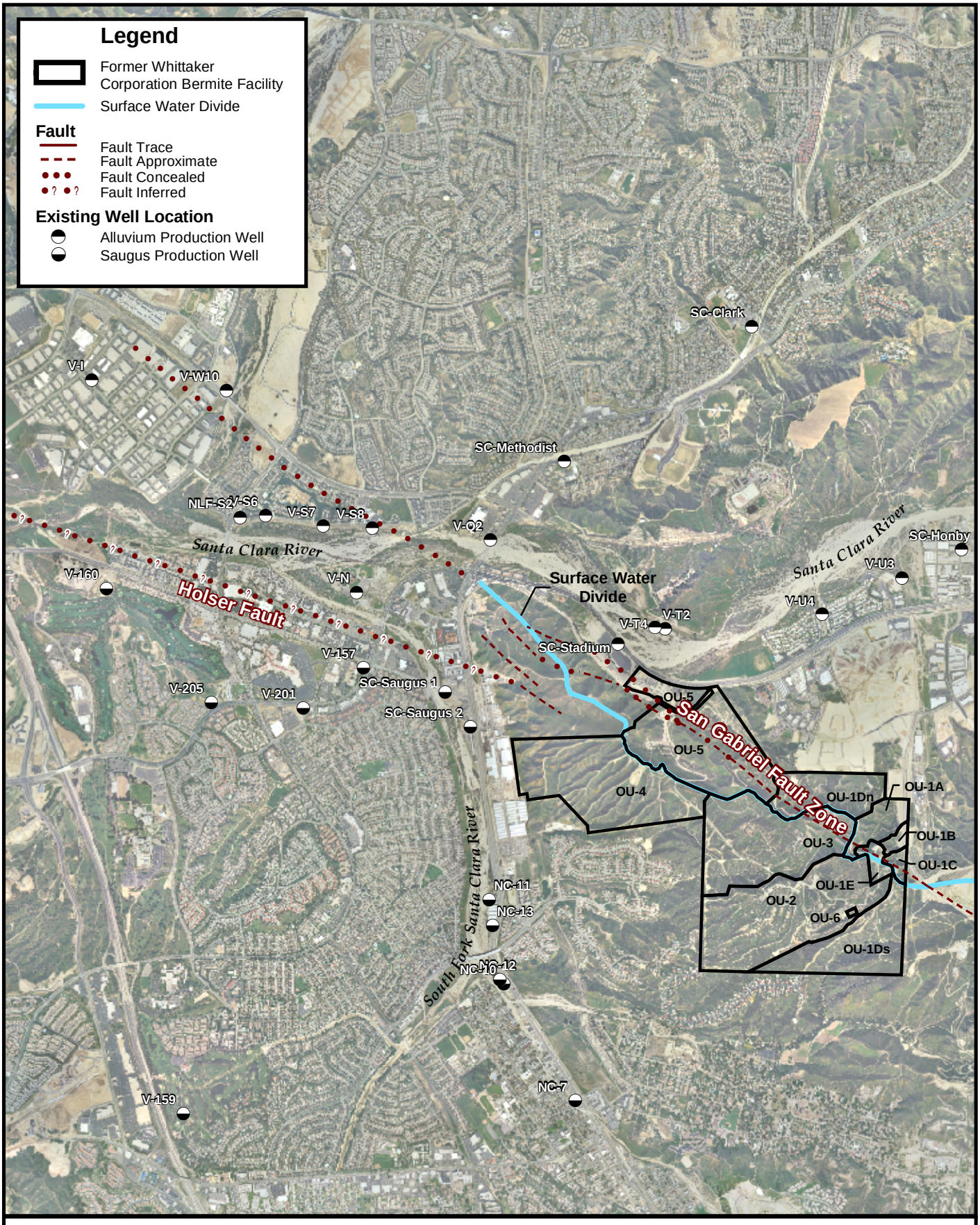
Between 1987 and 1998, Whittaker conducted environmental investigations and clean-up activities under the supervision of DTSC and its predecessor agency. In 1994, Whittaker entered into an enforceable agreement with DTSC to conduct a comprehensive site-wide investigation of areas of concern. In early 1997, with the remedial investigations underway, DTSC informed Whittaker that the soils, groundwater, and surface runoff would have to be reassessed for the presence of perchlorate, a compound that had been unregulated during the entire period of manufacturing at the site.

In 1998, Whittaker sold the property to Santa Clarita LLC, a brownfield development company. In addition to assuming all clean-up responsibilities, Santa Clarita LLC acquired the right to develop the property contingent upon the full cleanup and certification of the property's reuse by DTSC. Between 1999 and 2001, Santa Clarita LLC continued and expanded the site investigation and clean-up programs that had been initiated by Whittaker under the 1994 agreement. In 2002, however, with Santa Clarita LLC unable to fund additional site work due to financial difficulties, DTSC opened negotiations with Whittaker to resume site investigation and clean-up work. In November 2002, DTSC issued an Order that required Whittaker to complete the site investigations and feasibility studies for all contaminants of concern under a tight time schedule.

Recent Site Activities[2]

Because the site is so large, DTSC has divided the property into separate and distinct areas called Operable Units (OUs), which are defined largely by topographic features as shown in Figure D-1. OUs 1 through 6 comprise soils and perched groundwater zones from the ground surface to 200 feet below grade. OU-7 comprises soils below 200 feet from grade and site-wide groundwater and surface water, including any off-site migration of contaminants.

[2] See, "Recent Site Activities," http://www.whittaker-bermite.com/recent.html, pp. 1-5; see also, letter from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 20, 2004, pp. 1-20; and letters from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 25 and 26, 2004.



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0 3,500 7,000 Feet

Figure D-1
Site Location
Former Whittaker-Bermite Facility

SCO \\GALT\GIS2\SNTA_CLRTA\PLOTS\FIGURE_121404\FIGURE_2-16.MXD 12/14/2004

In complying with DTSC's Order, Whittaker consultants and contractors have conducted a significant amount of work since December 2002. The work has been performed pursuant to workplans submitted to and approved by DTSC. The principal activities, summarized by OU, include (1) additional remedial investigations, including soil samples, borings, exploratory trenching, and groundwater monitoring wells, (2) feasibility reports, treatability studies, and pilot tests, and (3) remedial action plans.[3] These efforts have included expediting the final remedial investigation reports, feasibility studies and remedial action plan for OU-1 soils. The final draft remedial action plan for OU-1 was submitted to DTSC in May 2004, and represents the results of efforts to initiate soil remediation work this year in some of the key source areas.[4]

In October 2004, DTSC issued a second public notice requesting comments on DTSC's proposal to clean-up perchlorate and other contaminants in the soil at OU-1.[5] Because of the different chemical and physical properties of the contaminants and the different types of soils in the impacted areas, DTSC has evaluated seven soil remediation alternatives that would protect human health and the environment. DTSC proposes to clean up perchlorate and VOCs in the soil by using a combination of the identified remediation alternatives.[6]

In addition, remedial investigation field work for the soil in OUs 2, 3, 4, 5 and 6 is almost complete, with the investigation results indicating it would be most expedient to conduct the remaining remedial response work for soils by modifying DTSC's Order to allow Whittaker to prepare and submit comprehensive site-wide documents for soil clean-up (e.g., remedial investigation, feasibility study, baseline risk assessment, and remedial action plan), rather than OU-specific documents.[7]

Whittaker also recently submitted a letter to DTSC requesting modifications to DTSC's Order, as it relates to the groundwater remedial response work for the area designated OU-7.[8] Although substantial progress has been made in OU-7, the remedial investigation and feasibility study field work for OU-7 is still ongoing.[9] Whittaker has proposed a tentative schedule for completing site-wide investigation and groundwater remediation work. The work is scheduled to be completed in 2005.[10]

In OU-7, in close coordination with the ACOE, CLWA, and local retail water purveyors, Whittaker has been conducting remedial investigation and clean-up work with respect to production wells impacted by the perchlorate contamination.[11] As part of that effort, ACOE has

[3] See, "Recent Site Activities," http://www.whittaker-bermite.com/recent.html, pp. 1-4.
[4] See, letter from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 20, 2004, p. 1.
[5] See, DTSC: Site Cleanup, Whittaker-Bermite Facility (former), Fact Sheet - October 2004, http://www.dtsc.ca.gov/SiteCleanup/Whittaker_Bermite/, p. 2.
[6] See, DTSC: Site Cleanup, Whittaker-Bermite Facility (former), Fact Sheet - May 2004, http://www.dtsc.ca.gov/SiteCleanup/Whittaker_Bermite/, p. 2.
[7] See, letter from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 25, 2004, pp. 1-2.
[8] See, letter from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 26, 2004, pp. 1-2.
[9] *Id.*
[10] *Id.*
[11] See, "Recent Site Activities," http://www.whittaker-bermite.com/recent.html, p. 4.

been investigating the nature and extent of the perchlorate contamination impacting the production wells. In OU-7, Whittaker, CLWA, the local retail water purveyors, and ACOE have conducted the following remedial investigation and feasibility study work in 2002-2004:

- Installed and sampled approximately 30 temporary Alluvial Aquifer monitoring wells
- Installed 12 permanent Alluvial Aquifer monitoring wells
- Installed and sampled six temporary Saugus monitoring wells on and off the site
- Installed five deep multi-port Saugus monitoring wells, four within the site boundaries and one off-site
- Installed one deep single-port Saugus monitoring well within the site boundaries
- Installed cluster wells at four locations to monitor discrete Saugus Formation zones, two within and two outside the site boundaries
- Conducted several rounds of groundwater monitoring for new and existing wells
- Constructed and calibrated a computer model capable of simulating aquifer conditions for development and evaluation of plume containment and treatment strategies
- Conducted aquifer pumping and permeability tests
- Conducted sampling of some of the impacted production wells
- Conducted pilot-scale testing of above-ground treatment options for removing perchlorate from drinking water, including ion exchange and bioremediation.[12]

Remedial response actions for groundwater is continuing through 2005. The schedule contemplates additional remedial investigations, feasibility studies, interim remedial measures, and a remedial action plan for groundwater. The remedial action plan will include the design, construction, and commencement of treatment of perchlorate-contaminated groundwater from two of the retail water purveyors' impacted production wells, which would concurrently provide treated potable water and contain and capture the OU-7 perchlorate plume along its downgradient edges. [13]

For contaminated surface waters on site, Whittaker updated the site-wide surface water sampling plan subject to the approval of DTSC and the Regional Water Quality Control Board (RWQCB).[14] Whittaker collected surface water samples from the primary site drainages during winter storm events in 2003 and 2004. In addition, Whittaker updated the site's stormwater pollution plan and devised and implemented erosion control measures in various areas of the site. Whittaker also conducted a sediment sampling program for the principal drainage areas.[15]

[12] *Id.* at pp. 4-5.
[13] See, letter from Hassan Amini, Ph.D., C.HG., Geomatrix Consultants, Inc., to Sayareh Amir, DTSC, dated August 20, 2004, pp. 16-19.
[14] See, "Recent Site Activities," http://www.whittaker-bermite.com/recent.html, p. 5.
[15] *Id.*

In short, the investigation of on-site sources of the perchlorate contamination and evaluation of clean-up options are substantially underway and closely monitored by DTSC (soils and groundwater), RWQCB (surface water), and ACOE (groundwater).

Perchlorate Impacted Water Purveyor Wells

As previously noted, in 1997, perchlorate was detected in four Saugus Formation production wells operating near the former Whittaker-Bermite site. These wells, CLWA Santa Clarita Water Division's (SCWD) Wells Saugus 1 and Saugus 2, Newhall County Water District's (NCWD) Well NC-11 and Valencia Water Company's (VWC) Well V-157, were removed from service. In 2002, perchlorate was detected in the SCWD Stadium well located directly adjacent to the Whittaker-Bermite site. This Alluvial well was also removed from service. Locations of the impacted wells, and other nearby non-impacted wells, relative to the Whittaker-Bermite site are shown on Figure D-1.

Since the detection of perchlorate and resultant inactivation of impacted wells, the retail water purveyors have been conducting regular monitoring of active wells near the Whittaker-Bermite site. In late March 2005, that monitoring detected the presence of perchlorate in VWC's Well Q2, an Alluvial well located immediately northwest of the confluent of Bouquet Creek and the Santa Clara River. As a result of the detection and confirmation of perchlorate in its Well Q2, VWC removed the well from active service and pursued rapid permitting and installation of wellhead treatment. The well was returned to water supply service in October 2005.

Regulatory Standards for Perchlorate

Perchlorate is a chemical salt and is very soluble in water. It is also very mobile in water and is persistent (i.e., doesn't degrade) under typical environmental conditions. The applicable drinking water standards for perchlorate are summarized below.

On December 6, 2002, the California Office of Environmental Health Hazard Assessment (OEHHA) proposed a public health goal (PHG) for the amount of perchlorate present in drinking water. OEHHA's proposal suggested a range of 2 to 6 micrograms per liter (µg/l). A proposed PHG is a theoretical calculation that initiates a thorough, multi-year standard-setting process by DHS. An adopted PHG reflects a very stringent health standard and is not an enforceable drinking water standard. A final PHG contributes to DHS' development of a Maximum Contaminant Level (MCL), which is an enforceable drinking water standard. DHS is required to establish an MCL at a level as close as is technically and economically feasible to the PHG.

In addition to OEHHA's proposal, DHS was required to adopt an MCL for perchlorate by January 1, 2004. However, this date has been extended into 2005 to allow additional review and study by DHS. Presently, there is no drinking water standard, or MCL, for perchlorate, only a provisional limit called an "action level". The perchlorate advisory action level is currently 6 µg/l, and is not an enforceable standard.

When perchlorate was first discovered in California drinking water supplies in 1997, DHS set the advisory action level at 18 µg/l. It was revised to 4 µg/l in January 2002 and then finally to its current level of 6 µg/l in March 2004. In September 2004, Assembly Bill 2528 was signed into law by Governor Schwarzenegger. This bill eliminates the term "action level" and replaces it with two new terms, "notification level" and "response level". This new terminology became

effective January 2005. However, DHS has advised public water systems that they may use the new terminology in advance of the effective date. Using this new approach, the term "notification level" is the same as the "action level". With respect to perchlorate, the notification level would be 6 µg/l and DHS recommends that the utility provide information to its customers about the presence of the contaminant using its annual consumer confidence report. The response level for perchlorate is 10 times the notification level, or 60 µg/l. At this level, DHS recommends the source be removed from service. At perchlorate levels greater than ten times the action level (or 60 µg/l), DHS recommends (or may require) that a water system remove the source(s) of supply with that concentrations from service. However, with the primary interest of protecting public health from those contaminants regulated by an action level, water utilities normally employ conservative operations by limiting use of the contaminated source, or elect to deliver an alternate source of supply until DHS establishes an enforceable drinking water standard (i.e., MCL). Accordingly, the local retail water purveyors removed all the perchlorate-impacted wells from active water supply service. At present, while prepared to comply with evolving terms, the retail water purveyors have adopted an intended goal in restoring impacted capacity to utilize groundwater for water supply at non-detect concentrations of perchlorate. This goal is consistent with the DHS Policy 97-005 for use of impaired water sources.

Water Purveyor Litigation and Interim Settlement

On November 29, 2000, CLWA and the local retail water purveyors filed suit against the current and prior owners of the Whittaker-Bermite facility. The lawsuit includes causes of action relating to payment of all necessary costs of response, removal of the perchlorate contamination, payment of remediation action costs, and compensation for other damages associated with the perchlorate contamination. CLWA and the local retail water purveyors have incurred substantial response costs and other expenses as a result of production lost on account of the contamination. As a result, CLWA's purveyors have used SWP water to make up for lost groundwater production.

In late summer 2003, CLWA, the local retail water purveyors, Whittaker and Remediation Financial, Inc. (RFI) and Santa Clarita LLC (SCLLC) entered into an interim settlement agreement, in which the parties agreed to work cooperatively for a minimum of one year to further define long-term costs and possibly achieve a long-term settlement. The interim settlement agreement specifies that Whittaker, RFI, and SCLLC and/or their insurers will reimburse certain past costs as well as fund studies and prepare cost estimates for the clean-up plan that will restore water production and capacity of the impacted wells and protect other wells from future contamination. The interim settlement provided for a one-year stay of the lawsuit between the parties and was subsequently amended to extend the stay through January 31, 2005. This has allowed the parties to focus on the final elements of the clean-up plan, which will be submitted to the regulatory agencies in early 2005. The parties continue negotiations to reach a complete settlement.

United States Army Corps of Engineers (ACOE) Groundwater Study

In early 2002, the owner of the Whittaker-Bermite property and CLWA initiated efforts to obtain federal assistance to conduct onsite and off-site groundwater investigations. Through Congressman McKeon, an initial federal authorization of seven million dollars was provided in the form of participation by the ACOE.

Toward that end, on April 11, 2002, ACOE and CLWA entered into a Feasibility Cost-Sharing Agreement to study and locate the source of perchlorate contamination, and other contaminants of interest (COI), in the groundwater in the Santa Clarita Valley. The main objective of the ACOE/CLWA study is to sufficiently characterize the existing groundwater conditions, develop and evaluate both interim and long-term solutions to the contamination and address the contaminated groundwater in the study area, which includes the former Whittaker-Bermite facility and areas adjacent to the property. The project is being implemented pursuant to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and in October 2004, the ACOE issued its report entitled, "Draft Final Conceptual Hydrology Memorandum, Eastern Santa Clara Subbasin Study, Santa Clarita, California".[16]

ACOE is actively testing the groundwater in the region in two major phases. ACOE completed five rounds of groundwater sampling in the Saugus Formation and the Alluvial Aquifer between October 2002 and April 2004.[17] ACOE drilled over 8,500 linear feet in the study area, and installed 41 groundwater monitoring wells at 11 different locations. Groundwater sampling was performed at all 41 wells, collecting a total of 149 groundwater samples. The testing began with an initial baseline assessment of each well[18] and was followed by additional groundwater sampling events of each well.[19] As a result of the testing program, ACOE identified the concentrated source areas, began tracing and understanding the contaminant plume, and developed two-dimensional geologic cross-sectional drawings of the study area.[20]

As a result of the sampling program, ACOE determined that perchlorate appears to be one of the primary COIs in the groundwater.[21] Perchlorate was detected in a monitoring well and reconnaissance sampling points in the Alluvial Aquifer approximately one mile west of the former Whittaker-Bermite facility at Bouquet Junction.[22] Additionally, ACOE found perchlorate in a monitoring well in the Alluvial Aquifer at the mouth of Oakdale Canyon in the South Fork of the Santa Clara River, apparently caused by surface water runoff from the former Whittaker-Bermite facility.[23] Testing at this monitoring well has revealed that perchlorate may have migrated vertically into the Saugus Formation at this location, which may have caused the contamination of the NC-11 well, one of the wells that has been inactivated.[24]

[16] See, ACOE, Los Angeles District, Draft Final Conceptual Hydrogeology Technical Memorandum (Memorandum), October, 2004, p.ES-1.
[17] See, Memorandum, p.ES-2; see also, ACOE, Los Angeles District, Citizens Advisory Group Update on City of Santa Clarita Eastern Santa Clara Subbasin Groundwater Study (Update), June 9, 2004, p.6.
[18] The initial baseline sampling tested for perchlorate, volatile organic compounds (VOCs), explosive compounds, nitrosamines and other contaminants of interest (COIs) (i.e., 1,4-dioxane, semivolatile organic compounds (SVOCs), chlorate, gross alpha and gross beta, cyanide and hexavalent chromium). The wells were also tested for metals (including major cations), major anions, alkalinity, total Kjedahl nitrogen (TKN), nitrate, ammonia, total dissolved solids (TDS), biochemical oxygen demand (BOD), chemical oxygen demand (COD) and total organic compound (TOC). See, Memorandum, p.ES-3.
[19] See, Memorandum, p.ES-3; Section 6.1.
[20] See, Update, p.7.
[21] See, Memorandum, p.ES-5; Section 6.1.
[22] See, Memorandum, p.ES-5; Section 6.1; see also, Update, p.15.
[23] See, Memorandum, p. ES-5; see also, Update, p.16.
[24] See, Memorandum, p.ES-5; Section 6.1.

In the Saugus Formation, ACOE found perchlorate in a monitoring well west of Bouquet Junction, over two miles from the former Whittaker-Bermite facility.[25] However, it appears that the impact on groundwater in this area of the Saugus Formation may be limited to the upper portions of the Saugus Formation, as the contamination was not detected below hydrostratigraphic unit (HSU) SIII. The contamination of the V-157 and SC-Saugus 1 and 2 wells, which also have been deactivated, appears to be caused by the vertical downward migration of perchlorate in HSU SIII, and lateral migration away from the source areas. It also appears that the NC-11 well also may have been impacted by this contaminant plume.[26]

As a result of ACOE's work to date, the extent of perchlorate contamination in the Santa Clara region is better understood. Further work will continue to define the lateral and vertical extent of the contaminated groundwater in the Saugus Formation and Alluvial Aquifer, and evaluate potential changes in groundwater contaminants over time.[27] Therefore, ACOE plans to continue integrating its current study results with other ongoing investigations in the area, including the remedial investigation by the Whittaker Company and the response activities undertaken by CLWA and the local retail water purveyors for impacted production wells.[28] ACOE also intends to complete further focused sampling programs and prepare follow-up technical memoranda of those test results.[29]

Based on the knowledge obtained by its testing and analysis, ACOE plans to implement interim remedial measures at selected locations to reduce the perchlorate concentration before it can disperse and/or interfere with the known transportation pathways. By these efforts, ACOE, in coordination with response actions of the property with oversight from DTSC, anticipates preventing further contamination and establishing source control.[30]

DTSC/CLWA/Purveyor Environmental Oversight Agreement

In February 2003, DTSC and CLWA, NCWD, SCWD, and VWC entered into an Environmental Oversight Agreement (Agreement) whereby DTSC provides review and oversight of the response activities being undertaken by CLWA and the local retail water purveyors relating to the detection of perchlorate in the five impacted wells.

The significance of the Agreement lies in the response actions to be undertaken in its "Scope of Work" (Exhibit B to the Agreement). Under the Scope of Work, CLWA and the retail water purveyors will prepare (1) Well Characterization Reports, (2) a Health-Based Risk Assessment, (3) a Regional Groundwater Flow Model, and (4) a Treatment Technology Evaluation Report. The regional groundwater flow model and the treatment technology evaluation are key inputs to the permitting for restoring the impacted wells by returning them to water supply service as described below. Both have been completed and are being utilized in conjunction to control contamination migration and restore impacted water supply well capacity. Most importantly, under the Scope of Work, CLWA and the retail water purveyors will prepare and implement a

[25] See, Memorandum, P.ES-5; see also, Update, p.9.
[26] See, Memorandum, p. ES-5; Section 6.1.
[27] See, Memorandum, p.ES-6; Section 6.2.
[28] See, Memorandum, p.ES-1.
[29] See, Update, p.17.
[30] See, ACOE, Los Angeles District, "Citizens Advisory Group Update on City of Santa Clarita Eastern Santa Clara Subbasin Groundwater Study," June 9, 2004, p.18.

Remedial Action Plan (RAP) that will be used in connection with water treatment programs and/or well relocation. The RAP is important to the retail water purveyors, who have been working cooperatively with DTSC to implement the groundwater clean-up. CLWA is planning to submit the RAP to DTSC for its review in early 2005.

Treatment Technology

A number of full scale perchlorate treatment systems have been implemented in California and other states. In an effort to evaluate the various available treatment technologies, CLWA commissioned an investigation to identify and evaluate alternative treatment processes effective in removing perchlorate. The scope of that investigation includes resolving permitting issues pertaining to the construction and certification of a treatment facility, conducting bench-scale and pilot-scale tests to determine treatment process performance, and preparing preliminary capital and operations and maintenance cost estimates.

Three treatment technologies, an ion exchange system and two biological systems, were selected for study. The report "Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer, TM 3 Bench and Pilot Test Results" (Carollo Engineers, February 2004), concluded that all three systems were effective in removing perchlorate. However, there was considerable uncertainty with respect to the capital and operations and maintenance costs associated with each process. Therefore, a technical group comprised of representatives from CLWA, the retail water purveyors, and consultants retained by Whittaker-Bermite agreed to solicit competitive bids for the design, construction, and operation of both ion exchange and biological treatment systems. After thorough evaluation of several bids, the technical group determined that ion exchange is the preferred technology based upon treatment performance, ease of regulatory compliance, and comparison of costs associated with construction and operations and maintenance.

The preferred single-pass ion exchange treatment technology does not generate a concentrated perchlorate waste stream that would require additional treatment before discharge to a sanitary sewer or a brine line (if one is available). This technology incorporates an active resin (a material that attracts perchlorate molecules) that safely removes the perchlorate from water. The resin is contained in pressure vessels and the water is pumped through the vessel. The resin is eventually replaced with new resin after a period of time. The old resin is removed and transported by truck to an approved waste disposal site where it is safely destroyed. This technology is robust and reliable for use in drinking water systems. DHS has approved operation of the perchlorate treatment plants currently in operation at the following locations:

- La Puente Valley Water District (2,500 gpm)
- San Gabriel Valley Water Company, El Monte (7,800 gpm)
- California Domestic Water Company, Whittier (5,000 gpm)
- City of Riverside (2,000 gpm)
- West San Bernardino Water District, Rialto (2,000 gpm)
- City of Rialto (2,000 gpm)
- City of Colton (3,500 gpm)
- Fontana Union WC (5,000 gpm)
- City of Pomona (10,000 gpm)

Based on (1) the results of CLWA's investigation of perchlorate removal technologies, (2) the technical group's evaluation, and (3) DHS' approval of single-pass ion exchange for treatment in other settings, CLWA and the local retail water purveyors are planning single-pass ion exchange for the treatment technology for restoration of impacted capacity (wells) in accordance with the permitting, testing, and installation process as currently scheduled and described in the next section. The wellhead treatment installed at VWC Well Q2 is the same single-pass ion exchange as is planned for restoration of impacted Saugus well capacity.

Restoration of Perchlorate Impacted Water Supply

Since the detection of perchlorate in the four Saugus wells in 1997, CLWA and the retail water purveyors have recognized that one element of an overall remediation program would most likely include pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. Thus, CLWA and the retail water purveyors expect that the overall perchlorate remediation program could include dedicated pumping from some or all of the impacted wells, with appropriate treatment, such that two desirable objectives could both be achieved. The first objective is control of subsurface flow and protection of downgradient wells and the second is restoration of some or all of the contaminated water supply. Not all impacted capacity is required for control of groundwater flow. The remaining capacity would be replaced by construction of replacement wells at other non-impacted locations.

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, CLWA and the local retail water purveyors developed an off-site plan that focuses on the above concepts of groundwater flow control and restored pumping capacity and is compatible with on-site and possibly other off-site remediation activities. Specifically relating to water supply, the plan includes the following:

- Constructing and operating a water treatment process that removes perchlorate from two impacted wells such that the produced water can be used for municipal supply
- Hydraulically containing the perchlorate contamination moving from the Whittaker-Bermite site toward the impacted wells by pumping the wells at rates that will capture water from all directions around them
- Protecting the downgradient non-impacted wells through the same hydraulic containment that results from pumping two of the impacted wells
- Restoring the annual volumes of water that were pumped from the impacted wells before they were inactivated, and also restoring the wells' total capacity to produce water in a manner consistent with the retail water purveyor's operational plan for groundwater supply

The current schedule for implementation of the plan to restore contaminated water supply (wells) is illustrated in Figure D-2. Included in the schedule is a planned extended test of the wells that will be returned to service as part of restoring contaminated water supply and that will also be operated to extract contaminated water and control the migration of contamination in the aquifer. Concurrent with the testing of the wells, several specific ion exchange resins will also be tested to evaluate their performance and longevity. The two key activities that comprise the majority of

effort required for implementation of the plan are general facilities-related work (design and construction of well facilities, treatment equipment, pipelines, etc.) and permitting work. Both activities are planned and scheduled concurrently resulting in planned completion (i.e., restoration of all impacted capacity) in 2006. Notable recent accomplishments toward implementation include completion of the Final Draft Interim Remedial Action Plan (RAP) in August 2005 and completion of environmental review with the adoption of a Mitigated Negative Declaration in September 2005.

In light of the preceding, with regard to the adequacy of groundwater as the local component of water supply in this UWMP, the impacted capacity will remain unavailable into 2006, during which time the non-impacted groundwater supply will be sufficient to meet near-term water requirements. Afterwards, the total groundwater capacity will be sufficient to meet the full range of normal and dry-year conditions as provided in the operating plan for groundwater supply, as described in Chapter 3 of this UWMP.

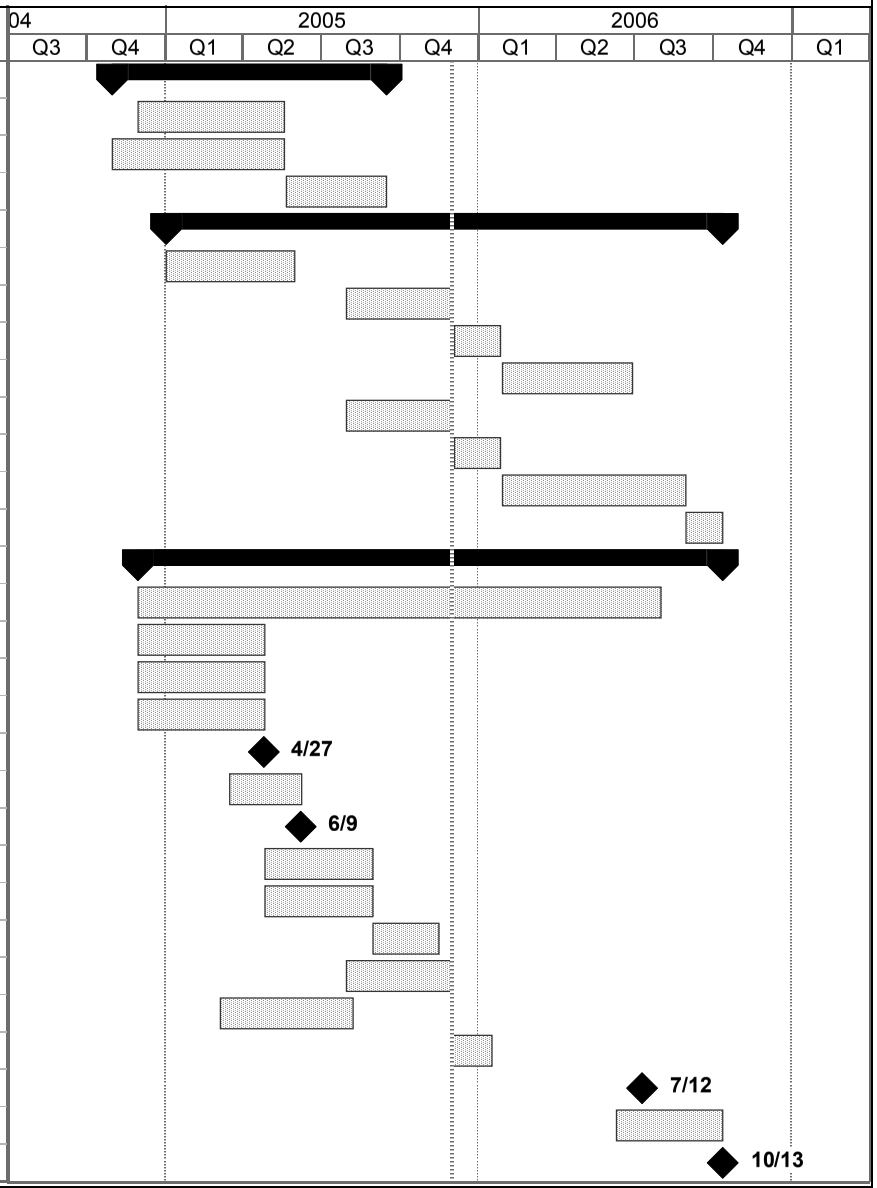
Returning contaminated wells to municipal water supply service by installing treatment requires issuance of permit from DHS before the water can be considered potable and safe for delivery to customers. The permit requirements are contained in DHS Policy Memo 97-005 for direct domestic use of impaired water sources. Before issuing a permit to a water utility for use of an impaired source as part of the utility's overall water supply permit, DHS requires that studies and engineering work be performed to demonstrate that pumping the wells and treating the water will be protective of public health for users of the water. The Policy Memo requires that DHS review the local retail water purveyor's plan, establish appropriate permit conditions for the wells and treatment system, and provide overall approval of returning the impacted wells to service for potable use. Ultimately, CLWA and the local retail water purveyor's plan and the DHS requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

The DHS 97-005 Policy Memo requires, among other things, the completion of a source water assessment for the impacted wells intended to be returned to service. The purpose of the assessment is to determine the extent to which the aquifer is vulnerable to continued migration of perchlorate and other contaminants of interest from the Whittaker-Bermite site. The assessment will include the following:

- Delineation of the groundwater capture zone caused by operating the impacted wells
- Identification of contaminants found in the groundwater at or near the impacted wells
- Identification of chemicals or contaminants used or generated at the Whittaker-Bermite facility
- Determination of the vulnerability of pumping the impacted wells to these contaminant sources

Figure D-2
Preliminary 97-005 Implementation Schedule
Castaic Lake Water Agency

ID	Task Name	Duration	Start	Finish
1	**DTSC Approval Activities**	**230 days**	**Mon 11/1/04**	**Fri 9/16/05**
2	Feasibility Study	6.15 mons	Wed 12/1/04	Fri 5/20/05
3	Draft RAP	29 wks	Mon 11/1/04	Fri 5/20/05
4	Final RAP	4.25 mons	Mon 5/23/05	Fri 9/16/05
5	**Implementation Activities**	**465 days**	**Mon 1/3/05**	**Fri 10/13/06**
6	Easements and ROW	5.4 mons	Mon 1/3/05	Wed 6/1/05
7	Treatment Design	4.4 mons	Mon 8/1/05	Wed 11/30/05
8	Treatment Bidding & Contracting	2 mons	Mon 12/5/05	Fri 1/27/06
9	Treatment Construction	5.5 mons	Mon 1/30/06	Fri 6/30/06
10	Pipeline Design	4.4 mons	Mon 8/1/05	Wed 11/30/05
11	Pipeline Bidding & Contracting	2 mons	Mon 12/5/05	Fri 1/27/06
12	Pipeline Construction	7.7 mons	Mon 1/30/06	Thu 8/31/06
13	System Startup	1.55 mons	Fri 9/1/06	Fri 10/13/06
14	**DHS Approval Activities (97-005)**	**488 days**	**Wed 12/1/04**	**Fri 10/13/06**
15	DHS Coordination	21.8 mons	Wed 12/1/04	Wed 8/2/06
16	TM1: Source Water Assessment	5.3 mons	Wed 12/1/04	Wed 4/27/05
17	TM2: Raw Water Quality Characterization	5.3 mons	Wed 12/1/04	Wed 4/27/05
18	TM3: Source Water Protection	5.3 mons	Wed 12/1/04	Wed 4/27/05
19	DHS Workshop No. 1	0 days	Wed 4/27/05	Wed 4/27/05
20	TM4: Effective Monitoring & Treatment	3 mons	Fri 3/18/05	Thu 6/9/05
21	DHS Workshop No. 2	0 days	Thu 6/9/05	Thu 6/9/05
22	TM5: Human Health Risk Assessment	4.5 mons	Thu 4/28/05	Wed 8/31/05
23	TM6: Alternative Source Assessment	4.5 mons	Thu 4/28/05	Wed 8/31/05
24	DHS Review of TMs 5 & 6	2.75 mons	Thu 9/1/05	Wed 11/16/05
25	Prepare 97-005 Engineer's Report	4.4 mons	Mon 8/1/05	Wed 11/30/05
26	CEQA Initial Study and Draft MND	5.55 mons	Mon 3/7/05	Mon 8/8/05
27	Permit Application	1.7 mons	Thu 12/1/05	Tue 1/17/06
28	Public Hearing	0 days	Wed 7/12/06	Wed 7/12/06
29	DHS Evaluation	4.5 mons	Mon 6/12/06	Fri 10/13/06
30	Obtain DHS Permit	0 days	Fri 10/13/06	Fri 10/13/06



Project: CLWA 97-005_r2
Date: Thu 12/1/05

Task
Split
Progress
Milestone
Summary
Project Summary
External Tasks
External Milestone
Deadline

CLWA is currently working directly with the retail water purveyors and its consultants on development of the DHS 97-005 Policy Memo permit application. Two coordination workshops have already been held with DHS. Drafts of all six elements of the 97-005 Policy Memo have been submitted to DHS and the retail purveyors for review, including: the Source Water Assessment, Raw Water Quality Characterization, Source Protection Plan, Effective Monitoring and Treatment Evaluation, Human Health Risk Assessment, and the Alternatives Sources Evaluation. The Engineer's Report, which summarizes these six elements for the 97-005 process, is anticipated to be complete by the end of November 2005.

As noted above, CLWA and the local retail water purveyors have recognized the probable need for some form of pumping in or near the impacted wells to extract contamination and protect downgradient non-impacted wells. As part of the permitting for use of impacted wells with treatment, DHS 97-005 Policy Memo requires an analysis to demonstrate contaminant capture and protection of other nearby water supply wells. The development and calibration of a numerical groundwater flow model of the entire basin was initiated as a result of a 2001 Memorandum of Understanding among the Upper Basin Water Purveyors (CLWA, CLWA SCWD, LACWWD #36, NCWD, and VWC) and the United Water Conservation District in Ventura County.

The groundwater model was initially intended for use in analyzing the yield and sustainability of groundwater in the Basin. Use of the model for that analysis is described in Chapter 3. The model was adaptable to analyze both the sustainability of groundwater under an operational scenario that includes full restoration of perchlorate-contaminated supply and the containment of perchlorate near the Whittaker-Bermite property (i.e., by pumping some of the contaminated wells), including preventing movement of perchlorate contamination to other portions of the aquifer system. DTSC reviewed and approved the construction and calibration of the regional model as described in the final model report "Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration" (CH2M Hill, April 2004).

After DTSC's approval of the model, it was used to simulate the capture and control of perchlorate by restoring impacted wells, with treatment, as described above. The results of that work were summarized in a second report "Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California" (CH2M Hill, December 2004). The modeling analysis indicate that the pumping of impacted wells SCWD-Saugus 1 and SCWD-Saugus 2 at rates of 1,200 gpm each on a nearly continual basis will effectively contain perchlorate migrating westward in the Saugus Formation from the Whittaker-Bermite property. The analysis also indicates that (1) no new production wells are needed in the Saugus Formation to meet the perchlorate containment objective, (2) impacted well NCWD-11 is not a required component of the containment program, and (3) pumping at SCWC-Saugus 1 and SCWC-Saugus 2 is necessary to prevent migration of perchlorate to other portions of the Saugus Formation.

This report also includes the general design of a sentinel groundwater monitoring network and program required by DHS as part of its 97-005 Policy Memo permitting. The perchlorate containment report was approved by DTSC in November 2004. With that approval, the model is now being used to support the source water assessment and the remainder of the permitting process required by DHS under its 97-005 Policy Memo.

Somewhat independent of the focus on impacted Saugus wells and restoration of that impacted water supply has been the Alluvial Stadium well. On-site investigations by Whittaker-Bermite since late 2003 have resulted in the completion, in June 2005, of a Workplan for a Pilot Remediation Pumping Program in the Northern Alluvium and certain on-site sub-areas that are east/southeast, or generally upgradient, of the impacted Stadium well. That program basically involves the establishment of containment, generally along the northern boundary of the Whittaker-Bermite site, upgradient of the Stadium well, by continuous pumping of a former Whittaker-Bermite facility well, at a continuous low capacity, complemented by pumping at several groundwater "hot spots" that are also generally upgradient of the Stadium well. Due to the low conductivity nature of the aquifer materials at the various "hot spots", pumping for containment at those locations would be from several wells at low pumping capacities. Extracted water would be treated at Whittaker-Bermite's existing on-site treatment system. Generally consistent with the Saugus restoration concept, the Northern Alluvium pumping program would have the concurrent objectives of preventing site-related contaminants from leaving the site and removing some contamination from groundwater such that it can be removed in the on-site treatment process prior to discharge of the water back to the groundwater Basin.

Appendix E

Project Description Excerpt from August 2005 "CLWA Groundwater Containment, Treatment, and Restoration Project" Mitigated Negative Declaration

Appendix E

Project Description Excerpt from August 2005 "CLWA Groundwater Containment, Treatment, and Restoration Project" Mitigated Negative Declaration

Containment/Treatment Facilities

The Proposed Project for containment/treatment is based on analysis of temporal and spatial variations in groundwater flow patterns using the Regional Groundwater Flow Model for Santa Clarita Valley ("*Draft Interim Feasibility Study*," Kennedy/Jenks 2005). Model development and calibration are described in the "*Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration*," CH2M HILL 2004. Based on the model, the movement of contaminated water from the Whittaker-Bermite Property in the Saugus Formation was in a westerly direction. The San Gabriel Fault Zone, which runs east-west through the northern portion of the Whittaker-Bermite Property, was determined to provide a partial barrier to northward migration of the perchlorate-contaminated groundwater, and perchlorate-contaminated water could therefore be intercepted at the existing Saugus 1 and Saugus 2 wells, which are located near the intersection of Magic Mountain Parkway and San Fernando Road. Pumping of groundwater along the leading edge of the plume at these wells would effectively create a cone of depression adjacent to the wells. Perchlorate-contaminated water would then flow into this cone of depression where it would be extracted. The volume of extraction was evaluated to match it to the inflow of perchlorate-contaminated water, thereby maintaining a cone of depression that does not induce migration of better quality groundwater from the Alluvial Aquifer into the cone of depression. An extraction rate of from 1,100 gpm to 1,250 gpm is proposed.

Once extracted, the contaminated water would then be treated to remove the perchlorate and utilized. Over time, this interception of the contaminated plume would (a) reduce downstream migration of the plume and (b) collect the perchlorate and permanently remove it from the groundwater basin. Given that no new contamination would occur up-gradient from the interceptor wells, this strategy should eventually remediate the perchlorate problem.

The primary elements of the Containment Facilities to be constructed and operated (Figure 4 [not included]; Table E-1) are new pumps for existing production wells, new monitoring wells, new pipelines, and a new treatment plant for perchlorate removal. In addition, several existing wells would be removed. These facilities would provide for extraction of contaminated groundwater, conveyance of this water to a treatment facility, and treatment to remove perchlorates. The treatment plant would be tied into existing CLWA distribution pipelines to deliver treated water. Containment facility elements and specifications are shown on Table E-1.

Table E-1
Proposed Project Perchlorate Containment Facilities

FACILITY	SITE	DESCRIPTION (SEE FIGURE 4 [Not Included])
New pumps	Saugus-1 and Saugus-2 wells	**New** variable speed up to 1200 gpm each, installed at existing well site.
Network of monitoring wells	North of Saugus-2 and adjacent to alluvial basin	**New** Small-diameter wells not used for production, located to characterize the contaminant plume and to monitor program effectiveness; included up gradient wells managed in cooperation with other entities.
Conveyance to Treatment Plant	Road rights of way and bike trail	**Segment 1: New** 10" pipeline from Saugus-2, along San Fernando Road to connect with an existing 14-21 inch pipeline on the east side of the South Fork of the Santa Clara River.
		Segment 2: **Connection** of segment 1 to an existing 14-21" pipeline under the Santa Clara River, along Magic Mountain Parkway, and north along Valencia Blvd. to the bridge at the South Fork of the Santa Clara River.
		Segment 3. **New** 16" pipeline under the Valencia Blvd. bridge at the South Fork of the Santa Clara River, along the north/west right-of-way of Valencia Boulevard, along a bike path around the gas station at Bouquet Canyon Bridge, suspended on the west side of Bouquet Canyon Bridge, then west along a bike path to the Rio Vista Intake Pump Station.
Treatment Plant	At Rio Vista Intake Pump Station	**New** one-train, two vessel ion exchange system using Amberlite PWA2 strong-base anion exchange resin followed by chloramination disinfection with a rated capacity of 2400 gpm.
Conveyance from Treatment Plant	West of Treatment Plant	**Connect new Treatment Plant to existing Rio Vista Intake Pump Plant** and CLWA's existing treated water pipeline.

Containment Facility Operation

Containment wells would initially be operated at 1,100 gpm, and then adjusted based on monitoring well data to achieve effective containment of perchlorates. Adjustments would be made in consultation with the Department of Toxic Substance Control (DTSC). Contaminants would be treated in accordance with DHS requirements.

The containment treatment facility utilizes disposable filters to remove perchlorates (US Filter). The dual vessel design of the facility would provide for continuous operation. Primary filtration would occur in Vessel 1, with Vessel 2 providing a final "polishing." When the filter in Vessel 1 requires replacement, primary filtration would switch to Vessel 2 while the filter in Vessel 1 is removed and replaced. Filters would then be collected from the facility and transported off site to an approved commercial disposal facility. The perchlorate treatment plant would be monitored on a continuous 24-hour basis at the adjacent Rio Vista Intake Pump Station using a Supervisory Control and Data Acquisition (SCADA) program.

Facilities for Restoration of Service

The containment element of the Proposed Project would restore up to 43% of production from the Saugus-1 and Saugus-2 wells. The permanent closure of VWC's V-157 well (V-157), NCWD's well number 11 (NC 11), and the Stadium well operated by CLWA's Santa Clara Water Division has created a deficit in local groundwater production of 6,300 gpm capacity, or about 3,838 afy. The containment project would also convert several existing pipelines from treated water use for conveyance of perchlorate-contaminated water to the treatment plant.

To restore local well production to pre-contamination levels and to restore service affected by conversion of existing facilities to carry untreated water, CLWA proposes to relocate production wells to areas outside of the zone of perchlorate contamination and to construct new conveyance facilities to replace the existing treated water pipelines that will be converted to convey water from Saugus 1 and Saugus 2 to the new treatment plant. This involves two elements (Figures 5 and 6 [not included]).

First, to replace lost production east of the confluence of the Santa Clara River and the South Fork of the Santa Clara River from closure of the Stadium Well, CLWA would relocate the Stadium Well from its location adjacent to the Stadium along the south bank of the Santa Clara River to a location about 0.6 miles upstream from the Stadium site to an existing CLWA facility at Furnivall Avenue and Santa Clara Street and would construct a short (50-100 foot) pipeline from the well to an existing 8-inch distribution line.

Second, in addition to VWC's new 2,500 gpm well northwest of Magic Mountain Amusement Park (hereafter MMA Park), CLWA would:

- Construct a new multiple-well 4,000 gpm facility (with chloramination facilities) along a dirt road to the west of the MMA Park), with wells connected via a 12-inch pipeline;
- Construct a new 18-inch treated water pipeline from CLWA's 48-inch pipeline at the McBean Parkway Bridge to a site opposite from NC 11; and
- Construct a new 18-inch groundwater pipeline along new road alignments that would connect these new wells directly to CLWA's existing 42-inch pipeline.

Long-term planning for CLWA's water storage and conveyance facilities includes potential development of a regulating reservoir southwest of the two proposed new wells. The regulating reservoir and the pipelines, which may be developed to connect it to the Proposed Project, are shown on Figure 6 [not included] for informational purposes and because they are addressed in the cumulative impacts discussion in this Initial Study. However, this reservoir facility and the pipelines needed to connect it to the Proposed Project are not a part of the Proposed Project and the Proposed Project does not depend upon them.

The wells, 12-inch connecting pipeline, chloramination facility, and 12-inch to 18-inch pipeline would be constructed within the road alignments of future planned roads. CLWA facilities would be constructed following the initial grading for these roads and the adjacent development. In combination with yield from the Saugus-1 and Saugus-2 wells and associated treatment plant, these actions would restore production lost due to perchlorate contamination and would restore service to areas previously served by the NC-11, V-157, and Stadium wells. Siting and details of the proposed restoration-of-service facilities are summarized on Table E-2. Note that the planned reservoir is not a part of the Proposed Project.

Chloramination Facilities

Chloramination facilities would be constructed at two sites: (a) at the new perchlorate treatment facility and (b) at the new well field west of MMA Park. Chloramines are formed by mixing sodium hypochlorate and ammonia, which are produced or stored in separate areas prior to mixing into the water stream. Several types of facilities would be considered during final design. Regardless of facility type, these facilities would be fully contained, and storage of water treatment chemicals would be within double-walled containers with separate containment back-up systems capable of holding 1.5 times the capacity of each chemical tank.

Table E-2
Proposed Project facilities for Restoration of Service

FACILITY	SITE	DESCRIPTION (SEE FIGURES 5 AND 6 [Not Included])
To replace Stadium Well		
New alluvial well	Furnivall Ave. & Santa Clara St.	**New** 800 gpm well and up to 100 foot long pipeline to connect to existing 8" pipeline.
To replace pumping capacity from contaminated wells to restore local dry year water supplies		
Well field and chloramination facility	West of MMA Park	**New** wells with a combined capacity of 4,000 gpm to be constructed along the unpaved perimeter road on the west boundary of the MMA Park, with a chloramination facility located at the last well along the 12" to 18" pipeline connecting these wells.
Pipeline from new wells to Existing 42" CLWA	West Magic Mountain Parkway to I-5	**Segment 4: New** 18" pipeline from the chloramination facility to Magic Mountain Parkway and then east along Magic Mountain Parkway to the terminus of CLWA's 42" pipeline at I-5.
Pipeline to serve area west of McBean Parkway	McBean Parkway to NC-11	**Segment 5. New** 33" pipeline along bikeway on south levee of the South Fork of the Santa Clara River to Valencia Boulevard; **Segment 6. New** 39" pipeline along Valencia Blvd. and Magic Mountain Parkway with a turnout west of San Fernando Road. **Segment 7. New** 18" pipeline from the Segment 5 turnout to San Fernando Road; and **Segment 8. New** turnout, connection to the CLWA existing 21" pipeline along the west side of the South Fork of the Santa Clara River, and 18" pipeline from the turnout parallel to CLWA's existing 21" pipeline along an access road to a site opposite NC-11, connecting to existing turnouts.

Appendix F
Best Management Practices

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2003**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	yes
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	44418
b. Determine other system verifiable uses (AF)	0
c. Determine total supply into the system (AF)	44838
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.99
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	yes
4. Did your agency complete a full-scale audit during this report year?	no
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	no
6. Does your agency operate a system leak detection program?	yes
a. If yes, describe the leak detection program:	
monthly review of metered sales vs. supply	

B. Survey Data

1. Total number of miles of distribution system line.	26
2. Number of miles of distribution system line surveyed.	26

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	5000	6000
2. Actual Expenditures	5000	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2003**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

Agency provides a quarterly community newsletter to approx. 2,000 people/organizatioms/elected officials. Utilize paid advertising, public and media events and Agency conservation garden to promote water conservation in service area.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	yes	10
b. Public Service Announcement	yes	0
c. Bill Inserts / Newsletters / Brochures	yes	4
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	15
f. Special Events, Media Events	yes	10
g. Speaker's Bureau	yes	3
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	147102	100000
2. Actual Expenditures	144283	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

A2d. Retailers are billed based on usage and are shown last year's usage of Agency wholesale production. B1 and B2. After 2003, began new accounting system, also re-organized personnel.

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2003**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? yes

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd	yes	147	3033	0
Grades 4th-6th	yes	67	2421	0
Grades 7th-8th	yes	0	0	0
High School	yes	0	0	0

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program? 09/01/1995

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	114670	115000
2. Actual Expenditures	110979	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Have expanded program to include more workshops, career days and job fairs. PROBLEM: increased school district emphasis on testing has made entry into Grades 7-12 very difficult.

Reported as of 5/7/05

BMP 10: Wholesale Agency Assistance Programs

Reporting Unit: **Castaic Lake Water Agency**

BMP Form Status: **100% Complete**

Year: **2003**

A. Implementation

1. Financial Support by BMP

BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded	BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded
1	No	0	0	8	yes	165852	162161
2	yes	10000	10000	9	No		
3	No			10	yes	93659	72659
4	No			11	No		
5	No			12	yes	58000	58000
6	No			13	No		
7	yes	147102	144283	14	yes	20000	20000

2. Technical Support

a. Has your agency conducted or funded workshops addressing CUWCC procedures for calculating program savings, costs and cost-effectiveness?	yes
b. Has your agency conducted or funded workshops addressing retail agencies' BMP implementation reporting requirements?	yes
c. Has your agency conducted or funded workshops addressing:	
1) ULFT replacement	yes
2) Residential retrofits	yes
3) Commercial, industrial, and institutional surveys	No
4) Residential and large turf irrigation	No
5) Conservation-related rates and pricing	No

3. Staff Resources by BMP

BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP	BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP
1	yes	.5	8	yes	10
2	yes	.5	9	yes	.5
3	yes	1	10	yes	2
4	yes	.5	11	yes	.5
5	yes	2.5	12	yes	2
6	yes	.5	13	yes	.5
7	yes	3	14	yes	.5

4. Regional Programs by BMP

BMP	Implementation/ Management Program?	BMP	Implementation/ Management Program?
1	No	8	yes
2	yes	9	yes
3	No	10	yes
4	No	11	No
5	yes	12	yes
6	No	13	No
7	yes	14	yes

B. Wholesale Agency Assistance Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	494613	500000
2. Actual Expenditures	467103	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2003**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$6049713
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$3264000
2. Commercial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
3. Industrial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
4. Institutional / Government	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
5. Irrigation	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
6. Other	
a. Water Rate Structure	

b. Sewer Rate Structure

c. Total Revenue from Volumetric Rates $

d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources $

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2003**

A. Implementation

1. Does your Agency have a conservation coordinator? yes
2. Is this a full-time position? no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ? no
4. Partner agency's name:
5. If your agency supplies the conservation coordinator:
   - a. What percent is this conservation coordinator's position? 50%
   - b. Coordinator's Name Mary Lou Cotton
   - c. Coordinator's Title Water Resources Manager
   - d. Coordinator's Experience and Number of Years 11
   - e. Date Coordinator's position was created (mm/dd/yyyy) 02/15/2001
6. Number of conservation staff, including Conservation Coordinator. 3

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	68497	59000
2. Actual Expenditures	68497	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no
   - a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

One position filled for only part of calendar year.

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2004**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	yes
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	46669
b. Determine other system verifiable uses (AF)	0
c. Determine total supply into the system (AF)	47088
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.99
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	yes
4. Did your agency complete a full-scale audit during this report year?	no
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	no
6. Does your agency operate a system leak detection program?	yes
a. If yes, describe the leak detection program:	
monthly review of metered sales vs. supply	

B. Survey Data

1. Total number of miles of distribution system line.	26
2. Number of miles of distribution system line surveyed.	26

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	6000	6000
2. Actual Expenditures	6000	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2004**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

Agency provides a quarterly community newsletter to approx. 50,000 people/organizatioms/elected officials. Utilize paid advertising, public and media events and Agency conservation garden to promote water conservation in service area.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	yes	15
b. Public Service Announcement	yes	0
c. Bill Inserts / Newsletters / Brochures	yes	5
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	15
f. Special Events, Media Events	yes	3
g. Speaker's Bureau	yes	8
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	235163	200000
2. Actual Expenditures	241461	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

A2d. Retailers are billed based on usage and are shown last year's usage of Agency wholesale production. B1 and B2. Relects new accounting process and reorganization.

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2004**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? yes

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd	yes	54	1080	0
Grades 4th-6th	yes	21	732	0
Grades 7th-8th	yes	0	0	0
High School	yes	0	0	0

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program? 09/01/1995

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	207270	200000
2. Actual Expenditures	219362	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Continuing difficulty gaining entry into Grades 7-12. B1 and B2. Reflects additonal staff hired in 2004.

Reported as of 5/7/05

BMP 10: Wholesale Agency Assistance Programs

Reporting Unit: **Castaic Lake Water Agency**

BMP Form Status: **100% Complete**

Year: **2004**

A. Implementation

1. Financial Support by BMP

BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded	BMP	Financial Incentives Offered?	Budgeted Amount	Amount Awarded
1	No			8	yes	235163	241461
2	yes	20000	21000	9	No		
3	No			10	yes	88659	86621
4	No			11	No		
5	No			12	yes	58000	58000
6	No			13	No		
7	yes	207270	219362	14	yes	25000	25000

2. Technical Support

a. Has your agency conducted or funded workshops addressing CUWCC procedures for calculating program savings, costs and cost-effectiveness?	yes
b. Has your agency conducted or funded workshops addressing retail agencies' BMP implementation reporting requirements?	yes
c. Has your agency conducted or funded workshops addressing:	
1) ULFT replacement	yes
2) Residential retrofits	yes
3) Commercial, industrial, and institutional surveys	No
4) Residential and large turf irrigation	No
5) Conservation-related rates and pricing	No

3. Staff Resources by BMP

BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP	BMP	Qualified Staff Available for BMP?	No. FTE Staff Assigned to BMP
1	yes	.5	8	yes	10
2	yes	.5	9	yes	.5
3	yes	1	10	yes	2
4	yes	.5	11	yes	.5
5	yes	2.5	12	yes	2
6	yes	.5	13	yes	.5
7	yes	3	14	yes	.5

4. Regional Programs by BMP

BMP	Implementation/ Management Program?	BMP	Implementation/ Management Program?
1	No	8	yes
2	yes	9	yes
3	No	10	yes
4	No	11	No
5	yes	12	yes
6	No	13	No
7	yes	14	yes

B. Wholesale Agency Assistance Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	634092	650000
2. Actual Expenditures	651444	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

all budget numbers reflect new accounting process started in 2004.

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2004**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$8561300
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$0
2. Commercial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
3. Industrial	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
4. Institutional / Government	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
5. Irrigation	
a. Water Rate Structure	
b. Sewer Rate Structure	
c. Total Revenue from Volumetric Rates	$
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$
6. Other	
a. Water Rate Structure	

b. Sewer Rate Structure

c. Total Revenue from Volumetric Rates $

d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources $

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Castaic Lake Water Agency	**100% Complete**	**2004**

A. Implementation

1. Does your Agency have a conservation coordinator? yes
2. Is this a full-time position? no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ? no
4. Partner agency's name:
5. If your agency supplies the conservation coordinator:
   - a. What percent is this conservation coordinator's position? 50%
   - b. Coordinator's Name Mary Lou Cotton
   - c. Coordinator's Title Water Resources Manager
   - d. Coordinator's Experience and Number of Years 11
   - e. Date Coordinator's position was created (mm/dd/yyyy) 02/18/2001
6. Number of conservation staff, including Conservation Coordinator. 3

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	80503	80000
2. Actual Expenditures	80503	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no
   - a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

CUWCC

Best Management Practices Report Filing

Base Year Data

Reporting Unit: **Santa Clarita Water Division**	**Submitted to CUWCC** 04/19/2003

INSTRUCTIONS: This form MUST BE completed and submitted to the CUWCC prior to filing any BMP reports. The data provided on this form is used in determining coverage requirements for specific BMPs as indicated. If some of the data requested is not available, make reasonable estimates. You can update and edit values, if more precise information becomes available in the future.

For Customer Classification Definitions (i.e. Single Family, Multi-Family) click HERE.

	1. Your **BASE YEAR is 2001**. NOTE: Many calculations in determining credit history and coverage requirements are contingent on your BASE YEAR, which is calculated based on the following criteria. If a Signatory signed the MOU in 1997 or earlier, then the Base Year is 1997. If a Signatory signed the MOU after 1997, then the Base Year is the year the MOU was signed. The same holds true for USBR Contractors, except the date their Base Year is calculated from is the date that their Plan was noticed in the Federal Register.	
	BMP 1	
	2. Number of single-family customers in 2001	20802
	3. Number of multi-family units in 2001	1892
	BMPs 2 and 14	
	4. Number of single-family housing units constructed prior to 1992	14457
	5. Number of multi-family units prior to 1992	3401
	BMP 4	
	6. Number of unmetered accounts in 2001	0
	BMPs 5 and 9	
	7. Number of commercial accounts in 2001	582
	8. Number of industrial accounts in 2001	19
	9. Number of institutional accounts in 2001	89
	10. Total water use (AF) by commercial, industrial and institutional accounts in 2001	2850
	BMP 14	
	11. Average number of toilets per single-family household	2
	12. Average number of toilets per multi-family household	2
	13. Five-year average resale rate of single-family households	10.6

	14. Five-year average resale rate of multi-family households	19.1
	15. Average persons per single-family household	3.3
	16. Average persons per multi-family household	3.3

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Webmaster

Reported as of 5/7/05

Accounts & Water Use

Reporting Unit Name:
Santa Clarita Water Division

Submitted to CUWCC
02/15/2005

Year:
2003

A. Service Area Population Information:

1. Total service area population 82200

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	21754	16006	0	0
2. Multi-Family	4216	2594	0	0
3. Commercial	617	888	0	0
4. Industrial	19	135	0	0
5. Institutional	95	764	0	0
6. Dedicated Irrigation	731	4231	0	0
7. Recycled Water	0	0	0	0
8. Other	0	0	0	0
9. Unaccounted	NA	0	NA	0
Total	27432	24618	0	0
	Metered		**Unmetered**	

Reported as of 5/7/05

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Based on your signed MOU date, 02/07/2001, your Agency STRATEGY DUE DATE is:	02/07/2003
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	

B. Water Survey Data

Survey Counts:	Single Family Accounts	Multi-Family Units
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	no	no
a. If yes, in what form are surveys tracked?		None

b. Describe how your agency tracks this information.

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Waiting on BMP revision before beginning implementation.

Reported as of 5/7/05

BMP 02: Residential Plumbing Retrofit

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Is there an enforceable ordinance in effect in your service area requiring replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts? — no

   a. If YES, list local jurisdictions in your service area and code or ordinance in each:

2. Has your agency satisfied the 75% saturation requirement for single-family housing units? — no

3. Estimated percent of single-family households with low-flow showerheads: — %

4. Has your agency satisfied the 75% saturation requirement for multi-family housing units? — no

5. Estimated percent of multi-family households with low-flow showerheads: — %

6. If YES to 2 OR 4 above, please describe how saturation was determined, including the dates and results of any survey research.

B. Low-Flow Device Distribution Information

1. Has your agency developed a targeting/ marketing strategy for distributing low-flow devices? — yes

   a. If YES, when did your agency begin implementing this strategy? — 5/12/2002

   b. Describe your targeting/ marketing strategy.

   Newspaper ads, flyers and newsletter notifications of distrbution events.

Low-Flow Devices Distributed/ Installed	SF Accounts	MF Units
2. Number of low-flow showerheads distributed:	83	4
3. Number of toilet-displacement devices distributed:	0	0
4. Number of toilet flappers distributed:	0	0
5. Number of faucet aerators distributed:	25	15

6. Does your agency track the distribution and cost of low-flow devices? — yes

   a. If YES, in what format are low-flow devices tracked? — Manual Activity

   b. If yes, describe your tracking and distribution system :

   Keep records of which account addresses received low-flow devices.

C. Low-Flow Device Distribution Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0

2. Actual Expenditures 0

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

All funding provided by CLWA on behalf of retailers.

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	no
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	
b. Determine other system verifiable uses (AF)	
c. Determine total supply into the system (AF)	
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.00
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	no
4. Did your agency complete a full-scale audit during this report year?	no
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	no
6. Does your agency operate a system leak detection program?	yes
a. If yes, describe the leak detection program:	
Visual inpsections/response to customers.	

B. Survey Data

1. Total number of miles of distribution system line.	286
2. Number of miles of distribution system line surveyed.	0

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

Reported as of 5/7/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use?	yes
2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use?	no
a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed?	
b. Describe the program:	
3. Number of previously unmetered accounts fitted with meters during report year.	0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	no
a. If YES, when was the feasibility study conducted? (mm/dd/yy)	
b. Describe the feasibility study:	
2. Number of CII accounts with mixed-use meters.	700
3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.	0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

All connections are metered.

Reported as of 5/7/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	731
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	
b. Description of marketing / targeting strategy:	
2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	yes
4. Does your agency offer financial incentives to improve	no

landscape water use efficiency?

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded
a. Rebates			
b. Loans			
c. Grants			

5. Do you provide landscape water use efficiency information to new customers and customers changing services? yes

a. If YES, describe below:

Information and training provided by Castaic Lake WA

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? no

8. Do you provide customer notices at the end of the irrigation season? no

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

F. Comments

Reported as of 5/7/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? no

   a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

2. Does your agency offer rebates for high-efficiency washers? no
3. What is the level of the rebate? 0
4. Number of rebates awarded. 0

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? no

a. If YES, describe the program and how it's organized.

CLWA as wholesaler runs program for retailers. See CLWA form.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	no	
b. Public Service Announcement	no	
c. Bill Inserts / Newsletters / Brochures	no	
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	no	
f. Special Events, Media Events	no	
g. Speaker's Bureau	no	
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program provided by Castaic Lake WA.

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? no

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd				
Grades 4th-6th				
Grades 7th-8th				
High School				

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program?

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program provided by CLWA on behalf of retailers.

Reported as of 5/7/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option? no

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered			
b. Number of New Surveys Completed			
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)			
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)			

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	no	no	no
f. Evaluation of all water-using apparatus and processes	no	no	no
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	no	no	no

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water savings for the purpose of complying with BMP 9 under this option?	no
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Not implementing BMP.

Reported as of 5/7/05

BMP 09a: CII ULFT Water Savings

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

1. Did your agency implement a CII ULFT replacement program in the reporting year? If No, please explain why on Line B. 10. — No

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

2. How does your agency advertise this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.)

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency?

3. What is the total number of customer accounts participating in the program during the last year ?

CII Subsector	Number of Toilets Replaced			
4.	**Standard Gravity Tank**	**Air Assisted**	**Valve Floor Mount**	**Valve Wall Mount**
a. Offices				
b. Retail / Wholesale				
c. Hotels				
d. Health				
e. Industrial				
f. Schools: K to 12				
g. Eating				
h. Govern-ment				
i. Churches				
j. Other				

5. Program design.

6. Does your agency use outside services to implement this program?

a. If yes, check all that apply.

7. Participant tracking and follow-up.

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business

b. Inadequate payback

c. Inadequate ULFT performance

d. Lack of funding

e. American's with Disabilities Act

f. Permitting

g. Other. Please describe in B. 9.

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and budgeting?

Not implementing BMP.

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor	0	0
b. Materials	0	0
c. Marketing & Advertising	0	0
d. Administration & Overhead	0	0
e. Outside Services	0	0
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution	
b. State agency contribution	
c. Federal agency contribution	
d. Other contribution	
e. Total	0

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$6968914
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$2740750
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$337293
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$122163
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$51278
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$9310
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$290286
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$42691
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$1606562
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$215115
6. Other	
a. Water Rate Structure	Service Not Provided

b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$0
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$0

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

2003 revenues reflect new accounting process.

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

1. Does your Agency have a conservation coordinator?	no
2. Is this a full-time position?	no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	yes
4. Partner agency's name:	Castaic Lake WA
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	%
b. Coordinator's Name	
c. Coordinator's Title	
d. Coordinator's Experience and Number of Years	
e. Date Coordinator's position was created (mm/dd/yyyy)	
6. Number of conservation staff, including Conservation Coordinator.	0

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	no
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

D. Comments

Reported as of 5/7/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? — no

   a. If YES, describe the ordinance:

2. Is a copy of the most current ordinance(s) on file with CUWCC? — no

   a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

   a. Gutter flooding — no

   b. Single-pass cooling systems for new connections — no

   c. Non-recirculating systems in all new conveyor or car wash systems — yes

   d. Non-recirculating systems in all new commercial laundry systems — no

   e. Non-recirculating systems in all new decorative fountains — yes

   f. Other, please name — no

2. Describe measures that prohibit water uses listed above:

   Recirculating systems required in all car washes and fountains (city/san district ordinance).

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

   a. Allow the sale of more efficient, demand-initiated regenerating DIR models. — no

   b. Develop minimum appliance efficiency standards that:

      i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. — no

      ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. — no

   c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. — no

4. Does your agency include water softener checks in home water audit programs? — no

5. Does your agency include information about DIR and exchange-type water softeners in educational efforts to encourage replacement of less efficient timer models? no

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Agency supported San District water softener ban ordinance adopted in 2003.

Reported as of 5/7/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2003**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	yes

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	60	9
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**60**	**9**

6. Describe your agency's ULFT program for single-family residences.

publicly advertised rebate program

7. Describe your agency's ULFT program for multi-family residences.

publicly advertised rebate program

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

B. Residential ULFT Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	10000	20000
2. Actual Expenditures	10000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program run by CLWA on behalf of retailers

Reported as of 5/7/05

Accounts & Water Use

Reporting Unit Name:
Santa Clarita Water Division

Submitted to CUWCC
02/15/2005

Year:
2004

A. Service Area Population Information:

1. Total service area population 85300

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	22404	16922	0	0
2. Multi-Family	4351	2538	0	0
3. Commercial	627	917	0	0
4. Industrial	19	127	0	0
5. Institutional	97	790	0	0
6. Dedicated Irrigation	773	4828	0	0
7. Recycled Water	0	0	0	0
8. Other	0	0	0	0
9. Unaccounted	NA	0	NA	0
Total	28271	26122	0	0
	Metered		**Unmetered**	

Reported as of 5/7/05

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Based on your signed MOU date, 02/07/2001, your Agency STRATEGY DUE DATE is:	02/07/2003
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	

B. Water Survey Data

Survey Counts:	Single Family Accounts	Multi-Family Units
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	no	no
a. If yes, in what form are surveys tracked?		None

b. Describe how your agency tracks this information.

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Waiting on BMP revision before beginning implementation.

Reported as of 5/7/05

BMP 02: Residential Plumbing Retrofit

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Is there an enforceable ordinance in effect in your service area requiring replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts? no

   a. If YES, list local jurisdictions in your service area and code or ordinance in each:

2. Has your agency satisfied the 75% saturation requirement for single-family housing units? no

3. Estimated percent of single-family households with low-flow showerheads: %

4. Has your agency satisfied the 75% saturation requirement for multi-family housing units? no

5. Estimated percent of multi-family households with low-flow showerheads: %

6. If YES to 2 OR 4 above, please describe how saturation was determined, including the dates and results of any survey research.

B. Low-Flow Device Distribution Information

1. Has your agency developed a targeting/ marketing strategy for distributing low-flow devices? yes

   a. If YES, when did your agency begin implementing this strategy? 5/12/2002

   b. Describe your targeting/ marketing strategy.

   Newspaper ads, flyers and newsletter notifications of distrbution events.

Low-Flow Devices Distributed/ Installed	SF Accounts	MF Units
2. Number of low-flow showerheads distributed:	41	3
3. Number of toilet-displacement devices distributed:	0	0
4. Number of toilet flappers distributed:	0	0
5. Number of faucet aerators distributed:	25	10

6. Does your agency track the distribution and cost of low-flow devices? yes

   a. If YES, in what format are low-flow devices tracked? Manual Activity

   b. If yes, describe your tracking and distribution system :

   Keep records of which account addresses received low-flow devices.

C. Low-Flow Device Distribution Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0

2. Actual Expenditures 0

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

All funding provided by CLWA on behalf of retailers.

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	no
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	
b. Determine other system verifiable uses (AF)	
c. Determine total supply into the system (AF)	
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.00
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	no
4. Did your agency complete a full-scale audit during this report year?	no
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	no
6. Does your agency operate a system leak detection program?	yes
a. If yes, describe the leak detection program:	
Visual inpsections/response to customers.	

B. Survey Data

1. Total number of miles of distribution system line.	299
2. Number of miles of distribution system line surveyed.	0

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

Reported as of 5/7/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use?	yes
2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use?	no
a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed?	
b. Describe the program:	
3. Number of previously unmetered accounts fitted with meters during report year.	0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	no
a. If YES, when was the feasibility study conducted? (mm/dd/yy)	
b. Describe the feasibility study:	
2. Number of CII accounts with mixed-use meters.	715
3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.	0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

All connections are metered.

Reported as of 5/7/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	773
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	
b. Description of marketing / targeting strategy:	
2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	yes
4. Does your agency offer financial incentives to improve	no

landscape water use efficiency?

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded
a. Rebates			
b. Loans			
c. Grants			

5. Do you provide landscape water use efficiency information to new customers and customers changing services? yes

a. If YES, describe below:

Information and training provided by Castaic Lake WA

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? no

8. Do you provide customer notices at the end of the irrigation season? no

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

F. Comments

Reported as of 5/7/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? — no

   a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

2. Does your agency offer rebates for high-efficiency washers? — no
3. What is the level of the rebate? — 0
4. Number of rebates awarded. — 0

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — no

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? no

a. If YES, describe the program and how it's organized.

CLWA as wholesaler runs program for retailers. See CLWA form.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	no	
b. Public Service Announcement	no	
c. Bill Inserts / Newsletters / Brochures	no	
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	no	
f. Special Events, Media Events	no	
g. Speaker's Bureau	no	
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program provided by Castaic Lake WA.

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? no

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd				
Grades 4th-6th				
Grades 7th-8th				
High School				

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program?

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program provided by CLWA on behalf of retailers.

Reported as of 5/7/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option?	no

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered			
b. Number of New Surveys Completed			
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)			
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)			

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	no		no
f. Evaluation of all water-using apparatus and processes	no	no	no
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	no	no	no

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water savings for the purpose of complying with BMP 9 under this option?	no
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Not implementing BMP.

Reported as of 5/7/05

BMP 09a: CII ULFT Water Savings

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

1. Did your agency implement a CII ULFT replacement program in the reporting year? If No, please explain why on Line B. 10. — No

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

2. How does your agency advertise this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.)

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency?

3. What is the total number of customer accounts participating in the program during the last year ?

CII Subsector	Number of Toilets Replaced			
4.	**Standard Gravity Tank**	**Air Assisted**	**Valve Floor Mount**	**Valve Wall Mount**
a. Offices				
b. Retail / Wholesale				
c. Hotels				
d. Health				
e. Industrial				
f. Schools: K to 12				
g. Eating				
h. Govern-ment				
i. Churches				
j. Other				

5. Program design.

6. Does your agency use outside services to implement this program?

a. If yes, check all that apply.

7. Participant tracking and follow-up.

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business

b. Inadequate payback

c. Inadequate ULFT performance

d. Lack of funding

e. American's with Disabilities Act

f. Permitting

g. Other. Please describe in B. 9.

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and budgeting?

Not implementing BMP.

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor		
b. Materials		
c. Marketing & Advertising		
d. Administration & Overhead		
e. Outside Services		
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution	
b. State agency contribution	
c. Federal agency contribution	
d. Other contribution	
e. Total	0

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$8082631
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$3716432
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$374628
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$166423
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$52330
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$12265
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$339935
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$57314
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$2072553
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$299384
6. Other	
a. Water Rate Structure	Service Not Provided

b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$0
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$0

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

CII revenues are combined and shown in Commercial

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

1. Does your Agency have a conservation coordinator? no
2. Is this a full-time position? no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ? yes
4. Partner agency's name: Castaic Lake WA
5. If your agency supplies the conservation coordinator:
   - a. What percent is this conservation coordinator's position? %
   - b. Coordinator's Name
   - c. Coordinator's Title
   - d. Coordinator's Experience and Number of Years
   - e. Date Coordinator's position was created (mm/dd/yyyy)
6. Number of conservation staff, including Conservation Coordinator. 0

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no
   - a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? — no

   a. If YES, describe the ordinance:

2. Is a copy of the most current ordinance(s) on file with CUWCC? — no

   a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

   a. Gutter flooding — no

   b. Single-pass cooling systems for new connections — no

   c. Non-recirculating systems in all new conveyor or car wash systems — no

   d. Non-recirculating systems in all new commercial laundry systems — no

   e. Non-recirculating systems in all new decorative fountains — no

   f. Other, please name — no

2. Describe measures that prohibit water uses listed above:

   Recirculating systems required in all car washes and fountains (city/san district ordinance).

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

   a. Allow the sale of more efficient, demand-initiated regenerating DIR models. — no

   b. Develop minimum appliance efficiency standards that:

      i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. — no

      ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. — no

   c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. — no

4. Does your agency include water softener checks in home water audit programs? — no

5. Does your agency include information about DIR and exchange-type water softeners in educational efforts to encourage replacement of less efficient timer models? no

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Agency supported San District water softener ban ordinance adopted in 2003.

Reported as of 5/7/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Santa Clarita Water Division	**100% Complete**	**2004**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	yes

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	125	10
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**125**	**10**

6. Describe your agency's ULFT program for single-family residences.

publicly advertised rebate program

7. Describe your agency's ULFT program for multi-family residences.

publicly advertised rebate program

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

B. Residential ULFT Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	20000	20000
2. Actual Expenditures	20000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program run by CLWA on behalf of retailers

CUWCC

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Memorandum of Understanding

Base Year Data

Reporting Unit: **Valencia Water Company**	**Submitted to CUWCC** 04/19/2003

INSTRUCTIONS: This form MUST BE completed and submitted to the CUWCC prior to filing any BMP reports. The data provided on this form is used in determining coverage requirements for specific BMPs as indicated. If some of the data requested is not available, make reasonable estimates. You can update and edit values, if more precise information becomes available in the future.

For Customer Classification Definitions (i.e. Single Family, Multi-Family) click HERE.

	1. Your **BASE YEAR is 2001.** NOTE: Many calculations in determining credit history and coverage requirements are contingent on your BASE YEAR, which is calculated based on the following criteria. If a Signatory signed the MOU in 1997 or earlier, then the Base Year is 1997. If a Signatory signed the MOU after 1997, then the Base Year is the year the MOU was signed. The same holds true for USBR Contractors, except the date their Base Year is calculated from is the date that their Plan was noticed in the Federal Register.	
	BMP 1	
	2. Number of single-family customers in 2001	19565
	3. Number of multi-family units in 2001	219
	BMPs 2 and 14	
	4. Number of single-family housing units constructed prior to 1992	12871
	5. Number of multi-family units prior to 1992	152
	BMP 4	
	6. Number of unmetered accounts in 2001	0
	BMPs 5 and 9	
	7. Number of commercial accounts in 2001	567
	8. Number of industrial accounts in 2001	901
	9. Number of institutional accounts in 2001	52
	10. Total water use (AF) by commercial, industrial and institutional accounts in 2001	6650
	BMP 14	
	11. Average number of toilets per single-family household	2
	12. Average number of toilets per multi-family household	2
	13. Five-year average resale rate of single-family households	8.6

	14. Five-year average resale rate of multi-family households	8.9
	15. Average persons per single-family household	3.3
	16. Average persons per multi-family household	3.3

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Webmaster

Reported as of 5/7/05

Accounts & Water Use

Reporting Unit Name:
Valencia Water Company

Submitted to CUWCC
02/15/2005

Year:
2003

A. Service Area Population Information:

1. Total service area population 89000

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	23365	14191	0	0
2. Multi-Family	277	1186	0	0
3. Commercial	854	5110	0	0
4. Industrial	441	1825	0	0
5. Institutional	59	1101	0	0
6. Dedicated Irrigation	400	2952	0	0
7. Recycled Water	1	96	0	0
8. Other	0	0	0	0
9. Unaccounted	NA	0	NA	0
Total	25397	26461	0	0
	Metered		**Unmetered**	

Reported as of 5/7/05

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Based on your signed MOU date, 02/07/2001, your Agency STRATEGY DUE DATE is:	02/07/2003
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	

B. Water Survey Data

Survey Counts:	**Single Family Accounts**	**Multi-Family Units**
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	no	no
a. If yes, in what form are surveys tracked?		None

b. Describe how your agency tracks this information.

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

waiting on BMP revision

Reported as of 5/7/05

BMP 02: Residential Plumbing Retrofit

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Is there an enforceable ordinance in effect in your service area requiring replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts? — no

   a. If YES, list local jurisdictions in your service area and code or ordinance in each:

2. Has your agency satisfied the 75% saturation requirement for single-family housing units? — no

3. Estimated percent of single-family households with low-flow showerheads: — %

4. Has your agency satisfied the 75% saturation requirement for multi-family housing units? — no

5. Estimated percent of multi-family households with low-flow showerheads: — %

6. If YES to 2 OR 4 above, please describe how saturation was determined, including the dates and results of any survey research.

B. Low-Flow Device Distribution Information

1. Has your agency developed a targeting/ marketing strategy for distributing low-flow devices? — yes

   a. If YES, when did your agency begin implementing this strategy? — 5/12/2002

   b. Describe your targeting/ marketing strategy.

   Distribution at public events, paid advertising.

Low-Flow Devices Distributed/ Installed	SF Accounts	MF Units
2. Number of low-flow showerheads distributed:	25	6
3. Number of toilet-displacement devices distributed:	0	0
4. Number of toilet flappers distributed:	0	0
5. Number of faucet aerators distributed:	30	5

6. Does your agency track the distribution and cost of low-flow devices? — yes

   a. If YES, in what format are low-flow devices tracked? — Database

   b. If yes, describe your tracking and distribution system :

   Names and address of recipient.

C. Low-Flow Device Distribution Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0

2. Actual Expenditures 0

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

CLWA provides program and funding on behalf of retailers.

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	no
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	
b. Determine other system verifiable uses (AF)	
c. Determine total supply into the system (AF)	
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.00
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	yes
4. Did your agency complete a full-scale audit during this report year?	yes
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	yes
6. Does your agency operate a system leak detection program?	no
a. If yes, describe the leak detection program:	

B. Survey Data

1. Total number of miles of distribution system line.	310
2. Number of miles of distribution system line surveyed.	310

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	yes
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	
see 2002 explanation	

E. Comments

Reported as of 5/7/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use?	yes
2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use?	no
a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed?	
b. Describe the program:	
3. Number of previously unmetered accounts fitted with meters during report year.	0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	no
a. If YES, when was the feasibility study conducted? (mm/dd/yy)	
b. Describe the feasibility study:	
2. Number of CII accounts with mixed-use meters.	0
3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.	0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

All connections are metered.

Reported as of 5/7/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit: **Valencia Water Company**

BMP Form Status: **100% Complete**

Year: **2003**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	400
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	
b. Description of marketing / targeting strategy:	
2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	yes
4. Does your agency offer financial incentives to improve	no

landscape water use efficiency?

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded
a. Rebates	0	0	0
b. Loans	0	0	0
c. Grants	0	0	0

5. Do you provide landscape water use efficiency information to new customers and customers changing services? No

a. If YES, describe below:

CLWA provides training and information on behalf of retailers

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? no

8. Do you provide customer notices at the end of the irrigation season? no

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

F. Comments

Reported as of 5/7/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? — no

    a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

2. Does your agency offer rebates for high-efficiency washers? — no

3. What is the level of the rebate?

4. Number of rebates awarded.

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — no

    a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

Newlsetters, bill inserts, website, coordination with wholesaler.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	yes	3
b. Public Service Announcement	no	
c. Bill Inserts / Newsletters / Brochures	yes	4
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	2
f. Special Events, Media Events	yes	3
g. Speaker's Bureau	no	
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Coordinate public outreach with CLWA programs/part of CLWA budget

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? no

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd				
Grades 4th-6th				
Grades 7th-8th				
High School				

3. Did your Agency's materials meet state education framework requirements? no

4. When did your Agency begin implementing this program?

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program is run by CLWA on behalf of retailers

Reported as of 5/7/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option? yes

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered	16	4	4
b. Number of New Surveys Completed	12	2	4
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)	0	0	0
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)	0	0	0

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	yes	yes	yes
f. Evaluation of all water-using apparatus and processes	yes	yes	yes
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	yes	yes	yes

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water savings for the purpose of complying with BMP 9 under this option?	no
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	0
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	0

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	40000	45000
2. Actual Expenditures	40000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Operating a pilot survey program while waiting on BMP revision.

Reported as of 5/7/05

BMP 09a: CII ULFT Water Savings

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

1. Did your agency implement a CII ULFT replacement program in the reporting year? No

If No, please explain why on Line B. 10.

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program?
Check all that apply.

a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

2. How does your agency advertise this program? Check all that apply.

a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.)

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency?

3. What is the total number of customer accounts participating in the program during the last year ?

CII Subsector	Number of Toilets Replaced			
4.	**Standard Gravity Tank**	**Air Assisted**	**Valve Floor Mount**	**Valve Wall Mount**
a. Offices				
b. Retail / Wholesale				
c. Hotels				
d. Health				
e. Industrial				
f. Schools: K to 12				
g. Eating				
h. Govern-ment				
i. Churches				
j. Other				

5. Program design.

6. Does your agency use outside services to implement this program?

a. If yes, check all that apply.

7. Participant tracking and follow-up.

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business

b. Inadequate payback

c. Inadequate ULFT performance

d. Lack of funding

e. American's with Disabilities Act

f. Permitting

g. Other. Please describe in B. 9.

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and budgeting?

ULFTs are part of a pilot CII survey program. Seemed well-accepted by those entities that accepted surveys

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor		
b. Materials		
c. Marketing & Advertising		
d. Administration & Overhead		
e. Outside Services		
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution

b. State agency contribution

c. Federal agency contribution

d. Other contribution

e. Total	0

D. Comments

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$5886000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$3181000
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$1984000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$468000
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$708000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$262000
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$426000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$426000
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$1152000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$238000
6. Other	
a. Water Rate Structure	Uniform

b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$33000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$1000

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

"Other" is recycled water service initiated in 2003.

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

1. Does your Agency have a conservation coordinator?	no
2. Is this a full-time position?	no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	yes
4. Partner agency's name:	Castaic Lake WA
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	%
b. Coordinator's Name	
c. Coordinator's Title	
d. Coordinator's Experience and Number of Years	
e. Date Coordinator's position was created (mm/dd/yyyy)	
6. Number of conservation staff, including Conservation Coordinator.	2

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	no
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

D. Comments

Reported as of 5/7/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? — no

   a. If YES, describe the ordinance:

2. Is a copy of the most current ordinance(s) on file with CUWCC? — no

   a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

   a. Gutter flooding — no

   b. Single-pass cooling systems for new connections — no

   c. Non-recirculating systems in all new conveyor or car wash systems — yes

   d. Non-recirculating systems in all new commercial laundry systems — no

   e. Non-recirculating systems in all new decorative fountains — yes

   f. Other, please name — no

2. Describe measures that prohibit water uses listed above:

   Local planning rules.

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

   a. Allow the sale of more efficient, demand-initiated regenerating DIR models. — yes

   b. Develop minimum appliance efficiency standards that:

      i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. — yes

      ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. — yes

   c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. — yes

4. Does your agency include water softener checks in home water audit programs? — no

5. Does your agency include information about DIR and exchange-

type water softeners in educational efforts to encourage replacement of less efficient timer models? no

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Reported as of 5/7/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2003**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	yes

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	40	7
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**40**	**7**

6. Describe your agency's ULFT program for single-family residences.

publicly-advertised rebate program

7. Describe your agency's ULFT program for multi-family residences.

publicly-advertised rebate program

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

B. Residential ULFT Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	10000	20000
2. Actual Expenditures	10000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program run by CLWA on behalf of retailers

Reported as of 5/7/05

Water Supply & Reuse

Reporting Unit:

Year:
2004

Water Supply Source Information

Supply Source Name	Quantity (AF) Supplied	Supply Type

Total AF:

Reported as of 5/7/05

Accounts & Water Use

Reporting Unit Name:
Valencia Water Company

Submitted to CUWCC
02/15/2005

Year:
2004

A. Service Area Population Information:

1. Total service area population 93000

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	24297	15522	0	0
2. Multi-Family	293	1288	0	0
3. Commercial	928	5827	0	0
4. Industrial	442	1957	0	0
5. Institutional	63	928	0	0
6. Dedicated Irrigation	405	3193	0	0
7. Recycled Water	8	420	0	0
8. Other	0	0	0	0
9. Unaccounted	NA	0	NA	0
Total	26436	29135	0	0
	Metered		**Unmetered**	

Reported as of 5/7/05

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Based on your signed MOU date, 02/07/2001, your Agency STRATEGY DUE DATE is:	02/07/2003
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	

B. Water Survey Data

Survey Counts:	**Single Family Accounts**	**Multi-Family Units**
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	no	no
a. If yes, in what form are surveys tracked?		None

b. Describe how your agency tracks this information.

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

waiting on BMP revision

Reported as of 5/7/05

BMP 02: Residential Plumbing Retrofit

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Is there an enforceable ordinance in effect in your service area requiring replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts? — no

   a. If YES, list local jurisdictions in your service area and code or ordinance in each:

2. Has your agency satisfied the 75% saturation requirement for single-family housing units? — no

3. Estimated percent of single-family households with low-flow showerheads: — %

4. Has your agency satisfied the 75% saturation requirement for multi-family housing units? — no

5. Estimated percent of multi-family households with low-flow showerheads: — %

6. If YES to 2 OR 4 above, please describe how saturation was determined, including the dates and results of any survey research.

B. Low-Flow Device Distribution Information

1. Has your agency developed a targeting/ marketing strategy for distributing low-flow devices? — yes

   a. If YES, when did your agency begin implementing this strategy? — 5/12/2002

   b. Describe your targeting/ marketing strategy.

   Distribution at public events, paid advertising.

Low-Flow Devices Distributed/ Installed	SF Accounts	MF Units
2. Number of low-flow showerheads distributed:	20	5
3. Number of toilet-displacement devices distributed:	0	0
4. Number of toilet flappers distributed:	0	0
5. Number of faucet aerators distributed:	25	5

6. Does your agency track the distribution and cost of low-flow devices? — yes

   a. If YES, in what format are low-flow devices tracked? — Database

   b. If yes, describe your tracking and distribution system :

   Names and address of recipient.

C. Low-Flow Device Distribution Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0

2. Actual Expenditures 0

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

CLWA provides program and funding on behalf of retailers.

Reported as of 5/7/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year?	no
2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:	
a. Determine metered sales (AF)	
b. Determine other system verifiable uses (AF)	
c. Determine total supply into the system (AF)	
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.00
3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production?	yes
4. Did your agency complete a full-scale audit during this report year?	yes
5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit?	yes
6. Does your agency operate a system leak detection program?	no
a. If yes, describe the leak detection program:	

B. Survey Data

1. Total number of miles of distribution system line.	323
2. Number of miles of distribution system line surveyed.	323

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	yes
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	
see 2002 explanation	

E. Comments

Reported as of 5/7/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use?	yes
2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use?	no
a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed?	
b. Describe the program:	
3. Number of previously unmetered accounts fitted with meters during report year.	0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters?	no
a. If YES, when was the feasibility study conducted? (mm/dd/yy)	
b. Describe the feasibility study:	
2. Number of CII accounts with mixed-use meters.	0
3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period.	0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	No
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

E. Comments

Reported as of 5/7/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit: **Valencia Water Company**

BMP Form Status: **100% Complete**

Year: **2004**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	1119
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	
b. Description of marketing / targeting strategy:	
2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	yes
4. Does your agency offer financial incentives to improve	no

landscape water use efficiency?

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded
a. Rebates	0	0	0
b. Loans	0	0	0
c. Grants	0	0	0

5. Do you provide landscape water use efficiency information to new customers and customers changing services? No

a. If YES, describe below:

CLWA provides training on behalf of retailers

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? no

8. Do you provide customer notices at the end of the irrigation season? no

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

F. Comments

Reported as of 5/7/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? — no

    a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

2. Does your agency offer rebates for high-efficiency washers? — no

3. What is the level of the rebate?

4. Number of rebates awarded.

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — no

    a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Reported as of 5/7/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

Newlsetters, bill inserts, website, coordination with wholesaler.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	yes	3
b. Public Service Announcement	no	
c. Bill Inserts / Newsletters / Brochures	yes	4
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	2
f. Special Events, Media Events	yes	3
g. Speaker's Bureau	no	
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Coordinate public outreach with CLWA programs/part of CLWA budget

Reported as of 5/7/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? no

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd				
Grades 4th-6th				
Grades 7th-8th				
High School				

3. Did your Agency's materials meet state education framework requirements? no

4. When did your Agency begin implementing this program?

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program is run by CLWA on behalf of retailers

Reported as of 5/7/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option? yes

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered	7	3	0
b. Number of New Surveys Completed	7	3	0
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)	0	0	0
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)	0	0	0

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	yes	yes	yes
f. Evaluation of all water-using apparatus and processes	yes	yes	yes
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	yes	yes	yes

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water savings for the purpose of complying with BMP 9 under this option?	no
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	0
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	0

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	40000	40000
2. Actual Expenditures	45000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Operating a pilot survey prorgam while waiting on BMP revision.

Reported as of 5/7/05

BMP 09a: CII ULFT Water Savings

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

1. Did your agency implement a CII ULFT replacement program in the reporting year? If No, please explain why on Line B. 10. — No

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

2. How does your agency advertise this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.)

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency?

3. What is the total number of customer accounts participating in the program during the last year ?

CII Subsector	Number of Toilets Replaced			
4.	Standard Gravity Tank	Air Assisted	Valve Floor Mount	Valve Wall Mount
a. Offices				
b. Retail / Wholesale				
c. Hotels				
d. Health				
e. Industrial				
f. Schools: K to 12				
g. Eating				
h. Govern-ment				
i. Churches				
j. Other				

5. Program design.

6. Does your agency use outside services to implement this program?

a. If yes, check all that apply.

7. Participant tracking and follow-up.

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business

b. Inadequate payback

c. Inadequate ULFT performance

d. Lack of funding

e. American's with Disabilities Act

f. Permitting

g. Other. Please describe in B. 9.

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and budgeting?

ULFTs are part of a pilot CII survey program. Seemed well-accepted by those entities that accepted surveys

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor		
b. Materials		
c. Marketing & Advertising		
d. Administration & Overhead		
e. Outside Services		
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution

b. State agency contribution

c. Federal agency contribution

d. Other contribution

e. Total	0

D. Comments

Reported as of 5/7/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$6504000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$3190000
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$2420000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$489000
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$813000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$245000
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$385000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$58000
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$1331000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$231000
6. Other	
a. Water Rate Structure	Service Not Provided

b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$143000
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$7000

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

"Other" is recycled water

Reported as of 5/7/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

1. Does your Agency have a conservation coordinator?	no
2. Is this a full-time position?	no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	yes
4. Partner agency's name:	Castaic Lake WA
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	%
b. Coordinator's Name	
c. Coordinator's Title	
d. Coordinator's Experience and Number of Years	
e. Date Coordinator's position was created (mm/dd/yyyy)	
6. Number of conservation staff, including Conservation Coordinator.	2

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP?	no
a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."	

D. Comments

Reported as of 5/7/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? — no

   a. If YES, describe the ordinance:

2. Is a copy of the most current ordinance(s) on file with CUWCC? — no

   a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

   a. Gutter flooding — no

   b. Single-pass cooling systems for new connections — no

   c. Non-recirculating systems in all new conveyor or car wash systems — yes

   d. Non-recirculating systems in all new commercial laundry systems — no

   e. Non-recirculating systems in all new decorative fountains — yes

   f. Other, please name — no

2. Describe measures that prohibit water uses listed above:

   Local planning rules.

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

   a. Allow the sale of more efficient, demand-initiated regenerating DIR models. — yes

   b. Develop minimum appliance efficiency standards that:

      i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. — yes

      ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. — yes

   c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. — yes

4. Does your agency include water softener checks in home water audit programs? — no

5. Does your agency include information about DIR and exchange-

type water softeners in educational efforts to encourage replacement of less efficient timer models? no

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

E. Comments

Reported as of 5/7/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Valencia Water Company	**100% Complete**	**2004**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	yes

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	90	4
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**90**	**4**

6. Describe your agency's ULFT program for single-family residences.

publicly-advertised rebate program

7. Describe your agency's ULFT program for multi-family residences.

publicly-advertised rebate program

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

B. Residential ULFT Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	20000	20000
2. Actual Expenditures	20000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

Program run by CLWA on behalf of retailers

CUWCC

Best Management Practices Report Filing

Base Year Data

Reporting Unit: **Newhall County Water District**	**Submitted to CUWCC** 08/21/2003

INSTRUCTIONS: This form MUST BE completed and submitted to the CUWCC prior to filing any BMP reports. The data provided on this form is used in determining coverage requirements for specific BMPs as indicated. If some of the data requested is not available, make reasonable estimates. You can update and edit values, if more precise information becomes available in the future.

For Customer Classification Definitions (i.e. Single Family, Multi-Family) click HERE.

	1. Your **BASE YEAR is 2002.** NOTE: Many calculations in determining credit history and coverage requirements are contingent on your BASE YEAR, which is calculated based on the following criteria. If a Signatory signed the MOU in 1997 or earlier, then the Base Year is 1997. If a Signatory signed the MOU after 1997, then the Base Year is the year the MOU was signed. The same holds true for USBR Contractors, except the date their Base Year is calculated from is the date that their Plan was noticed in the Federal Register.	
	BMP 1	
	2. Number of single-family customers in 2002	6662
	3. Number of multi-family units in 2002	4812
	BMPs 2 and 14	
	4. Number of single-family housing units constructed prior to 1992	5522
	5. Number of multi-family units prior to 1992	4756
	BMP 4	
	6. Number of unmetered accounts in 2002	0
	BMPs 5 and 9	
	7. Number of commercial accounts in 2002	323
	8. Number of industrial accounts in 2002	8
	9. Number of institutional accounts in 2002	71
	10. Total water use (AF) by commercial, industrial and institutional accounts in 2002	2289.66
	BMP 14	
	11. Average number of toilets per single-family household	2.5
	12. Average number of toilets per multi-family household	1.2
	13. Five-year average resale rate of single-family households	4.46

	14. Five-year average resale rate of multi-family households	9.02
	15. Average persons per single-family household	3.35
	16. Average persons per multi-family household	2.51

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Accounts & Water Use

Reporting Unit Name:	Submitted to	Year:
Newhall County Water District	CUWCC **11/30/2004**	**2003**

A. Service Area Population Information:

1. Total service area population 32000

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	6807	5687	0	0
2. Multi-Family	384	1803	0	0
3. Commercial	267	562	0	0
4. Industrial	7	76	0	0
5. Institutional	64	632	0	0
6. Dedicated Irrigation	70	945	0	0
7. Recycled Water	0	0	0	0
8. Other	72	130.4	0	0
9. Unaccounted	NA	21.55	NA	12.48
Total	7671	9856.95	0	12.48
	Metered		**Unmetered**	

Accounts & Water Use

Reporting Unit Name:	Submitted to	Year:
Newhall County Water District	CUWCC **11/30/2004**	**2004**

A. Service Area Population Information:

1. Total service area population 35000

B. Number of Accounts and Water Deliveries (AF)

Type	Metered		Unmetered	
	No. of Accounts	Water Deliveries (AF)	No. of Accounts	Water Deliveries (AF)
1. Single-Family	7544	6054	0	0
2. Multi-Family	367	1682	0	0
3. Commercial	283	524	0	0
4. Industrial	7	116	0	0
5. Institutional	63	613	0	0
6. Dedicated Irrigation	77	1457	0	0
7. Recycled Water	0	0	0	0
8. Other	81	54	0	0
9. Unaccounted	NA	6.62	NA	826.23
Total	8422	10506.62	0	826.23
	Metered		**Unmetered**	

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Based on your signed MOU date, 03/05/2002, your Agency STRATEGY DUE DATE is:	03/04/2004
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	N/A
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	N/A

B. Water Survey Data

Survey Counts:	Single Family Accounts	Multi-Family Units
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	no	no
a. If yes, in what form are surveys tracked?		None

b. Describe how your agency tracks this information.

NCWD did not have a residential survey program from 7/2002 - 6/2003. However, in Fiscal Year 2002/2003 NCWD updated their database system

to Inhance which allowed for customer service to more easily identify and log customers based on their class code. Single-family and multi-family customers were classified in separate classes and homeowner association accounts, neighborhood recreation facilities, and other common irrigated areas were coded as landscape for future BMP 5 programs. The Inhance system also allowed NCWD to electronically sort residential customers by parcel groupings or books. From the listed books/groups, Customer Service was able to calculate the estimated number of single and multi-family dwelling units built before 1992. This data information can then be used for the development and marketing BMP 2 (Residential Plumbing Retrofit) and 14 (ULFT Rebate Program).

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

NCWD signed the MOU in 3/2002 and therefore was not required to implement a Residential Water Use Survey Program until 7/2003 which is the start of the 2004 reporting period. Although a residential water use survey program was not implemented in FY 2002/03, NCWD offered residential customers informative material and guidebooks to help them identify water waste or inefficiency and how they could conserve. All new residential customers were given Conservation Packets with information on water conservation for indoor and outdoor residential water usage. These packets included irrigation and gardening guidebooks (Sunset Magazine), 55 Quick Tips, recommendations to identify and prevent leaks, how to complete a self audit of your home, and other useful pamphlets and material.

Reported as of 5/18/05

BMP 01: Water Survey Programs for Single-Family and Multi-Family Residential Customers

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Based on your signed MOU date, 03/05/2002, your Agency STRATEGY DUE DATE is:	03/04/2004
2. Has your agency developed and implemented a targeting/ marketing strategy for SINGLE-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	N/A
3. Has your agency developed and implemented a targeting/ marketing strategy for MULTI-FAMILY residential water use surveys?	no
a. If YES, when was it implemented?	N/A

B. Water Survey Data

Survey Counts:	Single Family Accounts	Multi-Family Units
1. Number of surveys offered:	0	0
2. Number of surveys completed:	0	0
Indoor Survey:		
3. Check for leaks, including toilets, faucets and meter checks	no	no
4. Check showerhead flow rates, aerator flow rates, and offer to replace or recommend replacement, if necessary	no	no
5. Check toilet flow rates and offer to install or recommend installation of displacement device or direct customer to ULFT replacement program, as neccesary; replace leaking toilet flapper, as necessary	no	no
Outdoor Survey:		
6. Check irrigation system and timers	no	no
7. Review or develop customer irrigation schedule	no	no
8. Measure landscaped area (Recommended but not required for surveys)	no	no
9. Measure total irrigable area (Recommended but not required for surveys)	no	no
10. Which measurement method is typically used (Recommended but not required for surveys)		None
11. Were customers provided with information packets that included evaluation results and water savings recommendations?	no	no
12. Have the number of surveys offered and completed, survey results, and survey costs been tracked?	yes	yes
a. If yes, in what form are surveys tracked?		database

b. Describe how your agency tracks this information.

A tracking system for monitoring participation in BMP 1 and other programs was created in NCWD's Inhance database in 2002/03 which is

connected to the customer service and billing database. In 2003/04, NCWDÌs Customer Service staff began connecting the BMP data to the district's GIS mapping software. With the GIS, NCWD is able to map out pre and post 1992 residential accounts so that the district could have additional information such as lot size, topographic conditions and other issues essential to identify ideal customers for a residential survey program. Furthermore, a new detailed BMP data section was added to the Inhance system to log customer participation in each of the BMP programs including residential surveys. Combining the new BMP data section and the GIS capabilities, NCWD was able to determine trends in customer behavior/participation so that BMP 1 and other programs can be better marketed and implemented. Specific data and information related to BMP 1 is also tracked in an excel database.

C. Water Survey Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

NCWD filed a late exemption in November 2004 for the District's first year (2003/04 reporting period) for implementing BMP 1. NCWD did not have the staff or budgeted funds to implement a residential survey program. NCWD has begun development of a pilot survey program in late FY 2003/04 to evaluate the effectiveness (resulting water savings and cost savings achieved) of a district managed residential survey program. The pilot survey program is expected to begin in 2005. After the completion of 30-50 surveys and post-survey monitoring and assessments, NCWD will determine the most cost-effective method for reducing residential water usage out of the listed options below: 1. In-house (staff operated and maintained) survey program. 2. Outsourced (to outside consulting firm) large scale residential survey program. 3. Valley-wide survey program (with other local retailers and CLWA assistance). 4. Discontinuation of any and all residential survey programs. Although a residential water use survey program was not implemented in FY 2003/04, NCWD continued to offer residential customers informative material and guidebooks to help them identify water waste or inefficiency and how they could conserve. All new residential customers were given Conservation Packets with information on water conservation for indoor and outdoor residential water usage. These packets included irrigation and gardening guidebooks (Sunset Magazine), 55 Quick Tips, recommendations to identify and prevent leaks, how to complete a self audit of your home, and other useful pamphlets and material.

Reported as of 5/18/05

BMP 02: Residential Plumbing Retrofit

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Is there an enforceable ordinance in effect in your service area requiring replacement of high-flow showerheads and other water use fixtures with their low-flow counterparts? no

   a. If YES, list local jurisdictions in your service area and code or ordinance in each:

   The City of Santa Clarita requires the replacement of high flow plumbing fixtures and devices in high stage drought conditions only. No other local ordinance or code requiring installation or retrofit of low flow plumbing devices (for residential customers) is in place for NCWDís service area in the Santa Clarita Valley. NCWD is creating a Water Use Efficiency Ordinance (effective 12/2004) with listed recommendations to be water efficient including the installation of low flow plumbing devices. NCWD is considering requiring that customers/residents follow these recommendations during a DWR declared drought.

2. Has your agency satisfied the 75% saturation requirement for single-family housing units? no

3. Estimated percent of single-family households with low-flow showerheads: 1.3%

4. Has your agency satisfied the 75% saturation requirement for multi-family housing units? no

5. Estimated percent of multi-family households with low-flow showerheads: .15%

6. If YES to 2 OR 4 above, please describe how saturation was determined, including the dates and results of any survey research.

   N/A

B. Low-Flow Device Distribution Information

1. Has your agency developed a targeting/ marketing strategy for distributing low-flow devices? yes

   a. If YES, when did your agency begin implementing this strategy? 01/01/2003

   b. Describe your targeting/ marketing strategy.

   Showerheads and aerators were provided by the wholesaler (CLWA) to give out to customers at local events (i.e. Open House, River Rally, Emergency Expo). The program was mainly marketed by CLWA; however NCWD advertised the program in the quarterly newsletter and at the front office desk. In 2003/04 NCWD expanded the BMP 2 program to also include all pre-1992 multi-family homes in addition to the (pre-1992) single-family homes. This includes several mobile home parks and small apartment buildings built prior to 1992. Customers were allocated up to 4 devices per household unless they could prove additional low flow devices were necessary.

Low-Flow Devices Distributed/ Installed	SF Accounts	MF Units
2. Number of low-flow showerheads distributed:	21	4
3. Number of toilet-displacement devices distributed:	0	0
4. Number of toilet flappers distributed:	0	0
5. Number of faucet aerators distributed:	29	27

6. Does your agency track the distribution and cost of low-flow devices? yes

a. If YES, in what format are low-flow devices tracked? Database

b. If yes, describe your tracking and distribution system :

In 2003/04 NCWD staff added data box in the customer service and billing database (Inhance) in order to accurately track customer participation. BMP participation was categorized by program and tracked based on the status or level of a customer's participation as follows: 1. Call or email of interest 2. Received Application Form (for rebate programs) 3. Participated in designated BMP program (example: received showerhead) 4. Customer on waiting list 5. Post program follow up completed For BMP 2, each low flow device (i.e. showerheads, faucet aerators and garden hose spray nozzles) was tracked as well. Using the database, NCWD was able to map the distribution of participation throughout the four service areas and easily identify patterns and trends. For example, participation in BMP 2 was clumped in neighborhoods most likely due to communication between neighbors regarding the programs.

C. Low-Flow Device Distribution Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	2228.4	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

In June of 2/004, NCWD offered the free devices to both single and multi-family customers to increase distribution and meet the requirements of BMP 2. NCWD also started providing the low flow devices to customers at the district's front office rather than strictly at public events. The estimated expenditures are for approximately 60 hours of staff time invested at $37.14/hour. Staff hours includes the time necessary to created the tracking database and maps, coordinating with CLWA, assisting customers, stocking front office inventory, and logging customer participation.

Reported as of 5/18/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year? yes

2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:

   a. Determine metered sales (AF) 9840.96

   b. Determine other system verifiable uses (AF) 0

   c. Determine total supply into the system (AF) 9869.43

   d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required. 1.00

3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production? yes

4. Did your agency complete a full-scale audit during this report year? no

5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit? no

6. Does your agency operate a system leak detection program? no

   a. If yes, describe the leak detection program:

   Although NCWD does not have a proactive leak detection program, the district monitors key data to quickly identify leaks and other necessary repairs in the distribution system. Monthly records of total water purchased from CLWA and water supply obtained through district wells (groundwater), as well as the total water sales and other verifiable usage for all 4 service areas is logged. The percent water loss is tracked to determine potential leaks or system misreads throughout the 4 service areas. The total (annual) water loss for the entire district averages around 7.5 to 9.0 percent.

B. Survey Data

1. Total number of miles of distribution system line. 134.93

2. Number of miles of distribution system line surveyed. 0

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	500000	382.343
2. Actual Expenditures	567444.49	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

   N/A

E. Comments

The listed budget and expenditures [Section C (1,2)] include all maintenance, leak and general repairs, upgrades and replacement of the distribution system in the four service areas. NCWD investigates

potential leaks and system damages as needed and monitors the collected data to detect major leaks and other irregularities in the system. The investigation of system leaks is classified under system maintenance in the 2002-03 Budget. A detailed breakdown of the budget and expenditures for Leak Detection, Repair and Distribution System Maintenance is attached (submitted separately to CUWCC).

Reported as of 5/18/05

BMP 03: System Water Audits, Leak Detection and Repair

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Has your agency completed a pre-screening system audit for this reporting year? — no

2. If YES, enter the values (AF/Year) used to calculate verifiable use as a percent of total production:

a. Determine metered sales (AF)	10507.16
b. Determine other system verifiable uses (AF)	-4.04
c. Determine total supply into the system (AF)	11332.85
d. Using the numbers above, if (Metered Sales + Other Verifiable Uses) / Total Supply is < 0.9 then a full-scale system audit is required.	0.93

3. Does your agency keep necessary data on file to verify the values used to calculate verifiable uses as a percent of total production? — yes

4. Did your agency complete a full-scale audit during this report year? — yes

5. Does your agency maintain in-house records of audit results or the completed AWWA audit worksheets for the completed audit? — no

6. Does your agency operate a system leak detection program? — no

a. If yes, describe the leak detection program:

Refer to 2002-03 Submission

B. Survey Data

1. Total number of miles of distribution system line.	147.41
2. Number of miles of distribution system line surveyed.	0

C. System Audit / Leak Detection Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	382343	500000
2. Actual Expenditures	358475.08	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

The listed budget and expenditures [Section C (1,2)] include all maintenance, leak and general repairs, upgrades and replacement of the distribution system in the four service areas. NCWD investigates potential leaks and system damages as needed and monitors the collected data to detect major leaks and other irregularities in the system. The investigation of system leaks is classified under system maintenance in the 2002-03 Budget. A detailed breakdown of the budget and expenditures for Leak Detection, Repair and Distribution System Maintenance is attached (submitted separately to CUWCC).

Reported as of 5/18/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use? yes

2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use? no

   a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed? Always Metered

   b. Describe the program:

   All existing accounts are metered and have been for several years. All new connections are required to install the appropriate size meter and type (i.e. CII mixed or dedication irrigation meter) as determined necessary by the district's engineering department and approved by management.

3. Number of previously unmetered accounts fitted with meters during report year. 0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? no

   a. If YES, when was the feasibility study conducted? (mm/dd/yy) N/A

   b. Describe the feasibility study:

   N/A - NCWD has an "at least as effective" district policy to assess the benefits of installing a dedicated irrigation meter on a case by case basis [see Section D(b)].

2. Number of CII accounts with mixed-use meters. 341

3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period. 0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? yes

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

   NCWD meets the requirements under BMP 4 Sections A(a), C, and D as described in the BMP. A dedicated irrigation meter retrofit program [Section A(b)] and a feasibility study [Section a(c)] on the merits of an incentive program to switch mixed meters to dedicated landscape (irrigation) meters has not been completed. These two requirements have been meet through NCWD*s new water service connection policies and procedures. Currently, dedicated irrigation meters have been installed in all appropriate CII properties within the district and therefore there are no retrofit opportunities available. Like all CII and other meters, the dedicated irrigation meters are

billed based on monthly usage. The irrigation meters are also separately billed from a property*s main meter with a separate monthly service fee (based on the size of the meter), energy and water availability fees, and other standard monthly charges. Instead of a feasibility study to determine the potential merits of an incentive program, NCWD requires developers to install dedicated irrigation meters when appropriate (as determined by the district). NCWD evaluates the cost/benefits of installing a dedicated irrigation meter during a new projects* (or customer*s) water service application and installation process. The engineering staff work with the developer/customer to determine if a dedicated irrigation meter is necessary and will benefit the customer and the district to help conserve water. If the NCWD*s engineering department determines a dedicated irrigation meter is necessary, the developer/customer is required to install the separate meter and incur any related installation costs. As a result of these policies, NCWD has a significant number of dedicated irrigation meters in the CII sectors that will allow the district to better audit these accounts and establish water budgets (for BMP 5 requirements) to reduce district water usage.

E. Comments

NCWD has met the requirements stated under BMP 4 requiring meters for all existing and new customers. Furthermore, dedicated irrigation meters are installed at the time of initial service connection (when appropriate) to reduce water usage and minimize costs to the district and the customer. NCWD will assist any property owners in retrofitting their property with a dedicated irrigation meter if there is an increase in the landscape area(s) or other circumstance to constitute the need for a separate landscape/irrigation meter. However, NCWD does not offer any incentive for customers to retrofit and the associated installation costs are the responsibility of the customers.

Reported as of 5/18/05

BMP 04: Metering with Commodity Rates for all New Connections and Retrofit of Existing

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Does your agency require meters for all new connections and bill by volume-of-use? — yes

2. Does your agency have a program for retrofitting existing unmetered connections and bill by volume-of-use? — no

   a. If YES, when was the plan to retrofit and bill by volume-of-use existing unmetered connections completed? — N/A

   b. Describe the program:

   All existing accounts are metered and have been for several years. All new connections are required to install the appropriate size meter and type (i.e. CII mixed, residential, dedication irrigation meter, etc.) as determined necessary by the district's engineering department.

3. Number of previously unmetered accounts fitted with meters during report year. — 0

B. Feasibility Study

1. Has your agency conducted a feasibility study to assess the merits of a program to provide incentives to switch mixed-use accounts to dedicated landscape meters? — no

   a. If YES, when was the feasibility study conducted? (mm/dd/yy) — N/ A

   b. Describe the feasibility study:

   N/A

2. Number of CII accounts with mixed-use meters. — 358

3. Number of CII accounts with mixed-use meters retrofitted with dedicated irrigation meters during reporting period. — 0

C. Meter Retrofit Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — yes

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

   N/A ñ NCWD has an "at least as effective" district policy to assess the benefits of installing a dedicated irrigation meter on a case by case basis [see Section D(a) 2002-03 submission].

E. Comments

NCWD continues to meet the requirements under BMP 4 Sections A(a), C, D as described in the BMP, as well as Section A(b) (retrofit program) and Section A(c) (feasibility study) under the district*s úat least as effectiveî program in place. These two requirements are met through NCWD*s new water service connection policies and procedures. The incentives of installing a dedicated irrigation meter are evaluated during the initial service application process for each individual service application.

Dedicated irrigation meters are installed in all appropriate CII properties during the initial service connection to minimize retrofit costs to the district and the customer (refer to BMP 4 2002-03 Comment submission).

Reported as of 5/18/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	118
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	N/A
b. Description of marketing / targeting strategy:	

N/A

2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	

N/A

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	no
4. Does your agency offer financial incentives to improve landscape water use efficiency?	no

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded

a. Rebates	0	0	0
b. Loans	0	0	0
c. Grants	0	0	0

5. Do you provide landscape water use efficiency information to new customers and customers changing services? yes

a. If YES, describe below:

NCWD offers basic landscape design manuals (published by AWWA) to help customers incorporate native and drought tolerant plants with consideration to the unique conditions found in the Santa Clarita Valley. Information on efficient gardening is also provided to children in the Culver and AWWA published coloring and activity books provided to customers at events and the NCWD office. The local water wholesaler (CLWA) also provides NCWD and the other local retailers with several sources and opportunities for all customers to learn more about water efficient landscape irrigation. Residents and businesses in the valley have access to an extensive list of plants and key information on planting and maintaining the recommended species on CLWAls website. CLWA also offers training courses to all Santa Clarita Valley residents (including NCWD customers), gardeners and business owners on creating and maintaining a water efficient landscape. Classes include organic gardening, drip irrigation, native and drought tolerant plants, among other classes available. NCWD further promotes water efficient landscape design and irrigation through newsletter articles, local newspaper articles and through the districtls Ordinance 101 (Water Conservation) that lists recommended watering hours and outdoor (and indoor) water wasting activities.

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? yes

8. Do you provide customer notices at the end of the irrigation season? yes

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

F. Comments

There are no listed expenditures for BMP 5 for 2002/03 since any costs for landscape /irrigation educational material and guidebooks were included in expenditures for BMP 7 (Public Information Programs). Estimated expenditures specifically for educational material on water efficient landscape/irrigation are approximately $400 ordered from AWWA. Staff hours and miscellaneous costs are also calculated under BMP 7. NCWD signed the MOU in 3/2002 and therefore was not

required to implement a Landscape Survey Program until 7/2004 which is the start of the 2005 reporting period.

Reported as of 5/18/05

BMP 05: Large Landscape Conservation Programs and Incentives

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Water Use Budgets

1. Number of Dedicated Irrigation Meter Accounts:	133
2. Number of Dedicated Irrigation Meter Accounts with Water Budgets:	0
3. Budgeted Use for Irrigation Meter Accounts with Water Budgets (AF):	0
4. Actual Use for Irrigation Meter Accounts with Water Budgets (AF):	0
5. Does your agency provide water use notices to accounts with budgets each billing cycle?	no

B. Landscape Surveys

1. Has your agency developed a marketing / targeting strategy for landscape surveys?	no
a. If YES, when did your agency begin implementing this strategy?	N/A
b. Description of marketing / targeting strategy:	
N/A	
2. Number of Surveys Offered.	0
3. Number of Surveys Completed.	0
4. Indicate which of the following Landscape Elements are part of your survey:	
a. Irrigation System Check	no
b. Distribution Uniformity Analysis	no
c. Review / Develop Irrigation Schedules	no
d. Measure Landscape Area	no
e. Measure Total Irrigable Area	no
f. Provide Customer Report / Information	no
5. Do you track survey offers and results?	no
6. Does your agency provide follow-up surveys for previously completed surveys?	no
a. If YES, describe below:	
N/A	

C. Other BMP 5 Actions

1. An agency can provide mixed-use accounts with ETo-based landscape budgets in lieu of a large landscape survey program. Does your agency provide mixed-use accounts with landscape budgets?	no
2. Number of CII mixed-use accounts with landscape budgets.	0
3. Do you offer landscape irrigation training?	yes
4. Does your agency offer financial incentives to improve landscape water use efficiency?	no

Type of Financial Incentive:	Budget (Dollars/ Year)	Number Awarded to Customers	Total Amount Awarded

a. Rebates	0	0	0
b. Loans	0	0	0
c. Grants	0	0	0

5. Do you provide landscape water use efficiency information to new customers and customers changing services? yes

a. If YES, describe below:

In 2003/04 NCWD expanded its library of water conservation information and resources to include more landscape and irrigation guidebooks, references and other helpful material for customers. The District provided the Sunset Magazine series to all new homeowners and made them available to customers attending public events and to customers at the NCWD office. The Sunset magazine series included; ìSmart Water & Energy Use in the West,î ìHow to Water Your Garden,î and ìWater-Wise Gardening for California.î NCWD also offers basic landscape design manuals (published by AWWA) to help customers incorporate native and drought tolerant plants with consideration to the unique conditions found in the Santa Clarita Valley. Information on efficient gardening is also provided to children in the Culver and AWWA published coloring and activity books provided to customers at events and the NCWD office. The local wholesaler (CLWA) continues to provide a list of native and drought tolerant vegetation on their website and offer various courses on water efficient landscape design and irrigation. The resources provided by CLWA are available to all NCWD customers and other residents of the Santa Clarita Valley. NCWD will continue to expand its efforts to promote water efficient landscape and irrigation practices throughout the district. At the end of 2003/04, The Engineering and Conservation Department began applying customer data to the districtís GIS mapping system to start gathering necessary information and data to establish water budgets. The information will also help the district in identify ideal candidates for landscape surveys and/or water budgets based on their lot size, location, topographic features and water usage history.

6. Do you have irrigated landscaping at your facilities? yes

a. If yes, is it water-efficient? yes

b. If yes, does it have dedicated irrigation metering? yes

7. Do you provide customer notices at the start of the irrigation season? yes

8. Do you provide customer notices at the end of the irrigation season? yes

D. Landscape Conservation Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

E. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

F. Comments

There are no listed expenditures for BMP 5 for 2002/03 since any costs for landscape /irrigation educational material and guidebooks was included in expenditures for BMP 7 (Public Information Programs). Estimated expenditures specifically for educational material on water

efficient landscape/irrigation are $2,343.30 for the 3 Sunset Magazine guidebooks, and approximately $1,500 to $2,000 for various education materials from AWWA and the Culver Company. Staff hours and miscellaneous costs are also calculated under BMP 7. NCWD is investigating installing a CIMIS weather station for district customers to use to obtain accurate (local) ET values to improve the efficiency of their irrigation systems. The district will be increasing its efforts to promote water efficient irrigation and will be developing a landscape survey program targeting top water using meters (per square foot landscape area). NCWD filed a late exemption in November 2004 for the District's second reporting period (2005/06) for implementing BMP 5. The exemption was filed since NCWD currently does not have the staff or budgeted funds to implement a landscape survey program, however the district will actively seek funding sources for such a program.

Reported as of 5/18/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? — no

   a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

   NCWD did not offer a rebate program in 2002-03. Los Angeles County Sanitation Districts 32 & 26 (LACSD) and Southern California Edison did not offer any type of rebate for water efficient clothes washers.

2. Does your agency offer rebates for high-efficiency washers? — no
3. What is the level of the rebate? — 0
4. Number of rebates awarded. — 0

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — no

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

   N/A

D. Comments

N/A

Reported as of 5/18/05

BMP 06: High-Efficiency Washing Machine Rebate Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Do any energy service providers or waste water utilities in your service area offer rebates for high-efficiency washers? — no

   a. If YES, describe the offerings and incentives as well as who the energy/waste water utility provider is.

   Los Angeles County Sanitation Districts or LACSD, (specifically 32 & 26) offer a cost reduction of 20%, 40% or 60% for customers that reduce their wastewater (sewer) discharge by 20% or more. The reduction is calculated based on a 12 month comparison of water usage as shown on the customer's water bill (from NCWD). If they reduced their bill 20%, they receive a 20% reduction on their fees. Customers must reduce their water usage (and thus discharge) by at least 20% in order to qualify for the financial incentives. Installing a water efficient clothes washer could generate 20% water savings and therefore qualify the customer for a reduction. However, neither LACSD nor Southern California Edison offers a rebate specifically for high efficiency clothes washers. Thus, at this time NCWD is not offering a complementing rebate to customers.

2. Does your agency offer rebates for high-efficiency washers? — no
3. What is the level of the rebate? — 0
4. Number of rebates awarded. — 0

B. Rebate Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? — no

   a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

   N/A

D. Comments

NCWD currently does not have the staff or funds to implement a water efficient clothes washer rebate program. NCWD will reassess the cost-effectiveness of such a program as funding sources change and/or Southern California Edison or LACSD implement a specific clothes washer rebate program.

Reported as of 5/18/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

NCWD has a comprehensive public outreach and education program to promote water conservation and water use efficiency. The district efforts are designed to target the various classes of customers including (single & multi-family) residential, CII and large landscape. For several years the district has been releasing a quarterly newsletter to the entire customer base to inform customers on district upgrades and additions to improve the water quality and service, recognition of employee excellence, and education on new district policies and programs. Most importantly, the newsletter includes a "Water Awareness" section that provides customers with useful tips and recommendations to be water efficient and to reduce water waste. The newsletters also include a seasonal article describing how to increase water efficiency such as how to set your summer irrigation schedule or how to protect pipes from freezing temperatures in the winter. In addition to the newsletter, NCWD includes a bill notice (or by-line) with important reminders and water conservation tips. For example, the bill notice in May 2003 reminded customers to change out their old toilets and receive a ULFT rebate voucher from the district. NCWD also includes bill stuffers in the customer*s monthly water bill several times a year to promote conservation programs and/or to provide general information on conservation. NCWD participates in 4 major community events (River Rally, CLWA Open House, Emergency Expo and The Street Fair) to further reach out to the customers and the general public. At these events and at the district office, customers can obtain pamphlets, guidebooks, conservation promo items and children*s coloring and activities books on water conservation, and other informative material. NCWD maintains an extensive inventory of information resource material on conservation, leak detection, water safety, district operations, water quality (annual reports), and more. In FY 2002-03 NCWD expanded its website to include a úWater Conservationî section which includes easy tips for conserving water. NCWD continues to expand all areas of public outreach and education

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	no	0
b. Public Service Announcement	no	0
c. Bill Inserts / Newsletters / Brochures	yes	5
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	1
f. Special Events, Media Events	yes	4
g. Speaker's Bureau	no	
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	14930.85	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

In 2002/03 the BMP 7 (Public Information Programs) budget was not separately defined and therefore only actual expenditures are provided. Expenditures were taken from a general account that is used for various uses including public outreach and education, employee supplies and uniforms, and other marketing uses. The expenditures were calculated based on the development and production (printing, mailing, etc.) costs associated with the PR material and events, as well as the employee time expended. Various levels of staff participated in public outreach efforts including management, customer service, accounting, and technical field staff. Therefore, an average hourly employee rate of $37.14 was used which includes auxiliary costs such as insurance, worker*s compensation, taxes and other fees. With a total of 7,715 meter accounts and an estimated population of 28,000, NCWD expended $1.94 per meter account or $0.53 per person.

Reported as of 5/18/05

BMP 07: Public Information Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Does your agency maintain an active public information program to promote and educate customers about water conservation? yes

a. If YES, describe the program and how it's organized.

NCWD continued to maintain a comprehensive public outreach and education program to promote water conservation and water use efficiency in FY 2003/04. In 2003/04 NCWD identified that irrigation constituted a significant portion of the districtÌs water usage and therefore added new information material to educate and promote water efficient irrigation (to residential customers). The District provided the Sunset Magazine series to all new homeowners and made them available to customers attending public events and to customers at the NCWD office. The Sunset magazine series included; ÌSmart Water & Energy Use in the West,Ó ÌHow to Water Your Garden,Ó and ÌWater-Wise Gardening for California.Ó NCWD continued to release a quarterly newsletter to the entire customer base to inform customers on district upgrades and additions to improve the water quality and service, recognition of employee excellence, education on new district policies and programs and water conservation. The newsletters also continued to include seasonal articles describing how to increase water efficiency for indoor and outdoor water usage. In May of 2003, NCWD included a bill notice (or by-line) in the customerÌs monthly water bill to remind customers to change out their old toilets and receive a ULFT rebate voucher from the district. A separate postcard was also sent to advertise the valley wide Residential ULFT Rebate Program sponsored and organized by the local wholesaler (CLWA). The district works with the wholesaler and the other local water retailers in the Santa Clarita Valley to promote water efficiency and conservation through various PR campaigns, advertising and newspaper articles. Since the annual city Street Fair was not held September 2003, NCWD only participated in 3 major community events (River Rally, CLWA Open House, and the Emergency Expo) to further reach out to the customers and the general public. At these events and at the district office, customers can obtain pamphlets, guidebooks, conservation promo items and childrenÌs coloring and activities books on water conservation, and other informative material. NCWD maintains an extensive inventory of information resource material on conservation, leak detection, water safety, district operations, water quality (annual reports), and more. NCWD continued to expand the ÌWater ConservationÓ section of the district website adding new easy tips for conserving water and links to useful information sites.

2. Indicate which and how many of the following activities are included in your public information program.

Public Information Program Activity	Yes/No	Number of Events
a. Paid Advertising	no	0
b. Public Service Announcement	no	0
c. Bill Inserts / Newsletters / Brochures	yes	6
d. Bill showing water usage in comparison to previous year's usage	yes	
e. Demonstration Gardens	yes	1
f. Special Events, Media Events	yes	3

g. Speaker's Bureau	no	0
h. Program to coordinate with other government agencies, industry and public interest groups and media	yes	

B. Conservation Information Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	10000
2. Actual Expenditures	25692.01	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

In mid 2003/04 a separate BMP budget account was created to better record expenses related to the BMP programs. Therefore, the expenditures for BMP 7 in 2003/04 are recorded under two separate accounts in the districtÌs budget and expenditures report. Most of the recorded BMP expenses were for BMP 7 (Public Information Programs) such as design and printing costs, educational and promotional item purchases and other related costs. The expenditures were calculated based on the development and production (printing, mailing, etc.) costs associated with the PR material and events, as well as the employee time expended. Various levels of staff participated in public outreach efforts including management, customer service, accounting, and technical field staff. Therefore, an average hourly employee rate of $37.14 was used which includes auxiliary costs such as insurance, workerÌs compensation, taxes and other fees. With a total of 8,531 meter accounts and an estimated population of 32,000, NCWD expended $3.01 per meter account or $0.80 per person.

Reported as of 5/18/05

BMP 08: School Education Programs

Reporting Unit:
Newhall County Water District

BMP Form Status:
100% Complete

Year:
2003

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? yes

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd	yes	47	1410	0
Grades 4th-6th	yes	23	700	0
Grades 7th-8th	yes	0	0	0
High School	yes	0	0	0

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program? 01/01/1993

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

The education program is provided entirely by our wholesaler (CLWA) on our behalf since 1993 for K-6 and 7-12, however the program has been unsuccessful at reach students and teachers in grades 7-12. Students travel to CLWA for their workshops and presentations which include a tour of CLWA's drought tolerant and native vegetation garden and classes how water science, conservation and composting. The actual number of workshops held was not provided to NCWD, therefore an estimated value is provided in this report. The estimated number of presentations was based on the total number of participating students assuming 30 students per workshop or presentation. Currently, CLWA does not offer curriculum workshops teachers on water conservation and related topics.

Reported as of 5/18/05

BMP 08: School Education Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1.Has your agency implemented a school information program to promote water conservation? yes

2. Please provide information on your school programs (by grade level):

Grade	Are grade-appropriate materials distributed?	No. of class presentations	No. of students reached	No. of teachers' workshops
Grades K-3rd	yes	29	844	0
Grades 4th-6th	yes	22	650	0
Grades 7th-8th	yes	0	0	0
High School	yes	0	0	0

3. Did your Agency's materials meet state education framework requirements? yes

4. When did your Agency begin implementing this program? 01/01/1993

B. School Education Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

CLWA continues to organize and implement a school education program on our behalf of NCWD and the other water retailers in the Santa Clarita Valley since 1993 for K-6. In 2003-04, grades and 7-12 students and teachers did not participate. CLWA is working on developing a program in 2005 specifically targeted at grades 7-12. The actual number of workshops held was not provided to NCWD for 2003-04, therefore an estimated value is provided in this report. The estimated number of presentations was based on the total number of participating students assuming 30 students per workshop or presentation. Currently, CLWA does not offer curriculum workshops teachers on water conservation and related topics.

Reported as of 5/18/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option? no

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered	0	0	0
b. Number of New Surveys Completed	0	0	0
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)	0	0	0
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)	0	0	0

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	no	no	no
f. Evaluation of all water-using apparatus and processes	no	no	no
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	no	no	no

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water no

savings for the purpose of complying with BMP 9 under this option?	
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	0
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	0

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

Based on NCWD signatory date of the MOU, the district does not need to implement a CII conservation program until FY 2004-05. NCWD's Customer Service staff began preparations for a CII program in 2002-03 by sorting accounts by the BMP class codes such as commercial, industrial, large landscape, etc. The class codes were applied to the Inhance (customer service and billing database) System to use for future CII programs.

Reported as of 5/18/05

BMP 09: Conservation Programs for CII Accounts

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Has your agency identified and ranked COMMERCIAL customers according to use?	yes
2. Has your agency identified and ranked INDUSTRIAL customers according to use?	yes
3. Has your agency identified and ranked INSTITUTIONAL customers according to use?	yes

Option A: CII Water Use Survey and Customer Incentives Program

4. Is your agency operating a CII water use survey and customer incentives program for the purpose of complying with BMP 9 under this option? no

CII Surveys	Commercial Accounts	Industrial Accounts	Institutional Accounts
a. Number of New Surveys Offered	0	0	0
b. Number of New Surveys Completed	0	0	0
c. Number of Site Follow-ups of Previous Surveys (within 1 yr)	0	0	0
d. Number of Phone Follow-ups of Previous Surveys (within 1 yr)	0	0	0

CII Survey Components	Commercial Accounts	Industrial Accounts	Institutional Accounts
e. Site Visit	no	no	no
f. Evaluation of all water-using apparatus and processes	no	no	no
g. Customer report identifying recommended efficiency measures, paybacks and agency incentives	no	no	no

Agency CII Customer Incentives	Budget ($/Year)	No. Awarded to Customers	Total $ Amount Awarded
h. Rebates	0	0	0
i. Loans	0	0	0
j. Grants	0	0	0
k. Others	0	0	0

Option B: CII Conservation Program Targets

5. Does your agency track CII program interventions and water no

savings for the purpose of complying with BMP 9 under this option?	
6. Does your agency document and maintain records on how savings were realized and the method of calculation for estimated savings?	no
7. Estimated annual savings (AF/yr) from site-verified actions taken by agency since 1991.	0
8. Estimated annual savings (AF/yr) from non-site-verified actions taken by agency since 1991.	0

B. Conservation Program Expenditures for CII Accounts

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

NCWD did not have a CII Survey program in 2003-04 as the MOU was signed in March 2002. During 2003-04, NCWD began gather necessary data and information to implement a CII Survey or conservation program for the next reporting period (2005-06) as scheduled.

Reported as of 5/18/05

BMP 09a: CII ULFT Water Savings

Reporting Unit: **Newhall County Water District** | BMP Form Status: **100% Complete** | Year: **2003**

1. Did your agency implement a CII ULFT replacement program in the reporting year? If No, please explain why on Line B. 10. — No

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program? Check all that apply.

Consumption ranking
Potential savings
Oldest meter

a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

NCWD did not implement a CII ULFT program during the 2003-04 reporting period, however a program is in potential development (as part of a CII survey program) for the 2004-05 that will identify target customers based on the facilities water usage (consumption) volume, water savings potential and if the site has plumbing fixtures installed or replaced prior to January 1992.

2. How does your agency advertise this program? Check all that apply.

Direct letter
Bill insert
Bill message
Newsletter
Telephone
Web page
Radio PSAs
Newspapers
Trade publications
Other print media
Trade shows and events
Telemarketing

a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

All BMP programs are advertised in our district newsletter, through newspaper articles, our website, customer calls, bill inserts and other applicable and other cost effective means. Although a CII toilet rebate program was not implemented in 2003-04 reporting period, the above marked advertising efforts were included for the residential ULFT rebate program (5/2003 & 5/2004).

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.) — Yes

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency? — Yes

3. What is the total number of customer accounts participating in the program during the last year ? — 0

CII Subsector	Number of Toilets Replaced			
4.	Standard	Air	Valve Floor	Valve Wall

	Gravity Tank	Assisted	Mount	Mount
a. Offices	0	0	0	0
b. Retail / Wholesale	0	0	0	0
c. Hotels	0	0	0	0
d. Health	0	0	0	0
e. Industrial	0	0	0	0
f. Schools: K to 12	0	0	0	0
g. Eating	0	0	0	0
h. Govern-ment	0	0	0	0
i. Churches	0	0	0	0
j. Other	0	0	0	0

5. Program design.

Rebate or voucher
Direct installation
Direct installation with customer co-payment
Direct distribution
Direct distribution with customer co-payment
Retrofit on resale

6. Does your agency use outside services to implement this program? Yes

a. If yes, check all that apply.

Community Based Organization
Plumbing contractors/subcontracts

7. Participant tracking and follow-up.

Letter
Telephone

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business	4
b. Inadequate payback	5
c. Inadequate ULFT performance	2
d. Lack of funding	4
e. American's with Disabilities Act	1
f. Permitting	2
g. Other. Please describe in B. 9.	3

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

Although a specific program has not been implemented, several CII customers have been informally surveyed during customer service phone calls and at public events. regarding participation in district programs. From the provided customer input, the above rankings were determined for reasons for not participating in conservation and rebate programs.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and

budgeting?

N/A - CII ULFT Retrofit program was not implemented in NCWD.

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor	0	0
b. Materials	0	0
c. Marketing & Advertising	0	0
d. Administration & Overhead	0	0
e. Outside Services	0	0
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution	0
b. State agency contribution	0
c. Federal agency contribution	0
d. Other contribution	0
e. Total	0

D. Comments

N/A - CII ULFT Retrofit program was not implemented in NCWD.

Reported as of 5/18/05

BMP 09a: CII ULFT Water Savings

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

1. Did your agency implement a CII ULFT replacement program in the reporting year? If No, please explain why on Line B. 10. — No

A. Targeting and Marketing

1. What basis does your agency use to target customers for participation in this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

   N/A

2. How does your agency advertise this program? Check all that apply.

   a. Describe which method you found to be the most effective overall, and which was the most effective per dollar expended.

   N/A

B. Implementation

1. Does your agency keep and maintain customer participant information? (Read the Help information for a complete list of all the information for this BMP.)

2. Would your agency be willing to share this information if the CUWCC did a study to evaluate the program on behalf of your agency? — Yes

3. What is the total number of customer accounts participating in the program during the last year ? — 0

CII Subsector	Number of Toilets Replaced			
4.	Standard Gravity Tank	Air Assisted	Valve Floor Mount	Valve Wall Mount
a. Offices	0	0	0	0
b. Retail / Wholesale	0	0	0	0
c. Hotels	0	0	0	0
d. Health	0	0	0	0
e. Industrial	0	0	0	0
f. Schools: K to 12	0	0	0	0
g. Eating	0	0	0	0
h. Govern-ment	0	0	0	0
i. Churches	0	0	0	0
j. Other	0	0	0	0

5. Program design.

6. Does your agency use outside services to implement this program? — No

a. If yes, check all that apply.

7. Participant tracking and follow-up.

8. Based on your program experience, please rank on a scale of 1 to 5, with 1 being the least frequent cause and 5 being the most frequent cause, the following reasons why customers refused to participate in the program.

a. Disruption to business	4
b. Inadequate payback	5
c. Inadequate ULFT performance	2
d. Lack of funding	4
e. American's with Disabilities Act	1
f. Permitting	2
g. Other. Please describe in B. 9.	3

9. Please describe general program acceptance/resistance by customers, obstacles to implementation, and other isues affecting program implementation or effectiveness.

N/A - NCWD did not implement a CII ULFT Rebate program in 2003/04. Refer to BMP 9(a) 2002/03 regarding general acceptance/resistance by customers for all BMP and other conservation programs within in NCWD.

10. Please provide a general assessment of the program for this reporting year. Did your program achieve its objectives? Were your targeting and marketing approaches effective? Were program costs in line with expectations and budgeting?

N/A

C. Conservation Program Expenditures for CII ULFT

1. CII ULFT Program: Annual Budget & Expenditure Data

	Budgeted	Actual Expenditure
a. Labor	0	0
b. Materials	0	0
c. Marketing & Advertising	0	0
d. Administration & Overhead	0	0
e. Outside Services	0	0
f. Total	0	0

2. CII ULFT Program: Annual Cost Sharing

a. Wholesale agency contribution	0
b. State agency contribution	0
c. Federal agency contribution	0
d. Other contribution	0
e. Total	0

D. Comments

A CII ULFT Rebate Program was not implemented in 2003/04. The district is reviewing the cost-effectiveness of incorporating a ULFT Rebate program with the CII Survey project.

Reported as of 5/18/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$2610115.2
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$4971003.58
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$195845.76
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$426019.58
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$26484.48
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$37008.69
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$220239.36
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$0
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$468008.64
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$605189.36
6. Other	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided

c. Total Revenue from Volumetric Rates	$48438.72
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$490129.57

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

All NCWD customers are metered and billed based on their usage and standard monthly fees and other miscellaneous charges. NCWD received $6,704,884.61 in revenue for volumetric and non-volumetric charges (as a total for all classes). Non-volumetric revenue collected from institutional customers is incorporated in the commercial class non-volumetric revenue. The volumetric revenue for each class was calculated using the flat rate of $0.80/ccf and the class usage values as provided in the Customer Account and Usage Worksheet.

Reported as of 5/18/05

BMP 11: Conservation Pricing

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

Rate Structure Data Volumetric Rates for Water Service by Customer Class

1. Residential	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$2695841.28
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$5672106.46
2. Commercial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$182603.52
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$458349.06
3. Industrial	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$40423.68
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$67094.02
4. Institutional / Government	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$213618.24
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$0
5. Irrigation	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric Rates	$507735.36
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$809294.6
6. Other	
a. Water Rate Structure	Uniform
b. Sewer Rate Structure	Service Not Provided
c. Total Revenue from Volumetric	

Rates	$18817.92
d. Total Revenue from Non-Volumetric Charges, Fees and other Revenue Sources	$462445.13

B. Conservation Pricing Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	30000
2. Actual Expenditures	0	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? No

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

D. Comments

All NCWD customers are metered and billed based on their usage and standard monthly fees and other miscellaneous charges. NCWD received $7,603,691.87 in revenue for volumetric and non-volumetric charges (as a total for all classes). Non-volumetric revenue collected from institutional customers is incorporated in the commercial class non-volumetric revenue. The volumetric revenue for each class was calculated using the flat rate of $0.80/ccf and the class usage values as provided in the Customer Account and Usage Worksheet. NCWD budgeted for a water rate structure study to identify the most effective rate structure for residential customers to increase water conservation while meeting revenue goals. The study evaluated several water districts' and other retailers' rate structures based on the impact on conservation, revenue, customer service and satisfaction, and implementation and maintenance time and effort. The NCWD Board voted to implement a tiered rate structure for individually metered residential customers starting January 2005.

Reported as of 5/18/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

1. Does your Agency have a conservation coordinator?	yes
2. Is this a full-time position?	no
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	yes
4. Partner agency's name:	Castaic Lake Water Agency (Wholesaler)
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	35%
b. Coordinator's Name	Paula Forsberg
c. Coordinator's Title	Customer Service Manager
d. Coordinator's Experience and Number of Years	Customer Service 22 years
e. Date Coordinator's position was created (mm/dd/yyyy)	03/01/2002
6. Number of conservation staff, including Conservation Coordinator.	5

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	30000	30000
2. Actual Expenditures	27000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

The budget and expenditures are strictly estimates based on the number of estimated staff hours used for BMP programs including gathering the Base Year data for the BMP reporting requirements. An estimated 535-550 hours of staff time went into BMP programs for 2002-03. An average employee per hour estimated cost including benefits and other miscellaneous charges is approximately $37.14, however management and supervisory level staff also participated in BMP efforts.

Reported as of 5/18/05

BMP 12: Conservation Coordinator

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

1. Does your Agency have a conservation coordinator?	yes
2. Is this a full-time position?	yes
3. If no, is the coordinator supplied by another agency with which you cooperate in a regional conservation program ?	no
4. Partner agency's name:	Castaic Lake Water Agency (CLWA)
5. If your agency supplies the conservation coordinator:	
a. What percent is this conservation coordinator's position?	85%
b. Coordinator's Name	Melinda Weinrich
c. Coordinator's Title	Environmental Conservation Specialist
d. Coordinator's Experience and Number of Years	Conservation/Program Management/Consulting 10 years
e. Date Coordinator's position was created (mm/dd/yyyy)	05/10/2004
6. Number of conservation staff, including Conservation Coordinator.	6

B. Conservation Staff Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	30000	60000
2. Actual Expenditures	35000	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

A new position was created in May of 2004 in order to address the conservation issues within the district and to meet the requirements of the BMP under CUWCC. The Conservation Coordinator works with the Customer Service staf, field team, engineering and other departments as needed. As a small district, the entire staff works on some aspect of the BMP and other water conservation programs at the district such as working at public events, providing data and reports, mapping participation, etc.

Reported as of 5/18/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? yes

a. If YES, describe the ordinance:

NCWD's Ordinance (Water Conservation) was adopted in 2/1991 due to water supply conditions in the district's service area. The purpose of the ordinance is to provide a water conservation plan to minimize the effect of shortage of water supplies on the customers of the district. The ordinance sets parameters or irrigation hours and schedules to optimize water efficiency and prevent water waste. The ordinance also states that it is the duty of all persons to inspect for leaks and damages to indoor and outdoor plumbing and fixtures and to repair as necessary as soon as possible. The ordinance also lists prohibited use of water for washing vehicles, for cleaning and operating decorative fountains and for serving water in restaurants, cafeterias and other food service locations. A copy of the complete ordinance was submitted to the CUWCC as an attachment to this BMP report.

2. Is a copy of the most current ordinance(s) on file with CUWCC? no

a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

1. LA County Sanitation District (32 & 26) 2. City of Santa Clarita 3. County of Los Angeles	1. Ordinance Prohibiting the Installation of Certain Water Softening Appliances 2. City Code, Title 9 Health & Safety, Chapter 9.38 (Water Conservation & Water Waste), Chapter 10.04 Runoff Water & Pollution 3. County Code, Title 11 Health & Safety, Chapter 11.38 (Water & Sewer) * All the above listed ordinances and codes were submitted to the CUWCC for reference.

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

a. Gutter flooding	yes
b. Single-pass cooling systems for new connections	no
c. Non-recirculating systems in all new conveyor or car wash systems	no
d. Non-recirculating systems in all new commercial laundry systems	no
e. Non-recirculating systems in all new decorative fountains	yes
f. Other, please name See listed measures below (B2) & in attached Ordinance 101	yes

2. Describe measures that prohibit water uses listed above:

1. Watering lawns and landscaped areas more than once a day. 2.

Watering lawns and landscaped areas between 10am through 5pm 3. Causing water to runoff into the street, storm drains, gutters, parking lots, etc. 4. Not repairing leaks or broken indoor and outdoor plumbing and fixtures. 5. Serving water to customers in restaurants, cafeterias or other food service location unless the customer specifically request water

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

a. Allow the sale of more efficient, demand-initiated regenerating DIR models. yes

b. Develop minimum appliance efficiency standards that:

i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. yes

ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. yes

c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. yes

4. Does your agency include water softener checks in home water audit programs? no

5. Does your agency include information about DIR and exchange-type water softeners in educational efforts to encourage replacement of less efficient timer models? yes

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

Copies of NCWD's Ordinance 101 as well as the LA County, Los Angeles County Sanitation District (LACSD) and city of Santa Clarita's ordinances and codes related to water waste were submitted to the CUWCC as an attachment to these 2003-04 BMP reports.

Reported as of 5/18/05

BMP 13: Water Waste Prohibition

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Requirements for Documenting BMP Implementation

1. Is a water waste prohibition ordinance in effect in your service area? yes

a. If YES, describe the ordinance:

NCWD's Ordinance (Water Conservation) was adopted in 2/1991 due to water supply conditions in the district's service area. The purpose of the ordinance is to provide a water conservation plan to minimize the effect of shortage of water supplies on the customers of the district. The ordinance sets parameters or irrigation hours and schedules to optimize water efficiency and prevent water waste. The ordinance also states that it is the duty of all persons to inspect for leaks and damages to indoor and outdoor plumbing and fixtures and to repair as necessary as soon as possible. The ordinance also lists prohibited use of water for washing vehicles, for cleaning and operating decorative fountains and for serving water in restaurants, cafeterias and other food service locations. A copy of the complete ordinance was submitted to the CUWCC as an attachment to this BMP report.

2. Is a copy of the most current ordinance(s) on file with CUWCC? yes

a. List local jurisdictions in your service area in the first text box and water waste ordinance citations in each jurisdiction in the second text box:

1. City of Santa Clarita 2. County of Los Angeles	1. Title 9 Health & Safety, Chapter 9.38 & Chapter 10.4 Stormwater & Urban Runoff Pollution Control (see submitted documents) 2. County Codes, Title 11 Health & Safety, Chapter 11.38 (Water & Sewers)

B. Implementation

1. Indicate which of the water uses listed below are prohibited by your agency or service area.

a. Gutter flooding	yes
b. Single-pass cooling systems for new connections	no
c. Non-recirculating systems in all new conveyor or car wash systems	no
d. Non-recirculating systems in all new commercial laundry systems	no
e. Non-recirculating systems in all new decorative fountains	yes
f. Other, please name See list of measures below & in Ordinance 101 (attached)	yes

2. Describe measures that prohibit water uses listed above:

1. Watering lawns and landscaped areas more than once a day. 2. Watering lawns and landscaped areas between 10am through 5pm 3. Causing water to runoff into the street, storm drains, gutters, parking lots, etc. 4. Not repairing leaks or broken indoor and outdoor plumbing and fixtures. 5. Serving water to customers in restaurants, cafeterias or other food service location unless the customer specifically request water.

Water Softeners:

3. Indicate which of the following measures your agency has supported in developing state law:

a. Allow the sale of more efficient, demand-initiated regenerating DIR models. yes

b. Develop minimum appliance efficiency standards that:

i.) Increase the regeneration efficiency standard to at least 3,350 grains of hardness removed per pound of common salt used. yes

ii.) Implement an identified maximum number of gallons discharged per gallon of soft water produced. yes

c. Allow local agencies, including municipalities and special districts, to set more stringent standards and/or to ban on-site regeneration of water softeners if it is demonstrated and found by the agency governing board that there is an adverse effect on the reclaimed water or groundwater supply. yes

4. Does your agency include water softener checks in home water audit programs? no

5. Does your agency include information about DIR and exchange-type water softeners in educational efforts to encourage replacement of less efficient timer models? yes

C. Water Waste Prohibition Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	0
2. Actual Expenditures	0	

D. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

E. Comments

Copies of NCWD's Ordinance 101 as well as the LA County and city of Santa ClaritaÃs ordinances and codes related to water waste were submitted to the CUWCC as an attachment to these 2003-04 BMP reports.

Reported as of 5/18/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2003**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	no

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	69	0
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**69**	**0**

6. Describe your agency's ULFT program for single-family residences.

The ULFT (residential) Rebate program was conducted by the area wholesaler (CLWA) for pre-1993 single family homes in the Santa Clarita Valley. All the local retailers participated including Valencia Water Company, Santa Clarita Water District and LA County District 36. CLWA promoted the program in the local paper and throughout the community. NCWD released additional PR notices to district customers in the quarterly newsletter, on the monthly water bill (by-line) and with a postcard notices regarding the program. The program started May 1, 2003. Customers were required to contact the district (by phone or in person) to receive a rebate form to complete. NCWD made a copy of the rebate form for district records and to log which customers received rebates and those who also returned the voucher forms. Customers had 30 days upon receiving their voucher sheet and rebate number to purchase a ULFT and return the voucher form and their receipt to NCWD or the wholesaler. NCWD forwarded all forms to CLWA for final processing. Santa Clarita Water District coordinated the processing of the rebate checks and tallied participation. Once a customer returned their voucher form and ULFT receipt, they were mailed a rebate check for either $20 or $40. Customers who purchased ULFT between $50 and $75 received a $20 rebate and $40 for ULFT above $75. There was no limit on the number of rebates allocated per customers, however no customer took more than 3 voucher forms. The program lasted until the end of May 2003 with NCWD customers receiving 69 total rebates.

7. Describe your agency's ULFT program for multi-family residences.

CLWA selected to only target single-family residents for the 2003 ULFT Rebate Program.

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

1. City of Santa Clarita 2. Los Angeles County	There is currently no ordinance requiring retrofit of toilets (to ULFT) upon resale in the Santa Clarita Valley.

B. Residential ULFT Program Expenditures

	This Year	Next Year
1. Budgeted Expenditures	0	5000
2. Actual Expenditures	3946.57	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

The 2003-03 ULFT Rebate Program Budget was based on the employee time and effort, program marketing and PR efforts and miscellaneous supplies and costs. The costs are as follows: 1. Printing cost for ULFT Rebate Program notification postcard - $393.21 2. Postcard Postage to 3,500 qualified customers (at $0.23/postcard) - $805.00 3. Staff Time of 74 hours at $37.14/hour (average wage with benefit costs) - $2,748.36 Total Costs $3,946.57

Reported as of 5/18/05

BMP 14: Residential ULFT Replacement Programs

Reporting Unit:	BMP Form Status:	Year:
Newhall County Water District	**100% Complete**	**2004**

A. Implementation

	Single-Family Accounts	Multi-Family Units
1. Does your Agency have program(s) for replacing high-water-using toilets with ultra-low flush toilets?	yes	yes

Number of Toilets Replaced by Agency Program During Report Year

Replacement Method	SF Accounts	MF Units
2. Rebate	104	5
3. Direct Install	0	0
4. CBO Distribution	0	0
5. Other	0	0
Total	**104**	**5**

6. Describe your agency's ULFT program for single-family residences.

CLWA coordinated a residential ULFT rebate program for all the local retailers in the Santa Clarita Valley (including NCWD). The rebate program starts on May 1st offering rebates to eligible customers (with toilets installed prior to 1992) to receive a rebate for purchasing a ULFT. Customers received a $30 rebate for ULFT from $50 to $75, and $60 rebate for ULFTs over $75. Retailers receive a percentage of the available rebate funds ($20,000 for entire program) based on their customer population or eligible residents. Customers had 30 days to return their voucher form with their ULFT receipt in order to receive their rebate check. NCWD had such a high demand from customers that a waiting list had to be created. Over 135 customers were signed up on the waiting list to receive a voucher form if additional program funding became available.

7. Describe your agency's ULFT program for multi-family residences.

NCWD allowed multi-family residents to receive a rebate for the purchase of a ULFT through the CLWA. Previously, the rebate was only offered to single-family residents. Two landlords (or property owners) received rebates to update their rental facilities and two tenants received rebates. There was no limit on the number of rebates allocated per person; however District staff confirmed the number of toilets needed for any customers who request more than 3 rebates.

8. Is a toilet retrofit on resale ordinance in effect for your service area? no

9. List local jurisdictions in your service area in the left box and ordinance citations in each jurisdiction in the right box:

City of Santa Clarita & LA County	There is no retrofit on resale ordinance in the Santa Clarita Valley.

B. Residential ULFT Program Expenditures

	This Year	Next Year

1. Budgeted Expenditures	5000	3000
2. Actual Expenditures	4417.31	

C. "At Least As Effective As"

1. Is your AGENCY implementing an "at least as effective as" variant of this BMP? no

a. If YES, please explain in detail how your implementation of this BMP differs from Exhibit 1 and why you consider it to be "at least as effective as."

N/A

D. Comments

Budget for Residential ULFT Rebate Program includes the following calculated costs: 1. Staff time (approximately 50 hours) - Preparation & implementation - Planning meetings - PR efforts, mail outs, bill stuffers, etc. - Creating rebate forms and database - Translating program documents into Spanish 2. Printing and postage cost for postcard notice to customers 3. Creating & incorporating bill stuffers 4. Miscellaneous Costs (supplies & materials & other costs)

Reported as of 5/18/05

Appendix G
Draft Water Shortage Contingency Resolution/Ordinance

(This appendix contains examples that were adopted in 1991 to address water shortage conditions and will be used as the model for future water shortage contingency ordinance.)

Appendix I

DROUGHT EMERGENCY WATER SHARING AGREEMENT

1. Parties. The parties to this agreement are: Valencia Water Company, Santa Clarita Water Company, Los Angeles County Waterworks District No. 36-Val Verde, Newhall County Water District, and the Castaic Lake Water Agency.

2. Critical Water Shortage Conditions. The State of California is experiencing a fifth year of drought, which has caused critical water shortages in many areas of the state, including the service area of the Castaic Lake Water Agency. The Agency has recently been informed that the State Water Project will have insufficient water to meet its demands for the coming year.

3. Water Sharing Agreement. In order to alleviate the emergency water shortage caused by the Drought and by insufficient agency water to meet demands, the undersigned parties agree to cooperate in sharing available water from all sources among themselves without regard to water, contractual or other rights for the duration of the emergency, and to facilitate among themselves water transfers, exchanges, and wheeling arrangements.

4. Preservation of Rights. By entering into this emergency water pooling and transfer, the parties do not waive their individual claims to water rights, or to contractual or other claims to water or the use of water. Each party agrees that no party hereto will lose any water right, contract right, or other entitlement to water by entering into this agreement,

nor shall any party attempt to use this agreement or the emergency exchange of water as a basis for a claim against any other party of a continued right to the use of that water. This agreement shall not be construed as constituting any alteration in the respective priorities or terms of any of the rights held by any party, nor as an admission with respect to any rights or claims. Each party further agrees that no party hereto will lose any water or other right by a claim of non-use by another party, prescription, or dedication to public use by entering into this agreement.

5. Termination. This agreement shall terminate upon the cessation of drought conditions affecting the service area of the Castaic Lake Water Agency, or January 1, 1992, whichever is sooner, but may be extended by mutual consent of all the parties.

6. Counterparts. This agreement shall be executed in counterparts, each of which shall be deemed an original.

7. Effective Date. The effective date of this agreement shall be that date upon which all the parties hereto have executed the agreement.

Valencia Water Company

Date: FEBRUARY 13, 1991

Attest:

by _____

_____

Santa Clarita Water Company

Date: February 26, 1991

by W. J. Manthey

Attest:

Benjamin L. Borelli

Los Angeles County Waterworks
District No. 36

Date: 8/27/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 21

Newhall County Water District

Date: 2/19/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 22

Castaic Lake Water Agency

Date: 2/28/91

by ORIGINAL SIGNED BY

Attest:

~~Pg~~ 23

s/Los Angeles County Waterworks District No. 36

Date: AUG 27 1991

by Michael D. Antonovich

Attest:
ATTEST: LARRY J. MONTEILH
EXECUTIVE OFFICER —
CLERK OF THE BOARD OF SUPERVISORS
By Lynne C. Valle, Deputy

s/Newhall County Water District

Date:

Attest:

by

s/Castaic Lake Water Agency

Date: 2/28/91

Attest:

by

APPROVED AS TO FORM
DE WITT W. CLINTON, County Counsel

BY
DEPUTY

ADOPTED
BOARD OF SUPERVISORS
COUNTY OF LOS ANGELES

S 9 1 AUG 27 1991

LARRY J. MONTEILH
EXECUTIVE OFFICER

s/ Newhall County Water District Date: 2/19/71

Attest:

by [signature] President [signature] Secy

s/ Castaic Lake Water Agency Date: _____

Attest:

by _____ _____

s/Los Angeles County Waterworks
District No. 36

Date:

Attest:

by

s/Newhall County Water District

Date:

Attest:

by

s/Castaic Lake Water Agency

Date: 2/28/91

Attest:

by

Appendix II

RESOLUTION NO.804

RESOLUTION OF THE BOARD OF DIRECTORS OF CASTAIC LAKE WATER AGENCY RECOGNIZING REDUCTIONS IN REQUESTED DELIVERY OF STATE WATER PROJECT SUPPLY FOR YEAR 1991 AND MANDATING A PROGRAM OF WATER CONSERVATION IN THE SANTA CLARITA VALLEY

WHEREAS, the Castaic Lake Water Agency is a public entity organized and operating pursuant to the California Water Code, Appendix, Chapter 103, and is primarily empowered to supply water at wholesale to retail water distributors within the Santa Clarita Valley; and

WHEREAS, the Agency's source of water is by contract with the State Water Project of the California Department of Water Resources; and

WHEREAS, the State Water Project, and the entire State of California is experiencing protracted drought conditions of unprecedented recent duration; and

WHEREAS, the California Department of Water Resources in a letter dated February 2, 1991 advised the Agency to plan for "severe reductions" in its State Water Project supply; and

WHEREAS, the letter further reported, "there is a 50% probability that the Department will only be able to deliver about half of the water requested for municipal and industrial use in 1991"; and

WHEREAS, half of the requested State Water Project supply of the Castaic Lake Water Agency would be 13,050 acre feet: and

WHEREAS, the retail water distributors within the Santa Clarita Valley operate ground water production facilities that have been planned to make up some portion of the delivery reductions in State Project Water; and

WHEREAS, the retail water distributors and the Agency, have pursuant to Water Code, Sections 10610 through 10656, adopted a URBAN WATER MANAGEMENT PROGRAM for retail sales which contains water conservation measures including, metering, leak detection, public education, public information, home retrofit devices, drip and sprinkler irrigation restrictions, and a landscape suggestion for use of drought tolerant plantings; and

WHEREAS, heretofore, the Castaic Lake Water Agency adopted Resolution No. 667 relating to a voluntary water conservation program to reduce water consumption by 10 percent; and

WHEREAS, it is now essential to enact a mandatory program;

NOW, THEREFORE, BE IT RESOLVED that this Agency's Board of Directors does hereby find and determine the following:

1. That the General Manager of the Agency be authorized to execute a "Drought Emergency Water Sharing Agreement" with the local water purveyors to make it clear that emergency drought sharing of Agency water supplies during year 1991 not result in any waiver of contractual or other right to use of Agency water.

2. That the General Manager confer with the retail water purveyors to coordinate the distribution and use of the limited State Project Water supply to maximize the distribution of the ground water production capacity of the combined facilities operated by the retail water purveyors.

3. That the Agency request both the City of Santa Clarita and the County of Los Angeles to adopt mandatory water use ordinances with terms generally as follows:

I. A WATER CONSERVATION ORDINANCE WHICH SHALL TERMINATE ON JANUARY 1, 1992 UNLESS RENEWED OR TERMINATED EARLIER

A. Hose Watering-Prohibition.

No person shall hose-water or wash down any sidewalks, walkways, driveways, parking areas, or other paved surfaces. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infraction.

B. Watering of Lawns and Landscaping

1. No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

2. No person shall water or cause to be watered any lawn or landscaping more than once a day.

3. No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

4. It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

5. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

C. Indoor Plumbing and Fixtures.

1. It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

2. Any new or replacement toilets installed in any residence or business shall be of a low-flow variety.

3. Willful violation hereof shall be an infraction punishable by a fine of $500.00.

D. Washing Vehicles

No vehicle of any type may be washed, except at a commercial car wash, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infraction.

E. Public Eating Places

No restaurant, cafeteria, coffee shop, or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to do so by such customer. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

F. Decorative Fountains

No person shall use water to clean, fill, or maintain levels in decorative fountains unless such water flows through a recycling system. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

4. That the above cited three paragraphs are deemed appropriate as PHASE ONE of the Agency's mandatory conservation program with recognition of the possibility that the California Department of Water Resources may declare deeper finite reductions for the municipal and industrial water supplies of the State Water Project. Residents of the Agency are put on notice that further and additional phases of the mandatory conservation program may be enacted by the Agency and could include the following:

A. Odd/Even landscape irrigation restriction, based upon address

B. A financial penalty of say triple the water rate for metered water service that exceeds historic use

C. Complete prohibition of landscape irrigation

I, the undersigned, hereby certify: That I am the duly appointed and acting Secretary of the Castaic Lake Water Agency, and that at a special meeting of the Board of Directors of said Agency held on Monday, February 11, 1991, the foregoing Resolution No. 804 was duly and regularly adopted by said Board, and that said resolution has not been rescinded or amended since the date of its adoption, and that it is now in full force and effect.

Betty L. Castleberry
Secretary

DATED: 2/12/91

Appendix III

ORDINANCE NO. 101

WATER CONSERVATION ORDINANCE OF
NEWHALL COUNTY WATER DISTRICT

* * * * * * * * * * * * * * *

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF NEWHALL COUNTY WATER DISTRICT, LOS ANGELES COUNTY, CALIFORNIA AS FOLLOWS:

Section 1: Because of the water supply conditions prevailing within the District's service area, the general welfare requires that water resources available to the District be put to the maximum beneficial use to the extent to which they are capable, and that the waste or unreasonable use, or unreasonable method of use of water be prevented, and that the conservation of such water be practiced with the view to the reasonable and beneficial use thereof in the interest of the people of the District, and for the public welfare. The purpose of this Ordinance is to provide a water conservation plan to minimize the effect of a shortage of water supplies on the customers of the District.

Section 2: No customer of the District shall make, cause, use or permit the use of water from the District in a manner contrary to any provision of this Ordinance.

Section 3: Watering of Lawns or Landscaping.

(a) No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

(b) No person shall water or cause to be watered any lawn or landscaping more than once a day.

(c) No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

(d) It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

Section 4: Indoor Plumbing and Fixtures.

(a) It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

(b) For new or replacement toilets installed in any residence or business, local low-flow types are recommended.

Section 5: Washing Vehicles. No vehicle of any type may be washed, except at a commercial car wash, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time.

Section 6: Public Eating Places. No restaurant, cafeteria, coffee shop or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to do so by such customer.

Section 7: No person shall use water to clean, fill or maintain levels in decorative fountains unless such water flows through a recycling system.

Section 8: Water Conservation Kits. Water conservation kits are available without charge to the District's customers at the District's office. In most cases, the kits include a plastic displacement bag, two sets of shower flow restrictors, two dye tablets to check for toilet leaks and a brochure which explains the use of the kit. The kits are to be installed by the District's customers.

Section 9: Effective Date. The water use restrictions of this Ordinance are effective immediately. Other provisions of this Ordinance are effective on March 21, 1991.

ADOPTED, SIGNED AND APPROVED by the Board of Directors of NEWHALL COUNTY WATER DISTRICT this 19th day of February, 1991.

MARY JUNE HERRINGTON, President
of the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

A T T E S T:

JAMES E. JINKS, Secretary of
the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

I hereby certify that the foregoing Ordinance No. 101 was duly and regularly adopted and passed by the Board of Directors of the NEWHALL COUNTY WATER DISTRICT at a regular meeting thereof on the 19th day of February, 1991 by the following vote of the members thereof:

AYES:	DIRECTORS:	Herrington, Hayes, Wade, Agajanian and Whiteside
NOES:	DIRECTORS:	None
ABSENT:	DIRECTORS:	None
ABSTAINED:	DIRECTORS:	None

JAMES E. JINKS, Secretary of
the Board of Directors of the
NEWHALL COUNTY WATER DISTRICT

ORDINANCE NO. 102

ORDINANCE AMENDING SECTION 3 OF ORDINANCE NO. 101 OF NEWHALL COUNTY WATER DISTRICT RE WATER CONSERVATION

* * * * * * * * * * * * * * *

BE IT ORDAINED BY THE BOARD OF DIRECTORS OF NEWHALL COUNTY WATER DISTRICT, LOS ANGELES COUNTY, CALIFORNIA AS FOLLOWS:

Section 1: Section 3 of Ordinance No. 101 is amended to provide as follows:

"Section 3: Watering of Lawns or Landscaping.

(a) No person shall water or cause to be watered any lawn or landscaping between the hours of 8:00 a.m. and 6:00 p.m.

(b) No person shall water or cause to be watered any lawn or landscaping more than once a day, or for a period of time not to exceed ten minutes per watering station or cycle.

(c) No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

(d) It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable."

Section 2: The provisions of this Ordinance shall be effective on November 19, 1991.

ADOPTED, SIGNED AND APPROVED by the Board of Directors of NEWHALL COUNTY WATER DISTRICT this 15th day of October, 1991.

MARY JUNE HERRINGTON, President of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

A T T E S T:

JAMES E. JINKS, Secretary of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

STATE OF CALIFORNIA)
) ss.
COUNTY OF LOS ANGELES)

I hereby certify that the foregoing Ordinance No. 102 was duly and regularly adopted and passed by the Board of Directors of the NEWHALL COUNTY WATER DISTRICT at a regular meeting thereof on the 15th day of October, 1991 by the following vote of the members thereof:

AYES:	DIRECTORS:	Herrington, Hayes, Wade, Agajanian and Whiteside
NOES:	DIRECTORS:	None
ABSENT:	DIRECTORS:	None
ABSTAINED:	DIRECTORS:	None

JAMES E. JINKS, Secretary of the Board of Directors of the NEWHALL COUNTY WATER DISTRICT

Appendix IV

ORDINANCE NO. 91-16

AN ORDINANCE OF THE CITY OF SANTA CLARITA
ADDING CHAPTER 9.38 TO TITLE 9
OF THE SANTA CLARITA MUNICIPAL CODE

WHEREAS, the State of California is experiencing a prolonged drought; and

WHEREAS, the delivery of State Project Water to the Castaic Lake Water Agency has been reduced by 90% of the requested delivery levels.

THE CITY COUNCIL OF THE CITY OF SANTA CLARITA DOES HEREBY ORDAIN AS FOLLOWS:

Section 1. The Santa Clarita Municipal Code is amended adding Chapter 9.38 to Title 9 relating to water conservation to read as follows:

CHAPTER 9.38

WATER CONSERVATION

Sections:

9.38.010 Drought Committee
9.38.015 Water Conservation Regulations
9.38.020 Penalties
9.38.025 Termination of Ordinance
9.38.030 Ordinance 91-16 Amended

9.38.010 Drought Committee

A. A drought committee shall be established, whose function shall be:

1. to review all available data on water consumption, water supply and ground water conditions;

2. to evaluate the level of compliance with the terms of this Ordinance;

3. to evaluate the level of achievement of the stated water consumption reductions;

4. to make recommendations to the City Council concerning the timing of and need for implementation of future additional water restrictions as may be developed; and

5. to make recommendations to the water purveyors in the City of Santa Clarita concerning additional measures to encourage water conservation, including but not limited to; conservation goals for individual water accounts, surcharges for excessive water use and the installation of flow restriction devices in water services.

B. The members of the Drought Committee shall include representatives from the staff of the City of Santa Clarita, the Upper Santa Clara Water Committee, other appointees as the City Council deems appropriate, and the staff of the Castaic Lake Water Agency.

9.38.015 Water Conservation Regulations

A. Water conservation shall be achieved through the restriction and/or prohibition of various types of water use. The restrictions and prohibitions shall be implemented immediately.

B. The following conditions and restrictions shall apply to the use of water within the City of Santa Clarita:

1. Hose Water Prohibition.

a. No person shall hose-water or wash down any sidewalks, walkways, driveways, parking areas, or other paved surface.

2. Watering of Lawns and Landscaping.

a. No person shall water or cause to be watered any lawn or landscaping between the hours of 8:00 a.m. and 6:00 p.m. except as provided in Section 9.38.015.B.2.e.

b. Lawns and landscaping shall be watered no more frequently than every other day.

c. No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or to excessive watering.

d. It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

e. Commercial gardeners and landscapers, municipal water uses, commercial nurseries, golf courses and other water-dependent industries shall not water or cause to be watered any lawn of landscaping between the hours of 10:00 a.m. and 3:00 p.m., and no more frequently than every other day, unless reclaimed water is used.

f. The maintenance and testing of irrigation systems may be performed without the restrictions specified in Section 9.38.015.B.2.a and 9.38.015.B.2.e.

3. Indoor Plumbing.

   a. Accessible indoor plumbing and fixtures must be inspected for leaks and repaired as soon as reasonably practicable.

   b. New and replacement toilets, showers and faucets shall be of a low-flow type. New or replacement faucets shall be equipped with aerators.

4. Washing Vehicles.

   a. Vehicles must be washed by hand-held bucket or with a hose equipped with automatic shutoff nozzle. Hoses may not be left running.

   b. These restrictions shall not be applied to commercial vehicle washing facilities and operations.

5. Public Eating Places.

   a. Water may be served only upon request by the customer.

6. Decorative Fountains.

   a. Water may not be used to clean, fill or maintain levels in decorative fountains unless the fountain has a water recycling system.

7. Landscaping and Irrigation Plans.

   a. All new landscaping and irrigation improvements shall be approved by the City of Santa Clarita Director of Parks and Recreation prior to construction.

   b. No person or entity shall be required to implement any landscaping requirements of any association, developer or governing agency until the termination of this ordinance.

C. Conservation Goal

1. The goal of this Water Conservation Ordinance is to achieve at least 25% reduction of overall water consumption within the City of Santa Clarita.

9.38.020 Penalties.

A. Willful violations of the terms of this Ordinance shall be subject to written warnings and/or citations. A written warning shall be issued upon the first violation of any part of this Ordinance. The second violation shall result in a fine of $50.00. The third violation shall result in a fine of $100.00, and all subsequent violations shall result in a fine of $300.00 for each violation.

9.38.025 Termination of Ordinance.

A. This Ordinance shall terminate on January 1, 1992, unless renewed or termination earlier by ordinance.

Section 2. The City Council hereby declares that the provisions of this Ordinance are severable and if for any reason a court or competent jurisdiction shall hold any sentence, paragraph or section of this Ordinance to be invalid, such decision shall not affect the validity of the remaining parts of this Ordinance.

Section 3. This Ordinance is adopted as an urgency measure. The facts of the urgency are these: The State of California is currently suffering from the effects of a five-year drought, and the deliveries of State Project water to local water agencies are being reduced. This Ordinance restricts or prohibits certain types of water usage. The immediate enactment of this Ordinance is therefore necessary to ensure the adequacy of the water supply for the City of Santa Clarita and is thereby directly related to public health, safety and welfare. Therefore, this Ordinance shall be effective immediately upon adoption.

Section 4. The City Clerk shall certify to the passage of this Ordinance and shall cause it to be published in the manner prescribed by law.

9.38.030 Ordinance 91-12 Amended

A. Ordinance 91-12 is hereby amended, deleting Section 9.38.015.b.8 in its entirety.

PASSED, APPROVED AND ADOPTED this 13th day of March, 1991.

Carl Boyer
CARL BOYER, MAYOR

ATTEST:

Donna M. Grindey
DONNA GRINDEY, CITY CLERK

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss.
CITY OF SANTA CLARITA)

I, Donna M. Grindey, City Clerk of the City of Santa Clarita, do hereby certify that the foregoing Ordinance No. 91-16 was duly adopted as an urgency ordinance at a regular meeting of the City Council on the 13th day of March, 1991, by the following four-fifths vote, to wit:

AYES: COUNCILMEMBERS Darcy, Heidt, McKeon, Boyer

NOES: COUNCILMEMBERS Klajic

ABSENT: COUNCILMEMBERS None

Donna M. Grindey
CITY CLERK

AGN:gmm-394

ORDINANCE NO. 91-48

AN ORDINANCE OF THE CITY COUNCIL OF THE CITY OF SANTA CLARITA, CALIFORNIA, AMENDING CHAPTER 9.38 OF THE SANTA CLARITA MUNICIPAL CODE RELATING TO WATER CONSERVATION

THE CITY COUNCIL OF THE CITY OF SANTA CLARITA, CALIFORNIA, DOES ORDAIN AS FOLLOWS:

SECTION 1. The Santa Clarita Municipal Code is hereby amended at Subsection 9.38.015.B.2.b to read as follows:

b. Lawns and landscaping shall be watered no more than 10 minutes per watering station or cycle per day.

SECTION 2. The Santa Clarita Municipal Code at Subsection 9.38.015.B.2.e is hereby amended to read as follows:

e. Commercial gardeners and landscapers, municipal water uses, commercial nurseries, golf courses and other water-dependent industries shall not water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 3:00 p.m., and no more than 10 minutes per watering station or cycle per day unless reclaimed water is used. This subsection does not apply to residential lawns which are subject to the time limitations indicated in the other subsections of this Ordinance.

SECTION 3. Section 9.38.015.C.1 is hereby amended to read as follows:

1. The goal of this Water Conservation Ordinance is to achieve a significant reduction of overall water consumption within the City of Santa Clarita.

SECTION 4. This Ordinance is adopted as an urgency measure. The facts of the urgency are these: The State of California is currently suffering from the effects of a five-year drought, and the deliveries of State Project water to local water agencies are being reduced. This Ordinance restricts or prohibits certain types of water usage. The immediate enactment of this Ordinance is therefore necessary to ensure the adequacy of the water supply for the City of Santa Clarita and is thereby directly related to public health, safety and welfare. Therefore, this Ordinance shall be effective immediately upon adoption.

SECTION 5. The City Clerk shall certify to the passage of this Ordinance and shall cause it to be published in the manner prescribed by law.

PASSED, APPROVED AND ADOPTED this 8th day of October, 1991.

Carl Boyer

Carl Boyer, Mayor

ATTEST:

Donna M. Grindey

Donna M. Grindey, City Clerk

STATE OF CALIFORNIA)
COUNTY OF LOS ANGELES) ss
CITY OF SANTA CLARITA)

I, Donna M. Grindey, City Clerk of the City of Santa Clarita, do hereby certify that the foregoing Ordinance No. 91-48 was duly adopted as an urgency ordinance at a regular meeting of the City Council on the 8th day of October, 19 91 by the following four-fifths vote, to wit:

AYES: COUNCILMEMBERS: Darcy, Heidt, McKeon, Boyer

NOES: COUNCILMEMBERS: Klajic

ABSENT: COUNCILMEMBERS: None

Donna M. Grindey

Donna M. Grindey, City Clerk

Appendix V

ORDINANCE NO. 91-0046U

An urgency ordinance amending Title 11, Chapter 11.38 of the Los Angeles County Code relating to Water and Sewers to add Part 4, Water Conservation.

The Board of Supervisors of the County of Los Angeles ordains as follows:

Section 1. Title 11, Chapter 11.38 of the County Code is amended by adding Part 4, to read:

Part 4. Water Conservation Requirements For The Unincorporated Los Angeles County Area.

Section 11.38.620 Hose Watering Prohibition. No person shall hose water or wash down any sidewalks, walkways, driveways, parking areas or other paved surfaces, except as is required for the benefit of public health and safety. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.630 Watering of Lawns and Landscaping.

a). No person shall water or cause to be watered any lawn or landscaping between the hours of 10:00 a.m. and 5:00 p.m.

b). No person shall water or cause to be watered any lawn or landscaping more than once a day.

c). No person shall water or cause to be watered any lawn or landscaping to such an extent that runoff into adjoining streets, parking lots or alleys occurs due to incorrectly directed or maintained sprinklers or excessive watering.

d). It shall be the duty of all persons to inspect all hoses, faucets and sprinkling systems for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

e). Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.640 Indoor Plumbing and Fixtures.

a). It shall be the duty of all persons to inspect all accessible indoor plumbing and faucets for leaks and to cause all leaks to be repaired as soon as is reasonably practicable.

b). Willful violation hereof shall be an infraction punishable by a fine of $500.00.

Section 11.38.650 Washing Vehicles.
No motor vehicle, boat, trailer or other type of mobile equipment may be washed, except at a commercial car wash or with reclaimed water, unless such vehicle is washed by using a hand-held bucket or a water-hose equipped with an automatic shutoff nozzle. No person shall leave a water hose running while washing a vehicle or at any other time. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.660 Public Eating Places.
No restaurant, hotel, cafeteria, cafe or other public place where food is sold or served shall serve drinking water to any customer unless specifically requested to

do so by such customer. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 11.38.670 Decorative Fountains.
No person shall use water to clean, fill or maintain levels in decorative fountains, ponds, lakes, or other similar aesthetic structures unless such water flows through a recycling system. Willful violation hereof shall be an infraction punishable by a fine of $100.00 for the first infraction and $500.00 each for subsequent infractions.

Section 2. This ordinance shall terminate on January 1, 1993, unless renewed or terminated earlier by ordinance.

Section 3. Due to the severity of the drought in the State of California, there is an immediate need to prohibit the wasting of water in the Los Angeles County unincorporated area to better utilize the available water supplies. This ordinance is urgently needed for the preservation of the public health, safety and general welfare and shall take effect immediately.

Section 4. This ordinance shall be published in

Metropolitan News Enterprise

a newspaper printed and published in the County of Los Angeles.

Michael D. Antonovich
Chairman

ATTEST:

Executive Officer
Board of Supervisors
of the County of Los Angeles

I hereby certify that at its meeting of March 21, 1991, the foregoing ordinance was adopted by the Board of Supervisors of said County of Los Angeles by the following vote, to wit:

Ayes:	Noes:
Supervisors Gloria Molina	Supervisors None
Edmund D. Edelman	
Deane Dana	
Michael D. Antonovich	

Executive Officer
Board of Supervisors
of the County of Los Angeles

Effective Date: March 21, 1991

Operative Date: _____

I hereby certify that pursuant to Section 25103 of the Government Code, delivery of this document has been made.
LARRY J. MONTEILH
Executive Officer
Clerk of the Board of Supervisors
By _____ DEPUTY

APPROVED AS TO FORM:
DE WITT W. CLINTON
County Counsel
By _____
GERALD F. CRUMP
Chief Assistant County Counsel

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. . . S A M P L E N O T I C E . . .

LOS ANGELES COUNTY WATER WASTING ORDINANCE
NOTICE OF WARNING

Date _____

Address: _____
_____
_____
_____

Dear Customer:

Due to the severity of the current drought, the County Board of Supervisors, on March 21, 1991, adopted an Ordinance that specifies a number of water saving measures. The Ordinance applies to the unincorporated areas of the County and includes the following provisions:

__ Washing down of paved surfaces is prohibited, except as required for public health and safety.

__ Lawn and landscape watering is prohibited between the hours of 10:00 a.m. and 5:00 p.m.

__ Landscape watering that results in runoff into adjoining streets, parking lots or alleys due to misdirected sprinklers or excessive watering is prohibited.

__ Leaking hoses, faucets and sprinkling systems must be repaired as soon as is reasonably practicable.

__ Leaks to indoor plumbing systems must be repaired as soon as is reasonably practicable.

__ Washing of a motor vehicle, boat or trailer is prohibited except at a commercial car wash or with a hand-held bucket or water hose equipped with an automatic shutoff nozzle.

__ Serving drinking water to customers at public eating places is prohibited unless specifically requested by such customers.

__ Water cannot be used in decorative fountains, ponds, lakes and other similar aesthetic structures unless the water flows through a recycling system.

We observed the violation(s) of the above noted provisions on your property. We request your support in complying with the provisions of this ordinance so that we can avoid unnecessary waste and stretch our limited water supplies for the duration of the drought. Violation of this Ordinance is punishable by a fine of up to $500. If you have any questions regarding this ordinance or its enforcement please contact (your office and phone number).

(WW3901)

Appendix VI

RESOLUTION

ADOPTING A WATER SHORTAGE CONTINGENCY PLAN
FOR THE SANTA CLARITA WATER COMPANY

WHEREAS, the California Legislature enacted Assembly Bill 11X during the 1991 Extraordinary Session of the California Legislature (an act to amend the California Water Code Sections 10620, 10621, 10631, and 10652, and to add Section 10656 to the California Water Code, relating to water); and

WHEREAS, AB 11X mandates that every urban water supplier providing municipal water directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre feet of water annually to develop a Water Shortage Contingency Plan; and

WHEREAS, AB 11X mandates that said Plan be filed with the California Department of Water Resources by January 31, 1992; and

WHEREAS, the Santa Clarita Water Company is an urban supplier of water providing water to more than 3,000 customers, and has therefore prepared and circulated for public review a Draft Water Shortage Contingency Plan, in compliance with the requirements of AB 11X, has held a properly noticed public hearing on January 29, 1992, regarding said Draft Plan, and has thereafter prepared a Final Water Shortage Contingency Plan;

NOW, THEREFORE, BE IT RESOLVED by the Santa Clarita Water Company's Board as follows:

1. A Final Water Shortage Contingency Plan is hereby adopted and is attached hereto as Exhibit "A" hereof, which exhibit is hereby incorporated herein;

2. The President is hereby authorized and directed to file the Plan with the California Department of Water Resources;

3. The President is hereby also authorized to follow lawful procedures to declare a Water Shortage Emergency and to implement this Water Shortage Contingency Plan; and

4. The President shall recommend to the Santa Clarita Water Company's Board additional procedures, rules, and regulations to carry out effective and equitable allocation of water resources during a water shortage.

Appendix VI

RESOLUTION

ADOPTING A WATER SHORTAGE CONTINGENCY PLAN
FOR THE SANTA CLARITA WATER COMPANY

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WHEREAS, AB 11X mandates that every urban water supplier providing municipal water directly or indirectly to more than 3,000 customers or supplying more than 3,000 acre feet of water annually to develop a Water Shortage Contingency Plan; and

WHEREAS, AB 11X mandates that said Plan be filed with the California Department of Water Resources by January 31, 1992; and

WHEREAS, the Santa Clarita Water Company is an urban supplier of water providing water to more than 3,000 customers, and has therefore prepared and circulated for public review a Draft Water Shortage Contingency Plan, in compliance with the requirements of AB 11X, has held a properly noticed public hearing on January 29, 1992, regarding said Draft Plan, and has thereafter prepared a Final Water Shortage Contingency Plan;

NOW, THEREFORE, BE IT RESOLVED by the Santa Clarita Water Company's Board as follows:

1. A Final Water Shortage Contingency Plan is hereby adopted and is attached hereto as Exhibit "A" hereof, which exhibit is hereby incorporated herein;

2. The President is hereby authorized and directed to file the Plan with the California Department of Water Resources;

3. The President is hereby also authorized to follow lawful procedures to declare a Water Shortage Emergency and to implement this Water Shortage Contingency Plan; and

4. The President shall recommend to the Santa Clarita Water Company's Board additional procedures, rules, and regulations to carry out effective and equitable allocation of water resources during a water shortage.

ORDINANCE NO. 112
AN ORDINANCE AMENDING ORDINANCE 101
WATER CONSERVATION, SHORTAGE, DROUGHT AND
EMERGENCY RESPONSE
ORDINANCE OF
NEWHALL COUNTY WATER DISTRICT

* * * * * * * * * * * * * * * * * ** * * * * * * * *

Be it ordained by The Board of Directors of Newhall County Water District, Los Angeles County, California, Ordinance No. 101 is amended to read as follows:

Section 1: ***PURPOSE*****:** The specific provisions of this Ordinance are necessary and proper to conserve water resources and minimize cost to the District and its customers. The District requires that water resources available to the District be put to the maximum beneficial use, and that water efficient practices be used to reach this objective. The District further finds that its water supplies may be reduced because of drought, failure of facilities, or catastrophic events such as earthquakes and regional power failures. Anti-waste and water conservation requirements are necessary to achieve demand reduction without unneeded hardship.

Section 2: ***DEFINITIONS AND TERMS:***

A. ***Water efficient practices****:* Cost-effective practices that require the least amount of water to generate the greatest benefit (water and cost savings) to the customer.

B. ***Water Waste:*** To use or expend water carelessly or needlessly.

C. ***Water User:*** Business or residential customer of the District.

D. ***Water Conservation Stages:*** The General Manager shall determine the conservation stage, except that the Board shall determine any conservation stage more restrictive than Stage 1. A water deficiency occurs when the current or near-term water demand exceeds the current or near-term water supply.

Stage 1. Water deficiencies range between 1 and 15 percent.

Stage 2. Water deficiencies range from more than 15 and up to 25 percent.

Stage 3. Water deficiencies range from more than 25 and up to 35 percent.

Stage 4. Water deficiencies are more than 35 percent.

E. ***Water Deficiency:*** A water deficiency occurs when the current or near-term water demand exceeds the current or near-term water supply, based on a yearly assessment. (Percent or deficiency = (1 – water supply/water demand) x 100

Section 3: ***WATER CONSERVATION ACTION PLAN:*** This plan establishes water conservation measures to be taken in response to current and anticipated levels of deficiency in State and/or local water supplies. No Water User shall waste water or make, cause, or permit the use of water for any purpose contrary to any provision of this Ordinance, or in quantities in excess of the use permitted by the conservation stage in effect pursuant to this Ordinance.

3.1 Efficient Water Use. *Because more severe effects of a water shortage are often brought about due to wasteful water use habits carried over from times of sufficient supply, certain voluntary water-use practices are encouraged at all times.*

3.1.1 Outdoor Water Use Efficiency Guidelines and Recommendations:

a) Sprinklers should be maintained and adjusted so that overspray, runoff, and water waste is avoided. The most effective and water-efficient irrigation should be used, and drip irrigation should be considered where appropriate.

b) All leaks in plumbing and irrigation systems should be repaired promptly

c) Vehicles should be washed using a hose equipped with automatic shutoff nozzle.

d) Sidewalks, walkways, driveways, parking lots or any other hard-surfaced areas should not be washed down, except for health and safety purposes.

e) Low-water-use native or drought-tolerant vegetation should be used to minimize the need for irrigation. Plants and trees with similar water needs should be grouped together for most efficient irrigation. (Please see our website ncwd.org for more information and links to other websites listing drought tolerant plants.)

f) Landscape should be installed in a manner that will reduce the amount of water needed for irrigation. For example, the use of mulches and watering basins is encouraged where appropriate.

g) Irrigation should occur during optimal watering hours, avoiding wind and heat. The following hours are considered the most efficient hours for NCWD customers to effectively irrigate lawns and landscaped areas:

Winter/Fall (November through April) – 6 PM to 10 AM

Spring/Summer (May through October) –8 PM to 9 AM

h) Water usage on any decorative fountains, ponds or other types of water streams should be minimized by incorporating a water recycling system so the water is continually recovered and reused.

i) Pool and spa safety covers or evaporation-reducing water treatments should be considered if safe and appropriate for the situation. These will help minimize water loss due to evaporation. Pool and spa chemistry should be balanced and maintained to help reduce the frequency of pool/spa draining and refilling.

3.1.2 Indoor Water Use Efficiency Guidelines and Recommendations:

a) All leaks and/or damage to faucets, toilets, and indoor pipes should be repaired immediately.

b) Low flow devices for indoor plumbing fixtures including faucets, kitchen spray nozzles, toilets, and showers should be used where possible.

c) Install 1.0 gallon per flush (gpf) ultra low-flow toilets or dual-flush toilets.

d) Water-efficient Energy Star® approved appliances including, but not limited to, clothes washers and dishwashers should be used.

e) Clothes washers and dishwashers should be run using full loads to maximize water efficiency.

f) A source specific hot water dispenser or a whole house hot water recirculation system should be considered. These devices generate hot water within seconds, minimizing running the water until it is hot.

g) All commercial establishments where food or beverages are provided should encourage the serving of water to their customers only when specifically requested by the customer.

3.1.3 ***New Construction Water Efficiency Guidelines:*** As new technology advances, builders of new structures or persons retrofitting existing facilities should consider options such as evapotranspiration-controlled sprinkler systems, grey water or non-potable water systems (where legally acceptable), storm water cisterns, and landscape designs minimizing the use of turf and water-intensive plants. Businesses should review industry-specific guidance for ways to reduce water usage and should consider programs such as multi-pass cooling towers and process water recycling.

3.2 ***Water Conservation Stage 1 –:*** *At this stage of water deficiency, the Water Users are strongly encouraged to adhere to all the guidelines in section 3.1, Water Use Efficiency Guidelines. The following practice is also strongly suggested during Stage 1 water deficiencies:*

a) Outdoor irrigation of all vegetation including lawns and landscaping is limited to three times per week and no more than 10 minutes per watering station. Irrigation should occur during the following hours:

Winter/Fall (November through April) – 6 PM to 10 AM

Spring/Summer (May through October) – 8 PM to 9 AM

3.3 ***Water Conservation Stage 2:*** *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1-3.1.2 above) and Stage 1 practices (3.2 above) become mandatory requirements. Further mandatory practices during Stage 2 are as follows:*

a) All new landscaping shall be limited to widely accepted drought-tolerant plants requiring less than typical water requirements.

b) No new lawns, whether by seed or sod, shall be installed.

c) No filling of pools or spas. Water levels may be maintained.

3.4 Water Conservation Stage 3: *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1-3.1.2 above), Stage 1 practices (3.2 above), and Stage 2 practices (3.3 above) become mandatory requirements. Further mandatory practices during Stage 3 are as follows:*

a) No new applications for service will be accepted.

b) No water for grading will be allowed.

c) Washing vehicles is prohibited, except at commercial facilities that recycle water.

d) Street cleaning with potable water is prohibited.

3.5 Water Conservation Stage 4: *At this stage of water deficiency, Efficient Water Use Guidelines (3.1.1- 3.1.2 above), Stage 1 practices (3.2 above), Stage 2 practices (3.3 above), and Stage 3 practices (3.4 above) become mandatory requirements. Further mandatory practices during Stage 4 are as follows:*

a) Outdoor irrigation of all vegetation including lawns and landscaping is prohibited. Existing trees and larger shrubs will be exempt.

b) No new landscaping shall be permitted.

Section 4: ENFORCEMENT:

4.1 Efficient Water Use and Stage 1 Enforcement:

a) Any notification to the District of signs or indications of water leaks or water waste will be documented. The District will confirm the water waste prior to any further action.

b) The District shall determine the action to be taken to inform the Water User of the guidelines in this Ordinance and to encourage more efficient and cost-effective water use.

4.2 Stage 2, 3 and 4 Enforcement. *The General Manager, and other District authorized representatives have the duty and are authorized to enforce provisions of Stage 2, 3, and 4 of this Ordinance. If a violation is ongoing, the District may disconnect service until the violation is corrected.*

4.2.1 First Violation. For a first violation, the District shall issue a verbal warning to the Water User and recommend corrective action.

4.2.2 Second Violation. For a second violation, the District shall issue a written warning to the Water User, and a fine of $40 shall be added to the Water User's bill at the property where the violation occurred if the corrective action is not taken within 30 days after receiving the written warning.

4.2.3 Third Violation. For a third violation, a fine of $100 shall be added to the Water User's bill at the property where the violation occurred if the corrective action is not taken within 30 days after receiving the written warning. In addition to the fine, the Board or the General Manager may require installation of a flow-restricting device on the Water User's service connection.

4.2.4 ***Fourth Violation.*** For the fourth and any additional violations, a fine of $250 shall be added to the Water User's bill at the property where the violation occurred. The District may also discontinue the Water User's water service at the property where the violation occurred. Re-connection shall be permitted only when there is reasonable protection against future violations, such as a flow-restricting device on the customer's service connection, as determined at the District's discretion.

4.3 ***District Enforcement Costs.*** District shall be reimbursed for its costs and expenses in enforcing the provisions of this Ordinance, including such costs as District incurs for District staff to investigate and monitor the Water User's compliance with the terms of this Ordinance. Charges for installation of flow-restricting devices or for discontinuing or restoring water service, as the District incurs those charges, shall be added to the Water User's bill at the property where the enforcement costs were incurred.

Section 5: ***ADMINISTRATION:***

5.1 ***General.*** The provisions of this Ordinance shall be administered and enforced by the District through the General Manager, who may delegate such enforcement to one or more employees or contractors of the District. The District may implement additional demand reduction practices, including surcharges, rationing, and specific water allocations, in times of severe shortage or emergency situations.

5.1.1 ***Water Utility Accounts.*** Accounts shall not be established for new customers, including the transfer of accounts upon change of ownership, until the customer agrees to comply with the provisions of this Ordinance. In pursuing the objectives of this Ordinance, the General Manager shall seek the cooperation of other water purveyors within the District's service area. The District will request that other water purveyors not permit the establishment of new accounts until the customer agrees to comply with the provisions of this Ordinance.

5.1.2 ***Discretionary Exemptions.*** The Board may, in its discretion, exempt Water Users and individual facilities of Water Users from the provisions of this Ordinance, or impose reasonable conditions in lieu of compliance with this Ordinance, if the Board finds that any of the following conditions exist:

a) Hardship. The requirements of this Ordinance would cause an unnecessary and undue hardship upon the Water User, the Water User facility or the public.

b) Health and Safety. Strict compliance with the requirements of this Ordinance would create an emergency condition, as determined by the Board or other governmental entity with appropriate jurisdiction, affecting the health, protection or safety of the Water User or the public.

c) No Impact on Water Use. The granting of the exemption or imposition of reasonable conditions in lieu of compliance with this Ordinance would not increase the quantity of water consumed by the Water User or otherwise adversely affect service to other Water Users. In other words, the Water User will create an offset. In granting any such relief, the departure from the requirements of this Ordinance shall be limited to the minimum necessary to address the circumstances upon which such departure is required by a Water User.

5.1.3 ***Appeals.*** Any customer or applicant for a water service may appeal any decision under this Ordinance to the Board whose decision shall be final.

ADOPTED, APPROVED AND SIGNED by the Board of Directors of NEWHALL COUNTY WATER DISTRICT this 14th day of July, 2005.

_____
MARIA GUTZEIT, President of the
Board of Directors of
NEWHALL COUNTY WATER DISTRICT

ATTEST:

_____
Karin J. Russell, Secretary of the
Board of Directors of
NEWHALL COUNTY WATER DISTRICT

Appendix H
References

Appendix H
REFERENCE LIST

The following documents were used in the preparation of the 2005 Urban Water Management Plan for the Santa Clarita Valley:

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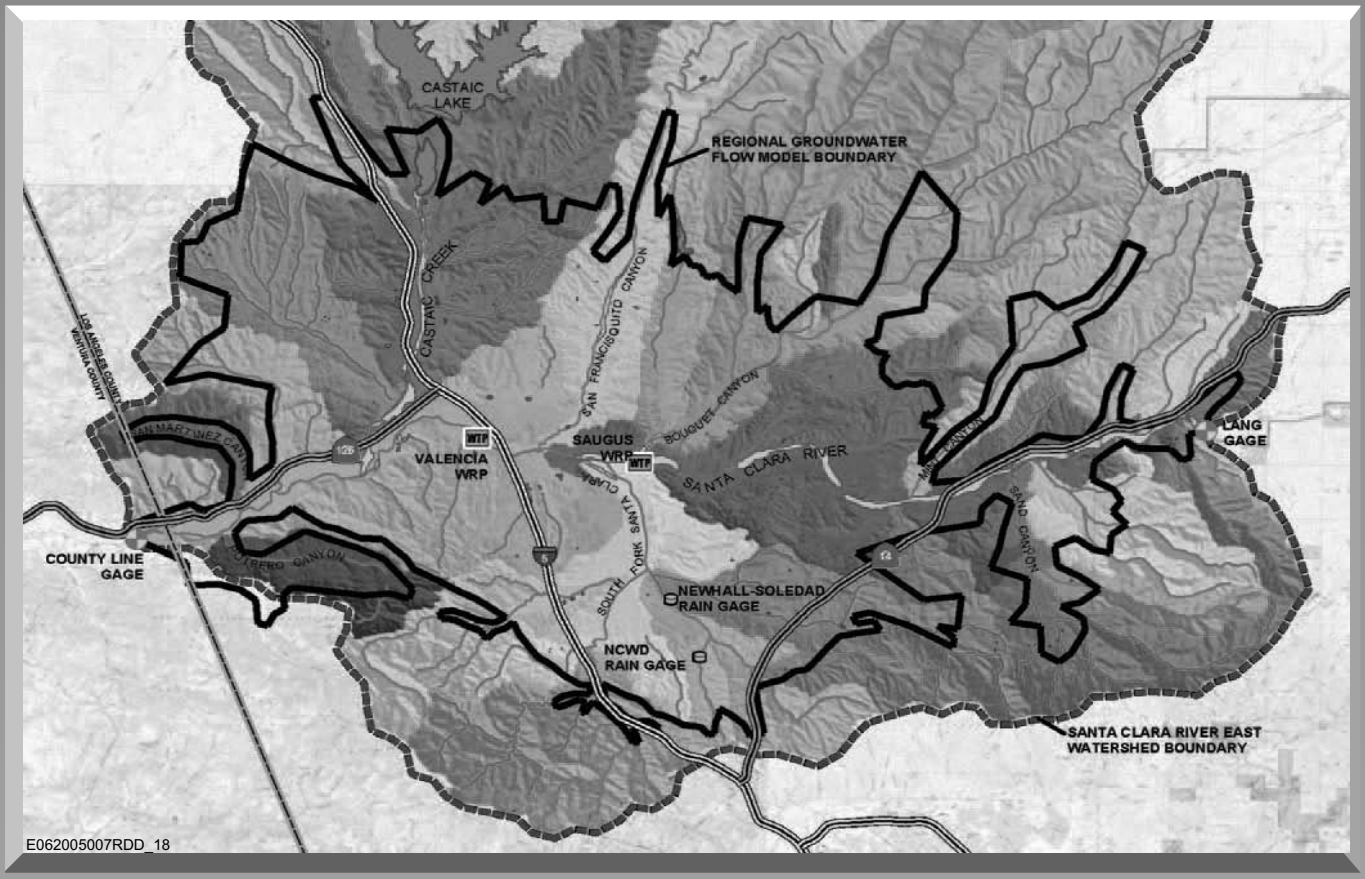
Dated August 2005

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District



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CH2MHILL

In cooperation with
Luhdorff & Scalmanini Consulting Engineers

August 2005

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September 23, 2005

178973.A4.02

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Santa Clarita, California 91322-0970

Subject: Submittal of Report on Basin Yield Analysis

Dear Mr. DiPrimio, Mr. Masnada, Mr. Manetta, and Mr. Cole:

CH2M HILL is pleased to submit the enclosed report titled *Analysis of Groundwater Basin Yield, Upper Santa Clara River Basin, East Subbasin, Los Angeles County, California*. This report has been developed for the Upper Basin Water Purveyors and is the second of two reports that present and evaluate the groundwater operating plan for water supply wells completed in the Alluvial Aquifer and the Saugus Formation. This work has been performed as part of the August 2001 Memorandum of Understanding between the Santa Clara River Valley Upper Basin Water Purveyors and the United Water Conservation District. The first report, dated April 2004, documented the construction and calibration of a groundwater flow model for the Santa Clarita Valley. The enclosed report presents a modeling analysis of the groundwater operating plan and concludes that the groundwater operating plan is a reliable long-term component of water supply for the valley.

It has been our pleasure to serve the Upper Basin Water Purveyors on this important project. Please call me at 503/235-5022 if you have any questions.

Sincerely,

CH2M HILL

John J. Porcello
Project Manager

Nathan R. Brown, P.G.
Hydrogeologist

RDD/051860005 (CAH3130.doc)
Enclosures

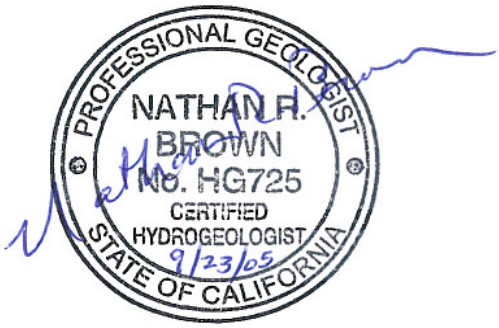
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District

Prepared for

Upper Basin Water Purveyors:

Castaic Lake Water Agency (CLWA)
Newhall County Water District
Santa Clarita Water Division of CLWA
Valencia Water Company



Prepared by

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August 2005

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Acronyms and Abbreviations

µg/L	micrograms per liter
AF/yr	acre-feet per year
AL	State of California's Action Level
Amended 2000 UWMP	2000 Urban Water Management Plan and 2005 amendments
CLWA	Castaic Lake Water Agency
DWR	California Department of Water Resources
ET	evapotranspiration
ft/day	feet per day
ft^2/day	square feet per day
in/yr	inches per year
Kh	horizontal hydraulic conductivity
LACSD	Los Angeles County Sanitation District
LADPW	Los Angeles County Department of Public Works
LSCE	Luhdorff & Scalmanini Consulting Engineers
MOU	Memorandum of Understanding
msl	mean sea level
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
OCAP	Operating Criteria and Plan
Purveyors	Upper Basin Water Purveyors
RCS	Richard C. Slade and Associates, LLC
Regional Model	Santa Clarita Valley Regional Groundwater Flow Model
SCWC	Santa Clarita Water Company
SWP	State Water Project
SWRM	Surface Water Routing Model
T	transmissivity
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan

VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WRP	water reclamation plant
UWCD	United Water Conservation District

SECTION 1

Introduction

This report presents an evaluation of the long-term sustainability of existing groundwater management practices in the Santa Clarita Valley, located in northwestern Los Angeles County, California. The groundwater system in the Santa Clarita Valley is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07) and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Groundwater in the basin is pumped from a shallow Alluvial Aquifer and deeper groundwater resources that are present in an older, underlying unit called the Saugus Formation. Most groundwater pumping is by the local water purveyors (the Upper Basin Water Purveyors [herein referred to as the Purveyors[1]]) for municipal uses (in the range of approximately 23,000 to 28,000 acre-feet per year [AF/yr] in recent years), with some continuing pumping by private landowners, primarily for irrigation uses (approximately 15,000 to 16,000 AF/yr in recent years). The Purveyors also have access to other sources of water, including imported State Water Project (SWP) water, groundwater banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs (Luhdorff & Scalmanini Consulting Engineers [LSCE], 2005a). The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, and limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly reduced because of drought conditions.

The evaluation of the Purveyors' current groundwater management practices has been performed using a detailed numerical groundwater flow model of the basin. The model, called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. The Regional Model has been developed for the Purveyors as a tool for the analysis of groundwater management options in the context of future water demands and water supply conditions in the valley. Among the objectives in developing the model were (1) to be able to evaluate the long-term sustainability (yield) of the Alluvial and Saugus aquifer systems under a range of existing and potential future water resource management conditions, and (2) to facilitate general management of water quantity and water quality issues. Figure 1-1 is a map showing the area simulated by the model (tables and figures are located at the end of each section).

1.1 Background

The Regional Model has been developed as part of the work scope contained in an August 2001 Memorandum of Understanding (MOU) that was entered into by the

[1]The Purveyors consist of the Castaic Lake Water Agency (CLWA), the Newhall County Water District, the Santa Clarita Water Division of CLWA, and the Valencia Water Company. The Santa Clarita Water Division of CLWA was acquired by CLWA in 1999. It was formerly called the Santa Clarita Water Company (SCWC).

Purveyors and the United Water Conservation District (UWCD), located downstream in Ventura County. The MOU, which is provided in Appendix A, is a commitment by the Purveyors to expand on previous analyses of groundwater conditions such that the adequacy of the local groundwater supply can be better understood and questions about surface water and groundwater resources can be more readily addressed. The MOU initiated a collaborative and integrated approach to data collection; database management; evaluating groundwater conditions and the sustainability of the Purveyors' operating plan; groundwater flow modeling; annual reporting on basin conditions; and technical reporting focused on geologic and hydrologic aspects of the overall stream-aquifer system.

In 2003, subsequent to the MOU, CLWA prepared and adopted a formal Groundwater Management Plan (CLWA, 2003), which includes 14 elements intended to achieve four management objectives, or goals, for the groundwater basin that were identified in the plan. Those four management objectives were development of local groundwater for water supply; avoidance of overdraft and associated undesirable effects; preservation of groundwater quality; and preservation of interrelated surface water resources. The intent of the Groundwater Management Plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, specifically avoidance of overdraft (Element 3 of the plan), no degradation of quality (Element 6 of the plan), no adverse impacts to surface waters (Element 2 of the plan). The plan identified these objectives and elements as being accomplished via continued conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Element 5 of the plan) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Elements 1 and 2 of the plan).

Both the MOU and the Groundwater Management Plan contain several technical components, including the development and calibration of a regional-scale groundwater flow model and the application of the model to evaluate the sustainability of the Purveyors' current groundwater operating plan. The development and calibration of the model was documented in detail in April 2004 in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a). A summary of the Regional Model's construction and calibration is presented in Appendix B. The analysis of the sustainability of the Purveyor's current groundwater operating plan began in 2004 and is the subject of this report. Consequently, this report and the earlier report on the development and calibration of the model represent the accomplishment of two of the key technical work components that were described in the MOU and in several elements of the Groundwater Management Plan.

The Purveyors prepared the first Urban Water Management Plan (UWMP) for the Santa Clarita Valley in 1985. At about that same time, the Purveyors began studying the local water resources to assess the condition, hydrogeologic character, storage capacity, water budgets, and water quality of the local groundwater aquifers. Some of that work involved evaluating the potential for conjunctive use of groundwater and imported water resources, specifically artificial recharge of the Alluvial Aquifer using spreading basins, and aquifer storage and recovery in the Saugus Formation. An update of the UWMP in December 2000 projected water demands in the valley through 2020 and delineated a number of local and other water supplies, in conjunction with SWP water, to meet those projected water demands. The UWMP also identified a water supply plan that consisted of using alternate

supplies and/or development of future supplies from groundwater storage projects, short-term transfers, local groundwater, and other sources to offset potentially reduced deliveries of SWP water, while meeting demands in a manner that would not cause overdraft conditions in the local aquifer systems. In 2005, CLWA amended the 2000 UWMP to address the adequacy of groundwater supplies in light of perchlorate contamination that had caused the inactivation of five municipal water supply wells. Included in the amendments to the 2000 UWMP (CLWA et al., 2005; hereafter referred to, together with the 2000 UWMP [Black & Veatch, 2000], as the Amended 2000 UWMP) was discussion of the plan currently being implemented to install treatment and restore impacted wells for water supply by 2006. In accordance with the California Urban Water Management Planning Act, the UWMP is currently undergoing a 5-year update that will be completed in late 2005.

The Purveyors and UWCD initially agreed in the MOU, and the Purveyors subsequently committed in the Groundwater Management Plan, to develop and use the Regional Model for the sustainability evaluation of the local groundwater operating plan, in part because (1) the available data showed that no long-term lowering of the water table or degradation of water quality had occurred during the 50 to 60 years of historical groundwater development in the valley, and (2) the various studies and water planning efforts performed up to that time had resulted in a local groundwater operating plan that places future pumping of the Alluvial Aquifer in the same range as historical pumping. However, although the MOU recognized a need to formally analyze the Alluvial Aquifer, it identified that the primary question to evaluate with the Regional Model would be the operational yield of the Saugus Formation, given that the Purveyors' operating plan called for dry-year pumping at rates higher than historically had been pumped. For that reason, the MOU identified that the model would evaluate the effect of the current groundwater operating plan on groundwater conditions in both the Alluvial Aquifer and the Saugus Formation over a multi-year wet/dry cycle. The operational yield was defined in the MOU as an operating plan for the local groundwater basin that would allow continued pumping from the Alluvial Aquifer and Saugus Formation while assuring that groundwater supplies would be adequately replenished from one wet/dry cycle to the next.

Together, the historical development of these plans and the evaluation of their sustainability that is described in this report are grounded in the following objectives, which have been identified by the Purveyors for local groundwater resource management:

1. Prepare a groundwater operating plan for the basin (locations of wells, pumping capacities, and variations in annual pumping volumes) that is integrated with SWP and other imported supplies and recycled water to meet local water demands.

2. Analyze the groundwater operating plan to quantify possible basin responses to the plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows. This includes evaluating the rate of recovery of Saugus Formation groundwater levels after 1 or more years of increased pumping in the Saugus Formation.

3. Evaluate the range of basin responses to the groundwater operating plan to determine whether the plan will result in sustainable groundwater resources and supplies. This includes evaluating the following:

    a. Whether groundwater level declines during future drought periods will continue to arise primarily from local drought conditions, instead of from the groundwater operating plan for the basin; and, more importantly, whether groundwater levels and storage will recover (recharge) in wet periods following dry or drought conditions

    b. Whether groundwater discharges to the Santa Clara River will continue to be relatively stable over time, compared to the year-to-year variations in groundwater recharge that occur in the rest of the basin

To meet these objectives, the Purveyors developed the Regional Model to be an evolving tool for local groundwater resource management. As discussed in the model development report (CH2M HILL, 2004a), specific objectives identified for the Regional Model were as follows:

1. To evaluate the long-term sustainability (yield) of the two aquifer systems in the valley, the Alluvial Aquifer and the Saugus Formation, under a range of existing and potential future water resource management conditions

2. To evaluate artificial recharge for the purpose of increasing the long-term sustainability of the aquifer system, particularly in conjunction with the availability of imported surface water supplies

3. To evaluate the influences of future water management plans and alternatives on groundwater conditions in the valley and on the flows of water into the downstream basins in Ventura County

4. To facilitate general management of water quantity and water quality issues

This report focuses on the application of the Regional Model to meet the first objective.

1.2 Report Organization

The remainder of this report is organized as follows:

- **Section 2** discusses the hydrogeology of the basin and describes the groundwater operating plan.
- **Section 3** describes the process that was used to simulate the groundwater operating plan with the Regional Model and evaluate the modeling results.
- **Section 4** discusses the results of the simulated groundwater operating plan.
- **Section 5** discusses the principal findings from the analyses of historical data and numerical modeling results, and the implications of these findings for long-term water management in the Santa Clarita Valley.
- **Section 6** is the reference list.

Figure

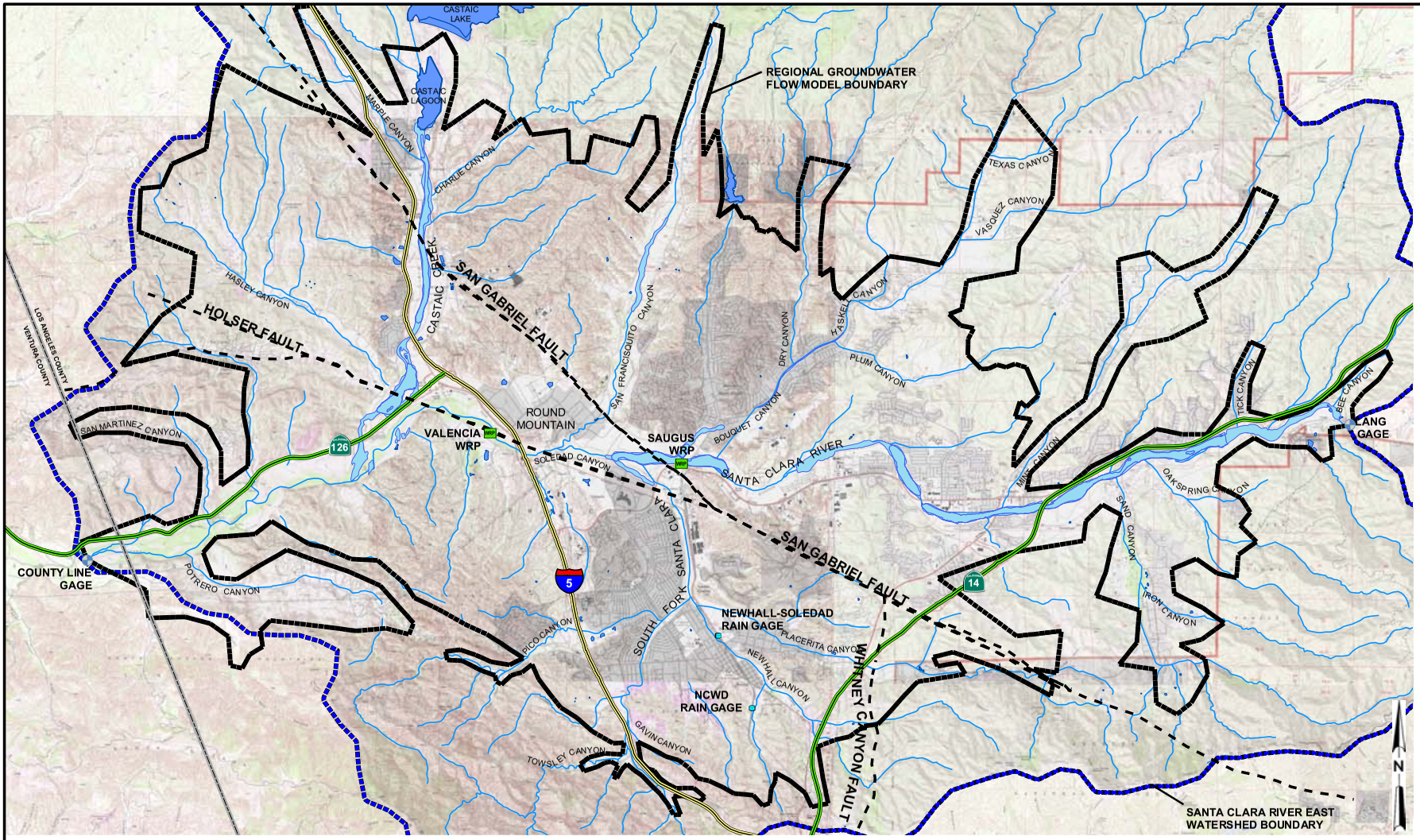

FIGURE 1-1
MAP OF STUDY AREA
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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SECTION 2

Groundwater Hydrology and Operating Plan

2.1 Basin Hydrogeology

The groundwater system in the Santa Clarita Valley is identified by DWR as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Figure 2-1 shows the location of this groundwater basin. The basin contains two aquifer systems: the Alluvial Aquifer and the Saugus Formation. Figure 2-2 is a geologic map showing the geographical extent of these and other rock units in and around the basin.

In general, natural groundwater recharge occurs in the eastern portion and at the northern and southern limits of the basin, and natural groundwater discharge occurs in the west-central portion of the basin, in the alluvial valley occupied by the Santa Clara River. Groundwater pumping is an additional groundwater discharge mechanism that occurs in discrete portions of the basin. A schematic representation of the regional-scale geology and hydrologic cycle in the Santa Clarita Valley is shown on Figure 2-3, and the components of the hydrologic cycle for the basin's groundwater and surface water resources are listed in Table 2-1. As indicated by the diagram and the table, groundwater is exchanged between the Alluvial Aquifer and the Saugus Formation, with the Alluvial Aquifer recharging the Saugus Formation in certain portions of the regional recharge areas, and the Alluvial Aquifer receiving groundwater from the Saugus Formation in the regional groundwater discharge areas. Additionally, the aquifer systems are affected by direct rainfall; stream-flows in the Santa Clara River and its tributaries; evapotranspiration (ET) by riparian vegetation along portions of the river; and human influences, which consist of pumping, agricultural and urban irrigation, discharge of treated water into the Santa Clara River from two water reclamation plants (WRP), and occasional releases of water into Castaic Creek from Castaic Lake and Castaic Lagoon.

The Santa Clarita Valley obtains its water supply from local groundwater sources and from imported water supplies. Total water use in the valley is largely for municipal and industrial uses and, to a lesser extent, for agricultural uses. In 2004, approximately 61 percent of groundwater pumping was by the Purveyors (for municipal uses) and 39 percent was by private land owners, primarily for irrigation. Figure 2-4 is a map showing the locations of production wells that are currently present in the Alluvial Aquifer and the Saugus Formation. Prior to the 1960s, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during much of the 1950s and early 1960s ranged between approximately 35,000 and 44,000 AF/yr. Pumping from the Alluvial Aquifer dropped gradually from approximately 40,000 AF/yr in the mid-1960s to less than 30,000 AF/yr through the 1980s, and did not rise above 30,000 AF/yr until 1993. Since then, it has ranged between 30,000 and nearly 44,000 AF/yr. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. As a

result of statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available.

2.2 Groundwater Operating Plan

The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer groundwater and SWP water during years of normal or above-normal availability of SWP water supplies and local Alluvial Aquifer groundwater resources. These practices recognize ongoing Alluvial pumping for agricultural water supply as well as other smaller (private) domestic and related water supply, and are intended to maintain overall pumping within sustainable rates. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. These water management practices are based, in part, on observations about the historical hydrology of the basin (described in Section 2.2.1) and form the groundwater operating plan for the basin (described in Section 2.2.2).

2.2.1 Historical Groundwater Conditions

Long-term water level data have been collected over the years at agricultural wells and Purveyor-owned wells in the City of Santa Clarita and along the South Fork Santa Clara River. The data have been collected in pumping wells, and the hydrographs of these wells are steep at certain times, suggesting that the measured water levels are influenced, to a certain degree, by pumping at the well. Nonetheless, the data show general relationships between groundwater elevation trends and changes in groundwater recharge and pumping over time. These relationships have been identified by examining the 50-year period from 1950 through 1999. During this period, the average rainfall was close to the long-term average rainfall observed since 1883. Consequently, long-term changes in the basin's hydrology arising from other factors could be more easily identified because rainfall was near normal for the 50-year period as a whole.

Following are discussions of the observed hydrologic trends in the basin, including rainfall, groundwater elevations in the Alluvial Aquifer and the Saugus Formation, and flows in the Santa Clara River.

2.2.1.1 Historical Trends in Rainfall

Rainfall data have been recorded since 1883 at the Newhall-Soledad gage (Station No. FC32CE), located at the Los Angeles County Department of Public Works (LADPW) Newhall-Soledad Division Headquarters office, on San Fernando Road in the community of Newhall. The average rainfall at this gage was 17.95 inches from 1883 through 2000 and 17.84 inches from 1950 through 2000[2]. Figure 2-5 shows the annual rainfall at the Newhall-Soledad gage for calendar years 1950 through 2000. Figure 2-5 also shows the cumulative departure from the average annual precipitation since 1950. Cumulative departure refers to the cumulative amount of rainfall that is greater than or less than the long-term average rainfall. The slope of the cumulative departure plot shows the temporal trends in rainfall

[2]Annual rainfall values for the Newhall-Soledad gage were derived from monthly values reported by the National Climate Data Center and LADPW.

over successive years. The figure shows the following trends in precipitation within the Santa Clarita Valley:

1. 1950 through 1964: Dry conditions except for single wet years in 1952, 1957, 1958, and 1962 (a nearly continuous decrease in cumulative departure values)
2. 1965 through 1970: Wet conditions (increase in cumulative departure values)
3. 1971 through 1977: Average to dry conditions (flat or declining cumulative departure values)
4. 1978 through 1983: Wet conditions (increase in cumulative departure values)
5. 1984 through 1991: Dry conditions (decrease in cumulative departure values)
6. 1992 through 1999: Highly variable conditions from year to year, but overall increase in cumulative departure values

A second rain gage is located approximately 1.3 miles to the south, at the Newhall County Water District (NCWD) office (see Figure 1-1). Figure 2-6 compares the annual rainfall at the Newhall-Soledad and NCWD gages for calendar years 1950 through 2000. Rainfall at the NCWD gage is usually greater than at the Newhall-Soledad gage, because the NCWD gage is located closer to the hills that form the southern boundary of the watershed and receive a greater amount of orographic precipitation, as shown on Figure 2-7.

2.2.1.2 Historical Trends in Alluvial Aquifer Groundwater Elevations

Figure 2-8 shows trends in groundwater elevations in two Alluvial Aquifer wells located in the basin interior (wells VWC-N and NLF-S, near the mouth of the South Fork Santa Clara River) and two Alluvial Aquifer wells located near the regional groundwater discharge zone at the western end of the basin (wells NLF-C5 and NLF-C7). The figure also shows trends in the following other components of the hydrologic cycle:

1. Precipitation at the Newhall-Soledad rain gage (plotted as the cumulative departure from the average precipitation)
2. Annual pumping volumes from the Alluvial Aquifer and the Saugus Formation
3. Total discharges to the Santa Clara River from two WRPs (which are discussed further in Section 2.2.1.5)
4. Measured flow volume in the Santa Clara River during the lowest flow month of each year

Observations from Figure 2-8 are as follows:

1. Alluvial Aquifer groundwater elevations show greater variability over time within the basin interior (wells VWC-N and NLF-S) than near the basin outlet (wells NLF-C5 and NLF-C7). The range in water levels during the 50-year period of record is approximately 100 feet at the interior wells, but only 20 to 30 feet in the two wells near the basin outlet.
2. The effect of reduced pumping from the Alluvial Aquifer from 1967 through 1989 was to minimize seasonal fluctuations in Alluvial Aquifer water levels near the aquifer's regional discharge zone at the western end of the valley. In this area, fluctuations in

Alluvial Aquifer pumping over time affected Alluvial groundwater elevations only seasonally; year-to-year variations in groundwater elevations were small. This indicates that water levels in this area are controlled less by pumping than by the discharge of Alluvial Aquifer groundwater to the Santa Clara River in the area downstream of Interstate 5.

3. As with the western portion of the Alluvial Aquifer, the central portion of the Alluvial Aquifer has not shown long-term water level declines. During the 1950s and early 1960s, total pumping from the Alluvial Aquifer ranged between approximately 35,000 and 44,000 AF/yr during all but 1 year, and long-term (year-to-year) groundwater elevations were relatively stable (see the hydrographs for wells VWC-N and NLF-S). When pumping from the Alluvial Aquifer decreased beginning in 1967, Alluvial groundwater elevations in this area quickly rose and have been relatively stable since about 1970, despite an increase in Alluvial Aquifer pumping during the 1990s. The hydrographs indicate that after an extended drought and high rates of pumping, Alluvial Aquifer groundwater elevations recover very quickly when normal or above-normal rainfall patterns return.

4. The seasonal low flow in the Santa Clara River at the County Line gage has shown a long-term increase since the mid-1970s and, to some degree, since the late 1960s. Figure 2-5 shows that this increase in flow coincides with increases in the annual discharges of treated water to the Santa Clara River from the two WRPs. Although Alluvial Aquifer pumping increased during the 1980s and 1990s, the seasonal low river flow did not show a long-term decrease during this period. The increases in WRP and Santa Clara River flows and the fluctuations in Alluvial Aquifer pumping have not caused long-term changes in Alluvial Aquifer groundwater elevations at the two wells near the basin outlet.

2.2.1.3 Historical Trends in Saugus Formation Groundwater Elevations

Figures 2-9 and 2-10 compare groundwater elevation trends in the Saugus Formation near the Santa Clara River, below the mouth of the South Fork Santa Clara River, with the same hydrologic components displayed on Figure 2-8. Figure 2-9 shows this information for the period 1950 through 1999, and Figure 2-10 shows this information during the 1990s, when groundwater levels rose in the Saugus Formation. Figures 2-11 and 2-12 show the same information, but for groundwater elevations at Saugus Formation wells located farther away from the Santa Clara River, along the tributary valley containing the South Fork Santa Clara River.

In examining the four Saugus Formation figures, it is difficult to distinguish between the influences of precipitation and pumping trends on changes in Saugus water levels. Although a slight rise in water levels might have occurred at wells VWC-157 and VWC-160 during the late 1960s and early 1970s, it appears to follow the trends in Saugus pumping volumes more closely than the precipitation trends. The data at VWC-157 also suggest that a succession of above-normal precipitation years (e.g., 1978 through 1983) or a year of precipitation that is substantially above normal (e.g., 1983) might have some influence on Saugus water levels. However, the data are limited, and the periods of increased precipitation tend to coincide with periods of decreased pumping, making it difficult to identify the effect of precipitation or pumping on Saugus water levels.

Another observation is that the rise in Saugus Formation water levels in the late 1960s and early 1970s occurred despite an increase in annual pumping volumes from the Alluvial Aquifer. During the late 1980s and 1990s, Saugus pumping increased from slightly less than 6,000 AF/yr (in 1986 and 1987) to approximately 15,000 AF/yr in 1991. When SWP deliveries were substantially reduced in 1991, pumping from the Saugus Formation made up for almost half of the reduction that year. This increased Saugus pumping resulted in short-term declines in groundwater elevations at the pumping wells, particularly from 1991 through 1994, reflecting the use of naturally-stored Saugus groundwater. However, as shown on Figures 2-9 and 2-10, the water levels subsequently rose when pumping declined. This indicates that Saugus water levels are controlled by precipitation and/or Saugus pumping trends, and not by pumping trends in the Alluvial Aquifer.

2.2.1.4 Comparison of Historical Trends in Alluvial and Saugus Groundwater Elevations

Figure 2-13 compares groundwater elevations at Alluvial Aquifer and Saugus Formation wells located near each other along the Santa Clara River, just below the mouth of the South Fork Santa Clara River. At this location, the trends in Alluvial groundwater elevations show no clear relationship with the trends in Saugus groundwater elevations. A moderate overall increase in groundwater elevations was observed in both the Alluvial Aquifer and the Saugus Formation during the late 1960s. However, this similarity in the water level trends might be a coincidence arising from reduced pumping in both aquifers. During the early 1970s, water levels in Saugus well VWC-157 decreased while water levels in the nearby Alluvial Aquifer well (VWC-N) generally increased. During the 1990s, the Alluvial Aquifer groundwater elevations at well VWC-N were generally stable despite (1) increased pumping from the Alluvial Aquifer and (2) a sharp decrease, then increase, in Saugus groundwater elevations, which correlated with the trends in Saugus pumping. In summary, although there might be a relationship between Alluvial and Saugus groundwater elevations near the margins of the groundwater basin, where folding of Saugus beds has brought permeable zones in contact with the alluvium, Figure 2-13 indicates that there is general independence between the Alluvial and Saugus water level trends at this location, which is near the center of the bowl-shaped Saugus Formation structure shown on Figure 2-3.

2.2.1.5 Historical Trends in Santa Clara River Baseflow

Long-term records of flows in the Santa Clara River are available for the eastern and western ends of the basin. The locations of the two gages are shown on Figure 1-1 and Figure 2-3. At the western end of the basin, the County Line gage has recorded Santa Clara River flows leaving the basin for most of the period since 1952, except for a 1-year period during water year 1969 (October 1968 through September 1969). At the eastern end of the basin, the Lang gage has recorded Santa Clara River flows entering the basin from October 1949 through September 1989 and from April 2003 to the present.

Baseflow in the Santa Clara River is perennial in the western portion of the Santa Clarita Valley. The following sources of water contribute to the river's baseflow:

1. **Groundwater discharge from the Alluvial Aquifer to the riverbed.** Groundwater in the Alluvial Aquifer seeps into the riverbed near, and downstream of, Round Mountain (which is located just below the mouth of San Francisquito Canyon).

2. **Discharges from two WRPs.** Treated water is discharged to the Santa Clara River from two Los Angeles County Sanitation District (LACSD) WRPs in the valley. The Saugus WRP (Plant No. 26) is located along the south side of the river near Bouquet Canyon, just above the mouth of the South Fork Santa Clara River. The Valencia WRP (Plant No. 32) is located along the north side of the river, just west of Interstate 5.

3. **Flood Flows in Castaic Creek.** DWR stores SWP water in Castaic Lake. In some years, DWR releases flood flows from Castaic Dam/Lagoon into Castaic Creek during the winter or spring months. Depending on the magnitude of the releases, some of these flows enter the Santa Clara River downstream of the Valencia WRP. As shown on Figure 2-14, these releases have occurred during many, though not all, years since the release program began in the late 1970s.

Hydrograph separation techniques were applied to the daily streamflow data for the County Line gage to estimate historical groundwater discharges (baseflow) to the Santa Clara River within the Santa Clarita Valley. The hydrograph separation was performed for calendar years 1953 through 1999 using the following five steps:

1. For each day, the average daily flow at the County Line gage, in cubic feet per second (cfs), was converted to acre-feet of volumetric flow for the day.

2. The daily flows from Castaic Dam and at the Castaic Creek South gage (located near the mouth of Castaic Creek) were subtracted from the flow at the County Line gage. These data reflect surface water flow from tributaries. Data from the Castaic Creek South gage were used through June 1977. Beginning in July 1977, operational data for Castaic Lagoon, presented in annual reports by DWR, were used to estimate surface flow contributions from Castaic Creek.

3. The discharges of treated water from the two WRPs were subtracted. This step was performed for calendar years 1975 and later, because 1975 was the first year that such records were available.

4. The resulting day-to-day trends in streamflows were scrutinized for days when notably elevated flows occurred suddenly. These days were assumed to be dominated by storm flow. In some cases, the elevated flows lasted for only 2 to 5 days. In other cases, flows remained elevated for several days, but showed steady declines, indicating that only the beginning of the elevated-flow period was dominated by surface runoff.

5. On all other days, storm flow was considered to be minimal or zero, and the flow values calculated for days not dominated by storm flow were assumed to represent river base-flow (that is, groundwater discharge to the river). For each month, an average flow was calculated for these non-storm days. The average flow was then converted to a total flow for the month, and the monthly flow volumes were summed to come up with the total flow for each year.

Table 2-2 presents the annual calculations from the hydrograph separation analysis. Table 2-3 presents summary statistics for the entire 47-year period that was analyzed, as well as for shorter time frames. Tables 2-4 and 2-5 show dry-year, normal-year, and

wet-year statistics for the entire period of record and the shorter time frames. The shorter time frames are as follows:

1. Calendar years 1953 through 1965, which were years of primarily agricultural water use prior to urbanization and construction of WRPs. This 13-year period was also characterized by 5 years of below-normal rainfall.

2. Calendar years 1975 through 1999, which represent 25 years of significant urbanization, including SWP water importation and WRP operations. This 25-year period was characterized by 6 years of below-normal rainfall, although rainfall volumes in general were somewhat higher (19.4 inches per year [in/yr] average, versus 15.5 in/yr average for 1953 through 1965).

3. Calendar years 1953 through 1999, but excluding 8 years (1966 through 1974) when WRP discharges occurred but were not recorded.

The daily streamflow data and the hydrograph separation technique indicate the following:

1. Summary statistics in Table 2-3 for all types of rainfall years (dry, normal, and wet) show that average groundwater discharges to the river from 1953 through 1965 were approximately 2,500 AF/yr (3.5 cfs). Groundwater discharges to the river were typically 14,000 to 22,000 AF/yr (19 to 31 cfs) from 1975 through 1999 because of more rainfall, increasing urbanization, and increasing importation of water from outside the valley.

2. For normal rainfall years only, median and average groundwater discharges to the river were approximately 4,000 and 3,600 AF/yr (5.5 and 5.0 cfs), respectively, from 1953 through 1965 (see Table 2-4); and approximately 12,500 and 14,300 AF/yr (17 and 20 cfs), respectively, during 1975 through 1999 (see Table 2-4).

3. For drought years only, Table 2-4 shows that groundwater discharges to the river ranged from 400 to 4,900 AF/yr (0.5 to 7 cfs) between 1953 and 1965, and from 5,200 to 14,500 AF/yr (7 to 20 cfs) between 1975 and 1999. Table 2-4 also shows that median and average groundwater discharges to the river during drought years were 600 and 1,700 AF/yr (1 and 2 cfs), respectively, from 1953 through 1965, and typically 9,600 and 10,200 AF/yr (13 and 14 cfs), respectively, from 1975 through 1999.

In summary, significant increases in the baseflow of the Santa Clara River have occurred since urbanization of the Santa Clarita Valley began during the late 1960s and early 1970s. Water imports began in 1980, and have increased in volume as urbanization has continued. The imported water has reached the river through releases from Castaic Dam/Lagoon and, more significantly, discharges of treated water into the river. As a result, water is now present in the Santa Clara River on a continuous basis in the western portion of the basin, even during dry years. This is a sharp contrast to conditions prior to the 1970s, when the river would become dry during drought periods.

2.2.2 Historical Estimates of Basin Yield

During the late 1980s, Richard C. Slade, Consulting Groundwater Geologist, now known as Richard C. Slade and Associates, LLC (both hereafter referred to as RCS), conducted hydrogeologic assessments of the two aquifer systems in the basin. RCS performed separate

evaluations for the Alluvial Aquifer in 1986 and the Saugus Formation in 1988, then updated this work in 2002.

The first study of the Alluvial Aquifer (RCS, 1986) identified a "practical or perennial yield" of 31,600 to 32,600 AF/yr. RCS derived these values using the so-called "Pumpage and Change-In-Storage" method, a commonly used method at the time that compares groundwater pumping volumes with changes in the volume of groundwater in storage during a multi-year period when cumulative rainfall is close to average. As RCS discussed in a more recent report (2002), this method works best in aquifers that are fully developed or in overdraft, and where recharge does not play an important role in determining the amount of groundwater in storage. Consequently, as discussed by RCS (2002), this method is not well suited to estimating sustainable pumping rates in this setting because natural recharge and water importation are major influences on the groundwater basin in the Santa Clarita Valley, and the local groundwater resources are not fully developed or in overdraft.

The first study of the Saugus Formation (RCS, 1988) did not identify a practical or perennial yield or a range of pumping rates that were estimated to be sustainable on a long-term basis. Instead, this study first estimated the "usable groundwater in storage," which was defined as the volume of Saugus Formation groundwater that is economically obtainable and of satisfactory quality for beneficial use. RCS estimated the usable groundwater in storage to be 1.41 million acre-feet. Then, using precipitation records and calculations of the exposed area of the Saugus Formation and overlying terrace deposits, and also considering the hydraulic potential for inter-aquifer flow from the overlying Alluvial Aquifer, RCS estimated that the Saugus Formation potentially receives between approximately 11,000 and 22,000 AF/yr of recharge from a combination of direct rainfall and inter-aquifer flow in any given year, depending on local hydrologic conditions. However, RCS did not discuss the relationship of these estimates to long-term pumping from the Saugus Formation. In fact, RCS noted that these assessments "…should not be construed as a rigorous determination of the perennial yield of the Saugus…."

In the *2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems* (RCS, 2002), RCS concluded that groundwater levels in the Alluvial Aquifer and Saugus Formation have fluctuated over time, but have shown no long-term progressive declines in the amount of groundwater storage that could be considered indicative of overdraft conditions. From the long-term pumping and water level data, the report concluded that the Alluvial Aquifer can be pumped at rates between 30,000 and 40,000 AF/yr over the long term, and suggested that pumping be between 30,000 and 35,000 AF/yr during local droughts. For the Saugus Formation, the report concluded that pumping can occur at rates between 7,500 and 15,000 AF/yr on a long-term basis, with short-term increases to as much as 35,000 AF/yr toward the end of a multi-year period of reduced availability of imported water supplies.

RCS (2002) referred to these pumping rates for the Alluvial and Saugus aquifer systems as the "operational yield" of both aquifers, a term that was previously described in the August 2001 MOU. The term perennial yield is often interpreted as a "not-to-exceed" volume, with a related potential for pumping above the perennial yield value in any given year to be incorrectly interpreted as "overdraft." Consequently, the MOU advanced the concept of operational yield to deal with the misinterpretations commonly associated with the concept of perennial yield. In the Santa Clarita Valley, operational yield is used today to describe the

flexible use of groundwater that allows increased pumping during dry periods and subsequent recharge (direct or in-lieu) in wet/normal rainfall periods, performed in a manner that protects the aquifer by assuring that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. This concept is the basis for the development of the current groundwater operating plan for the local groundwater basin, which is discussed in the following section.

2.2.3 Development of Current Operating Plan

The groundwater operating plan for the Santa Clarita Valley's groundwater resources has been defined in the Amended 2000 UWMP for the Santa Clarita Valley (Black & Veatch, 2000; CLWA et al., 2005) and in annual water reports that discuss the water demands, water supplies, and surface water and groundwater resources of the valley (including the *Santa Clarita Valley Water Report 2004* [LSCE, 2005a]). These reports provide ranges of values for groundwater extractions from the Alluvial Aquifer and the Saugus Formation during wet/normal years and dry years. The Purveyors have developed the operating plan by considering the water supply needs of the valley, the availability of imported water supplies, and knowledge of the historical recovery of both aquifers (following the peak pumping years that occurred prior to the mid-1960s in the Alluvial Aquifer and during the early 1990s in the Saugus Formation). The plan is summarized in Table 2-6 and is as follows:

1. Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern part of the basin. Under the operating plan, pumping ranges between 30,000 and 40,000 AF/yr during normal and above-normal rainfall years, but, because of operational constraints in the eastern part of the basin, is reduced to between 30,000 and 35,000 AF/yr during locally dry years.

2. Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly imported water from the SWP system. For the Saugus Formation, the operating plan consists of pumping between 7,500 and 15,000 AF/yr during average-year conditions within the SWP system. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 AF/yr during a drought year, and increases to between 21,000 and 25,000 AF/yr if SWP deliveries are reduced for 2 consecutive years, and between 21,000 and 35,000 AF/yr if SWP deliveries are reduced for 3 consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 AF/yr, to further enhance the effectiveness of natural recharge processes that would rapidly recover water levels and groundwater storage volumes in the Saugus Formation, as has been historically experienced.

The Purveyors have developed this plan as part of an overall water supply strategy designed to meet increasing water demands in the Santa Clarita Valley while assuring a reasonable degree of water supply reliability[3] and not exceeding the operational yield of the local aquifer systems on a long-term basis. In particular, this plan employs an integrated use

[3]As discussed in Section ES.5 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a), the Purveyors are in the process of establishing a water reliability policy, for planning purposes, sufficient for meeting projected demands 95 percent of the time over each 20-year period. In the remaining 5 percent of the time, it is planned that the maximum supply shortage will be 10 percent of demand, a level that is based on past experience that a 10 percent water demand reduction is feasible during a drought. (During the last drought, in the early 1990s, voluntary conservation efforts by area residents resulted in a reduction in water demands of approximately 20 percent below demands in preceding years.)

of the Alluvial Aquifer and the Saugus Formation that recognizes the fundamental differences in the hydrogeologic characteristics of these two units[4]. Maintaining the substantial volume of water in the Saugus Formation is an important part of this strategy, to help maintain local groundwater supplies on a long-term basis. In implementing this operating plan, the Purveyors blend groundwater and imported water for area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and any given location in the valley is an operational decision, which varies over time according to source availability and the operational capacities of Purveyor-owned facilities. In years when SWP supplies are reduced because of regulatory factors and/or dry weather conditions in the watersheds that provide SWP water supplies, the water demands in the Santa Clarita Valley can be met through a combination of the following alternate supplies:

1. Local groundwater pumping (increased short-term Saugus pumping)
2. Deliveries from CLWA's groundwater banking programs, such as the Semitropic Groundwater Storage Program in Kern County, where CLWA has banked excess SWP water in recent years
3. Deliveries from CLWA's flexible storage account in Castaic Lake Reservoir
4. Participation in DWR dry-year water purchase programs
5. Short-term water exchanges

The Purveyors have emphasized developing water supplies that add diversity in water supply options, especially in years of dry conditions in the Santa Clarita Valley (which can reduce Alluvial Aquifer supplies) and/or reduced availability of SWP imports. Drought periods, local or in the SWP system, can affect water supplies in single and multiple years. Details concerning the nature of local hydrologic variations, which govern Alluvial Aquifer pumping, are presented in Section 2.2.3.1. Section 2.2.3.2 discusses variations in imported water availability, which governs pumping from the Saugus Formation.

2.2.3.1 Variations in Local Hydrology and Alluvial Aquifer Pumping

The rate of pumping from the Alluvial Aquifer in a given year is partly affected by groundwater elevations in the eastern portion of the basin, which is the primary groundwater recharge area for the local groundwater systems. Historically, during dry years, decreases in Alluvial Aquifer pumping occur in the eastern-most Alluvial Aquifer production wells, which are located adjacent to the Santa Clara River in Soledad Canyon, upstream of the mouth of Bouquet Canyon. Reduced groundwater pumping occurs in these areas because of declines in groundwater elevations resulting from reduced groundwater recharge by the Santa Clara River during dry years. Groundwater levels in this area have historically decreased between approximately 50 and 100 feet during multi-year periods of below-normal rainfall and Santa Clara River streamflows. Consequently, the approximate

[4]As discussed in this report and other documents (RCS, 2002; CH2M HILL, 2004a; LSCE, 2005a), the Alluvial Aquifer is more permeable and much thinner than the Saugus Formation. The eastern portion of the Alluvial Aquifer also shows considerably greater short-term (month-to-month) and long-term (year-to-year) fluctuations in groundwater levels than the rest of the Alluvial Aquifer and the Saugus Formation.

5,000 AF/yr reduction in Alluvial Aquifer pumping in dry years that is called for under the operating plan occurs primarily as reduced pumping from wells in eastern Soledad Canyon.

Elsewhere in the Alluvial Aquifer, where groundwater elevations have fluctuated much less during single-year or multi-year dry periods, reductions in pumping rates have been unnecessary. Throughout the Alluvial Aquifer, groundwater elevations have historically recovered fully in response to the normal and above-normal rainfall and stream flows that mark the end of each dry period.

The historical record of rainfall and pumping indicates that the 5,000 AF/yr of dry-year reduction in Alluvial Aquifer pumping typically occurs when rainfall is below 12 in/yr, as measured at the Newhall-Soledad rain gage. Annual rainfall at this gage was below 12 in/yr during 14 years of this 50-year period, as shown on Figure 2-5.

2.2.3.2 Variations in State Water Project Hydrology and Saugus Formation Pumping

The rate of pumping from the Saugus Formation in a given year is governed by the availability of imported water supplies, particularly imported water from the SWP system. CLWA has performed a statistical evaluation of SWP deliveries (Kennedy/Jenks Consultants, 2003) using the 2021B scenario from the CALSIM II model, which was developed by DWR for its SWP Delivery Reliability Report (DWR, 2003). The CALSIM II model and the SWP Delivery Reliability Report were developed to support (1) the preparation of urban water management plans by the water agencies that are SWP contractors, (2) analyses required to comply with Senate Bills 221 and 610, and (3) other water supply planning activities that include the SWP as a supply component. The 2021B scenario simulates the anticipated deliveries of water to the 29 SWP contractors using an historical hydrologic record and anticipated operating and regulatory conditions for the SWP system in 2021. The U.S. Bureau of Reclamation (USBR) has also used CALSIM II to perform biological assessment studies for the Operating Criteria and Plan (OCAP) for the SWP (USBR, 2004). Both the CLWA and the USBR studies, which were made public for review in February 2004, include evaluations of the role and function of an Environmental Water Account (EWA), which consists of water purchased to mitigate the water supply impacts of protection measures for endangered species. These CALSIM II simulations have been performed for the SWP system at a present-day level of development and for the anticipated level of development in 2020. Table 2-7 compares the municipal and industrial water use allocations calculated by CALSIM II for the SWP Reliability Report (DWR, 2003) and for the OCAP (USBR, 2004) for the hydrology that occurred from 1950 through 1993.

CLWA's evaluation reached the following conclusions regarding the deliveries it will receive under this scenario (Kennedy/Jenks Consultants, 2003):

1. A regression analysis indicates that there is a weak relationship between the SWP delivery in a given year and the previous year's delivery.

2. SWP deliveries will equal or exceed 70 percent of CLWA's 95,200 AF/yr Table A water amount during approximately 75 percent of the simulated years. During the remaining years, the deliveries will vary between 20 and 70 percent.

3. A Monte Carlo analysis of projected deliveries during 73 consecutive years indicated that at a 95 percent confidence level, 4 years of a 7-year drought period in the SWP

system (such as was observed from 1988 through 1994) will have sufficiently low deliveries to require short-term pumping of increased groundwater volumes to meet local water demands. This includes a period of 3 consecutive years of increased pumping.

Section 3.3.3 of this report discusses the relationship between SWP hydrology, SWP allocations to the 29 SWP contractors, and corresponding pumping from the Saugus Formation, and how this relationship was built into the modeling analysis of the groundwater operating plan.

Tables

TABLE 2-1
Recharge and Discharge Components of the Hydrologic Cycle in the Upper Santa Clara River Basin
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Recharge	Discharge
Surface Water	
Direct runoff of precipitation	Evapotranspiration of precipitation
Precipitation runoff from upstream watershed areas	Santa Clara River flow to Ventura County
Castaic Lake/Lagoon releases into Castaic Creek	Streamflow seepage to the Alluvial Aquifer
WRP discharges to the Santa Clara River	Evapotranspiration of applied irrigation water
Groundwater seepage into the Santa Clara River	
Irrigation return flows (agricultural and urban)	
Groundwater	
Infiltration of precipitation	Pumping
Infiltration of outdoor applied water (agricultural and urban)	Evapotranspiration of Alluvial Aquifer groundwater by riparian vegetation
Alluvial Aquifer subsurface inflow (Castaic Dam, Lang gage)	Alluvial Aquifer subsurface outflow (western study area boundary)
Streamflow seepage to Alluvial Aquifer	Groundwater seepage into the Santa Clara River

Notes:

The two sources of water for agricultural and municipal water uses in the basin are groundwater pumping and imported water from the SWP.

Because SWP water is stored in Castaic Lake, which is outside the limits of the Alluvial and Saugus aquifers, it is not considered a part of the valley's hydrologic cycle while it is still in storage. However, SWP water that is land-applied or that is discharged from a WRP qualifies as a component of the hydrologic cycle. In addition, subsurface groundwater flow into the Santa Clarita Valley occurs beneath Castaic Creek through water seepage beneath Castaic Dam.

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1953	0	4,986	4,943	0	4,943	4.88	Dry
1954	977	7,316	5,554	0	5,554	15.82	Normal
1955	134	4,795	4,122	0	4,122	13.91	Normal
1956	311	5,429	3,803	0	3,803	14.21	Normal
1957	559	4,782	2,410	0	2,410	22.85	Wet
1958	21,204	38,756	5,344	0	5,344	23.14	Wet
1959	473	3,277	2,206	0	2,206	9.81	Dry
1960	1	777	586	0	586	11.64	Dry
1961	79	804	410	0	410	8.82	Dry
1962	5,101	28,460	2,433	0	2,433	21.22	Wet
1963	32	1,884	1,058	0	1,058	12.79	Normal
1964	1	1,030	646	0	646	10.09	Dry
1965	3,702	35,614	996	0	996	32.28	Wet
1966	5,780	10,101	2,332	No data	---	14.57	Normal
1967	27,819	40,480	8,640	No data	---	23.23	Wet
1968	4,381	7,216	3,895	No data	---	6.90	Dry
1969	46,461	258,660	29,395	No data	---	32.42	Wet
1970	6,597	31,066	14,924	No data	---	23.19	Wet
1971	2,310	15,883	10,843	No data	---	13.75	Normal
1972	2,205	16,027	12,975	No data	---	4.15	Dry
1973	12,671	52,631	26,115	No data	---	19.79	Wet
1974	7,288	25,265	11,918	No data	---	18.04	Wet
1975	2,027	14,770	10,806	5,534	5,272	10.92	Dry
1976	156	10,162	9,754	6,095	3,659	14.02	Normal
1977	1,380	13,454	9,359	6,004	3,355	20.87	Wet
1978	35,378	129,187	60,955	6,982	53,973	42.17	Wet
1979	13,626	57,594	42,448	7,397	35,051	21.47	Wet
1980	16,785	95,211	57,593	7,372	50,221	27.00	Wet
1981	6,519	24,232	21,172	7,949	13,223	13.42	Normal
1982	9,102	36,488	32,531	8,436	24,095	20.20	Wet
1983	67,058	131,236	55,878	9,420	46,458	39.07	Wet

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1984	13,787	39,279	35,215	9,512	25,703	12.86	Normal
1985	2,619	24,466	24,089	9,614	14,475	8.37	Dry
1986	4,945	48,024	31,327	10,822	20,505	18.02	Wet
1987	911	26,198	23,663	11,844	11,819	14.45	Normal
1988	2,415	36,611	24,934	12,363	12,571	16.92	Wet
1989	Unavailable	24,799	23,453	13,560	9,893	7.56	Dry
1990	0	23,472	21,772	14,006	7,766	6.98	Dry
1991	65	34,901	18,702	14,108	4,594	17.21	Wet
1992	4,450	68,577	23,601	15,703	7,898	32.03	Wet
1993	7,725	152,783	65,054	17,179	47,875	32.72	Wet
1994	Unavailable	32,039	31,239	16,946	14,293	10.27	Dry
1995	5,611	82,409	51,001	17,824	33,177	29.15	Wet
1996	5,632	47,930	36,366	16,831	19,535	15.88	Normal
1997	9,885	36,780	27,521	15,778	11,743	13.35	Normal
1998	47,803	205,139	81,744	17,695	64,049	30.73	Wet
1999	5,830	32,382	27,176	17,847	9,329	8.96	Dry

[a]Values through June 1977 are from the former Castaic Creek South gage (U.S. Geologic Survey [USGS] Gage Station 11108145). Values after June 1977 are derived from records of releases from Castaic Dam/Lagoon into Castaic Creek, as provided by DWR.

[b]Values through September 30, 1996, are from USGS Gage Station 11108500. This gage was located immediately downstream of the Los Angeles-Ventura County Line and was taken permanently out of service after October 21, 1996. Data beginning on October 1, 1996, are from new USGS gage station 11109000, located approximately 2.5 miles farther downstream, near Piru Junction, at the Las Brisas Bridge.

[c]Annual rainfall values are based on monthly records for this gage, as reported by the National Climate Data Center and LADPW.

[d]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-3
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	311	4,795	2,410	0	2,410	13.91
Average	2,506	10,608	2,655	0	2,655	15.50
Maximum	21,204	38,756	5,554	0	5,554	32.28
Statistics for 1975 through 1999						
Minimum	0	10,162	9,359	5,534	3,355	6.98
Median	5,632	36,611	27,521	11,844	14,293	16.92
Average	11,466	57,125	33,894	11,873	22,021	19.38
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	3,161	30,250	22,613	11,844	8,613	15.14
Average	8,230	41,211	23,207	11,873	15,396	18.05
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	4,450	28,460	18,702	11,844	8,613	15.82
Average	9,151	43,050	21,338	11,873	15,396	17.92
Maximum	67,058	258,660	81,744	17,847	64,049	42.17

TABLE 2-4
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1965 versus 1975 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 5 Dry Years during 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	1	1,030	646	0	646	9.81
Average	111	2,175	1,758	0	1,758	9.05
Maximum	473	4,986	4,943	0	4,943	11.64
Statistics for 4 Normal Years during 1953 through 1965						
Minimum	32	1,884	1,058	0	1,058	12.79
Median	222	5,112	3,963	0	3,963	14.06
Average	363	4,856	3,634	0	3,634	14.18
Maximum	977	7,316	5,554	0	5,554	15.82
Statistics for 4 Wet Years during 1953 through 1965						
Minimum	559	4,782	996	0	996	21.22
Median	4,402	32,037	2,421	0	2,421	23.00
Average	7,641	26,903	2,796	0	2,796	24.87
Maximum	21,204	38,756	5,344	0	5,344	32.28
Statistics for 6 Dry Years during 1975 through 1999						
Minimum	0	14,770	10,806	5,534	5,272	6.98
Median	2,323	24,633	23,771	13,783	9,611	8.67
Average	2,619	25,322	23,089	12,918	10,171	8.84
Maximum	5,830	32,382	31,239	17,847	14,475	10.92
Statistics for 6 Normal Years during 1975 through 1999						
Minimum	156	10,162	9,754	6,095	3,659	12.86
Median	6,076	31,489	25,592	10,678	12,521	13.72
Average	6,148	30,763	25,615	11,335	14,280	14.00
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 13 Wet Years during 1975 through 1999						
Minimum	65	13,454	9,359	6,004	3,355	16.92
Median	7,725	68,577	42,448	10,822	33,177	27.00
Average	16,642	83,970	42,702	11,639	31,063	26.74
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-5
Statistics on Annual Groundwater Discharge to the Santa Clara River, Including and Excluding 1966 through 1974
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 13 Dry Years during 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	473	14,770	10,806	13,783	5,272	8.82
Average	1,601	14,311	12,630	12,918	6,347	8.41
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 12 Normal Years during 1953 through 1999						
Minimum	0	7,316	2,433	6,004	2,433	13.35
Median	5,101	26,198	21,172	11,844	11,743	16.92
Average	5,238	27,883	16,963	10,788	8,671	17.10
Maximum	12,671	52,631	27,521	15,778	13,223	21.22
Statistics for 22 Wet Years during 1953 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	7,507	44,252	25,525	10,822	20,505	23.17
Average	15,807	73,060	29,877	11,639	24,412	25.62
Maximum	67,058	258,660	81,744	17,824	64,049	42.17
Statistics for 11 Dry Years during 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	79	14,770	10,806	13,783	5,272	8.96
Average	1,226	14,800	13,393	12,918	6,347	8.94
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 10 Normal Years during 1953 through 1965 and 1975 through 1999						
Minimum	32	1,884	1,058	6,095	1,058	12.79
Median	944	17,197	15,463	10,678	8,649	13.97
Average	3,834	20,400	16,823	11,335	10,022	14.07
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 17 Wet Years during 1953 through 1965 and 1975 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	5,611	48,024	31,327	10,822	20,505	23.14
Average	14,524	70,543	33,312	11,639	24,412	26.30
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-6
Annual Pumping Rates Specified by the Operating Plan for Santa Clarita Valley Groundwater Resources
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Aquifer	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Operating Plan Pumping				
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**
Modeled Pumping				
Alluvium	38,429	33,767	33,767	33,767
Saugus	10,679	15,760	24,346	34,096
Total	**49,108**	**49,527**	**58,113**	**67,863**

Notes:

All pumping volumes are listed in acre-feet.

The operating plan is defined in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005).

In the model simulations, total pumping is different than listed in this table when dry-year pumping conditions in one aquifer coincide with normal-year pumping conditions in the other aquifer (because of differences in the timing of dry conditions locally versus reduced deliveries of SWP water imports).

TABLE 2-7
CALSIM II Calculated State Water Project Municipal and Industrial Allocations
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	OCAP Current EWA[a]	OCAP Future EWA[a]	2020 SWP Reliability[b]
1950	0.88	0.91	0.79
1951	1.00	1.00	0.96
1952	1.00	1.00	1.00
1953	1.00	1.00	0.95
1954	1.00	1.00	0.96
1955	0.44	0.45	0.43
1956	1.00	1.00	1.00
1957	0.94	0.91	0.75
1958	1.00	1.00	1.00
1959	0.84	0.88	0.83
1960	0.51	0.55	0.56
1961	0.68	0.72	0.76
1962	0.93	0.98	0.87
1963	1.00	1.00	1.00
1964	0.84	0.74	0.73
1965	0.87	0.81	0.77
1966	1.00	1.00	0.92
1967	1.00	1.00	1.00
1968	0.89	0.90	0.85
1969	1.00	1.00	1.00
1970	1.00	1.00	0.95
1971	1.00	1.00	1.00
1972	0.76	0.75	0.65
1973	1.00	1.00	0.91
1974	1.00	1.00	1.00
1975	1.00	1.00	1.00
1976	0.78	0.75	0.65
1977	0.03	0.04	0.20
1978	1.00	1.00	1.00
1979	1.00	0.94	0.89
1980	1.00	0.91	0.85
1981	0.90	0.92	0.84
1982	1.00	1.00	1.00
1983	1.00	1.00	1.00
1984	0.66	1.00	0.99
1985	0.97	0.91	0.83
1986	0.74	0.70	0.78
1987	0.70	0.77	0.71
1988	0.12	0.17	0.23
1989	0.96	0.95	0.83
1990	0.24	0.27	0.28
1991	0.24	0.29	0.25
1992	0.39	0.43	0.29
1993	1.00	1.00	1.00

[a]Source: USBR, 2004

[b]Source: DWR, 2003

Figures

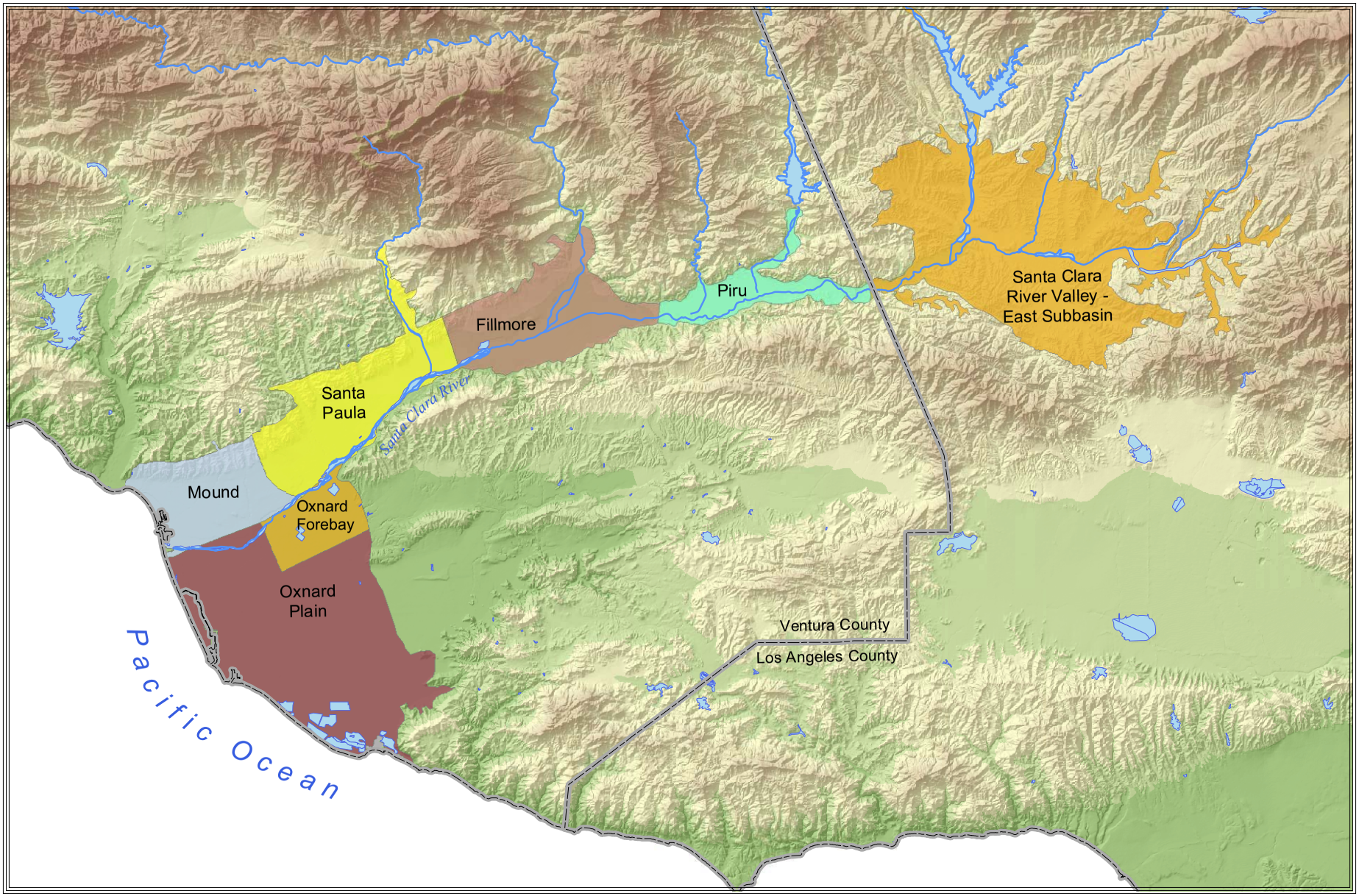

FIGURE 2-1
GROUNDWATER BASINS IN THE SANTA CLARA RIVER DRAINAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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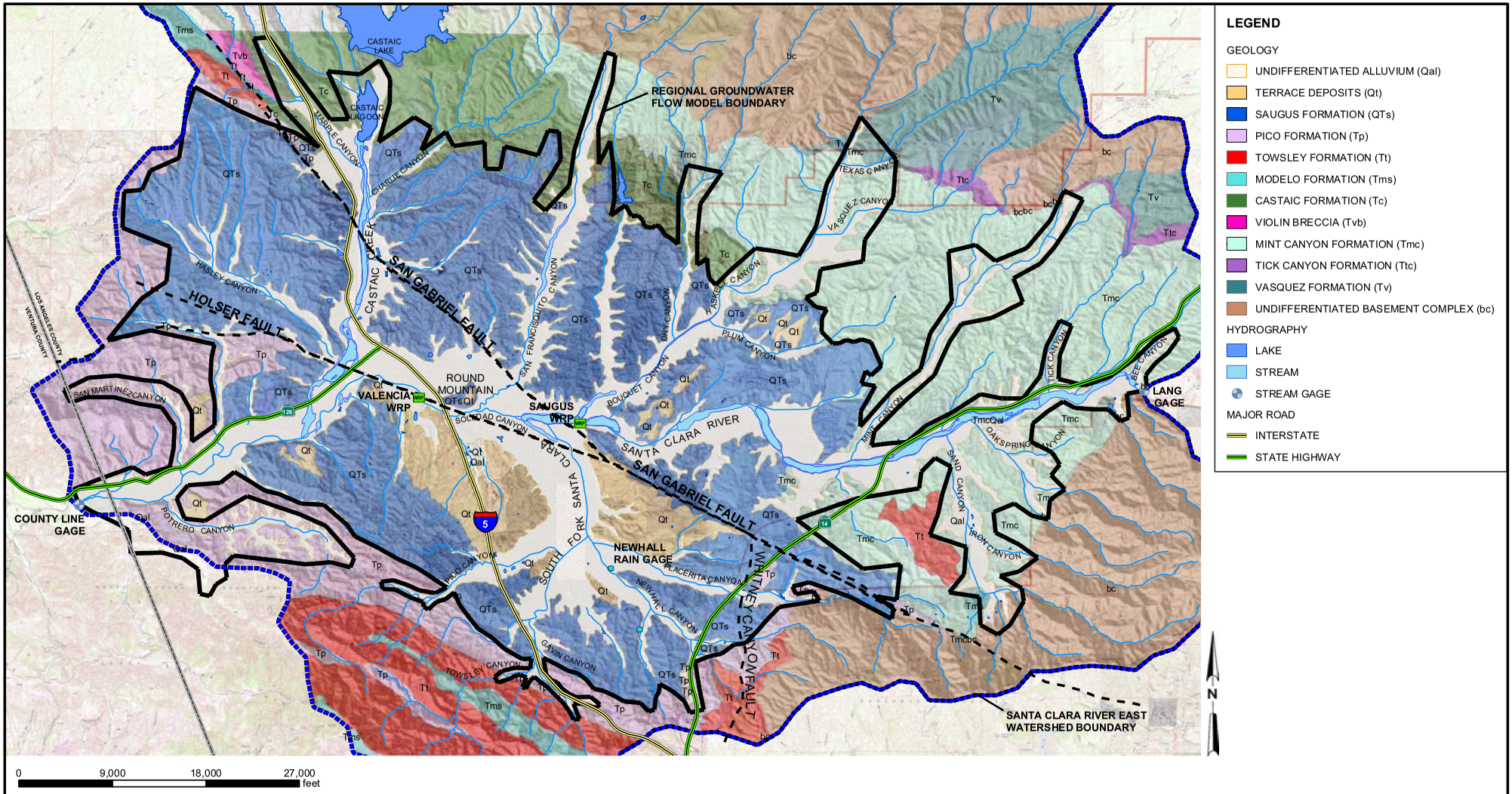

LEGEND

GEOLOGY
- UNDIFFERENTIATED ALLUVIUM (Qal)
- TERRACE DEPOSITS (Qt)
- SAUGUS FORMATION (QTs)
- PICO FORMATION (Tp)
- TOWSLEY FORMATION (Tt)
- MODELO FORMATION (Tms)
- CASTAIC FORMATION (Tc)
- VIOLIN BRECCIA (Tvb)
- MINT CANYON FORMATION (Tmc)
- TICK CANYON FORMATION (Ttc)
- VASQUEZ FORMATION (Tv)
- UNDIFFERENTIATED BASEMENT COMPLEX (bc)

HYDROGRAPHY
- LAKE
- STREAM
- STREAM GAGE

MAJOR ROAD
- INTERSTATE
- STATE HIGHWAY

FIGURE 2-2
BASIN GEOLOGIC MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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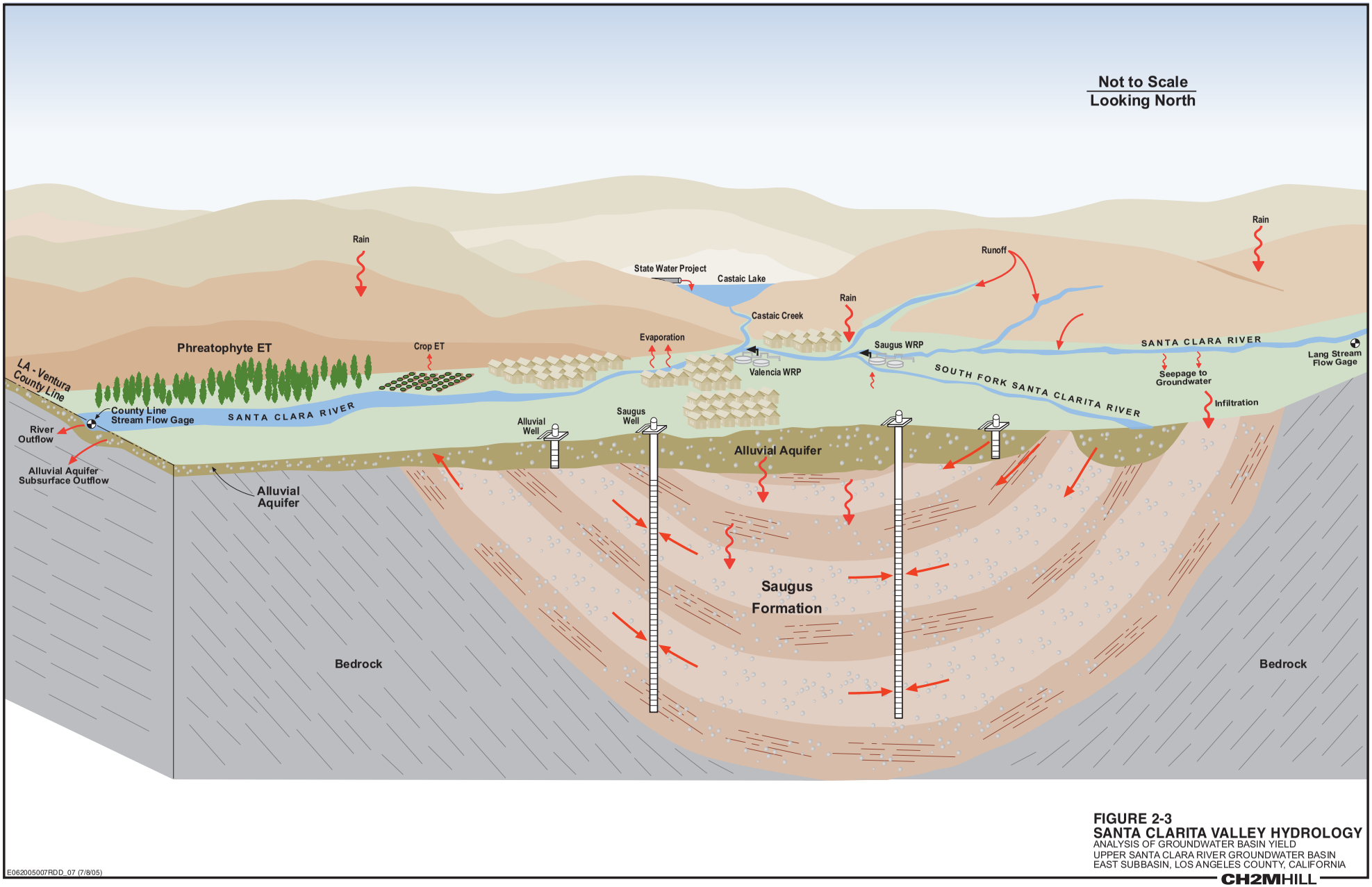

FIGURE 2-3
SANTA CLARITA VALLEY HYDROLOGY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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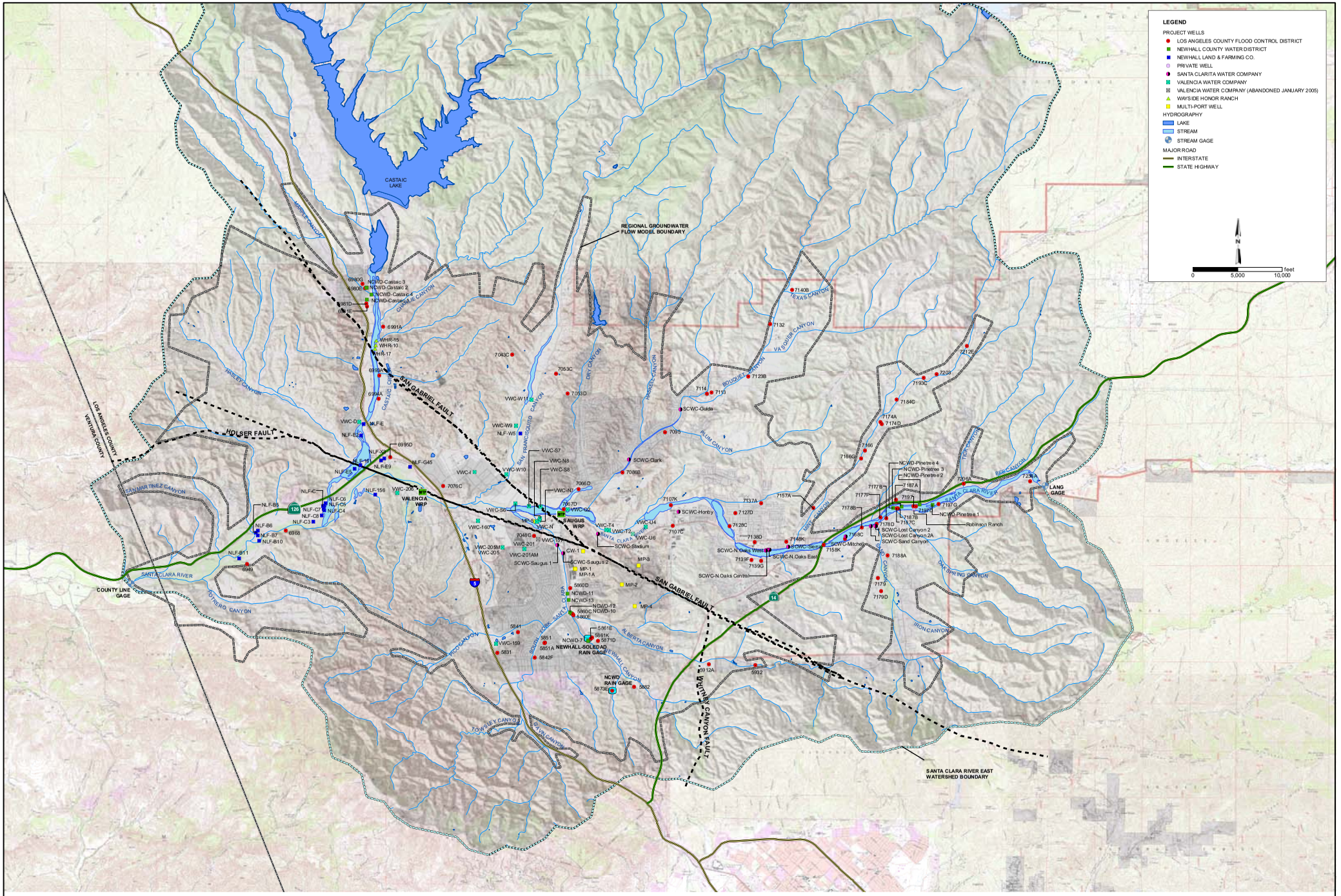

FIGURE 2-4
REGIONAL WELL LOCATION MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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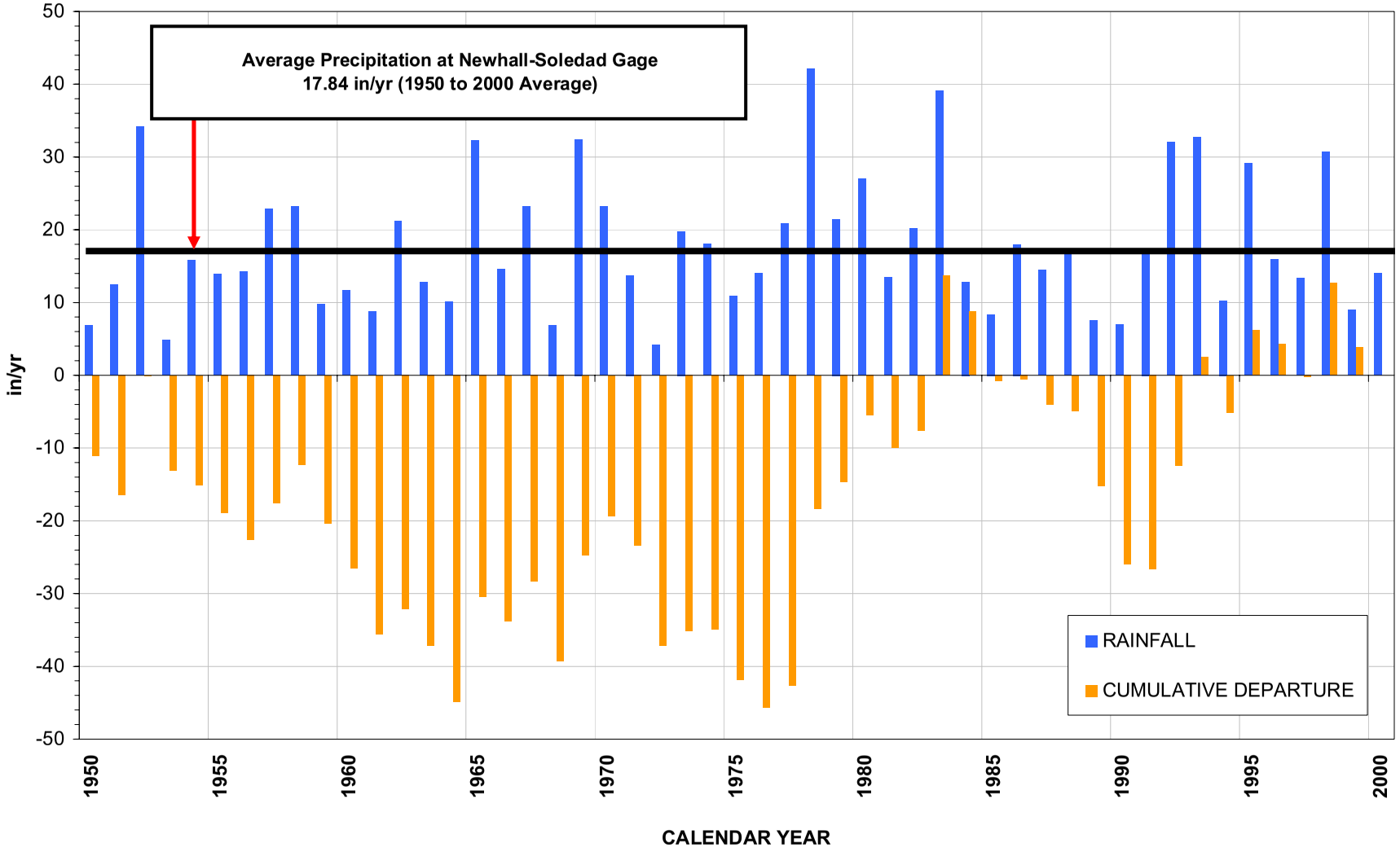

FIGURE 2-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE

ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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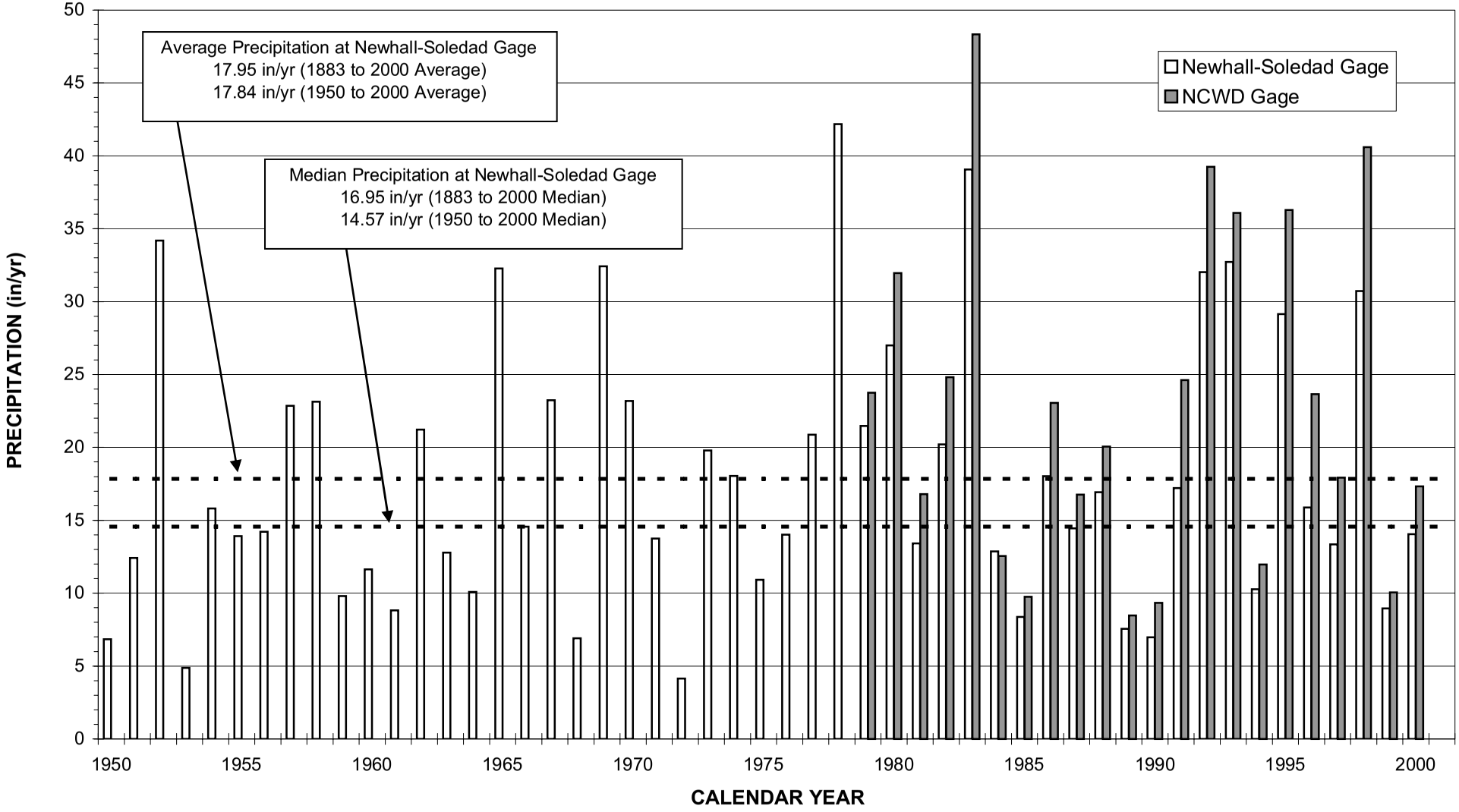

FIGURE 2-6
ANNUAL PRECIPITATION AT THE NEWHALL-SOLEDAD AND NCWD RAIN GAGES SINCE 1950
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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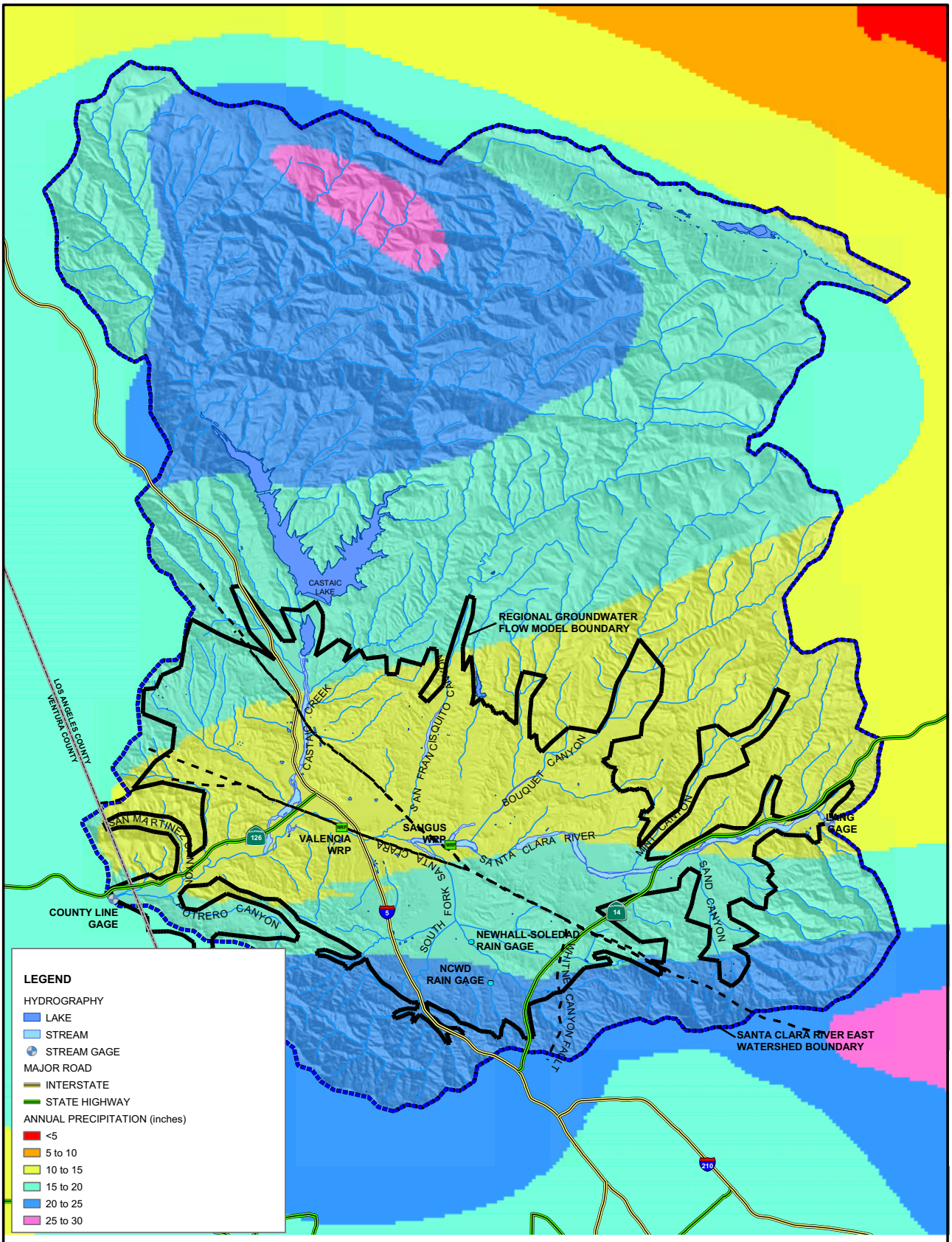

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

N

0 2.5 5 miles

FIGURE 2-7
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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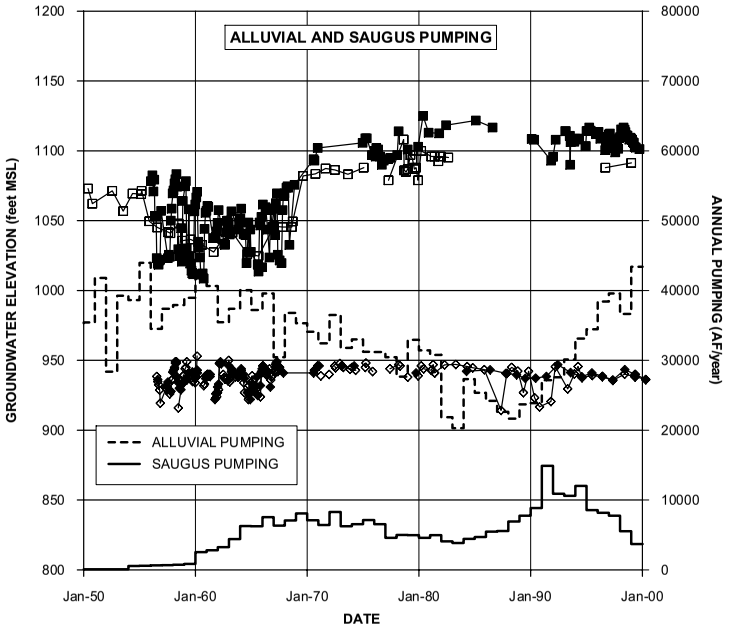
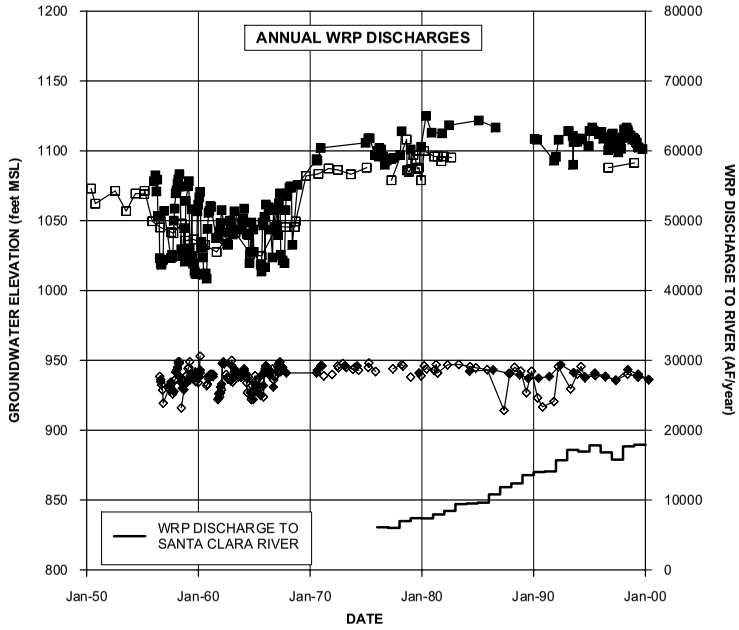
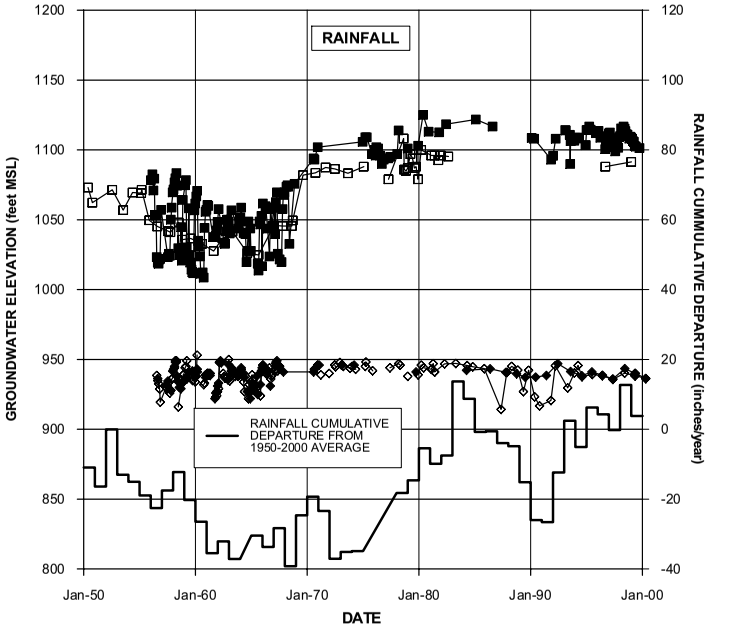
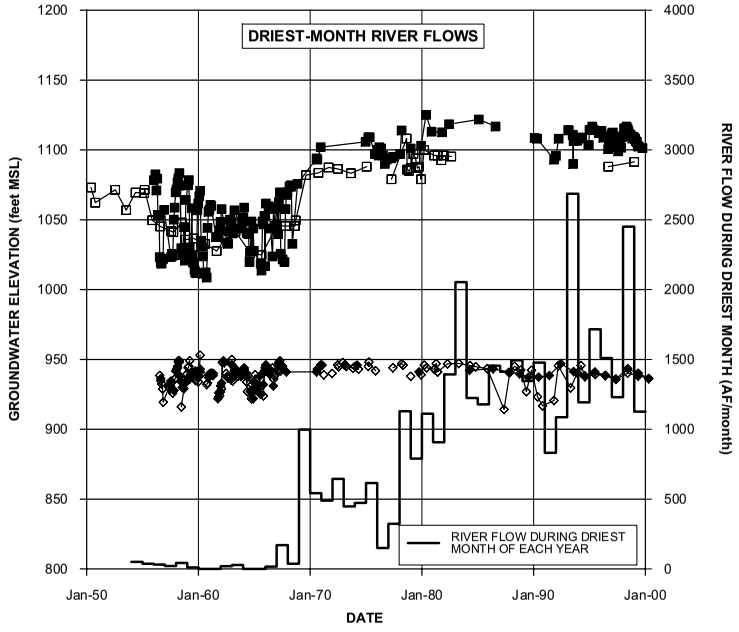








LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N
- ELEVATION OF GROUNDWATER IN NLF-S
- ELEVATION OF GROUNDWATER IN NLF-C5
- ELEVATION OF GROUNDWATER IN NLF-C7

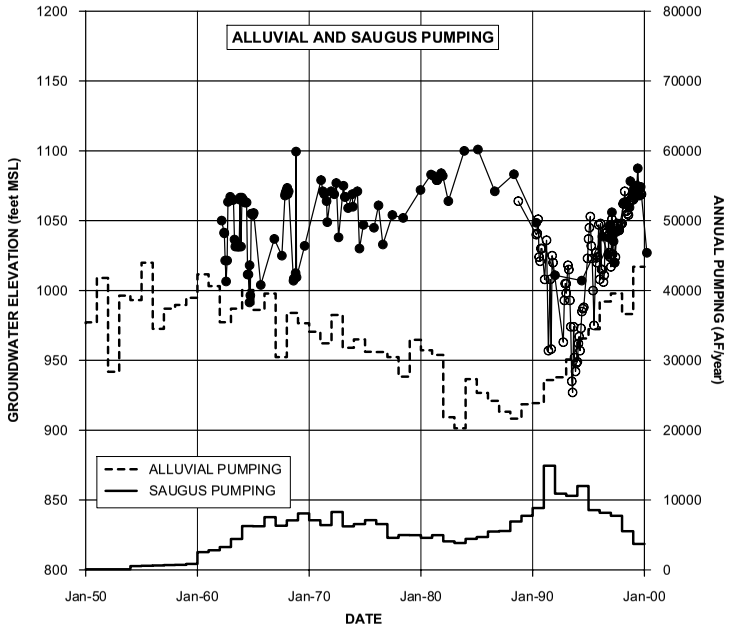
NOTES:

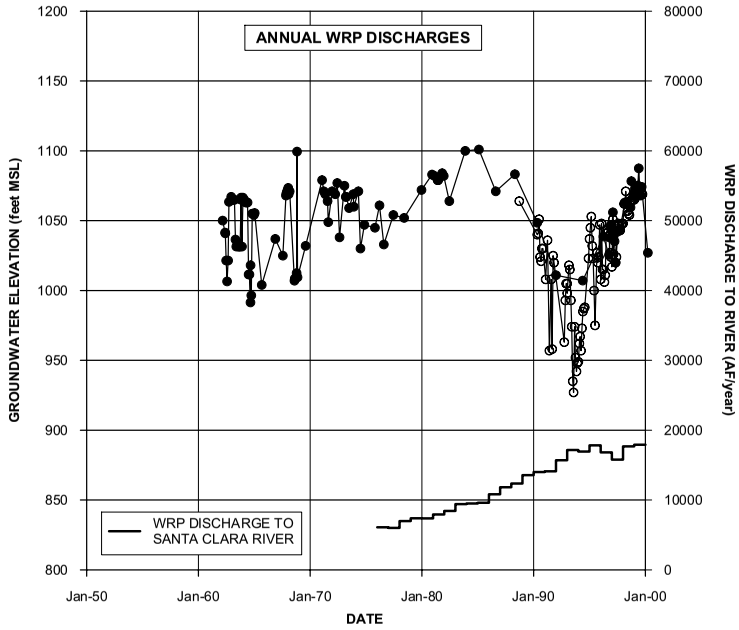
1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. FORMER WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6.
2. WRP = WATER RECLAMATION PLANT.

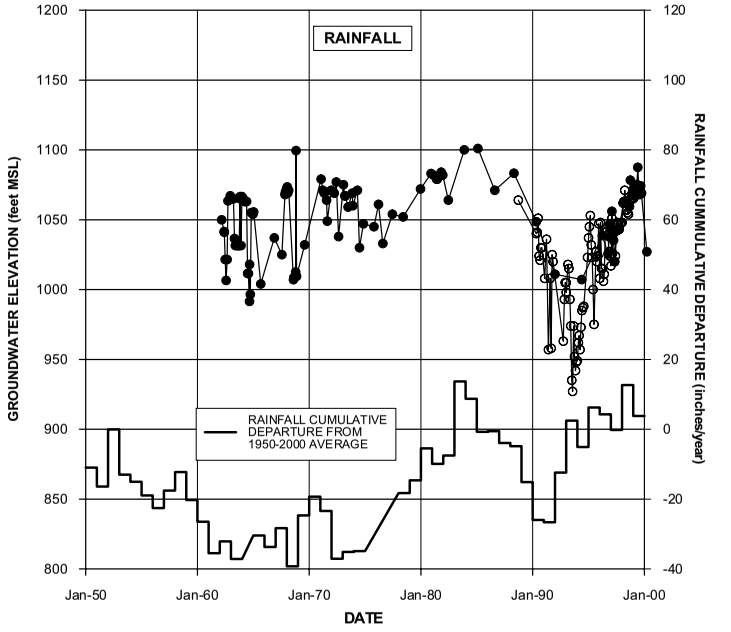
FIGURE 2-8
ALLUVIAL GROUNDWATER ELEVATIONS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

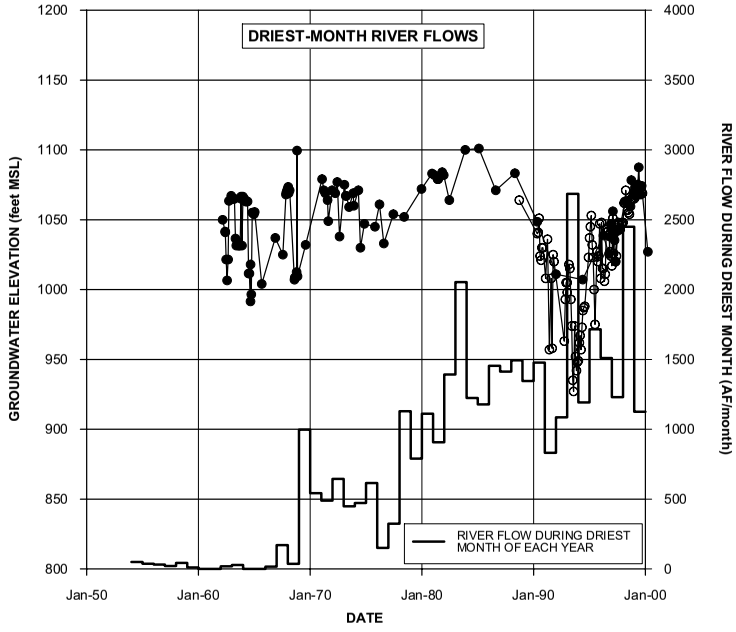
CH2MHILL

178973-359.GRF









LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (DESTROYED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

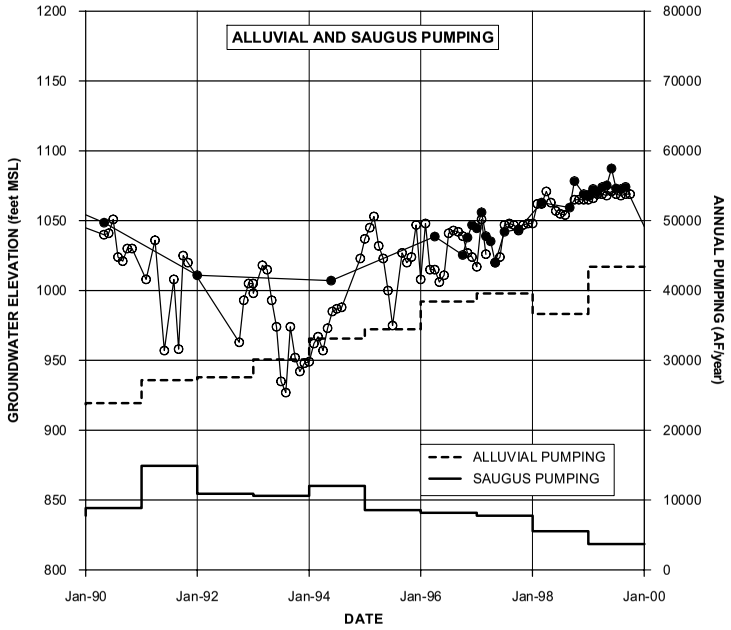
NOTES:

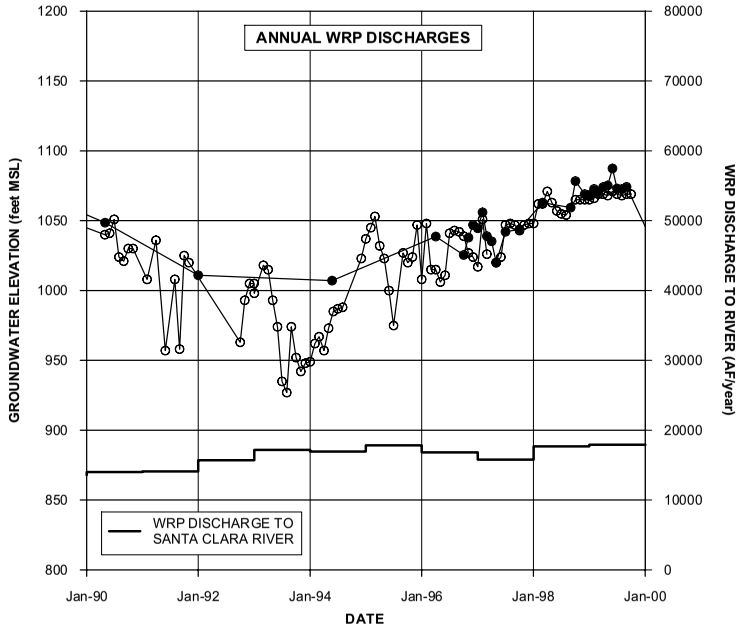
1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

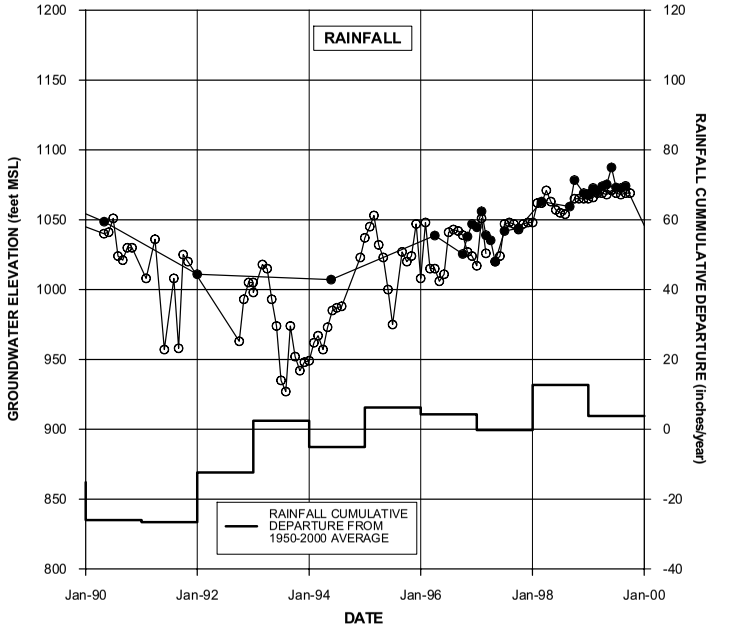
FIGURE 2-9
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

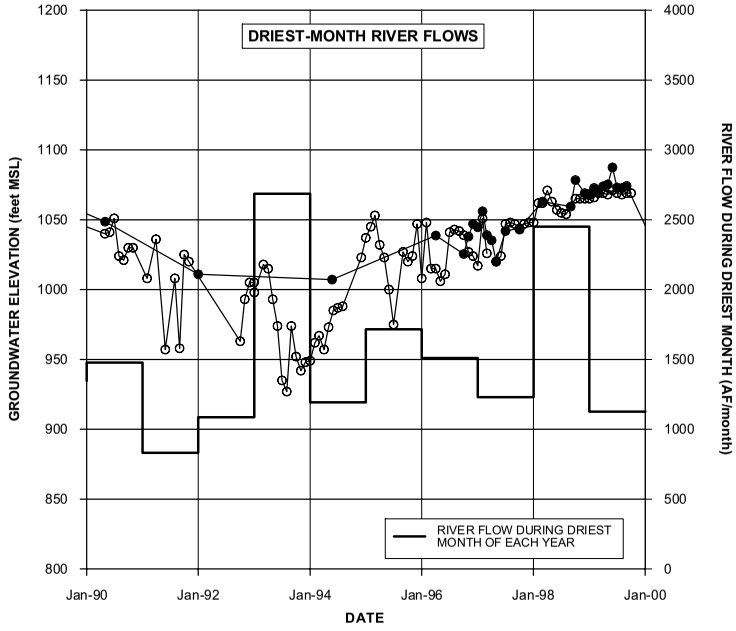
CH2MHILL

178973-360.GRF









LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (ABANDONED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

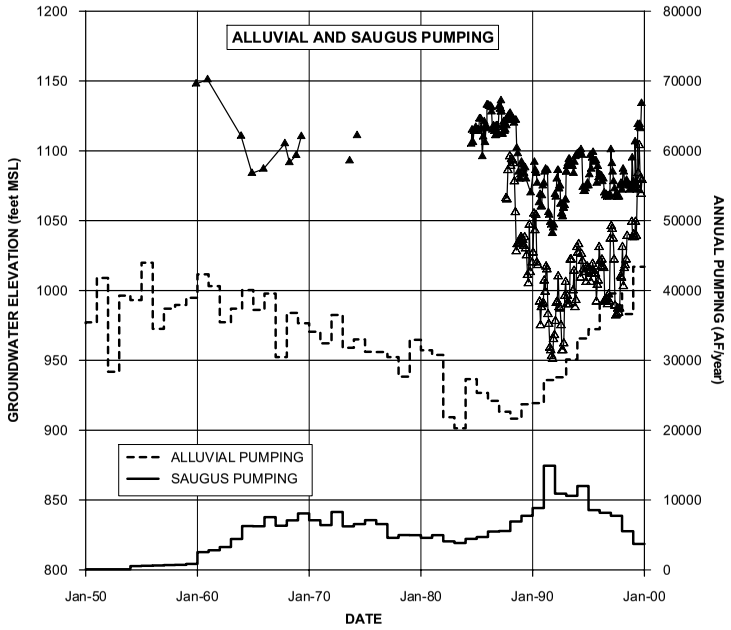
NOTES:

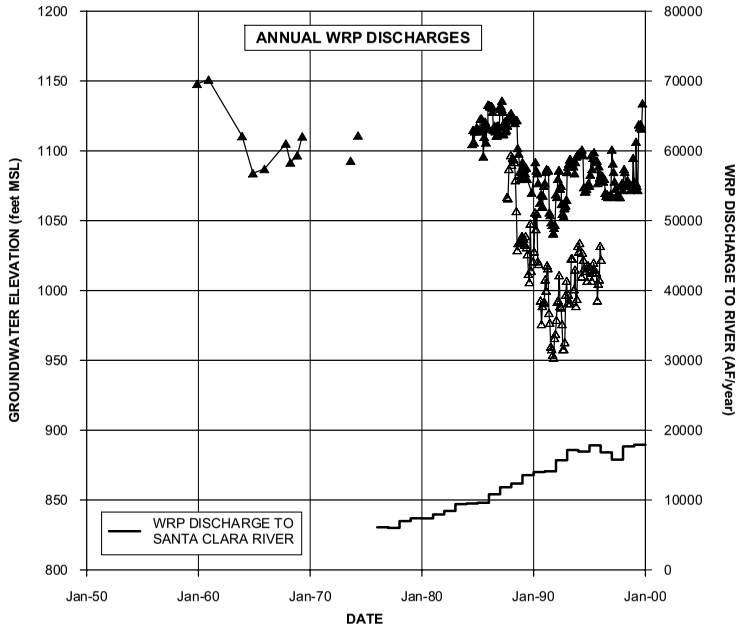
1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

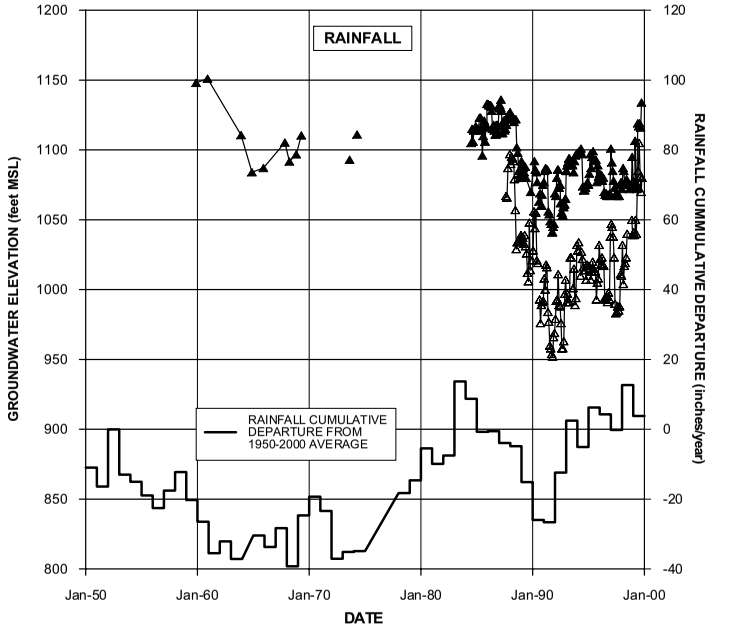
FIGURE 2-10
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

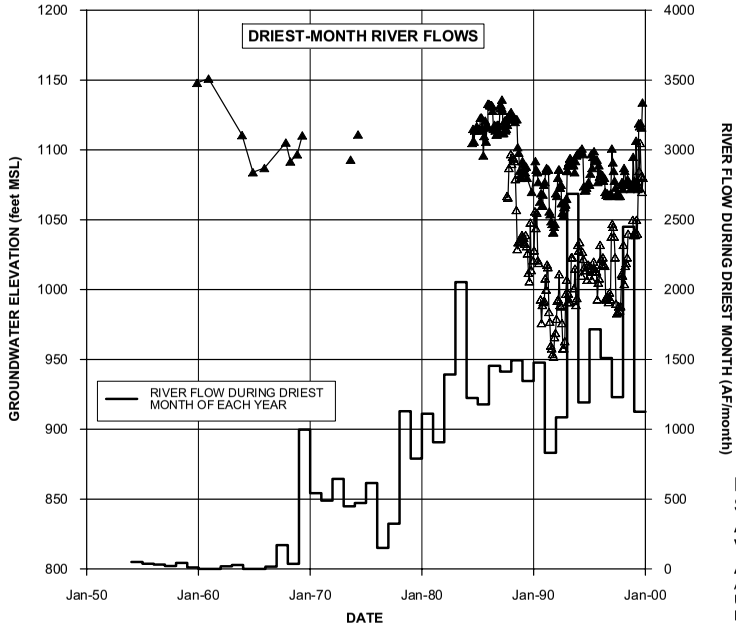
CH2MHILL

178973-361.GRF









LEGEND

- ELEVATION OF GROUNDWATER IN NCWD-7
- ELEVATION OF GROUNDWATER IN NCWD-12

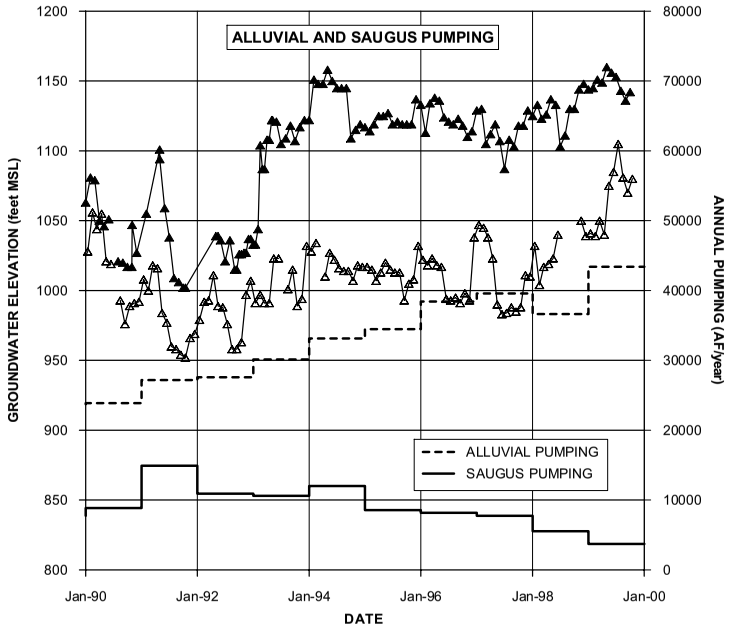
NOTES:

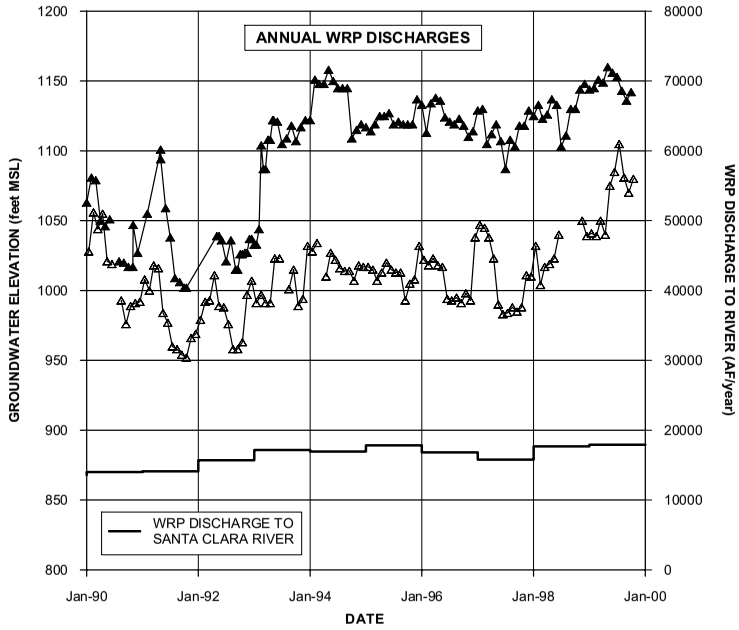
1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

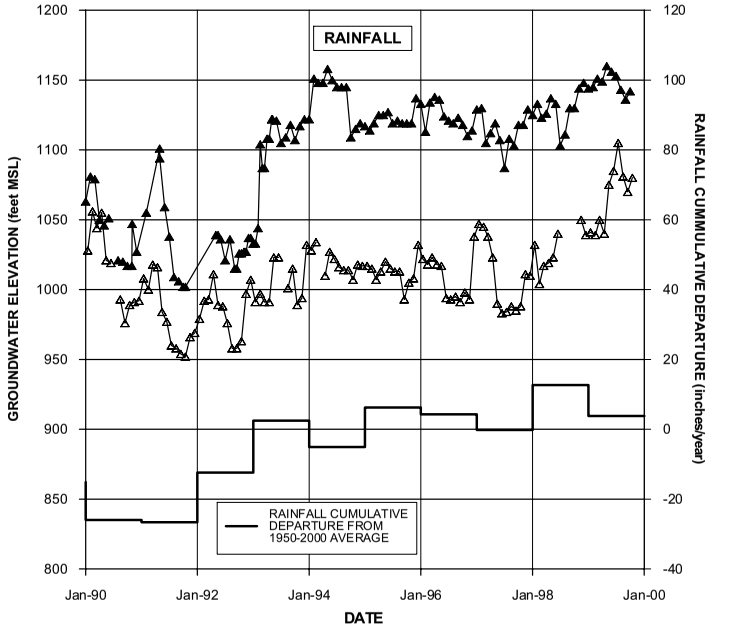
FIGURE 2-11
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

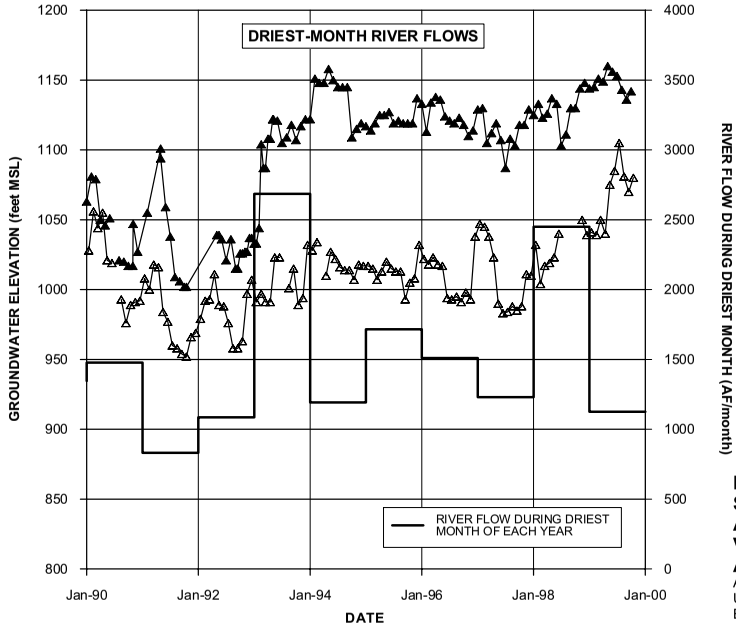
CH2MHILL

178973-362.GRF









LEGEND

ELEVATION OF GROUNDWATER IN NCWD-10
ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-12
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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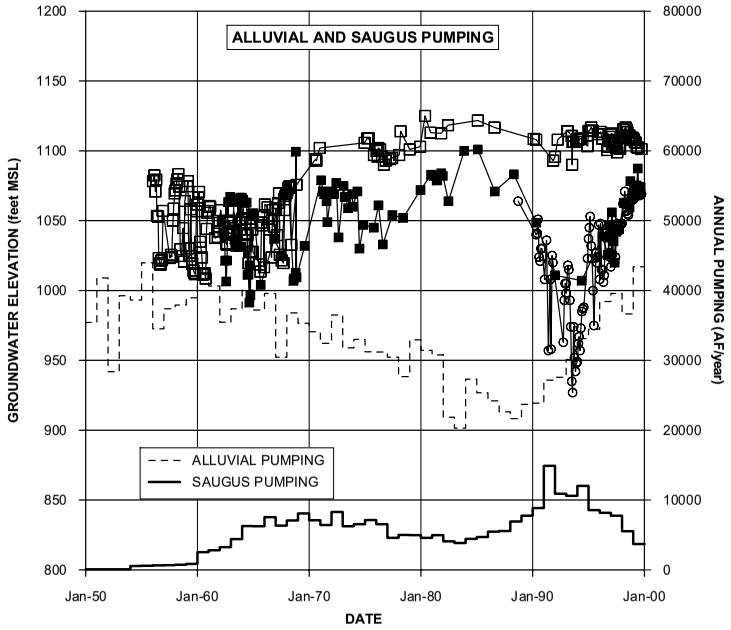

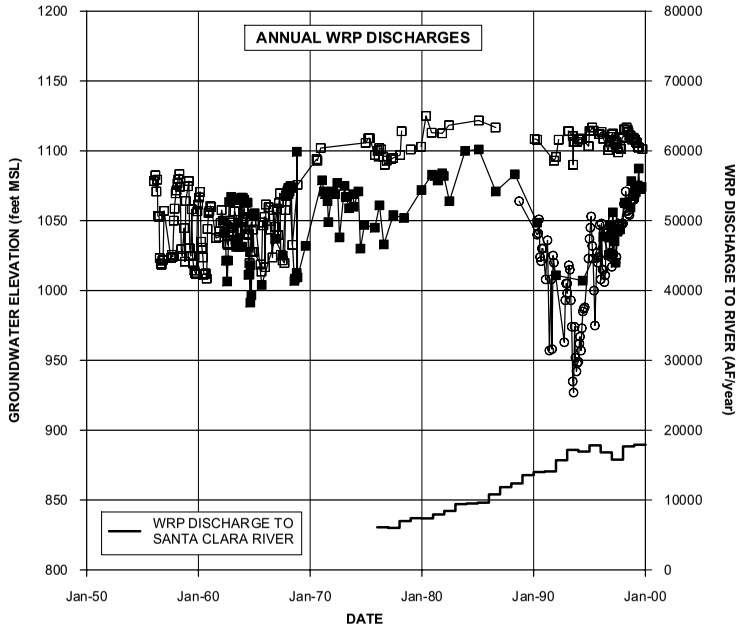

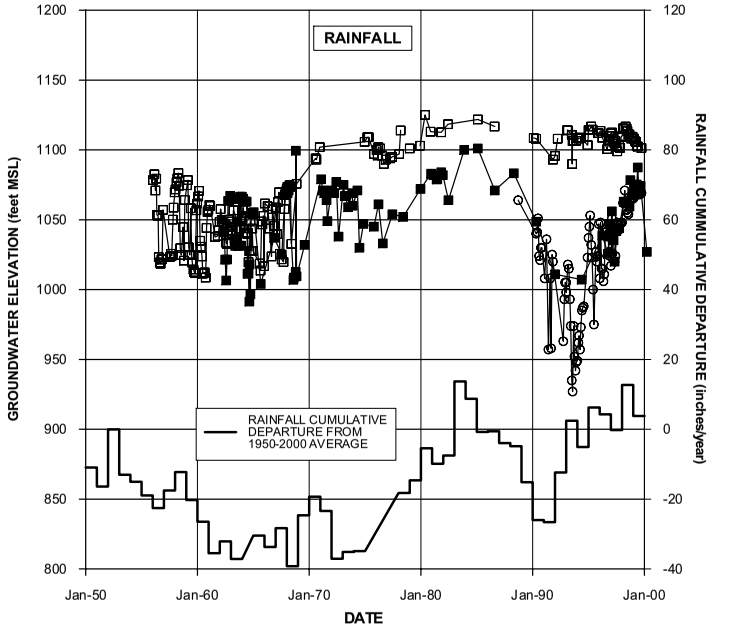

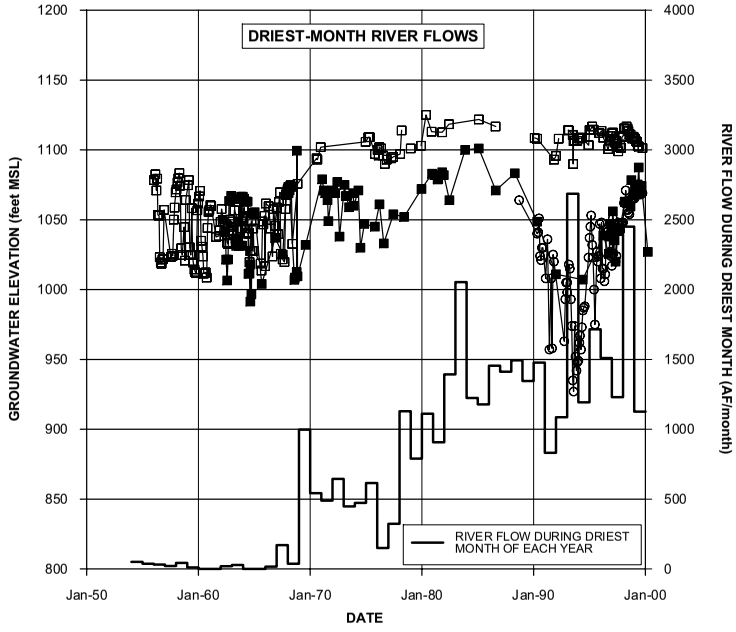

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N (ALLUVIUM)
- ELEVATION OF GROUNDWATER IN VWC-157 (SAUGUS)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2 (SAUGUS)

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-13
GROUNDWATER ELEVATIONS IN ADJACENT ALLUVIAL AND SAUGUS WELLS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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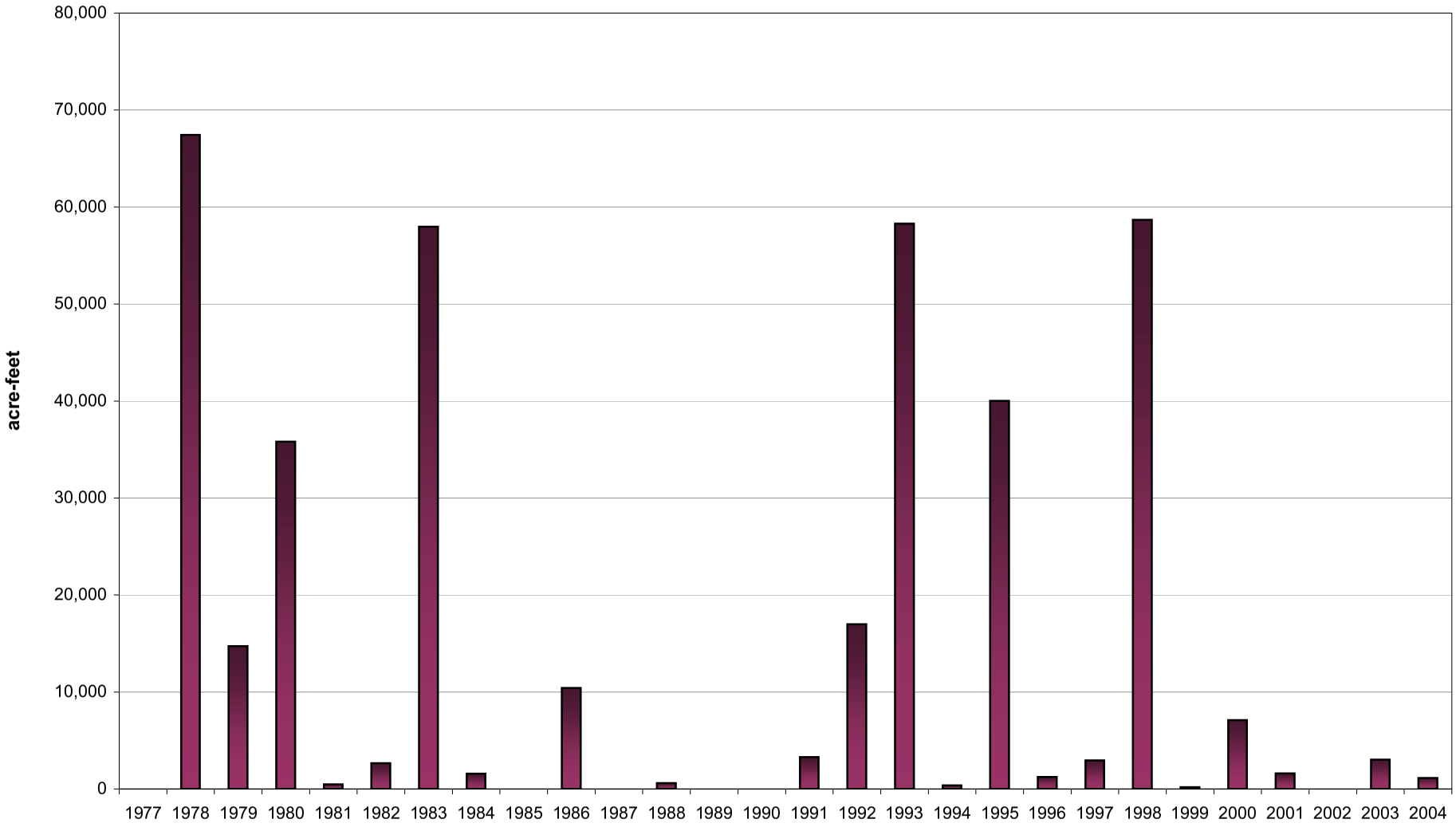

Note:
This chart shows the potential Flood Flows available during water years 1977 through 2004. Water Year 1977 is defined as October 1, 1976, through September 30, 1977, but the water is generally available only from October 1 through April 30.

FIGURE 2-14
HISTORICAL CASTAIC CREEK FLOOD FLOWS AVAILABLE TO DOWNSTREAM USERS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

178973-413.xls\FIG2-14

SECTION 3

Modeling Approach for Analyzing Basin Yield

The approach to using the Regional Model for the basin yield analysis began with identifying a simulation period spanning several decades to capture short-term (year-to-year) and longer-term (multi-year) variations in pumping from both aquifer systems. Pumping was then assigned in the Regional Model in accordance with historical and current uses of each production well, and in consideration of how the pumping rate assignments are currently impacted by the presence of perchlorate in groundwater in specific areas. Regional Model simulation results were then studied to evaluate short-term and long-term trends in groundwater elevations, groundwater budgets, and river flows. This section presents the design details of this modeling evaluation.

3.1 Model Description

The Regional Model is a three-dimensional, numerical model that uses MicroFEM® finite-element software (Hemker and de Boer, 2003). The Regional Model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. Figure 3-1 shows the model domain, along with its location relative to the upstream watersheds that contribute runoff into the model study area. The Regional Model's construction and calibration is summarized in Appendix B and discussed in detail in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a).

The Regional Model area largely coincides with the Santa Clara River Valley Groundwater Basin, East Subbasin, delineated by DWR, extending from the Lang stream gage at the eastern end of the valley to the County Line stream gage area in the west. The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. Figure 3-2 shows the spacing of the individual nodes that make up the grid. The upper model layer simulates the Alluvial Aquifer and also the upper portion of the Saugus Formation where the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and its Sunshine Ranch Member. The layer representation is summarized schematically on Figure 3-3. Figure 3-4 shows the model layering in three cross-sectional views.

The boundary conditions in the model consist of the following:

1. Specified flux boundaries for the following:

    a. Precipitation
    b. Irrigation
    c. Recharge from ephemeral streams
    d. Pumping
    e. Underflow from beneath Castaic Dam

2. Head-dependent flux boundaries for the following:
    a. Groundwater discharges to the perennial reach of the Santa Clara River
    b. Residual drainage of groundwater to the Santa Clara River in the ephemeral reach under high water table conditions
    c. Evapotranspiration (ET) by phreatophyte plants, which extract groundwater from the shallow water table that lies along riparian river corridors
3. Constant-head boundaries for the following:
    a. Subsurface inflow in the Alluvial Aquifer at the eastern end of the valley, at the Lang gage[5]
    b. Subsurface outflow in the Alluvial Aquifer at the western end of the valley, at the County Line gage

Groundwater recharge rates are estimated using precipitation records; streamflow records; watershed maps; topographic maps; and aerial photography. These recharge rates are calculated using a detailed Surface Water Routing Model (SWRM), which was written specifically to provide time-dependent, spatially varying recharge rates as input to the Regional Model. The SWRM relies on streamflow records at the Lang and County Line gages; historical records of rainfall data from the NCWD rain gage (see Figure 1-1 for the location of this gage); spatial variations in rainfall across the basin (see Figure 2-7); and, for the basin yield analysis, the rates and locations of future WRP discharges to the Santa Clara River and irrigation from agricultural and urban water uses.

The depths from which production wells obtain water are defined in the Regional Model from well construction records. The rates and locations of pumping are based on the Purveyors' operating plan for the basin and on the surveyed location of each production well.

3.2 Modeling Approach

The process of designing the modeling analysis of the operating plan for the basin consisted of the following five activities:

1. Selecting a period over which to simulate groundwater conditions resulting from various pumping configurations
2. Defining pumping rates and schedules for each production well in the Santa Clarita Valley, considering the variability in pumping demands that occur due to cycles of drought and nondrought conditions and year-to-year variations in the availability of other water supplies
3. Defining the variation in local hydrology (rainfall, streamflows, and groundwater recharge) on a month-to-month basis throughout the simulation period

[5]A constant-head boundary was established in the Regional Model at this location using recent field conditions that were observed after the model calibration report (CH2M HILL, 2004a) was published. This change improved the Regional Model's calibration in the Alluvial Aquifer in the upper reaches of Soledad Canyon and did not appreciably change the calibration quality elsewhere. See CH2M HILL (2005) for further details.

4. Running the model to calculate time-varying (monthly) groundwater elevations and groundwater discharge terms throughout the multi-year simulation period
5. Evaluating the modeling results by examining forecasted time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the effects of the operating plan in the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River

These activities are described in further detail below.

3.3 Simulation Period

The locations and temporal variation in pumping from the Alluvial Aquifer were defined in the model from the operating plan and from historical records of the year-to-year variability in local hydrology. Simulated pumping from the Saugus Formation was defined from the operating plan, historical pumping records, and operational constraints and historical patterns of SWP water supply availability.

3.3.1 Selection of Simulation Period

Because the operating plan for the Saugus Formation is linked to the hydrology and operational constraints for the SWP system, the year-to-year variability in Saugus Formation pumping is, to a great extent, dependent on the hydrology outside the valley (i.e., in northern California). As shown in Table 3-1, local hydrology is often not a good indicator of local pumping conditions in the Saugus Formation, because local droughts and SWP droughts frequently do not coincide with each other. The following are examples:

1. In 1955, dry conditions in the SWP system coincided with approximately 14 inches of rainfall at the Newhall-Soledad rain gage, which is similar to the long-term median rainfall recorded at this gage.
2. In 1976 and 1977, the SWP system hydrology was critical, while the local hydrology during those years was near normal (1976) and wetter than normal (1977).
3. In 1987 and 1988, the SWP system hydrology was dry (1987) and critical (1988), while the local hydrology during those years was near normal (1987) and wetter than normal (1988).
4. In 1991 and 1992, the SWP system hydrology was in its fifth and sixth consecutive years of dry or critical hydrology, while the local hydrology was wetter than normal both years.
5. In 2001, dry conditions in the SWP system coincided with wetter-than-normal local conditions.

Consequently, it was decided that the model would need to be run over several decades to capture the year-to-year variability in the hydrology of each system, as well as the less frequent times when both systems experience similar hydrologic conditions (as occurred

periodically during the 1960s and in 1994). Historical records were then analyzed to identify a synthetic simulation period that would meet the following criteria:

1. The simulation time should be long enough to include an historical period that accounts for the year-to-year variations in local hydrology that have been observed in the past.
2. The period should be long enough to include longer-term (i.e., on the order of decades) periods of relatively dry conditions and relatively wet conditions.
3. The average rainfall during the simulation period should be similar to the average rainfall of 17.84 in/yr that was observed from 1950 through 2000 at the Newhall-Soledad gage.
4. The period should be sufficiently long to allow simulation of two occurrences of reduced SWP water supplies during the period 1990 through 1992, which corresponds to periods of increased pumping from the Saugus Formation under the operating plan.
5. The frequency of dry-year occurrences in the SWP system, corresponding to increased pumping from the Saugus Formation, should be similar to the historical frequency.
6. If necessary to meet other criteria, the simulation should repeat parts of this sequence before and/or after the historical sequence.

Examination of historical local hydrology and independent simulations of SWP deliveries resulted in the selection of a 78-year period over which the model was run, with monthly time steps. The 78-year period replicates the historical hydrology of the following years:

1. Years 1 through 24 = 1980 through 2003
2. Years 25 through 78 = 1950 through 2003

3.3.2 Relationship of Simulation Period to Variations in Alluvial Aquifer Pumping

Figure 3-5 shows the year-to-year rainfall in the valley and the cumulative departure from average rainfall for each year during the 78-year simulation period. The figure also shows each simulation year's corresponding historical year. The cumulative departure from average rainfall is plotted to show the occurrence of relatively wet versus relatively dry periods. A year-to-year decline in the slope of the cumulative departure curve indicates that conditions are dry, whereas a year-to-year increase indicates that rainfall is above normal. Also plotted are the occurrences of SWP droughts. The figure shows the following:

1. The first 19 years of the simulation period are generally wet, as a whole, though a multi-year drought occurs in years 5 through 12 (1984 through 1991).
2. A prolonged dry period begins in year 20, as indicated by the downward slope in the cumulative departure curve. This period lasts through year 39, as the curve starts to slope upward to the right beginning in year 40[6]. This 20-year period of generally dry conditions corresponds to the historical period 1999 through 2003, followed by 1950 through 1964.

[6]Year 40 is equivalent to historical year 1965, when rainfall was over 32 inches, or 2.2 times the long-term median rainfall and 1.8 times the long-term average rainfall.

3. Rainfall was generally at or above normal from years 40 through 45 (historical years 1965 through 1970), before a drought ensued from years 46 through 51 (historical years 1971 through 1976).

4. Rainfall was then generally above normal during years 52 through 58 (1977 through 1983), followed by the drought years 59 through 66 (1984 through 1991), the wetter-than-normal years 67 through 76 (1992 through 2001), and dry years 77 and 78 (2002 and 2003).

Table 3-2 shows the sequence of local hydrologic conditions and resulting valleywide pumping volumes for the Alluvial Aquifer that have been defined from the groundwater operating plan for the valley. The 78-year simulation period contains the following:

1. Twenty-four years of sporadic dry-year pumping, which is approximately 30 percent of the simulated 78-year period.

2. One drought consisting of 4 consecutive years of below-normal pumping (in years 34 through 37, based on historical hydrology from 1959 through 1962).

3. Two droughts consisting of 3 consecutive years of below-normal pumping (in years 10 through 12 and 64 through 66, both of which are based on historical hydrology from 1989 through 1991).

4. Three years (years 12, 37, and 66) when rainfall is near or above normal, but pumping is assigned at a dry-year rate because the year was preceded by a multi-year local drought.

3.3.3 Relationship of Simulation Period to Variations in Saugus Pumping

Table 3-3 shows the sequence of SWP droughts, SWP allocations, and resulting pumping volumes for the Saugus Formation that have been defined based on the CLWA and USBR analyses. With respect to Saugus Formation pumping, the 78-year period contains the following:

1. Two droughts lasting 2 years
2. Two droughts lasting 3 years
3. A dry year that occurs 2 years before the beginning of each 3-year drought
4. A dry year that begins 1 year after each 3-year drought has ended
5. A total of 18 dry years, or an average of 1 dry year approximately every 4 years
6. Sixty years of normal-year pumping from the Saugus Formation

3.4 Assignment of Pumping Rates

Pumping rates for Purveyor-owned wells and known private pumping wells (owned by the Newhall Land & Farming Company (NLF), the Wayside Honor Rancho, and Robinson Ranch) were assigned in accordance with the groundwater operating plan for the Santa Clarita Valley, which defines ranges of valleywide annual pumping, given the water supply needs of the Purveyors. Pumping rates at individual wells were also assigned using the recent and planned production schedules for each well, information on the depths and lengths of the intake sections (open intervals) of each well, and by incorporating current

plans addressing the presence of perchlorate in specific portions of the Saugus Formation and the Alluvial Aquifer.

As noted in the discussion of the groundwater operating plan in Section 2.2, the water management practices of the Purveyors recognize ongoing Alluvial Aquifer pumping for agricultural water supply, as well as other smaller private domestic and related pumping. For the last 7 years of formal annual water report preparation in the Santa Clarita Valley, those reports have included estimates of the latter private pumping. In recent years, that estimate has been 500 AF/yr. Initially in 2003, during the preparation of the Groundwater Management Plan (CLWA, 2003), and recently, during ongoing preparation of the 2005 UWMP, the Santa Clarita Valley Well Owners' Association submitted limited information about the nature and magnitude of private well pumping. The most notable input from the Well Owners' Association was its detailed estimate of private well pumping in the San Francisquito Canyon portion of the basin: a total of 85 AF/yr by 73 individual private pumpers, or an average of approximately 1.2 AF/yr per private well (equivalent to approximately 0.7 gallon per minute). As a result of that information, there is increased confidence that total private pumping in the basin by smaller users is within the 500 AF/yr estimate presented in recent annual water reports and is, therefore, approximately 1 percent of typical Alluvial Aquifer pumping by the Purveyors and other known private well owners (including agricultural pumpers) combined. However, the small private wells are not explicitly modeled in the basin yield analysis described herein because their locations and operations are not known, and their operation creates a pumping stress that is essentially negligible at the scale of the regional model. Ultimately, as discussed throughout this report, the intent to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (Purveyor), agricultural, and private groundwater use on an ongoing basis. Thus, private well owners in the basin, like the large municipal and agricultural pumpers, can expect groundwater supplies to continue to be available as they have been in the past, with some fluctuations in water levels through wet and dry periods, but no long-term depletion of supply.

Details of pumping rate assignments for Purveyor-owned wells and known private pumping wells are discussed for the Alluvial Aquifer in Section 3.4.1 and for the Saugus Formation in Section 3.4.2. Section 3.4.3 discusses the monthly distribution of pumping for each well. Section 3.4.4 discusses how the pumping rate assignments relate to the presence of perchlorate in groundwater.

3.4.1 Variations in Alluvial Aquifer Pumping

Pumping rates at specific wells were assigned for normal and dry years using the operating plan and information on the capacity, recent and planned use, and location of each well. Figure 2-4 shows the locations of these wells and other wells in the valley. Table 3-4 compares recent annual pumping volumes at each Alluvial Aquifer well with the assumed future production rates at each well under normal and dry-year conditions. Most Alluvial Aquifer wells were specified to operate at similar rates regardless of year type. However, there were two exceptions, as follows:

1. Wells in the eastern portion of the basin (the NCWD-Pinetree wells, nine wells owned by SCWC, and the privately owned Robinson Ranch well) were assumed to have lower

pumping capacities during dry years than nondrought years because of lower groundwater elevations during dry periods. This assumption was based on historical observations indicating that the eastern portion of the Alluvial Aquifer, in contrast to other parts of the valley, experiences declines in water levels during dry periods.

2. Pumping was also reduced at NCWD's three operating wells in Castaic Valley, in accordance with recent pumping records from those wells.

3.4.2 Variations in Saugus Formation Pumping

Pumping rates at specific Saugus Formation production wells were assigned for each type of year (normal, dry year 1, dry year 2, and dry year 3) using the operating plan for the valley and information on the capacity, recent and planned use, and location of each well. Table 3-5 summarizes the annual pumping volumes at each Saugus Formation well[7]. Significant aspects of the pumping rate selection at each well are as follows:

1. Pumping from most existing Saugus Formation production wells was based on recent and planned use of these wells, as defined by the Purveyors. The simulation included increased dry-year pumping from the Saugus Formation in the western portion of the basin, where it is anticipated that future wells will be installed.

2. Each Saugus Formation production well has an intake section (open interval) that is significantly longer in vertical extent than the thicknesses of the individual layers that represent the Saugus Formation in the Regional Model. Consequently, the Saugus pumping rates were assigned to multiple layers in the model by considering the depths of the intake section of each well and the transmissivity of each model layer. Table 3-6 shows the allocation of pumping in each model layer for each Saugus Formation production well, along with the intake sections of each well and the model-simulated transmissivity in each layer at each well location.

3.4.3 Monthly Allocation of Pumping

Table 3-7 shows the allocation of pumping, by month, for agricultural and urban production wells in both the Saugus Formation and the Alluvial Aquifer. Separate distributions were used because agricultural demands are for exclusively outdoor uses, whereas urban demands are for both indoor and outdoor uses. As discussed in the model development report (CH2M HILL, 2004a), the monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining historical monthly flow records for the two LACSD WRPs and monthly demand distributions recorded by the Purveyors during the past several years.

3.4.4 Influence of Perchlorate Contamination on Groundwater Pumping

In 1997, two Saugus Formation production wells owned by CLWA's Santa Clarita Water Division (formerly SCWC) (wells SCWC-Saugus1 and SCWC-Saugus2), one Saugus Formation production well owned by the Newhall County Water District (NCWD)

[7]Table 3-5 only lists wells that are anticipated to be operating in the future. Existing wells that are not listed in this table (such as NCWD-7 and NCWD-10) are currently not in service or pump very limited quantities of groundwater, and, therefore, are not expected to provide significant quantities of water in the future.

(well NCWD-11), and one Saugus Formation production well owned by VWC (well VWC-157) were shut down because perchlorate was detected in groundwater at these wells[8]. In 2002, an Alluvial Aquifer production well owned by SCWC (well SCWC-Stadium) was shut down because of perchlorate detection. In March 2005, an Alluvial Aquifer production well owned by VWC (well VWC-Q2) was shut down because of perchlorate detection. The locations of the six impacted production wells and nearby nonimpacted production wells are shown on Figure 3-6, along with the locations of monitoring wells and exploratory borings that have been installed to investigate the extent of perchlorate contamination. Figure 3-6 also shows perchlorate concentrations at locations where perchlorate has been detected in groundwater. At each of the six production wells, the detected perchlorate concentrations exceeded the State of California's Action Level (AL) for perchlorate at the time of the detection[9].

In 2003, the Purveyors entered into a voluntary cleanup agreement with the California Department of Toxic Substances Control whereby the Department of Toxic Substances Control provides review and oversight of the activities of the Purveyors in response to the perchlorate detections. The Purveyors have also initiated a process for approval by the California Department of Health Services, in accordance with its Policy 97-005, for restoration of water supply from "severely impaired" water sources, such as the perchlorate-impacted wells. Also in 2003, the Purveyors and the responsible party (the Whittaker Corporation) entered into an Interim Settlement Agreement. Activities since execution of the Interim Settlement Agreement have consisted of developing the elements of a remedial strategy that will entail pumping of two impacted wells for containment of perchlorate migration; treatment and subsequent use of the pumped water for water supply; and installation of replacement wells in non-impacted portions of the basin to restore the remainder of groundwater supply impacted by perchlorate. A noteworthy detail of these activities is that the Regional Model was used to identify the design of a pumping scheme that would meet the Purveyors' objectives for perchlorate containment in the Saugus Formation (CH2M HILL, 2004b).

With respect to perchlorate presence in the Alluvial Aquifer, the selection of pumping rates for the basin yield analysis was as follows:

1. Well SCWC-Stadium was simulated as pumping during each year of the 78-year simulation period. The Whittaker Corporation is developing plans to mitigate the source of perchlorate to the portion of the Alluvial Aquifer immediately north and downgradient of the Whittaker-Bermite property. The modeled pumping scenario simulates the possibility that the well will be returned to service in the future and pump at a rate similar to historical volumes after source mitigation activities have reduced perchlorate concentrations to undetectable levels in the Alluvial Aquifer at and near this well.

[8]As part of the ongoing implementation of perchlorate containment and restoration of impacted capacity, well VWC-157 was abandoned in January 2005 and replaced by new well VWC-206. Thus, this analysis includes planned pumping from replacement well VWC-206.

[9]The AL has varied over time. The California Department of Health Services initially established an AL of 18 micrograms per liter (μg/L) in 1997, at the same time the four impacted Saugus Formation production wells were taken offline. In 2002, the Department of Health Services revised the AL to 4 μg/L based on studies by the U.S. Environmental Protection Agency. In March 2004, the AL was revised to 6 μg/L based on a public health goal published by the Office of Environmental Health Hazard Assessment. See http://www.dhs.ca.gov/ps/ddwem/chemicals/perchl/actionlevel.htm for further details.

2. Well VWC-Q2 was simulated as pumping during each year of the 78-year simulation period. VWC and the Whittaker Corporation are currently implementing plans to install perchlorate treatment (ion exchange) facilities at the wellhead to remove perchlorate so that the well can be returned to service (LSCE, 2005b). VWC is working with USFilter to install and maintain this treatment and is preparing an application to amend its water supply permit to allow treatment at this well, which is expected to be returned to service by fall 2005. The perchlorate detected in well VWC-Q2 does not significantly impact the water supplies used to meet demand in the Santa Clarita Valley during the time required to respond to the contamination at this well (LSCE, 2005b).

With respect to perchlorate presence in the Saugus Formation, the Purveyors have developed a hydraulic containment plan for the Saugus Formation that consists of pumping from the SCWC-Saugus1 and SCWC-Saugus2 production wells. The three Saugus wells impacted by perchlorate had produced a combined average of 4,186 AF/yr of water during the 5 years preceding the detection of perchlorate. Restoration of that volume of water is currently planned to be achieved by reactivating wells SCWC-Saugus1 and SCWC-Saugus2, with treatment for removal of perchlorate, and by constructing replacement wells in other parts of the Saugus Formation not impacted by perchlorate. Full restoration of impacted water supply, including implementation of the containment plan, is currently scheduled for 2006. The containment plan will consist of (1) pumping groundwater on a nearly continual basis from production wells SCWC-Saugus1 and SCWC-Saugus2 production wells; (2) treating the pumped water using ion exchange resins followed by chlorine and ammonia disinfection; and (3) pumping the treated water to CLWA's Rio Vista Intake Pump Station for subsequent distribution for municipal water supply. This containment plan was developed to meet the following objectives, which were identified by the Purveyors:

1. Hydraulically contain perchlorate that is migrating westward in the Saugus Formation from the Whittaker-Bermite property toward the impacted production wells
2. Hydraulically contain perchlorate that is present at monitoring well MP-5 and production well VWC-157, which are located downgradient of the impacted wells
3. Protect downgradient production wells that are currently not impacted
4. Restore the annual volumes of water that were pumped from the impacted wells before they were shut down
5. Operate the impacted wells in a manner that is consistent with the groundwater operating plan
6. If possible, pump one or more of the impacted Saugus Formation production wells in a manner that also contains perchlorate migrating in the Alluvial Aquifer from the northern portion of the Whittaker-Bermite property

A detailed analysis of this perchlorate containment plan in the Saugus Formation is presented in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (CH2M HILL, 2004b). The pumping plan described in that report for the SCWC-Saugus1 and SCWC-Saugus2 production wells was also used in the basin yield modeling evaluation. These wells were assumed to operate on a continuous basis to contain perchlorate in this portion of the Saugus Formation. The analysis assumed each well

would be offline 1 month each year for routine maintenance, but would otherwise operate on a continuous basis.

Additionally, for the previous evaluations of the containment plan and for the basin yield analysis, the third impacted production well (NCWD-11) was assumed to operate at a yield of 1,200 gallons per minute for a period of 5 months during the peak-demand season, providing a volume of 811 acre-feet that would be treated prior to entering the distribution system. Consequently, total pumping from the three perchlorate-impacted Saugus Formation production wells that will be returned to service (SCWC-Saugus1, SCWC-Saugus2, and NCWD-11) was simulated as 4,355 AF/yr. Total pumping from NCWD wells completed in the Saugus Formation was simulated as 3,441 AF/yr in normal years and 4,899 AF/yr in dry years, with pumping occurring from NCWD-11 and nearby production wells NCWD-12 and NCWD-13. Because they are closely spaced geographically, the three wells together form a pumping center in the Saugus Formation. Thus, although NCWD may choose to no longer use well NCWD-11, this analysis includes a pumping distribution that examines the sustainability of the Saugus Formation with a conservatively high pumping capacity at this pumping center.

3.5 Simulation Methods for Other Local Hydrologic Processes

In addition to groundwater pumping, infiltration from irrigation (from urban and agricultural lands), precipitation, and streamflows (stormwater and WRP discharges) were also modeled. These other local hydrologic processes were defined using the Surface Water Routing Model (SWRM), which is described in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Key aspects of the derivation of these terms are described in the following sections.

3.5.1 Recharge from Urban Irrigation

Under existing land use and water use conditions, the estimated long-term infiltration rates of applied irrigation water beneath urban areas, under full build-out conditions in the valley, were estimated to be 1.0 in/yr for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses. These rates were applied during each year (and each month) of the 78-year simulation period. The areas over which these rates were applied were larger than under current conditions. The areas were defined from existing land use data and from LACSD mapping of projected future land uses in the rest of the Santa Clarita Valley under full build-out conditions[10]. Figure 3-7 shows the land use that was simulated in the model for full build-out conditions.

3.5.2 Recharge from Agricultural Irrigation

As discussed in the *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002), irrigation of lands owned by NLF results in existing agricultural return flows. The source of most irrigation water is groundwater pumping from the Alluvial Aquifer, with some limited pumping occurring from one Saugus Formation well (NLF-156).

[10]LACSD land use mapping indicates that, including Newhall Ranch, approximately 14,000 acres of currently undeveloped land will be urbanized in the future within the Regional Model simulation area. Additional urbanization will also occur in areas that are within the watershed, but outside the Regional Model's boundaries.

Under full valley build-out conditions, the currently irrigated lands will no longer be irrigated because their water source will be used as part of the water supply for Newhall Ranch. Therefore, under full build-out conditions, no agricultural irrigation will occur within the area simulated by the Regional Model.

3.5.3 Precipitation Recharge

Infiltration from direct precipitation within the Regional Model domain was defined using data from the Newhall-Soledad and NCWD rain gages, an isohyet map of rainfall throughout the watershed, and a power-function equation developed by Turner (1986) that describes the relationship between annual rainfall and ET rates within the valley. Details concerning the derivation of precipitation infiltration rates from these data are contained in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Table 3-8 lists the simulated monthly precipitation at the NCWD rain gage for the 78-year model period[11].

3.5.4 Stormwater Flows and Recharge from Streams

For each month of the simulation, the SWRM calculated the amounts of stormwater flow and groundwater recharge in all streams, plus the amount of flow and groundwater recharge arising from projected future WRP discharges to the Santa Clara River. For the Santa Clara River, the volume of streamflow was defined from measured and estimated streamflow data at the Lang gage (Table 3-9). For Castaic Creek, the volume of streamflow was defined from historical DWR operations and consideration of the hydrologic year type (Table 3-10). For the remaining Santa Clara River tributaries, streamflow volumes were defined by the SWRM using monthly rainfall data and the Turner (1986) relationship between rainfall, ET, and the subsequent yield from each watershed.

3.5.5 WRP Discharges to the Santa Clara River

Treated water is discharged to the Santa Clara River from two LACSD WRPs. As shown on Figure 1-1, the Saugus WRP discharges to the river immediately above the mouth of the South Fork Santa Clara River, and the Valencia WRP discharges to the river just west of Interstate 5.

Under full valley build-out conditions, future flows into and from WRPs will be higher than historical flows because of increased development and the associated increase in indoor water use volumes. Additionally, a portion of the future treated water will be reclaimed, as described in CLWA's recycled water master plan (Kennedy/Jenks Consultants, 2002). Future inflows to the Saugus and Valencia WRPs were estimated from projected future water demands and from comparisons of historical water use and measured inflows to both WRPs. Table 3-11 shows the derivation of urban water demands outside the Newhall Ranch development (which will be served by a new, separate WRP). Table 3-12 shows the total amount of treated water generated by the Saugus and Valencia WRPs, and the amount of this water that is reclaimed and discharged to the river, by month. The analysis assumes that the reclaimed water volume will be no more than 16,000 AF/yr, to maintain existing flow volumes in the Santa Clara River. For the Newhall Ranch WRP, discharges to the river

[11]The simulated monthly precipitation was defined from measurements at the NCWD gage from 1979 through 2003, as well as by combining the isohyet map with measurements at the Newhall-Soledad gage from 1950 through 1978.

will be 286 AF/yr, occurring primarily in December and January, when demands for reclaimed water are at their seasonal low. The total combined volumes of treated water discharged to the Santa Clara River under full valley build-out conditions (including Newhall Ranch) are summarized, by month, in Table 3-13. These rates were used in each year of the 78-year simulation.

3.5.6 Monthly Assignment and Tracking of Surface Water Budget

The month-by-month assignment of the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system was performed by the SWRM using the procedures described in Section C.8.5 of Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Streambed infiltration capacities were the same as those used in the calibrated model. For each of the 78 years in the model simulation, the streambed infiltration capacity values were selected by matching the year to 1 of the 20 years (1980 through 1999) from the model calibration runs, using rainfall and streamflow data to select the corresponding streambed infiltration rates.

The SWRM also tracked the volume of surface water in each simulated stream that does not infiltrate during each month because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage was calculated to remain as surface water in the Santa Clara River and to eventually exit the Regional Model at the west end of the valley, at the County Line gage.

3.6 Running the Model and Evaluating Results

As discussed in the previous sections, the modeling evaluations were performed by simulating conditions on a monthly basis for the 78-year simulation period. The first step in this process consisted of running the SWRM to calculate the monthly distribution of recharge to the Alluvial Aquifer system (from rainfall, streamflow, irrigation, and WRP discharges) and recharge to the Saugus Formation (from rainfall and irrigation) in areas where the Alluvial Aquifer is not present. The output from the SWRM consisted of monthly files that assigned recharge to each node in the model grid.

The Regional Model was then run using monthly time steps, in which pumping and recharge terms were varied each month. The model was run by solving the groundwater flow equations for three time intervals during each month to improve the accuracy of the calculations. For each sub-interval of time, the model was run with a convergence criterion of 0.0001 foot for groundwater elevations and a water budget convergence criterion of 1 cubic foot per day. The model results were then evaluated by generating time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the potential effects of the groundwater operating plan across the basin. The hydrographs were used to evaluate whether the operating plan is consistent with the objective of operating the basin in a manner that maintains long-term stability in groundwater levels and river flows. This analysis and its findings are presented in Section 4.

Tables

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1950	Below Normal	6.84
1951	Above Normal	12.42
1952	Wet	34.19
1953	Wet	4.88
1954	Above Normal	15.82
1955	Dry	13.91
1956	Wet	14.21
1957	Above Normal	22.85
1958	Wet	23.14
1959	Below Normal	9.81
1960	Dry	11.64
1961	Dry	8.82
1962	Below Normal	21.22
1963	Wet	12.79
1964	Dry	10.09
1965	Wet	32.28
1966	Below Normal	14.57
1967	Wet	23.23
1968	Below Normal	6.90
1969	Wet	32.42
1970	Wet	23.19
1971	Wet	13.75
1972	Below Normal	4.15
1973	Above Normal	19.79
1974	Wet	18.04
1975	Wet	10.92
1976	Critical	14.02
1977	Critical	20.87
1978	Above Normal	42.17
1979	Below Normal	21.47
1980	Above Normal	27.00
1981	Dry	13.42
1982	Wet	20.20
1983	Wet	39.07
1984	Wet	12.86

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1985	Dry	8.37
1986	Wet	18.02
1987	Dry	14.45
1988	Critical	16.92
1989	Dry	7.56
1990	Critical	6.98
1991	Critical	17.21
1992	Critical	32.03
1993	Above Normal	32.72
1994	Critical	10.27
1995	Wet	29.15
1996	Wet	15.88
1997	Wet	13.35
1998	Wet	30.73
1999	Wet	8.96
2000	Above Normal	14.04
2001	Dry	22.24
2002	Dry	7.90
2003	Above Normal	15.70

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Records are for the Newhall-Soledad rain gage (Station No. FC32CE), in inches. As shown on Figure 2-6, the median and average rainfall at this gage from 1950 through 2002 were 14.57 in/yr and 17.84 in/yr, respectively.

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
1	1980	27.00	35,000-40,000
2	1981	13.42	35,000-40,000
3	1982	20.20	35,000-40,000
4	1983	39.07	35,000-40,000
5	1984	12.86	35,000-40,000
6	1985	8.37	30,000-35,000
7	1986	18.02	35,000-40,000
8	1987	14.45	35,000-40,000
9	1988	16.92	35,000-40,000
10	1989	7.56	30,000-35,000
11	1990	6.98	30,000-35,000
12	1991	17.21	30,000-35,000
13	1992	32.03	35,000-40,000
14	1993	32.72	35,000-40,000
15	1994	10.27	30,000-35,000
16	1995	29.15	35,000-40,000
17	1996	15.88	35,000-40,000
18	1997	13.35	35,000-40,000
19	1998	30.73	35,000-40,000
20	1999	8.96	30,000-35,000
21	2000	14.04	35,000-40,000
22	2001	22.24	35,000-40,000
23	2002	7.90	30,000-35,000
24	2003	15.70	35,000-40,000
25	1950	6.84	30,000-35,000
26	1951	12.42	35,000-40,000
27	1952	34.19	35,000-40,000
28	1953	4.88	30,000-35,000
29	1954	15.82	35,000-40,000
30	1955	13.91	35,000-40,000
31	1956	14.21	35,000-40,000
32	1957	22.85	35,000-40,000
33	1958	23.14	35,000-40,000
34	1959	9.81	30,000-35,000
35	1960	11.64	30,000-35,000
36	1961	8.82	30,000-35,000
37	1962	21.22	30,000-35,000
38	1963	12.79	35,000-40,000
39	1964	10.09	30,000-35,000
40	1965	32.28	35,000-40,000
41	1966	14.57	35,000-40,000

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
42	1967	23.23	35,000-40,000
43	1968	6.90	30,000-35,000
44	1969	32.42	35,000-40,000
45	1970	23.19	35,000-40,000
46	1971	13.75	35,000-40,000
47	1972	4.15	30,000-35,000
48	1973	19.79	35,000-40,000
49	1974	18.04	35,000-40,000
50	1975	10.92	30,000-35,000
51	1976	14.02	35,000-40,000
52	1977	20.87	35,000-40,000
53	1978	42.17	35,000-40,000
54	1979	21.47	35,000-40,000
55	1980	27.00	35,000-40,000
56	1981	13.42	35,000-40,000
57	1982	20.20	35,000-40,000
58	1983	39.07	35,000-40,000
59	1984	12.86	35,000-40,000
60	1985	8.37	30,000-35,000
61	1986	18.02	35,000-40,000
62	1987	14.45	35,000-40,000
63	1988	16.92	35,000-40,000
64	1989	7.56	30,000-35,000
65	1990	6.98	30,000-35,000
66	1991	17.21	30,000-35,000
67	1992	32.03	35,000-40,000
68	1993	32.72	35,000-40,000
69	1994	10.27	30,000-35,000
70	1995	29.15	35,000-40,000
71	1996	15.88	35,000-40,000
72	1997	13.35	35,000-40,000
73	1998	30.73	35,000-40,000
74	1999	8.96	30,000-35,000
75	2000	14.04	35,000-40,000
76	2001	22.24	35,000-40,000
77	2002	7.90	30,000-35,000
78	2003	15.70	35,000-40,000

[a]From records at Newhall-Soledad rain gage (Station No. FC32CE).

[b]Alluvial Aquifer pumping rates listed in this column will occur under the operating plan for the valley if the 1950 through 2003 local hydrology repeats itself in the future.

[c]Alluvial Aquifer pumping is set at the dry-year rate in years 12, 37, and 66 because each of these years is the first nondrought year that occurs after a multi-year drought ends.

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
1	Above Normal	90	Normal (7,500-15,000)
2	Dry	90	Normal (7,500-15,000)
3	Wet	100	Normal (7,500-15,000)
4	Wet	100	Normal (7,500-15,000)
5	Wet	100	Normal (7,500-15,000)
6	Dry	95	Normal (7,500-15,000)
7	Wet	70	Normal (7,500-15,000)
8	Dry	75	Normal (7,500-15,000)
9	Critical	15	Dry Year 1 (15,000)
10	Dry	95	Normal (7,500-15,000)
11	Critical	25	Dry Year 1 (15,000)
12	Critical	30	Dry Year 2 (25,000)
13	Critical	45	Dry Year 3 (35,000)
14	Above Normal	100	Normal (7,500-15,000)
15	Critical	50	Dry Year 1 (15,000)
16	Wet	80	Normal (7,500-15,000)
17	Wet	100	Normal (7,500-15,000)
18	Wet	100	Normal (7,500-15,000)
19	Wet	100	Normal (7,500-15,000)
20	Wet	100	Normal (7,500-15,000)
21	Above Normal	90	Normal (7,500-15,000)
22	Dry	39	Dry Year 1 (15,000)
23	Dry	70	Normal (7,500-15,000)
24	Above Normal	90	Normal (7,500-15,000)
25	Below Normal	90	Normal (7,500-15,000)
26	Above Normal	100	Normal (7,500-15,000)
27	Wet	100	Normal (7,500-15,000)
28	Wet	100	Normal (7,500-15,000)
29	Above Normal	100	Normal (7,500-15,000)
30	Dry	45	Dry Year 1 (15,000)
31	Wet	100	Normal (7,500-15,000)
32	Above Normal	90	Normal (7,500-15,000)
33	Wet	100	Normal (7,500-15,000)
34	Below Normal	85	Normal (7,500-15,000)
35	Dry	55	Dry Year 1 (15,000)
36	Dry	70	Dry Year 2 (25,000)
37	Below Normal	95	Normal (7,500-15,000)
38	Wet	100	Normal (7,500-15,000)
39	Dry	75	Dry Year 1 (15,000)
40	Wet	80	Normal (7,500-15,000)
41	Below Normal	100	Normal (7,500-15,000)
42	Wet	100	Normal (7,500-15,000)

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
43	Below Normal	90	Normal (7,500-15,000)
44	Wet	100	Normal (7,500-15,000)
45	Wet	100	Normal (7,500-15,000)
46	Wet	100	Normal (7,500-15,000)
47	Below Normal	75	Normal (7,500-15,000)
48	Above Normal	100	Normal (7,500-15,000)
49	Wet	100	Normal (7,500-15,000)
50	Wet	100	Normal (7,500-15,000)
51	Critical	75	Dry Year 1 (15,000)
52	Critical	4	Dry Year 2 (25,000)
53	Above Normal	100	Normal (7,500-15,000)
54	Below Normal	95	Normal (7,500-15,000)
55	Above Normal	90	Normal (7,500-15,000)
56	Dry	90	Normal (7,500-15,000)
57	Wet	100	Normal (7,500-15,000)
58	Wet	100	Normal (7,500-15,000)
59	Wet	100	Normal (7,500-15,000)
60	Dry	95	Normal (7,500-15,000)
61	Wet	70	Normal (7,500-15,000)
62	Dry	75	Normal (7,500-15,000)
63	Critical	15	Dry Year 1 (15,000)
64	Dry	95	Normal (7,500-15,000)
65	Critical	25	Dry Year 1 (15,000)
66	Critical	30	Dry Year 2 (25,000)
67	Critical	45	Dry Year 3 (35,000)
68	Above Normal	100	Normal (7,500-15,000)
69	Critical	50	Dry Year 1 (15,000)
70	Wet	80	Normal (7,500-15,000)
71	Wet	100	Normal (7,500-15,000)
72	Wet	100	Normal (7,500-15,000)
73	Wet	100	Normal (7,500-15,000)
74	Wet	100	Normal (7,500-15,000)
75	Above Normal	90	Normal (7,500-15,000)
76	Dry	39	Dry Year 1 (15,000)
77	Dry	70	Normal (7,500-15,000)
78	Above Normal	90	Normal (7,500-15,000)

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Defined from simulations performed by CLWA (Kennedy/Jenks Consultants, 2003) and USBR (2004) using the CALSIM II model. This condition is for the year 2020 level of development. In any given year, the allocation may be made up, in part, of carryover water from the prior year.

TABLE 3-4

Recent and Simulated Future Annual Groundwater Pumping Volumes from the Alluvial Aquifer

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

		Historical Pumping			UWMP Pumping	
Well Name	**Location**[a]	**2001**	**2002**	**2003**	**Normal Years**	**Dry Years**
NCWD-Castaic 1	Castaic Valley	345	385	561	385	345
NCWD-Castaic 2	Castaic Valley	166	0	123	166	125
NCWD-Castaic 3	Castaic Valley	0	0	0	0	0
NCWD-Castaic 4	Castaic Valley	100	47	56	100	45
NCWD-Pinetree 1	Mint Canyon	164	0	0	164	0
NCWD-Pinetree 2	Mint Canyon	0	0	0	0	0
NCWD-Pinetree 3	Mint Canyon	566	544	525	545	525
NCWD-Pinetree 4	Mint Canyon	300	5	0	300	0
NCWD Total		**1,641**	**981**	**1,265**	**1,660**	**1,040**
NLF-161	Downstream of Valencia WRP	496	485	2,021	485	485
NLF-B10	Downstream of Valencia WRP	1,240	534	344	344	344
NLF-B11	Downstream of Valencia WRP	205	232	271	232	232
NLF-B5	Downstream of Valencia WRP	1,680	2,280	1,582	1,582	1,582
NLF-B6	Downstream of Valencia WRP	1,312	2,175	1,766	1,766	1,766
NLF-B7	Downstream of Valencia WRP	474	584	402	584	584
NLF-C	Downstream of Valencia WRP	1,319	1,720	1,373	1,373	1,373
NLF-C3	Downstream of Valencia WRP	93	192	186	192	192
NLF-C4	Downstream of Valencia WRP	1,028	809	764	809	809
NLF-C5	Downstream of Valencia WRP	680	850	622	850	850
NLF-C6	Downstream of Valencia WRP	231	241	108	241	241
NLF-C7	Downstream of Valencia WRP	741	866	443	866	866
NLF-C8	Downstream of Valencia WRP	293	594	408	594	594
NLF-E	Castaic Valley	1,691	16	28	16	16
NLF-E2	Castaic Valley	141	55	14	55	55
NLF-E4	Downstream of Valencia WRP	0	0	0	0	0
NLF-E5	Downstream of Valencia WRP	172	679	537	679	679
NLF-E9	Downstream of Valencia WRP	238	814	47	814	814
NLF-G45	Downstream of Valencia WRP	291	283	60	283	283
NLF-W4	San Francisquito Canyon[b]	46	1	0	0	0
NLF-W5	San Francisquito Canyon	276	104	23	107	107
NLF-X3	Downstream of Valencia WRP	12	0	0	0	0
NLF Total		**12,659**	**13,514**	**10,999**	**11,872**	**11,872**
SCWD-Clark	Bouquet Canyon	696	782	712	782	700
SCWD-Guida	Bouquet Canyon	1,047	1,320	1,230	1,320	1,230
SCWD-Honby	Above Saugus WRP	721	696	874	696	870
SCWD-Lost Canyon 2	Mint Canyon	741	730	644	741	640
SCWD-Lost Canyon 2A	Mint Canyon	1,034	905	593	1,034	590
SCWD-Mitchell #5A	Mint Canyon	407	143	19	0	0
SCWD-Mitchell #5B	Mint Canyon	0	150	0	557	0
SCWD-N. Oaks Central	Mint Canyon	822	1,646	1,641	822	1,640
SCWD-N. Oaks East	Mint Canyon	1,234	448	485	1,234	485
SCWD-N. Oaks West	Mint Canyon	898	1,123	31	898	0
SCWD-Sand Canyon	Mint Canyon	930	705	195	930	195
SCWD-Sierra	Mint Canyon	846	87	0	846	0
SCWD-Stadium	Above Saugus WRP	565	778	0	800	800
SCWD Total		**9,941**	**9,513**	**6,424**	**10,660**	**7,150**

TABLE 3-5
Simulated Annual Groundwater Pumping from the Saugus Formation for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Owner	Well Name	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
NCWD	11	811	811	811	811
	12	1,315	2,044	2,044	2,044
	13	1,315	2,044	2,044	2,044
Total Pumping (NCWD)		**3,441**	**4,899**	**4,899**	**4,899**
NLF	156	369	369	369	369
Total Pumping (NLF)		**369**	**369**	**369**	**369**
SCWC	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
Total Pumping (SCWC)		**3,544**	**3,544**	**3,544**	**3,544**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Valencia Country Club)	500	500	500	500
	201	100	100	3,577	3,577
	205	1,000	2,734	3,827	3,827
	206	1,175	2,734	3,500	3,500
Total Pumping (VWC)		**3,325**	**6,948**	**12,284**	**12,284**
To Be Determined	Future #1	0	0	3,250	3,250
	Future #2	0	0	0	3,250
	Future #3	0	0	0	3,250
	Future #4	0	0	0	3,250
Total Pumping (Future)		**0**	**0**	**3,250**	**13,000**
Total Saugus Formation Pumping		**10,679**	**15,760**	**24,346**	**34,096**

Notes:

All pumping volumes are listed in acre-feet.

Wells VWC-157 and NCWD-7, 8, 9, and 10 are assumed to no longer operate in the future.

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-11	2	200	1,075	300	10	3,000	72.3
	3			500	2	1,000	24.1
	4			75	2	150	3.6
NCWD-12	2	485	1,280	15	10	150	8.8
	3			500	2	1,000	58.5
	4			280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
	3			250	2	500	38.5
NLF-156	2	320	1,800	180	10	1,800	21.8
	3			500	6.5	3,250	39.4
	4			500	4	2,000	24.2
	5			300	4	1,200	14.5
SCWC-Saugus1	2	490	1,620	10	10	100	1.8
	3			500	6.5	3,250	59.9
	4			500	4	2,000	36.8
	5			20	4	80	1.5
SCWC-Saugus2	2	490	1,591	10	10	100	1.7
	3			500	6.5	3,250	56.9
	4			500	4	2,000	35.0
	5			91	4	364	6.4
VWC-159	3	662	1,900	338	0.025	8.45	27.3
	4			500	0.025	12.5	40.4
	5			400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.6
	4			500	4	2,000	46.2
	5			500	4	2,000	46.2
VWC-201	3	540	1,670	460	6.5	2,990	52.7
	4			500	4	2,000	35.3
	5			170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
	4			500	4	2,000	40.9
	5			430	4	1,720	35.2
VWC-206	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
Future Wells	3	820	1,930	180	6.5	1,170	23.9
Near VWC-206	4			500	4	2,000	40.9
(Assumed)	5			430	4	1,720	35.2

Notes:

Existing wells NCWD-7 and NCWD-10 are assumed to no longer operate in the future.

Kh = horizontal hydraulic conductivity
T = transmissivity
ft/day = feet per day
ft^2/day = square feet per day

TABLE 3-7
Allocation of Pumping, by Month, for Agricultural and Urban Production Wells
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Percent of Annual Water Use, Agricultural	Percent of Annual Water Use, Urban	Percent of May through October Water Use, Urban
January	3.75	5.2	
February	5.10	3.7	
March	6.60	5.2	
April	9.10	6.6	
May	10.55	8.7	13.2
June	11.40	10.4	15.8
July	14.10	13.0	19.7
August	12.95	13.6	20.6
September	10.20	10.9	16.6
October	7.50	9.3	14.1
November	5.00	7.1	
December	3.75	6.3	
Total	**100.0**	**100.0**	**100.0**

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
2	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
3	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
4	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
5	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
6	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
7	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
8	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
9	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
10	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
11	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
12	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
13	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
14	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
15	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
16	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
17	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
18	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
19	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
20	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
21	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
22	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
23	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
24	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47
25	2.58	1.69	1.27	0.86	0.01	0.00	0.00	0.00	0.32	0.36	0.73	0.21	8.03
26	2.96	0.93	1.16	1.69	0.09	0.00	0.00	0.05	0.00	0.49	1.33	5.88	14.57
27	17.68	0.61	10.30	1.80	0.00	0.00	0.00	0.00	0.12	0.00	4.52	5.09	40.12
28	0.80	0.02	0.21	1.64	0.69	0.00	0.00	0.00	0.00	0.00	2.32	0.04	5.73
29	6.38	3.36	4.86	0.12	0.00	0.00	0.00	0.00	0.00	0.00	2.38	1.47	18.56
30	5.69	1.69	0.21	3.38	1.91	0.00	0.00	0.00	0.00	0.00	1.43	2.01	16.32
31	7.55	1.00	0.00	5.90	1.82	0.00	0.11	0.00	0.00	0.15	0.00	0.15	16.68
32	7.22	2.71	3.05	1.16	1.06	0.25	0.00	0.00	0.00	2.68	0.40	8.30	26.81
33	2.11	10.42	5.82	7.18	0.00	0.00	0.00	0.00	0.04	1.35	0.23	0.00	27.15
34	3.70	5.47	0.00	0.59	0.00	0.00	0.00	0.00	0.08	0.00	0.00	1.68	11.51
35	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
36	1.88	0.00	0.76	0.33	0.09	0.00	0.07	0.00	0.11	0.00	4.12	2.99	10.35
37	3.86	19.44	1.53	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.00	0.00	24.90
38	0.99	3.63	4.10	2.23	0.06	0.43	0.00	0.00	0.77	0.50	2.29	0.01	15.01
39	2.95	0.00	1.88	2.41	0.04	0.12	0.00	0.00	0.00	0.52	1.47	2.48	11.84
40	0.25	0.07	1.65	9.14	0.00	0.02	0.26	0.16	0.95	0.00	17.49	7.89	37.88
41	1.42	1.55	0.33	0.00	0.09	0.00	0.00	0.00	0.09	0.11	7.56	5.95	17.10

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	6.76	0.22	3.23	5.41	0.19	0.00	0.00	0.00	0.50	0.00	9.36	1.58	27.26
43	0.86	0.93	2.91	0.97	0.07	0.00	0.00	0.38	0.00	0.39	0.35	1.24	8.10
44	19.53	13.89	0.82	1.16	0.05	0.05	0.18	0.00	0.00	0.00	2.32	0.05	38.04
45	0.94	6.63	4.33	0.00	0.00	0.00	0.00	0.00	0.00	0.13	8.86	6.33	27.21
46	1.23	1.41	0.48	0.94	0.15	0.00	0.00	0.00	0.47	0.50	0.38	10.57	16.14
47	0.00	0.12	0.00	0.02	0.05	0.05	0.00	0.06	0.00	0.05	3.45	1.08	4.87
48	5.19	11.74	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.15	1.83	1.03	23.22
49	10.58	0.02	4.30	0.06	0.00	0.00	0.02	0.00	0.00	1.17	0.12	4.89	21.17
50	0.28	3.02	6.04	2.96	0.00	0.00	0.00	0.00	0.00	0.39	0.04	0.09	12.81
51	0.00	7.39	1.47	0.46	0.15	0.35	0.01	0.00	3.40	0.22	2.09	0.90	16.45
52	5.75	0.12	2.15	0.00	5.27	0.00	0.00	2.68	0.02	0.05	0.06	8.40	24.49
53	10.74	13.23	17.10	2.72	0.00	0.00	0.00	0.00	1.23	0.01	2.70	1.76	49.49
54	12.44	3.20	6.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.89	1.19	23.75
55	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
56	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
57	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
58	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
59	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
60	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
61	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
62	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
63	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
64	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
65	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
66	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
67	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
68	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
69	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
70	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
71	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
72	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
73	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
74	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
75	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
76	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
77	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
78	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
2	594	98	339	240	107	18	18	12	338	321	258	394	2,739
3	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
4	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
5	0	596	405	240	143	166	228	411	154	220	904	578	4,044
6	483	461	274	215	77	0	0	0	12	179	221	301	2,224
7	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
8	117	117	65	31	12	0	0	0	0	0	258	516	1,116
9	222	209	506	117	77	68	0	0	0	0	12	25	1,236
10	50	111	60	25	6	0	0	0	102	94	34	18	499
11	212	276	230	46	46	5	0	0	0	27	36	147	1,025
12	162	775	879	736	145	142	14	0	45	69	62	263	3,291
13	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
14	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
15	388	493	497	319	163	80	20	7	37	102	193	941	3,239
16	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
17	666	896	730	315	151	46	7	0	54	154	307	510	3,836
18	517	346	140	85	33	5	4	50	66	240	566	809	2,859
19	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
20	92	85	204	224	197	107	80	46	52	54	31	80	1,252
21	117	117	65	31	12	0	0	0	0	0	258	516	1,116
22	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
23	50	111	60	25	6	0	0	0	102	94	34	18	499
24	666	896	730	315	151	46	7	0	54	154	307	510	3,836
25	83	198	184	126	105	83	51	54	56	53	43	42	1,078
26	49	40	66	91	98	84	79	72	57	71	47	53	807
27	9,629	636	7,091	2,114	895	326	153	138	86	97	178	313	21,656
28	300	282	271	237	165	134	102	86	85	83	74	68	1,888
29	145	278	404	356	181	108	110	99	91	90	80	75	2,017
30	103	156	157	128	153	99	78	76	74	68	66	62	1,220
31	69	85	130	137	139	98	86	80	77	76	67	69	1,113
32	67	55	78	90	93	80	78	78	76	79	66	71	910
33	66	329	743	4,550	825	283	130	108	95	145	146	116	7,536
34	246	351	189	127	111	92	84	86	83	69	68	68	1,575
35	68	67	70	69	70	68	65	65	60	58	316	164	1,140
36	124	91	38	38	36	32	28	33	22	19	19	119	597
37	139	1,904	791	449	329	169	97	82	80	84	82	82	4,287
38	85	142	145	131	104	86	79	74	66	65	62	58	1,096
39	69	50	51	62	66	54	53	53	54	45	43	41	640
40	30	23	25	46	43	36	31	34	37	35	1,305	3,300	4,944
41	1,765	1,014	778	450	308	115	68	54	45	63	91	523	5,274

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	757	489	1,028	2,295	1,880	729	212	104	89	73	255	487	8,397
43	300	247	276	180	72	32	32	30	25	133	208	851	2,384
44	13,797	2,856	1,005	489	320	147	98	98	46	318	392	399	19,966
45	461	550	1,168	465	290	169	74	60	58	27	501	1,338	5,161
46	614	524	556	397	262	167	70	25	5	30	200	420	3,270
47	332	250	131	90	50	22	32	6	0	0	11	58	983
48	153	1,717	950	471	226	71	18	12	8	3	8	44	3,679
49	608	229	392	190	129	49	17	6	0	3	19	87	1,728
50	53	90	228	181	104	31	15	3	0	0	0	0	704
51	0	110	63	39	33	12	0	0	1	0	0	0	258
52	28	7	28	19	60	5	0	0	0	0	0	0	147
53	744	9,486	11,412	1,696	2,736	1,154	418	209	101	264	422	86	28,730
54	1,254	433	1,113	506	246	190	178	111	125	90	120	558	4,925
55	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
56	594	98	339	240	107	18	18	12	338	321	258	394	2,739
57	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
58	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
59	0	596	405	240	143	166	228	411	154	220	904	578	4,044
60	483	461	274	215	77	0	0	0	12	179	221	301	2,224
61	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
62	117	117	65	31	12	0	0	0	0	0	258	516	1,116
63	222	209	506	117	77	68	0	0	0	0	12	25	1,236
64	50	111	60	25	6	0	0	0	102	94	34	18	499
65	212	276	230	46	46	5	0	0	0	27	36	147	1,025
66	162	775	879	736	145	142	14	0	45	69	62	263	3,291
67	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
68	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
69	388	493	497	319	163	80	20	7	37	102	193	941	3,239
70	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
71	666	896	730	315	151	46	7	0	54	154	307	510	3,836
72	517	346	140	85	33	5	4	50	66	240	566	809	2,859
73	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
74	92	85	204	224	197	107	80	46	52	54	31	80	1,252
75	117	117	65	31	12	0	0	0	0	0	258	516	1,116
76	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
77	50	111	60	25	6	0	0	0	102	94	34	18	499
78	666	896	730	315	151	46	7	0	54	154	307	510	3,836

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
2	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
3	0	0	0	0	0	667	842	735	0	0	0	0	2,244
4	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
8	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
9	0	0	809	341	900	0	0	0	0	0	0	0	2,050
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	66	66
13	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
14	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
15	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
16	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
17	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
18	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
19	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
20	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
21	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
22	0	0	0	0	0	667	842	735	0	0	0	0	2,244
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
28	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
30	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
31	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
32	0	0	0	0	0	667	842	735	0	0	0	0	2,244
33	0	0	0	0	0	667	842	735	0	0	0	0	2,244
34	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
35	0	0	0	0	0	0	0	0	0	0	0	0	0
36	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
37	0	0	0	0	0	667	842	735	0	0	0	0	2,244
38	0	0	0	0	0	0	0	0	0	0	0	0	0
39	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
40	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
41	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	0	0	0	0	0	667	842	735	0	0	0	0	2,244
43	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
45	0	0	0	0	0	667	842	735	0	0	0	0	2,244
46	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
47	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	667	842	735	0	0	0	0	2,244
49	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
50	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
51	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
52	0	0	0	0	0	667	842	735	0	0	0	0	2,244
53	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
54	0	0	0	0	0	667	842	735	0	0	0	0	2,244
55	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
56	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
57	0	0	0	0	0	667	842	735	0	0	0	0	2,244
58	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
59	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0
61	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
62	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
63	0	0	809	341	900	0	0	0	0	0	0	0	2,050
64	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	66	66
67	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
68	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
69	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
70	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
71	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
72	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
73	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
74	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
75	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
76	0	0	0	0	0	667	842	735	0	0	0	0	2,244
77	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632

TABLE 3-11
Water Demands and Indoor Water Use under Full Build-out Conditions (Excluding Newhall Ranch)
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year 2000 Actual (AF/yr)	Full Build-out Conditions (AF/yr)	Comments
Annual Urban Water Use Outside Newhall Ranch		
60,988	123,038	Year 2000 value is retail purveyor demand plus other demands in Table II-6 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a). Year 2045 value is from Table 2.5-4 of the *Newhall Ranch Draft Additional Analysis* (Impact Sciences, Inc., 2001). Consists of 89,805 AF/yr Development Monitoring System[a] demand, plus 55,995 AF/yr additional urban demand, minus 14,480 AF/yr conservation, minus 5,193 AF/yr agricultural uses and 3,089 AF/yr "other" uses. Does not include 4,500 AF/yr for aquifer storage and recovery or 17,680 AF/yr of demand for the Newhall Ranch Specific Plan.
Annual Indoor Water Use Outside Newhall Ranch (Equal to LACSD WRP Influent Volumes)		
18,723	40,313 (average year)	The year 2000 volume is from the Saugus and Valencia WRPs for the period January 2000 through December 2000. The long-term current generated effluent volume is based on the influent volume estimated from water balance calculations performed for the chloride mass balance analysis. The effluent volume is 32.8 percent of the total urban water production of 123,038 AF/yr, which includes other uses.

[a]Development Monitoring System water demands are demands associated with future build-out of developments identified in Los Angeles County's Development Monitoring System for the Santa Clarita Valley.

TABLE 3-12

Treated Water Discharges from the Saugus and Valencia WRPs to the Santa Clara River under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Treated Water Volume (2000)[a]	Treated Water Volume (Full Build-out Conditions)[b]	Percent of Annual Outdoor Demand	Reclaimed Volume under Full Build-out Conditions (Before Maintaining Existing Streamflows)	Reclaimed Volume under Full Build-out Conditions (After Maintaining Existing Streamflows)	WRP Discharges to River under Full Build-out Conditions[c]	Month
January	1,503	3,237	3.75	637	637	2,600	January
February	1,443	3,106	5.10	867	867	2,239	February
March	1,528	3,290	6.60	1,122	1,122	2,168	March
April	1,505	3,240	9.10	1,547	1,547	1,693	April
May	1,569	3,379	10.55	1,794	1,794	1,585	May
June	1,543	3,322	11.40	1,938	1,781	1,541	June
July	1,606	3,459	14.10	2,397	1,854	1,605	July
August	1,649	3,550	12.95	2,202	1,902	1,648	August
September	1,593	3,430	10.20	1,734	1,734	1,696	September
October	1,631	3,512	7.50	1,275	1,275	2,237	October
November	1,546	3,329	5.00	850	850	2,479	November
December	1,607	3,459	3.75	637	637	2,822	December
Total Annual	**18,723**	**40,313**	**100.0**	**17,000**	**16,000**	**24,313**	**Total Annual**

[a]Values shown are the actual volumes of treated water discharged to the Santa Clara River from the Saugus and Valencia WRPs during calendar year 2000. (See also Table 3-11.)

[b]Values shown are the combined treated water volumes estimated to be produced by the Saugus and Valencia WRPs for full build-out conditions in the Santa Clarita Valley. These values do not include the future Newhall Ranch WRP, which will be operated by LACSD.

[c]Values shown do not include discharges of treated water to the river from the future Newhall Ranch WRP. These volumes are 10 acre-feet in November, 138 acre-feet in December, and 138 acre-feet in January. During the other nine months of the year, this WRP will not discharge treated water to the river (see the *Newhall Ranch Draft Additional Analysis* [Impact Sciences, Inc., 2001] for further details). The combined total discharge from the Saugus, Valencia, and Newhall Ranch WRPs is summarized in Table 3-13.

Note:
All units are in acre-feet.

TABLE 3-13

Simulated Monthly Treated Wastewater Discharges from Santa Clarita Valley WRPs under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

WRP	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Saugus	493	487	500	490	503	466	457	508	586	555	514	596	6,155
Valencia	2,107	1,752	1,668	1,203	1,082	1,075	1,148	1,140	1,110	1,682	1,965	2,226	18,158
Newhall	138	0	0	0	0	0	0	0	0	0	10	138	286
Total	**2,738**	**2,239**	**2,168**	**1,693**	**1,585**	**1,541**	**1,605**	**1,648**	**1,696**	**2,237**	**2,489**	**2,960**	**24,599**

Note:

Wastewater discharge volumes are listed in acre-feet.

Figures

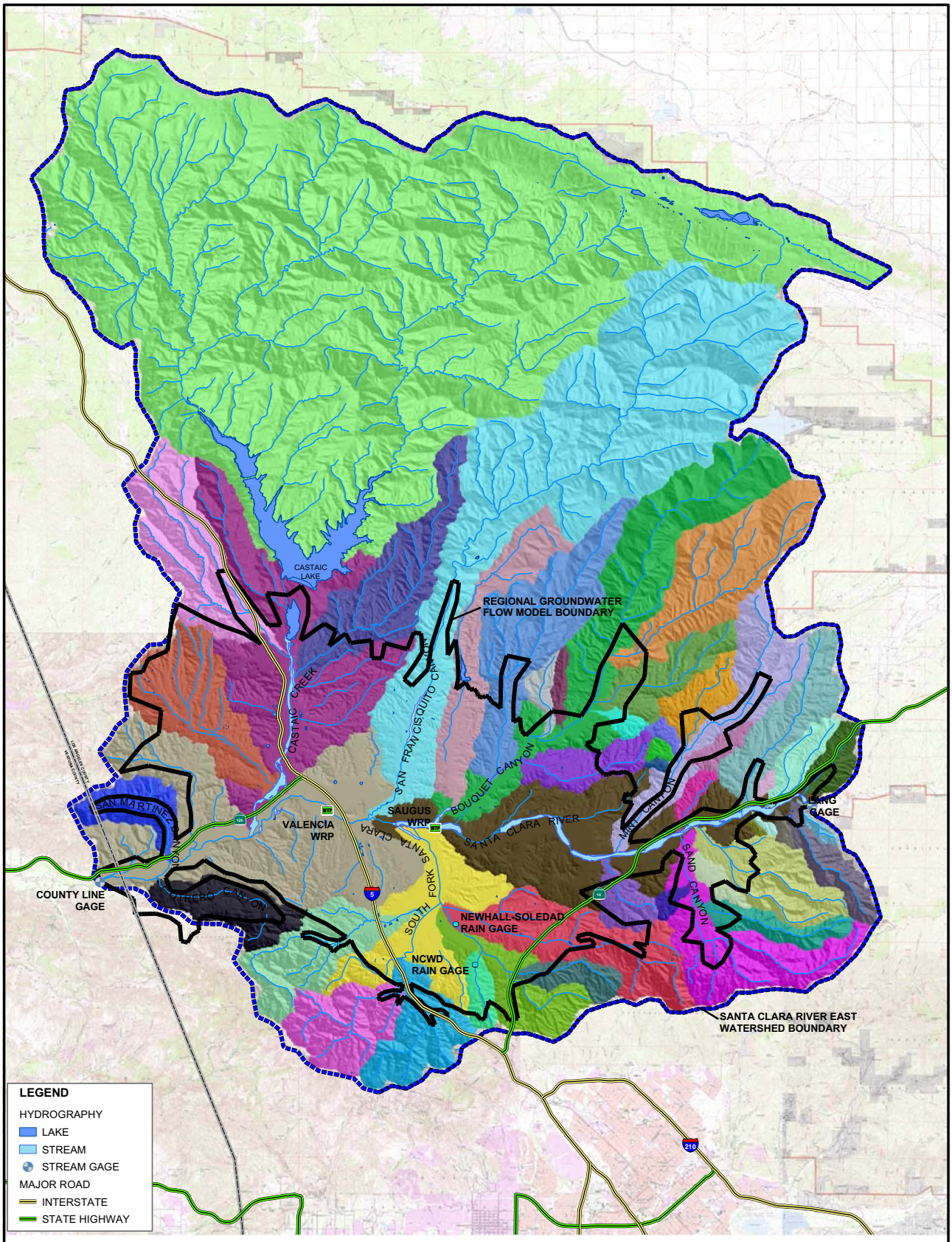

FIGURE 3-1
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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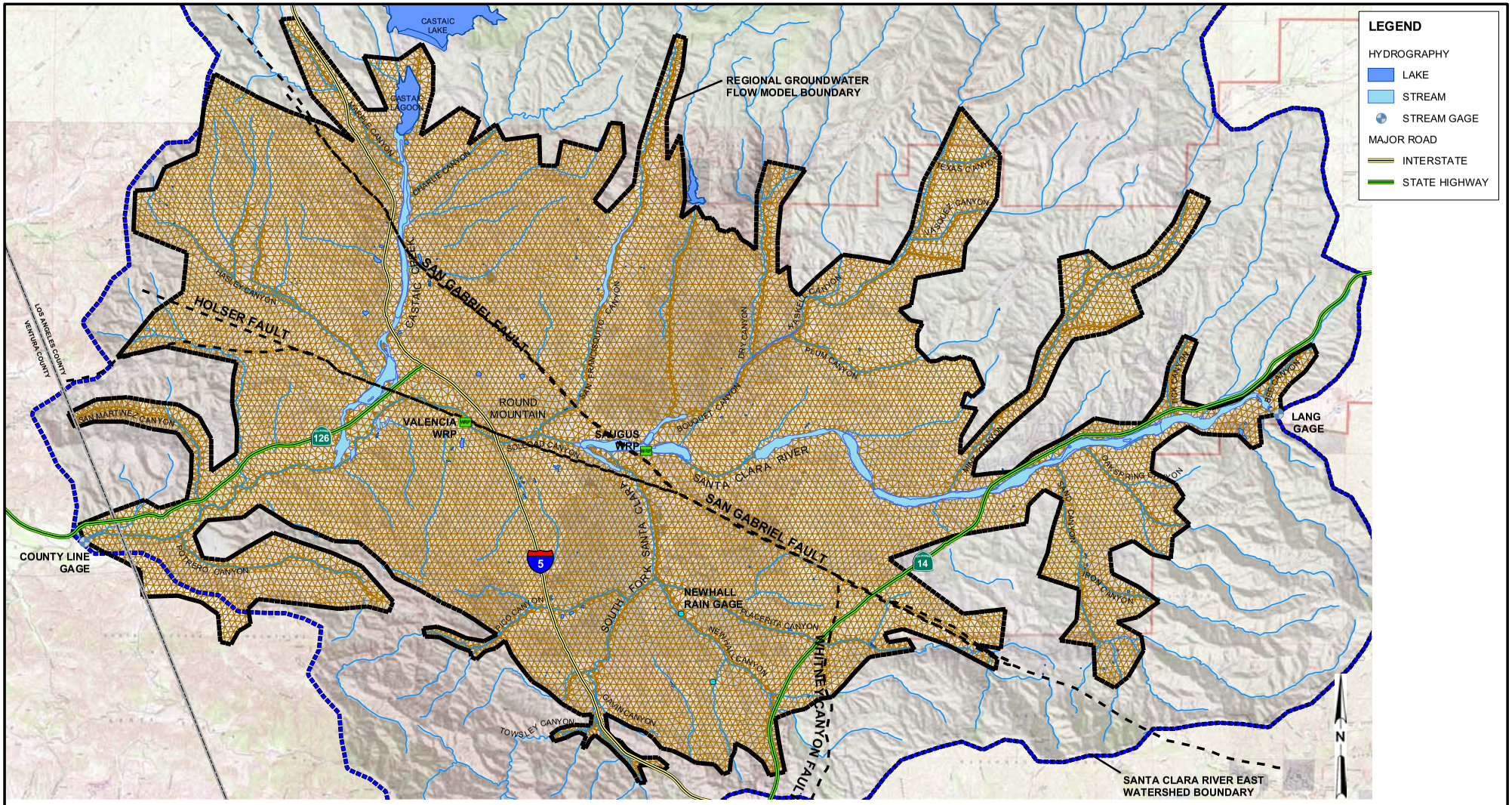

FIGURE 3-2
REGIONAL MODEL GRID
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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	Stratigraphy		Model Layer	Thickness (feet)
Saugus	Alluvium	Saugus	1	500
Saugus	Saugus	Saugus	2	
Saugus	Saugus	Saugus	3	500
Saugus	Saugus	Saugus	4	500
Saugus	Saugus	Saugus	5	500
Saugus	Saugus	Saugus	6	500
Sunshine	Sunshine	Sunshine	7	Variable

FIGURE 3-3
SCHEMATIC DIAGRAM OF THE MODEL'S REPRESENTATION OF STRATIGRAPHY IN THE MIDDLE OF THE BASIN
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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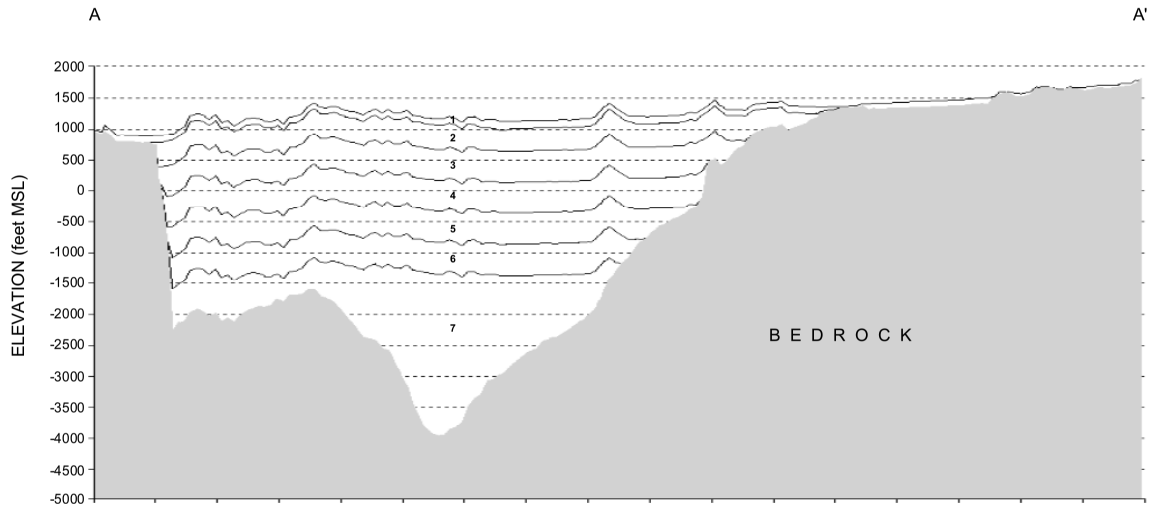
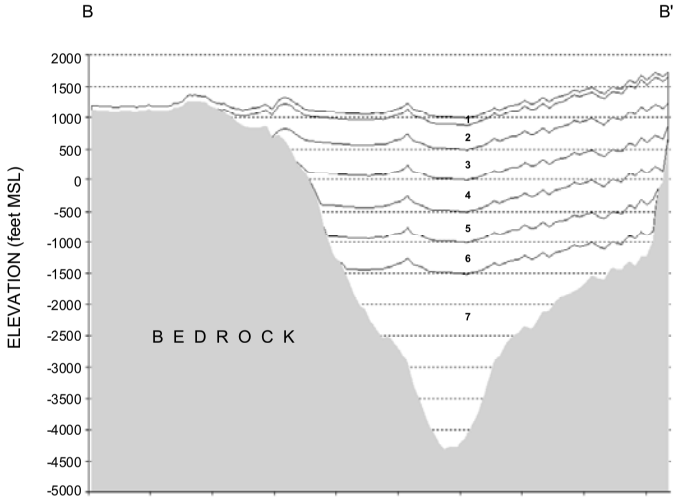
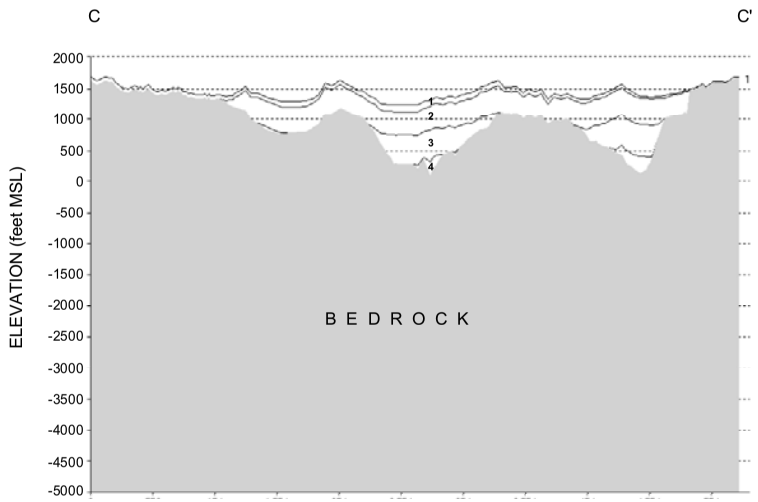
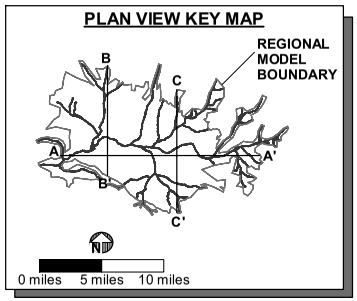
178973-414.xls\FIG3-3









LEGEND

1 = MODEL LAYER 1

2 = MODEL LAYER 2

3 = MODEL LAYER 3

4 = MODEL LAYER 4

5 = MODEL LAYER 5

6 = MODEL LAYER 6

7 = MODEL LAYER 7

HORIZONTAL CROSS SECTION SCALE

0 feet 10,000 feet 20,000 feet

5x VERTICAL EXAGGERATION

FIGURE 3-4
SCHEMATIC CROSS SECTIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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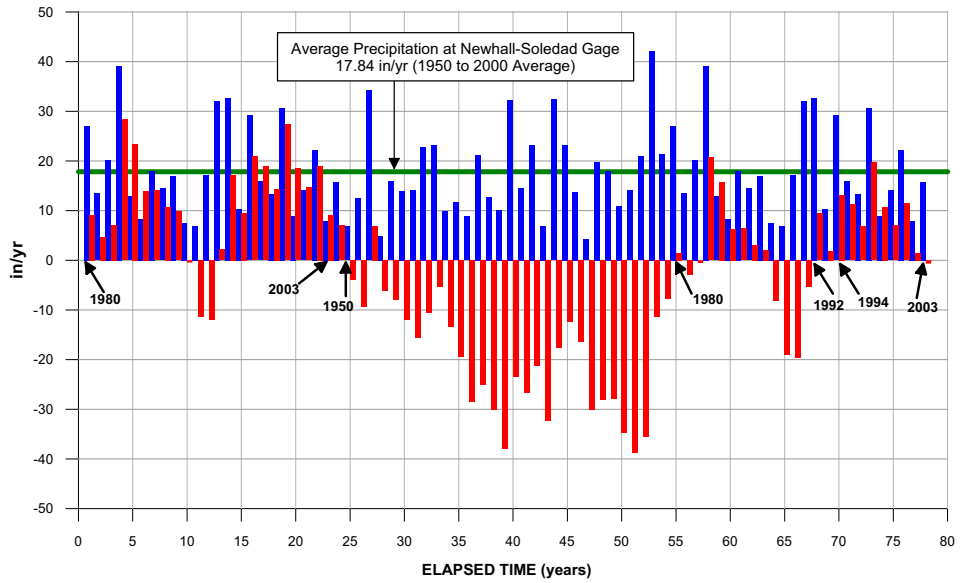

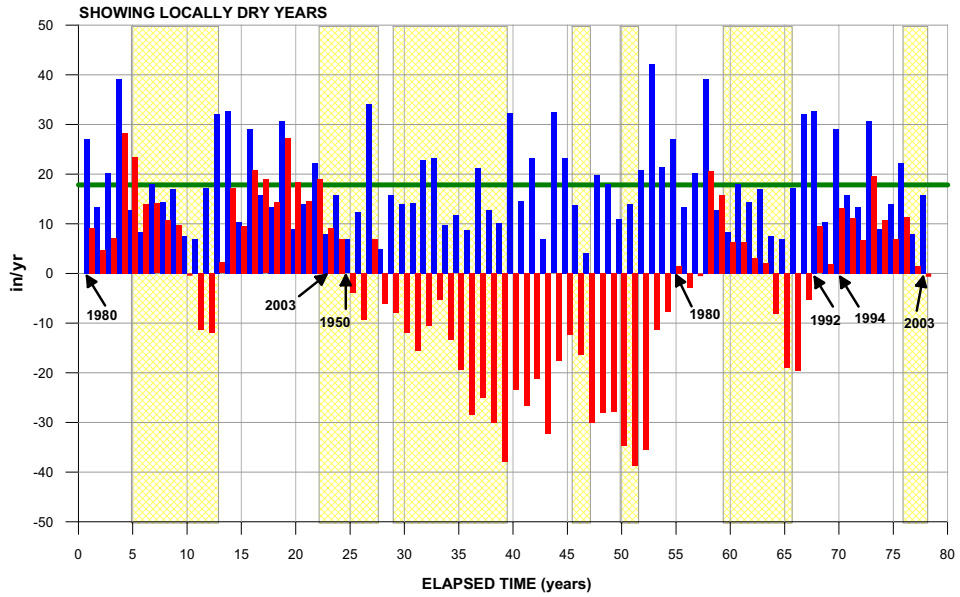

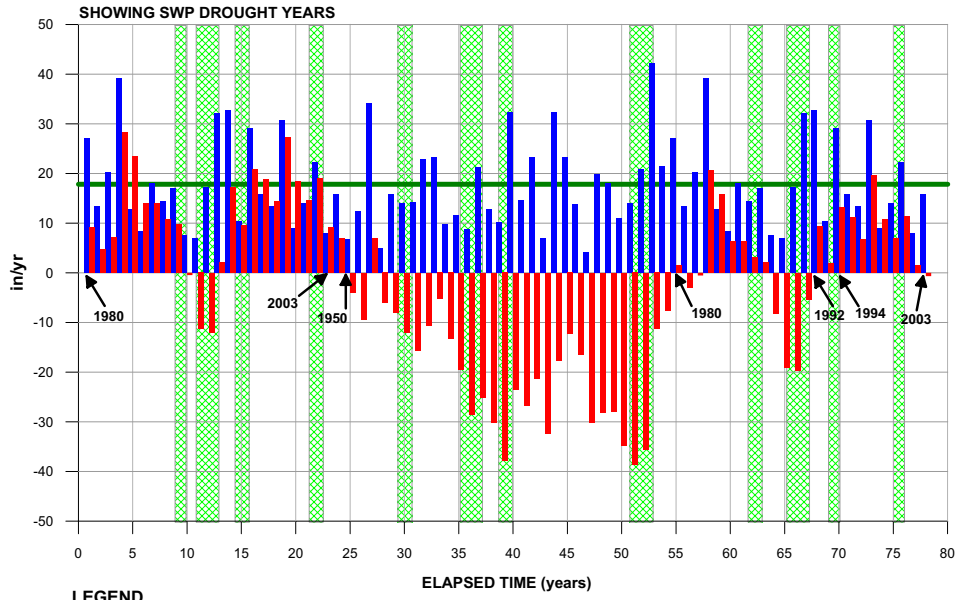

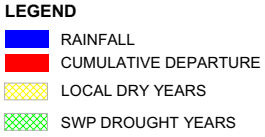

FIGURE 3-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE FOR THE 78-YEAR SIMULATION PERIOD
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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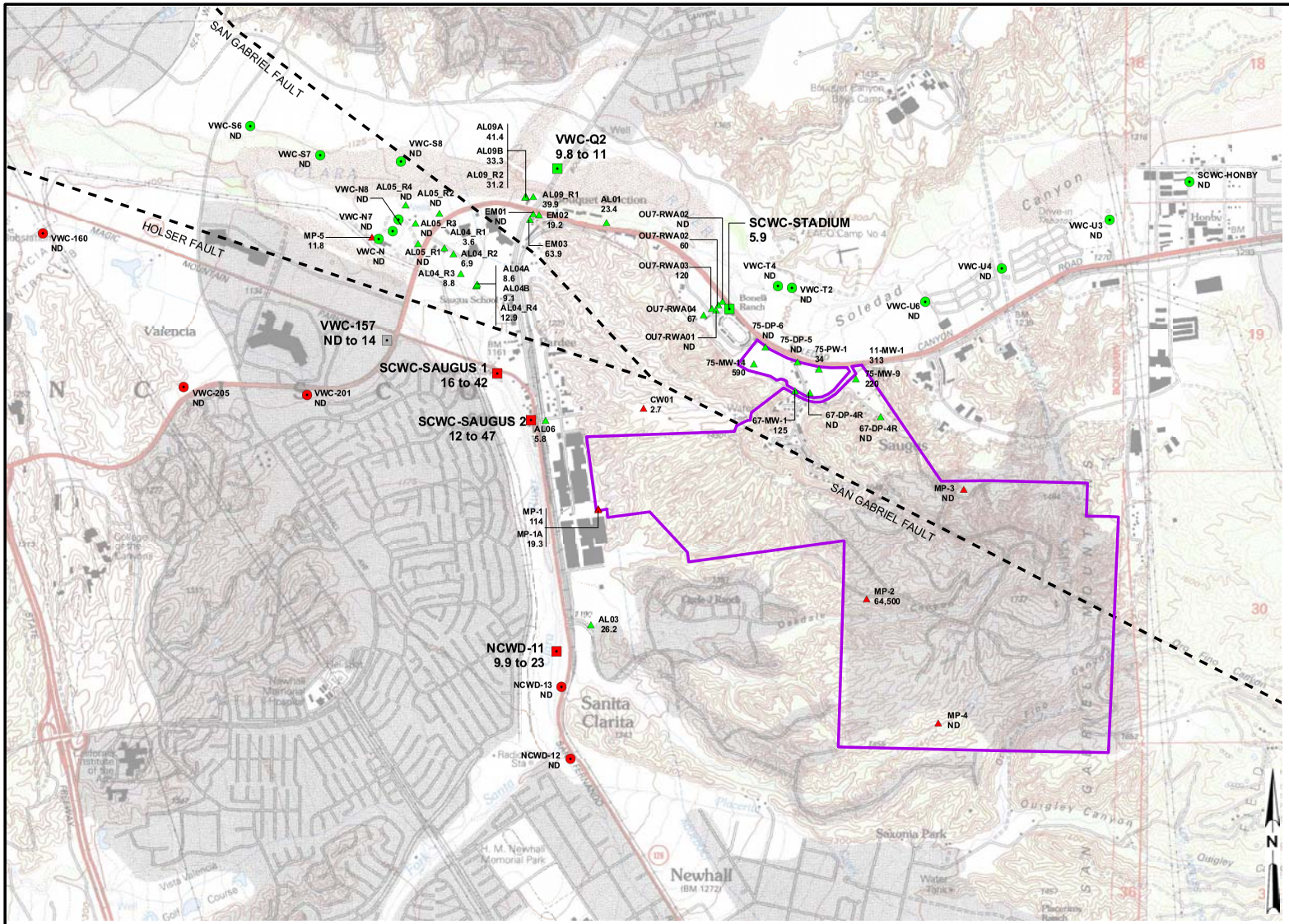

LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS
- SAUGUS (DESTROYED JANUARY 2005)

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
3. µg/L = MICROGRAMS PER LITER.

FIGURE 3-6
WELL LOCATIONS AND PERCHLORATE CONCENTRATIONS NEAR THE WHITTAKER-BERMITE PROPERTY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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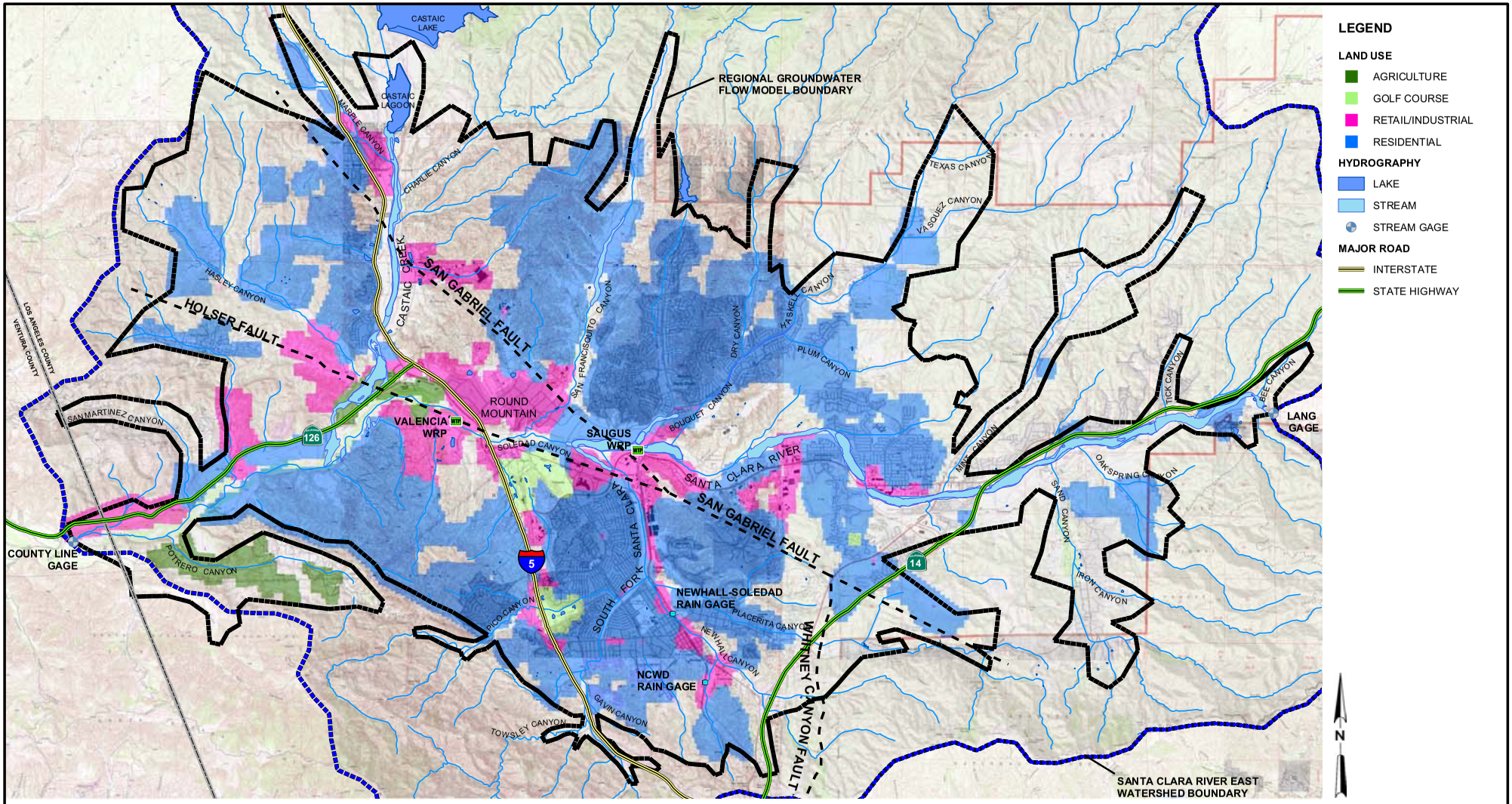

NOTE:
LAND USES UNDER FULL BUILD-OUT CONDITIONS ARE SHOWN ONLY INSIDE THE MODEL BOUNDARY, AND ARE NOT SHOWN OUTSIDE THE MODEL BOUNDARY.

FIGURE 3-7
SIMULATED LAND USE WITHIN THE REGIONAL MODEL BOUNDARY UNDER FULL BUILD-OUT CONDITIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\0605_TM\FIG03-07.MXD FIG03-07.PDF 6/21/2005 17:29:31

SECTION 4

Model Results

This section of the report presents and discusses hydrographs of simulated groundwater elevations, groundwater budget terms, and Santa Clara River flows for the 78-year modeling period.

4.1 Groundwater Elevations

Groundwater elevation hydrographs for different portions of the Alluvial Aquifer are presented on Figures 4-1 through 4-5. Hydrographs for different portions of the Saugus Formation are presented on Figures 4-6 and 4-7. Each figure shows the monthly groundwater elevations simulated for the 78-year modeling period.

These figures show that the spatial distribution and temporal variation of pumping are not expected to cause a long-term decline in groundwater levels in the Alluvial Aquifer or the Saugus Formation. The Regional Model simulates distinct multi-year periods of overall declining or overall increasing groundwater elevations resulting from cycles of below-normal and above-normal rainfall periods. This variation is consistent with historical observations of the relationship between rainfall and groundwater level fluctuations (CH2M HILL, 2004a). The Regional Model also simulates short-term declines in Saugus Formation groundwater elevations that arise from the increased Saugus pumping that occurs during the second and third years of reduced water imports. The model simulates water level recovery within a few years after Saugus pumping returns to normal-year pumping rates, a finding that is consistent with historical observations following a peak pumping period in the early 1990s (see Figures 2-9 and 2-10).

4.2 Groundwater Recharge, Discharge, and Storage

Figures 4-8 and 4-9 show the annual valleywide variations in groundwater recharge and discharge, respectively, throughout the 78-year simulation period. These groundwater recharge and discharge rates are also listed in Table 4-1. Figure 4-10 shows the annual and cumulative changes in groundwater storage volumes. Figures 4-8 through 4-10 and Table 4-1 together show the following:

1. Groundwater recharge rates (see Figure 4-8) vary greatly from year to year, because of variations in (a) precipitation within the groundwater basin and (b) precipitation and stormwater generation in the watersheds lying upstream of the groundwater basin. In contrast, total groundwater discharge (see Figure 4-9) is much less variable from year to year, with the more limited variations arising from increased pumping during drought years and increased ET and groundwater discharge to the Santa Clara River during wet years.
2. Year-to-year and cumulative changes in groundwater storage during the 78-year simulation period (see Figure 4-10) provide insights as to the manner in which the basin is

functioning hydrologically under the groundwater operating plan for the valley. The cumulative change in groundwater storage is a measure of the longer-term trends in the amount of groundwater in storage, and is plotted on a monthly basis. Table 4-1 tabulates the annual water budget for each year of the 78-year simulation, and shows the cumulative change on an annual basis (in contrast to the monthly basis shown on Figure 4-10). Figure 4-10 and Table 4-1 together show the following:

a. The cumulative change in total groundwater storage volume, which measures the continuous change in storage in the combined Alluvial-Saugus aquifer system since the beginning of the simulation, ranges between approximately a 150,000-acre-foot decline and a 260,000-acre-foot increase. The change in groundwater storage during a single year ranges from approximately an 80,000-AF/yr decline to a 170,000-AF/yr increase.

b. A nearly 20-year period of overall decline in the cumulative groundwater storage volume occurs between years 19 and 39, as shown on Figure 4-10. Beginning in year 40, the cumulative change in storage shows a generally upward trend, with occasional downward trends during specific drought periods.

3. Implementation of the groundwater operating plan will not cause permanent declines in groundwater storage volumes. This is shown by the forecasted recovery of groundwater storage volumes after periods of continued decline, such as after the 20-year period of groundwater declines that occurs during years 19 through 39.

4. Based on the previous observations, changes in groundwater storage volumes, particularly over a period of many years, are governed significantly by variations in local hydrologic conditions. Local precipitation and streamflows are the primary recharge mechanisms in the valley and therefore have a direct influence on year-to-year and longer-term changes in groundwater storage volumes.

4.3 River Flows

Figure 4-11 shows the total flows estimated by the model for the Santa Clara River at the County Line gage, which is located at the western end of the valley. The figure contains both a linear plot and a semi-logarithmic plot, to better illustrate the flows during low-flow periods. As shown by both plots, the total streamflows vary considerably over time at this location, due primarily to variations in rainfall.

The influences of the local hydrology and the groundwater operating plan on the Santa Clara River are also shown by Figure 4-12, which displays the model-calculated volumes of monthly groundwater discharge to the river. Groundwater discharges to the river occur along the river reach lying downstream of the mouth of San Francisquito Canyon. The figure shows that the groundwater discharge rates to the river also vary over time, both seasonally and over multi-year periods. Additionally, the figure shows that the Regional Model simulates a period of relatively low groundwater discharge to the river from years 23 through 39 (historical years 2002 through 2003, followed by 1950 through 1964), which corresponds to the prevailing below-normal rainfall conditions in those years. The figure also shows higher volumes of groundwater discharge to the river in years of above-normal

rainfall, particularly the very wet periods years 1 through 4, 13 through 19, 52 through 58, and 67 through 72.

The similarity between rainfall and groundwater discharges to the river indicates that local hydrology is the primary influence on these discharges. Additionally, the groundwater discharge hydrographs do not show any marked short-term declines in flows when Saugus Formation groundwater levels decrease during years of increased Saugus Formation pumping. The Regional Model, therefore, indicates that the operating plan for the groundwater system is not expected to adversely affect river flows.

4.4 Relationship of Simulation Results to Future Conditions

The curves presented on Figures 4-1 through 4-12 provide a general indication of the types of fluctuations in groundwater conditions that could be expected to occur in the future in the Santa Clarita Valley over a period of many years. However, these curves have been derived using an assumed sequence of local hydrologic conditions that is based on the sequence of rainfall and streamflow volumes that were measured during the past several decades. In the future, the year-to-year volumes and trends in rainfall and streamflow could vary from those observed in the past. Consequently, actual future trends in rainfall and streamflow might differ from those presented in this simulation on a short-term basis. However, over a period of several years or decades, the model-simulated recharge values and basin responses are more likely to reflect actual long-term average basin conditions under this operating plan.

The modeling simulation described in this report meets the intended objectives of quantifying possible basin responses to the operating plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows; and using the quantified responses to evaluate the sustainability of the operating plan with respect to potential trends in groundwater levels and Santa Clara River flows. The principal conclusions about the groundwater operating plan that have been drawn from the historical analyses and modeling simulations presented in this report are discussed in Section 5.

Table

TABLE 4-1

Simulated Annual Groundwater Budget

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year			Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
0	to	1	41,053	13,970	39,953	17,871	112,847	49,119	21,649	17,524	18,464	106,756	6,091	6,091
1	to	2	11,601	13,970	3,373	18,632	47,576	49,035	10,147	10,469	18,136	87,788	-40,212	-34,120
2	to	3	51,672	13,970	28,415	18,444	112,501	49,035	10,925	12,319	18,585	90,863	21,638	-12,483
3	to	4	181,820	13,970	89,448	16,985	302,223	49,035	36,265	29,506	19,056	133,861	168,361	155,879
4	to	5	687	13,970	527	18,253	33,437	49,119	16,665	23,150	18,225	107,158	-73,721	82,158
5	to	6	2	13,970	535	18,927	33,434	44,372	9,497	13,286	18,171	85,326	-51,891	30,266
6	to	7	42,574	13,970	19,998	18,619	95,161	49,035	11,479	14,376	18,568	93,458	1,703	31,969
7	to	8	11,415	13,970	2,484	19,419	47,288	49,035	7,923	10,419	18,277	85,654	-38,366	-6,397
8	to	9	27,363	13,970	10,507	19,743	71,583	54,214	6,664	10,234	18,507	89,618	-18,036	-24,433
9	to	10	0	13,970	523	20,113	34,606	44,372	4,739	8,041	18,359	75,510	-40,904	-65,336
10	to	11	0	13,970	1,472	20,347	35,789	49,446	2,584	5,612	18,354	75,996	-40,208	-105,544
11	to	12	50,580	13,970	28,173	19,613	112,336	58,025	3,061	8,476	18,563	88,125	24,211	-81,334
12	to	13	130,074	13,970	80,760	17,850	242,654	72,600	14,234	18,462	18,728	124,024	118,630	37,296
13	to	14	112,433	13,970	51,561	17,509	195,472	49,035	24,221	29,084	18,797	121,137	74,335	111,632
14	to	15	414	13,970	1,979	18,575	34,939	49,446	7,788	16,616	18,157	92,007	-57,068	54,563
15	to	16	113,543	13,970	60,100	17,636	205,250	49,035	29,255	26,983	18,745	124,018	81,232	135,795
16	to	17	45,609	13,970	21,594	18,204	99,376	49,119	15,122	21,342	18,635	104,218	-4,842	130,954
17	to	18	16,967	13,970	5,320	18,758	55,015	49,035	11,851	16,757	18,242	95,885	-40,870	90,084
18	to	19	137,727	13,970	59,717	17,397	228,810	49,035	27,143	31,249	18,923	126,350	102,460	192,544
19	to	20	13	13,970	4,717	18,586	37,286	49,035	14,305	20,865	18,200	102,405	-65,119	127,425
20	to	21	14,095	13,970	4,962	19,294	52,321	49,119	11,194	14,485	18,342	93,139	-40,818	86,607
21	to	22	58,364	13,970	35,154	18,639	126,127	54,116	12,710	19,337	18,655	104,818	21,309	107,917
22	to	23	0	13,970	523	19,557	34,050	44,372	8,105	13,129	18,311	83,916	-49,866	58,051
23	to	24	19,602	13,970	5,065	19,867	58,504	49,035	8,138	10,710	18,375	86,258	-27,754	30,297
24	to	25	0	13,970	524	20,258	34,752	44,441	5,486	7,896	18,418	76,240	-41,489	-11,192
25	to	26	3,053	13,970	518	20,406	37,947	49,035	4,033	6,132	18,386	77,587	-39,639	-50,832
26	to	27	135,033	13,970	73,747	18,014	240,763	49,035	16,024	17,254	18,639	100,951	139,812	88,980
27	to	28	0	13,970	536	18,764	33,270	44,372	9,238	15,229	18,125	86,963	-53,693	35,287
28	to	29	20,048	13,970	4,960	19,518	58,496	49,119	7,646	10,808	18,326	85,898	-27,402	7,885
29	to	30	9,397	13,970	2,999	19,929	46,296	54,116	4,726	8,252	18,339	85,433	-39,138	-31,253
30	to	31	11,022	13,970	2,348	20,308	47,647	49,035	4,024	7,140	18,409	78,609	-30,962	-62,215
31	to	32	62,138	13,970	37,429	19,568	133,105	49,035	6,854	11,497	18,820	86,205	46,900	-15,315
32	to	33	63,939	13,970	36,375	18,890	133,174	49,119	11,471	19,025	18,678	98,293	34,881	19,566
33	to	34	244	13,970	2,395	20,199	36,808	44,372	6,943	11,585	18,375	81,275	-44,466	-24,900
34	to	35	1,555	13,970	524	20,530	36,579	49,446	3,767	7,507	18,404	79,124	-42,545	-67,445
35	to	36	32	13,970	4,852	20,690	39,543	58,025	303	5,882	18,401	82,610	-43,067	-110,512
36	to	37	52,098	13,970	24,510	19,931	110,509	44,441	4,564	10,236	18,620	77,860	32,648	-77,864
37	to	38	4,170	13,970	616	20,483	39,239	49,035	2,503	6,237	18,378	76,152	-36,913	-114,777
38	to	39	362	13,970	2,463	20,816	37,610	49,446	719	4,966	18,418	73,549	-35,938	-150,716
39	to	40	122,459	13,970	74,037	19,276	229,741	49,035	8,546	10,468	18,766	86,814	142,927	-7,789
40	to	41	12,997	13,970	4,096	19,066	50,129	49,119	8,998	13,953	18,220	90,290	-40,161	-47,950
41	to	42	64,499	13,970	40,945	18,797	138,210	49,035	10,243	16,890	18,577	94,745	43,465	-4,484
42	to	43	0	13,970	536	19,752	34,258	44,372	6,577	12,461	18,301	81,711	-47,454	-51,938
43	to	44	123,377	13,970	53,751	18,022	209,121	49,035	17,543	21,442	18,640	106,660	102,461	50,523
44	to	45	64,250	13,970	39,379	18,423	136,022	49,119	13,271	20,449	18,544	101,383	34,639	85,163
45	to	46	8,541	13,970	2,217	19,103	43,830	49,035	10,232	18,196	18,249	95,712	-51,882	33,281
46	to	47	0	13,970	533	19,897	34,399	44,372	6,746	10,372	18,334	79,823	-45,424	-12,143

TABLE 4-1

Simulated Annual Groundwater Budget

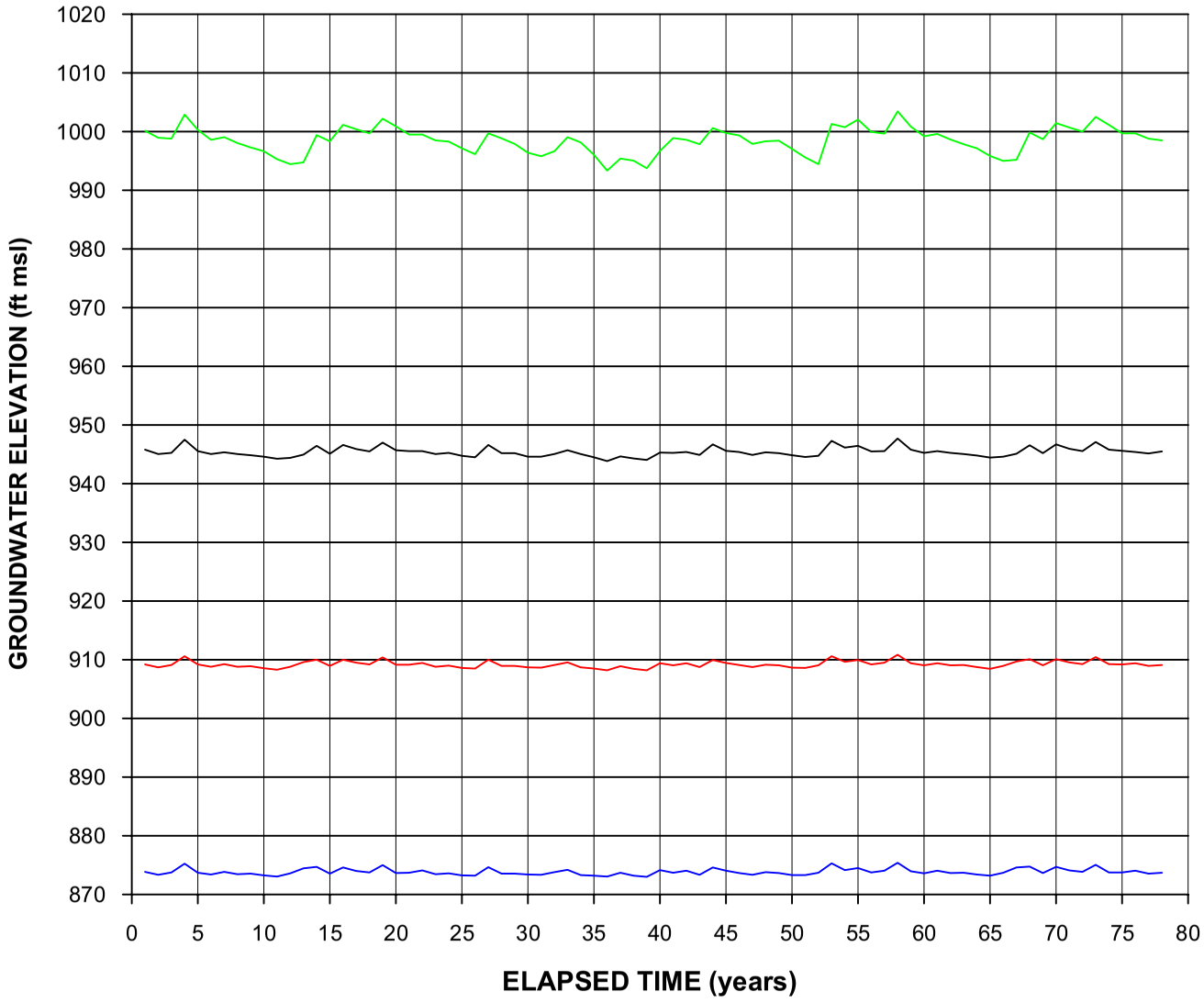
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
47 to 48	43,414	13,970	18,560	19,505	95,448	49,035	8,927	12,755	18,638	89,355	6,094	-6,050
48 to 49	32,966	13,970	13,527	19,953	80,416	49,119	8,497	12,634	18,666	88,916	-8,499	-14,549
49 to 50	839	13,970	1,856	20,451	37,117	44,372	5,528	8,992	18,434	77,326	-40,209	-54,758
50 to 51	9,990	13,970	2,645	20,684	47,289	54,116	3,517	6,845	18,455	82,933	-35,643	-90,401
51 to 52	49,961	13,970	25,027	20,153	109,112	62,702	3,319	9,913	18,755	94,689	14,423	-75,978
52 to 53	188,493	13,970	69,633	17,584	289,679	49,119	22,292	27,398	18,933	117,742	171,937	95,959
53 to 54	46,125	13,970	20,155	18,290	98,539	49,035	15,148	24,661	18,522	107,366	-8,827	87,132
54 to 55	89,718	13,970	39,953	17,979	161,620	49,035	20,589	29,655	18,624	117,903	43,716	130,848
55 to 56	11,601	13,970	3,373	19,267	48,211	49,035	11,347	18,242	18,316	96,940	-48,729	82,119
56 to 57	51,672	13,970	28,415	19,203	113,260	49,119	11,982	18,862	18,806	98,769	14,491	96,610
57 to 58	181,820	13,970	89,448	17,106	302,343	49,035	32,399	38,747	19,048	139,229	163,114	259,725
58 to 59	687	13,970	527	18,350	33,534	49,035	16,623	29,046	18,213	112,917	-79,383	180,342
59 to 60	2	13,970	535	19,266	33,773	44,372	10,576	17,223	18,266	90,437	-56,664	123,678
60 to 61	42,574	13,970	19,998	18,987	95,529	49,119	12,553	18,152	18,704	98,527	-2,998	120,680
61 to 62	11,415	13,970	2,484	19,754	47,622	49,035	9,005	13,268	18,366	89,674	-42,052	78,628
62 to 63	27,363	13,970	10,507	20,014	71,853	54,116	7,752	12,812	18,539	93,219	-21,366	57,262
63 to 64	0	13,970	523	20,416	34,909	44,372	5,755	10,119	18,437	78,683	-43,774	13,488
64 to 65	0	13,970	1,472	20,680	36,121	49,522	3,569	7,254	18,475	78,820	-42,698	-29,210
65 to 66	50,580	13,970	28,173	19,854	112,576	58,025	4,004	10,335	18,623	90,989	21,588	-7,622
66 to 67	130,074	13,970	80,760	17,898	242,702	72,452	13,502	21,223	18,686	125,863	116,839	109,216
67 to 68	112,433	13,970	51,561	17,536	195,499	49,035	23,462	32,532	18,803	123,833	71,667	180,883
68 to 69	414	13,970	1,979	18,661	35,024	49,522	8,596	18,842	18,226	95,186	-60,162	120,721
69 to 70	113,543	13,970	60,100	17,647	205,261	49,035	29,552	30,176	18,761	127,523	77,737	198,459
70 to 71	45,609	13,970	21,594	18,166	99,339	49,035	15,740	23,534	18,602	106,911	-7,572	190,886
71 to 72	16,967	13,970	5,320	18,777	55,034	49,035	12,551	18,552	18,264	98,402	-43,368	147,518
72 to 73	137,727	13,970	59,717	17,442	228,856	49,119	28,296	34,847	19,001	131,263	97,592	245,111
73 to 74	13	13,970	4,717	18,592	37,292	49,035	14,986	23,059	18,220	105,299	-68,007	177,103
74 to 75	14,095	13,970	4,962	19,254	52,281	49,035	11,783	15,930	18,311	95,059	-42,779	134,324
75 to 76	58,364	13,970	35,154	18,654	126,142	54,116	13,385	20,958	18,673	107,132	19,010	153,334
76 to 77	0	13,970	523	19,646	34,139	44,441	8,624	14,082	18,380	85,527	-51,388	101,946
77 to 78	19,602	13,970	5,065	19,899	58,536	49,035	8,607	11,515	18,393	87,550	-29,014	72,932
Minimum	0	13,970	518	16,985	33,270	44,372	303	4,966	18,125	73,549	-79,383	-150,716
Maximum	188,493	13,970	89,448	20,816	302,343	72,600	36,265	38,747	19,056	139,229	171,937	259,725
Average	42,498	13,970	21,480	19,092	97,040	49,823	11,520	16,262	18,498	96,105	935	44,866
Median	19,602	13,970	5,193	19,153	58,500	49,035	9,822	14,430	18,446	92,573	-28,384	36,292

Note:

All flow volumes are listed in AF/yr.

Figures



NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. WELL NLF-TOPCO1 IS LOCATED 210 feet SOUTHWEST OF WELL NLF-B11.

FIGURE 4-1
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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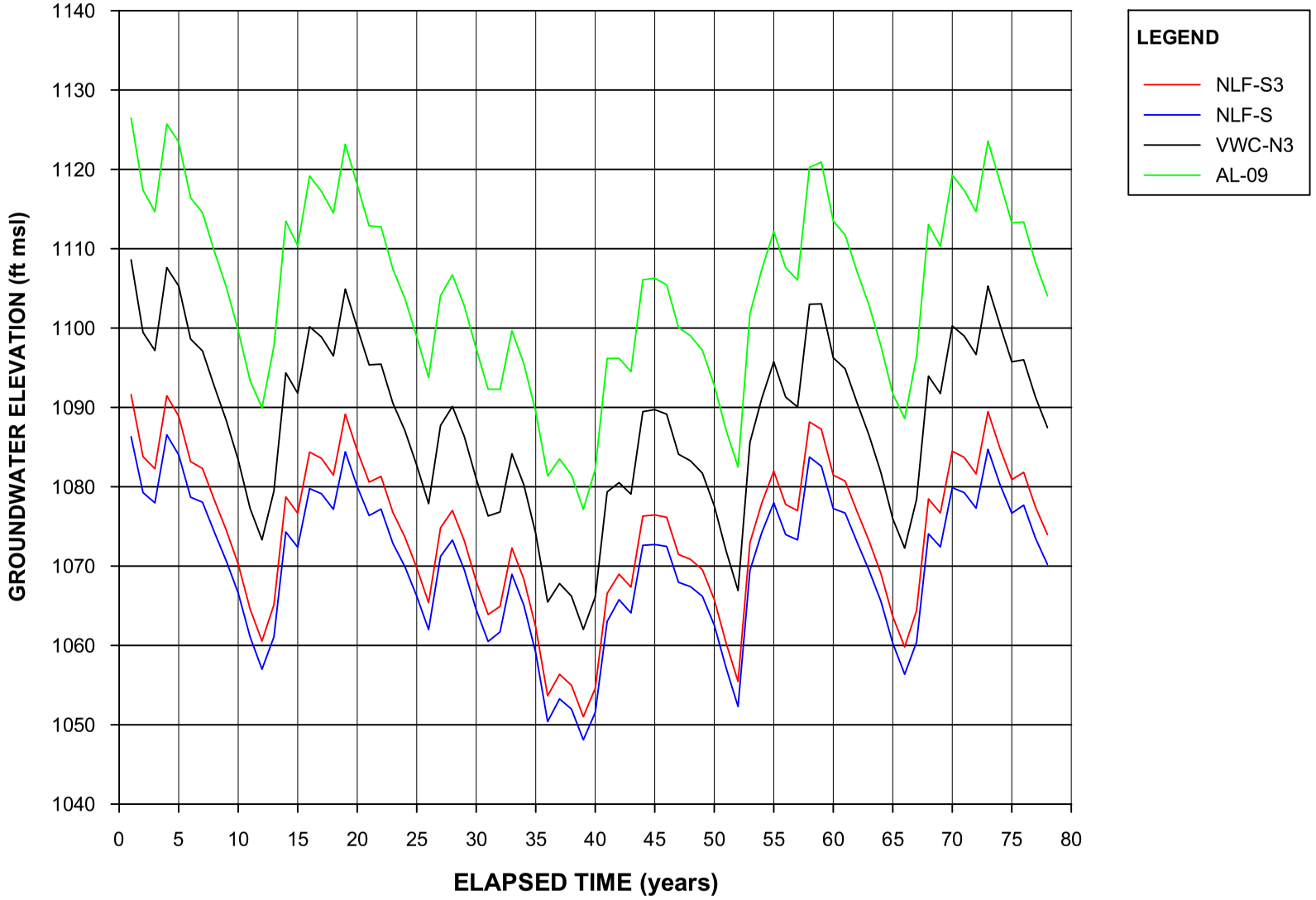

NOTES:

1. AL09 IS A CLUSTER OF OBSERVATION WELLS LOCATED 845 feet SOUTHWEST OF PRODUCTION WELL VWC-Q2.

2. THE REMAINING HYDROGRAPHS REPRESENT FORMER ALLUVIAL AQUIFER WELLS THAT HAVE BEEN ABANDONED AND THEREFORE ARE NOT PUMPED IN THE MODEL SIMULATIONS. RELATIVE TO EXISTING WELLS SHOWN ON FIGURE 2-4, THESE FORMER WELLS WERE LOCATED AS FOLLOWS:

   – WELL NLF-S3 WAS LOCATED 305 feet EAST OF WELL VWC-S6
   – WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6
   – WELL VWC-N3 WAS LOCATED 435 feet NORTHEAST OF WELL VWC-N8

FIGURE 4-2
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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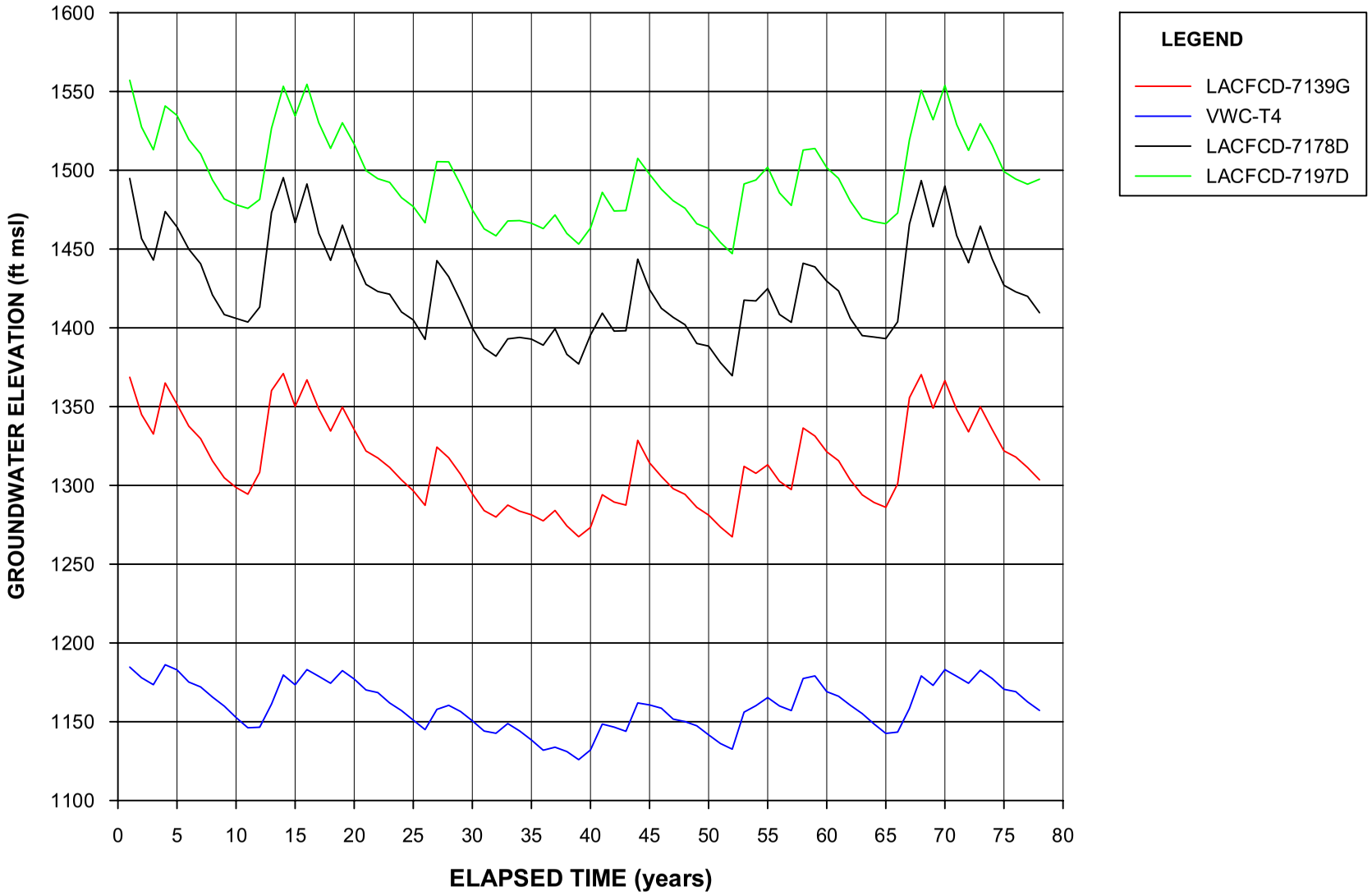

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR VWC- T4 = 1101 ft msl; ALLUVIUM BOTTOM ELEVATION ~1050 TO 1065 ft msl.
3. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7139G = 1289 ft msl; ALLUVIUM BOTTOM ELEVATION ~1256 ft msl OR LOWER.
4. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7178D = 1463 ft msl; ALLUVIUM BOTTOM ELEVATION ~1398 TO 1425 ft msl.
5. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7197D = 1474 ft msl; ALLUVIUM BOTTOM ELEVATION ~1423 TO 1447 ft msl.

FIGURE 4-3
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER IN SOLEDAD CANYON
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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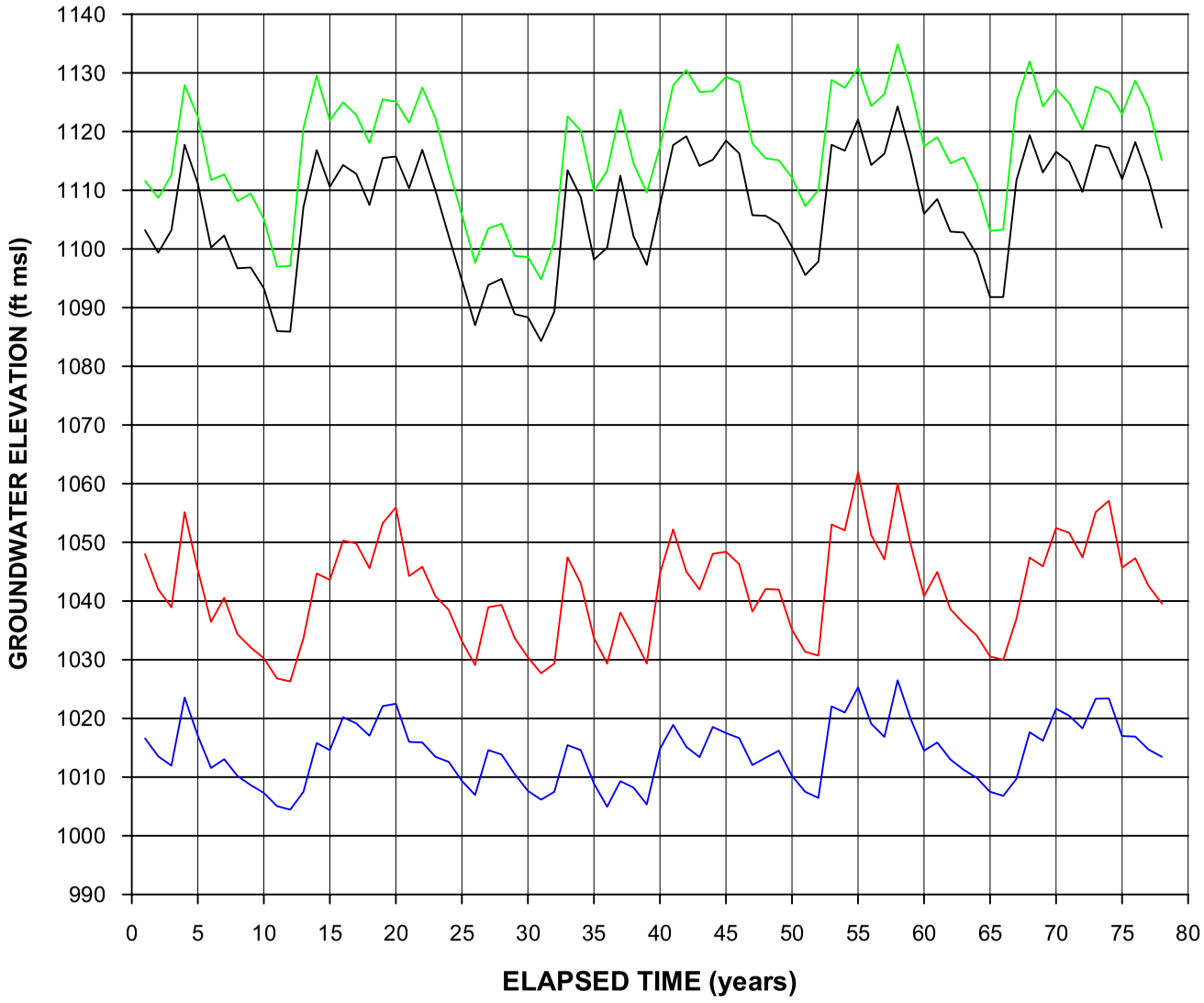

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-4
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG CASTAIC CREEK
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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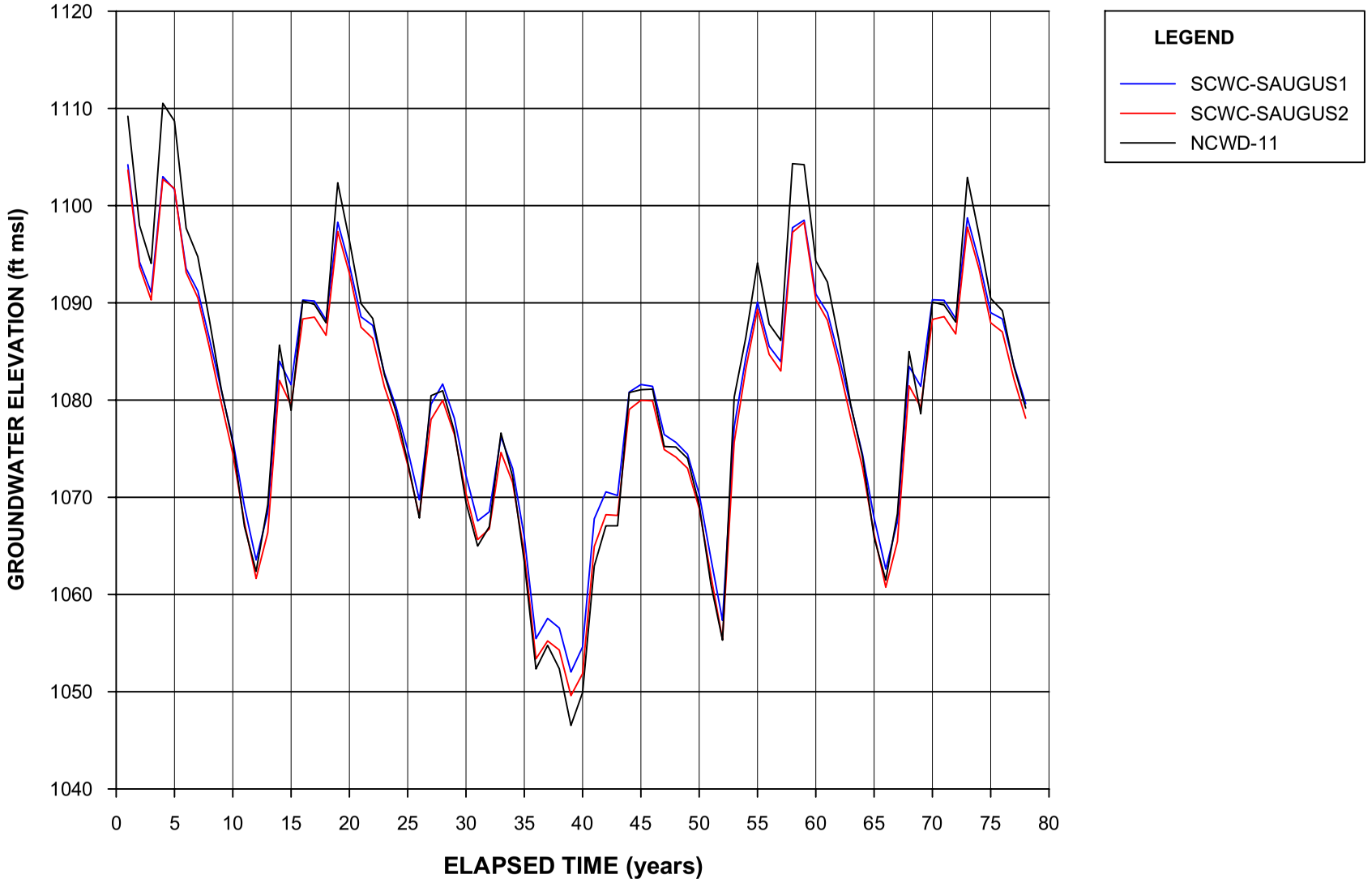

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. THESE WELLS ARE CONSTRUCTED IN THE SAUGUS FORMATION AND ARE NOT OPEN TO THE ALLUVIAL AQUIFER. THE SIMULATED HYDROGRAPHS AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER, ABOVE THE OPEN INTERVALS OF THESE WELLS.

FIGURE 4-5
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG THE SOUTH FORK SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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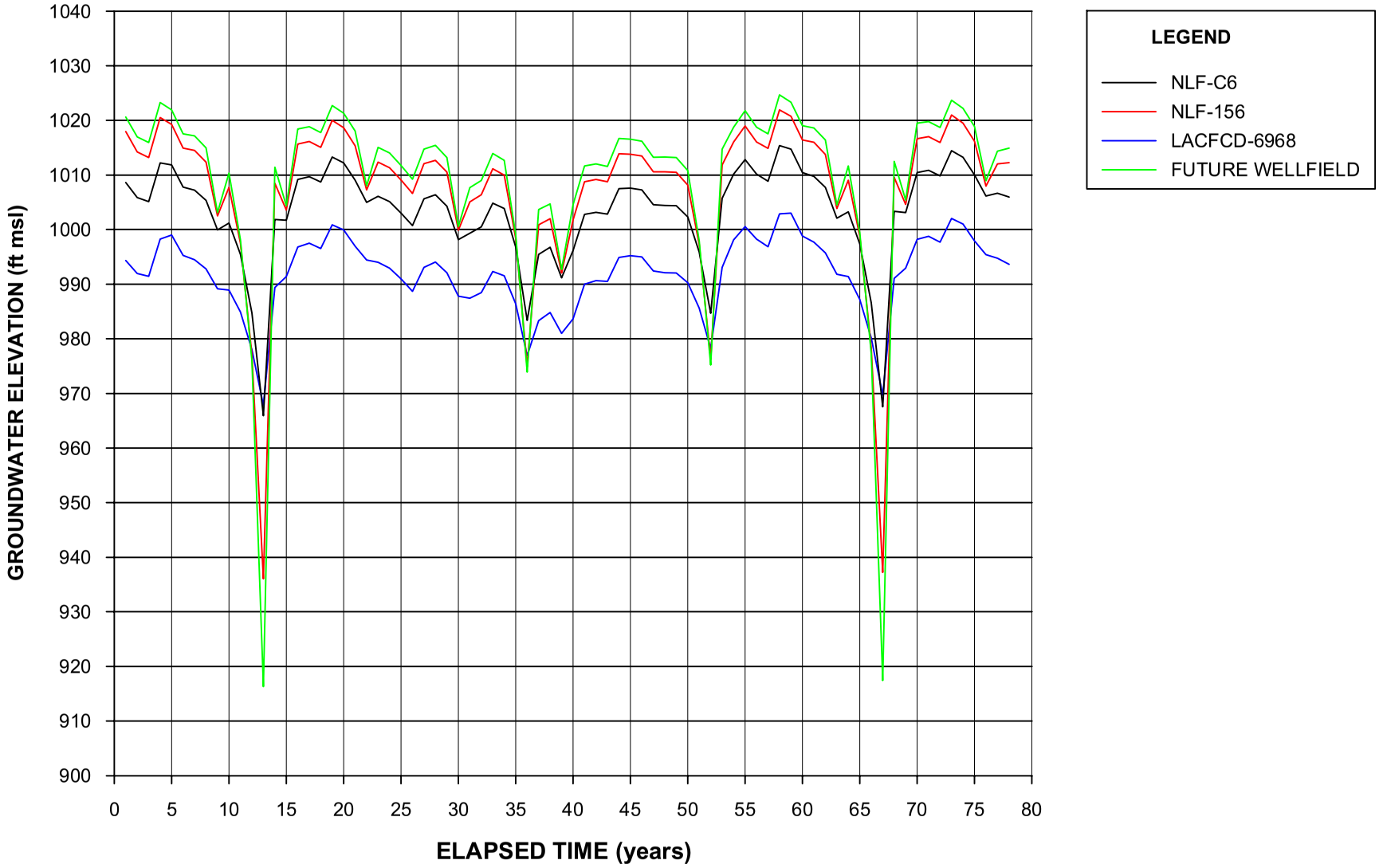

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WELLS NLF-C6 AND LACFCD-6968 ARE CONSTRUCTED IN THE ALLUVIAL AQUIFER AND ARE NOT OPEN TO THE SAUGUS FORMATION. THE SIMULATED HYDROGRAPHS SHOWN AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE SAUGUS FORMATION, BELOW THE OPEN INTERVALS OF THESE WELLS.
3. THE SIMULATED HYDROGRAPH FOR THE FUTURE WELLFIELD IS FOR A MODEL NODE WITH NO ASSIGNED PUMPING, LOCATED INSIDE THE WELLFIELD NEAR VWC-206.

FIGURE 4-6
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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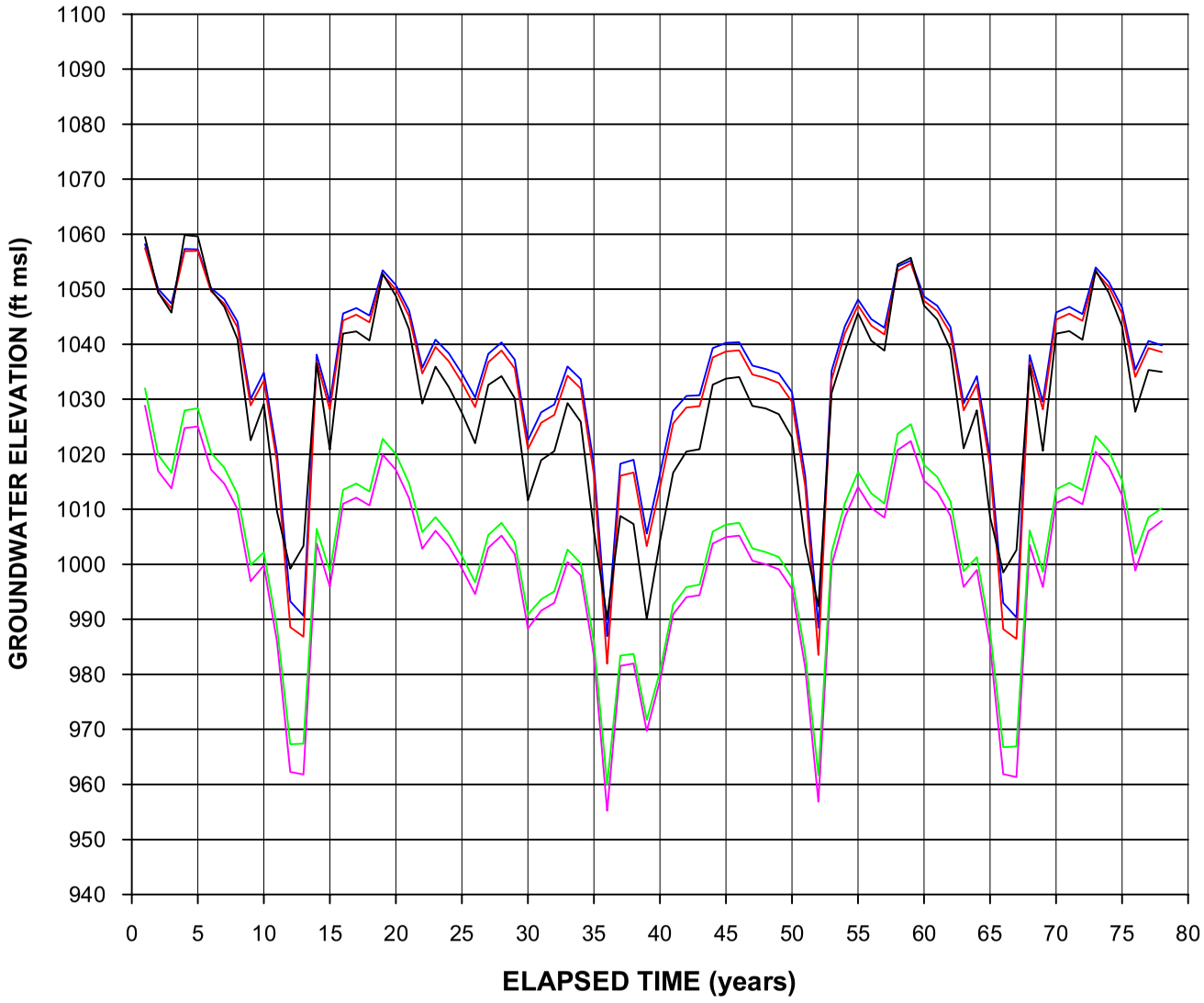

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-7
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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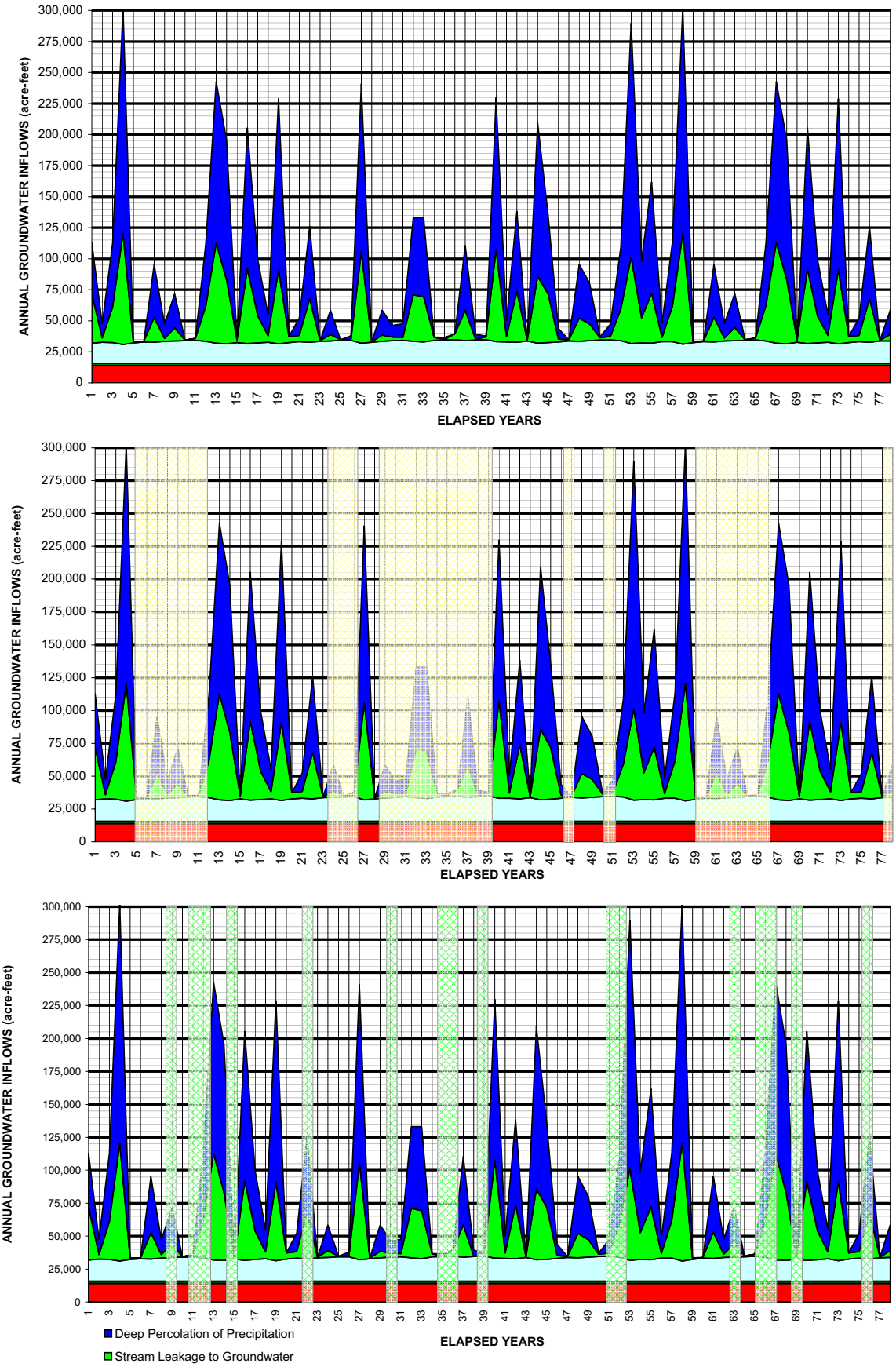

Note:

The deep percolation of applied water is calculatedfor full build-out conditions within the Regional Model boundary, as shown on Figure 3-7 and discussed in Section 3.5.

FIGURE 4-8
SIMULATED ANNUAL GROUNDWATER INFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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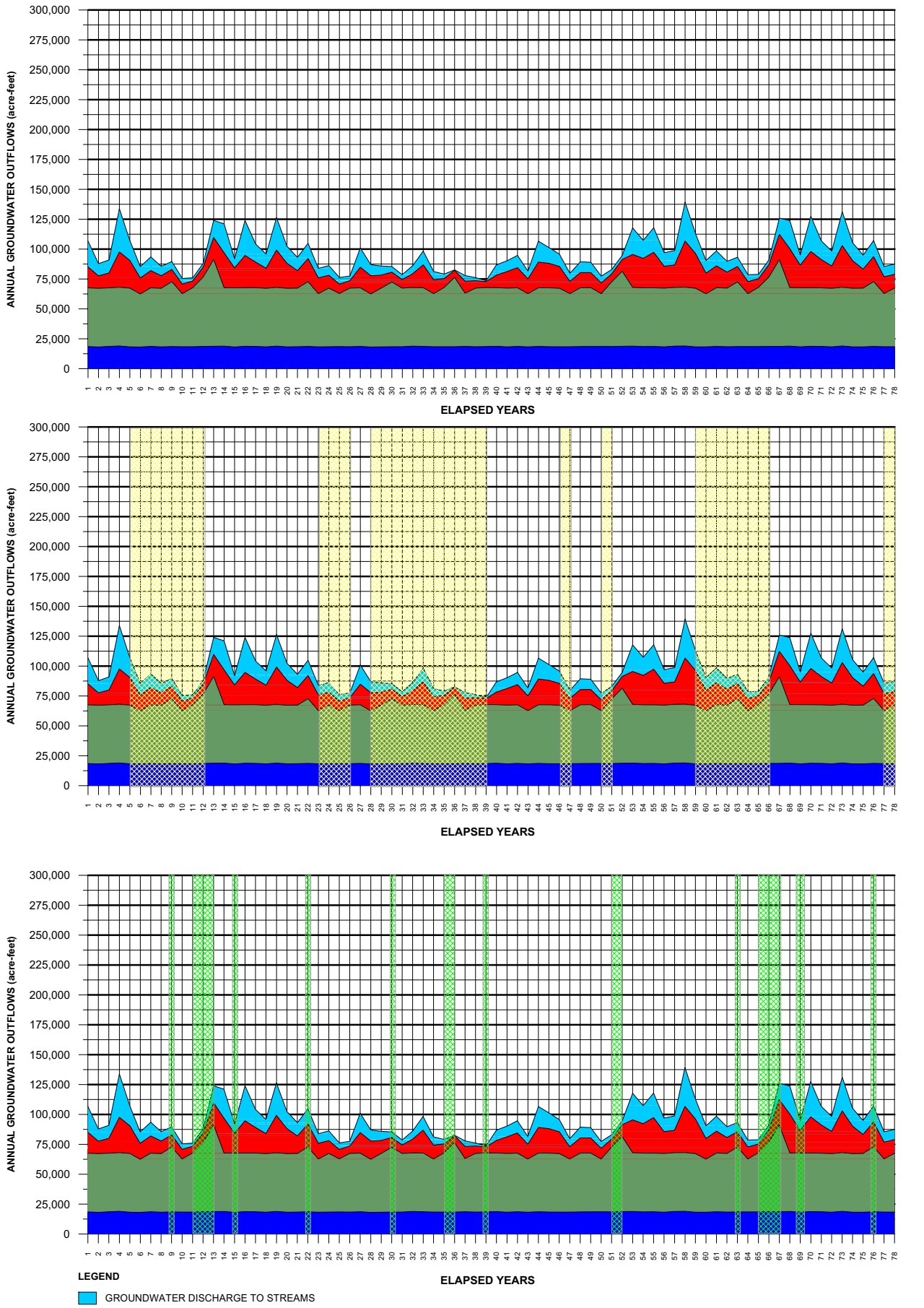

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FIGURE 4-9
SIMULATED ANNUAL GROUNDWATER OUTFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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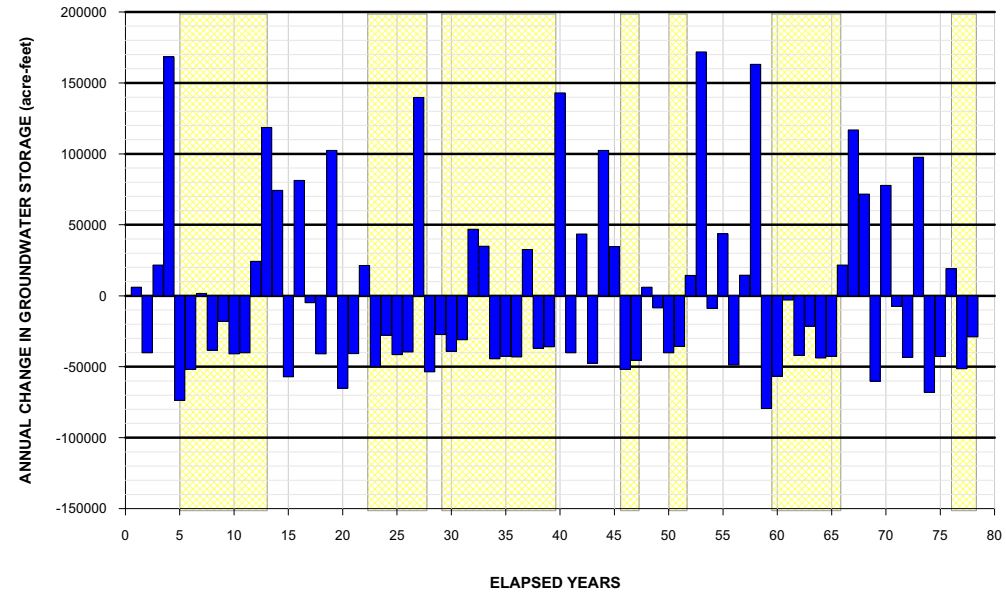

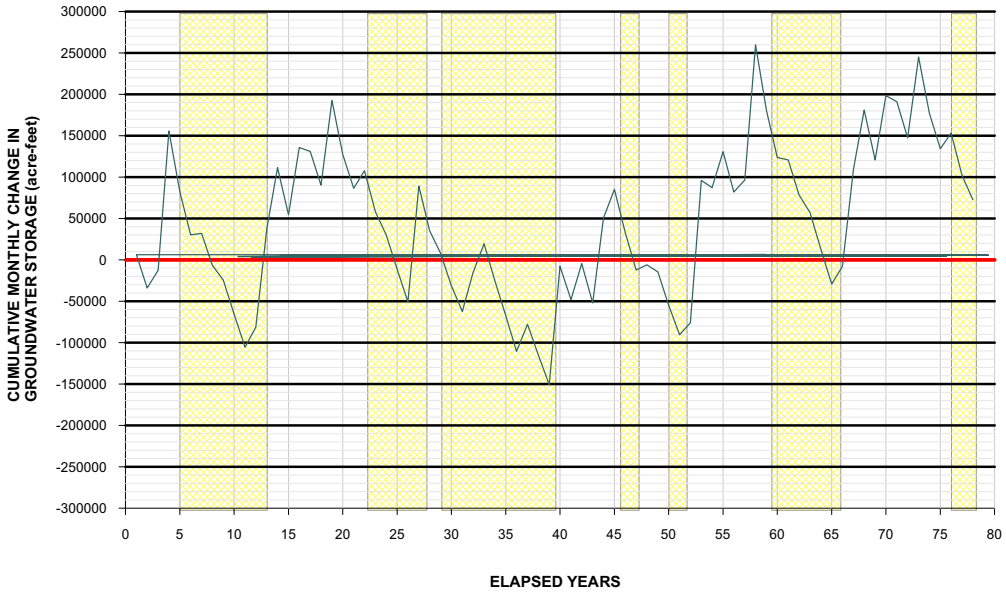

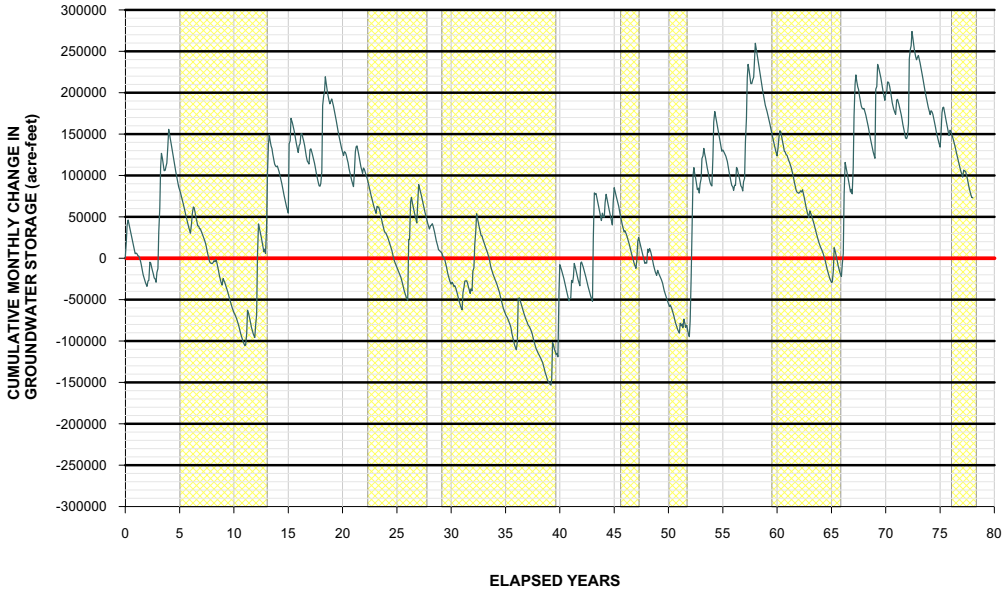

LOCAL DRY YEARS

FIGURE 4-10 (PAGE 1 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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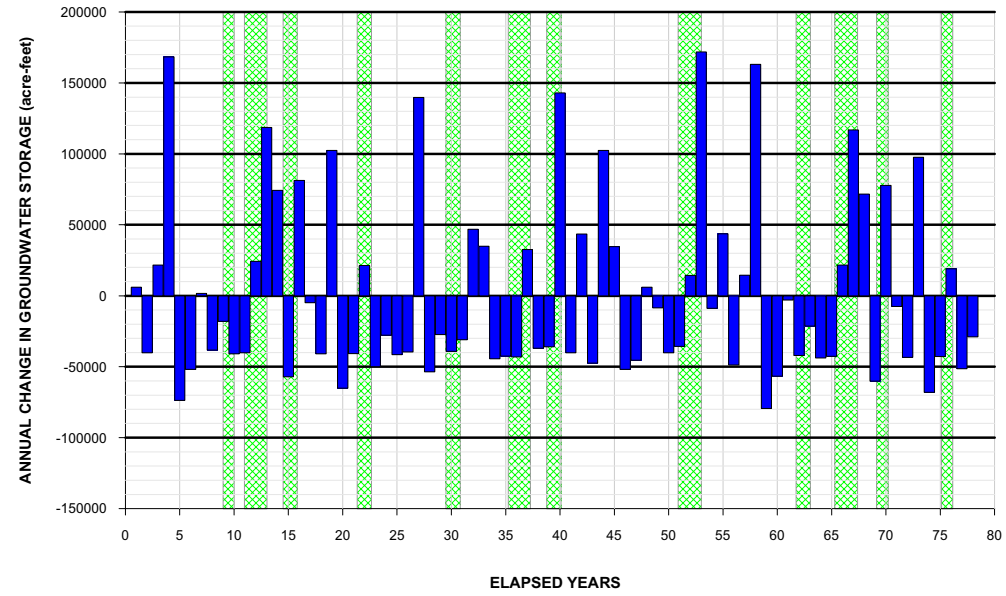

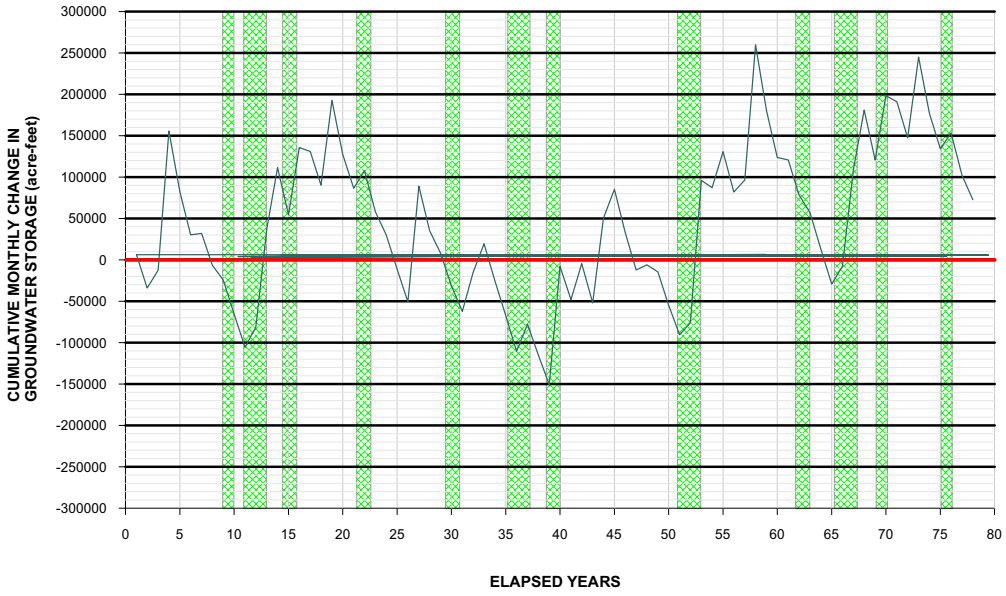

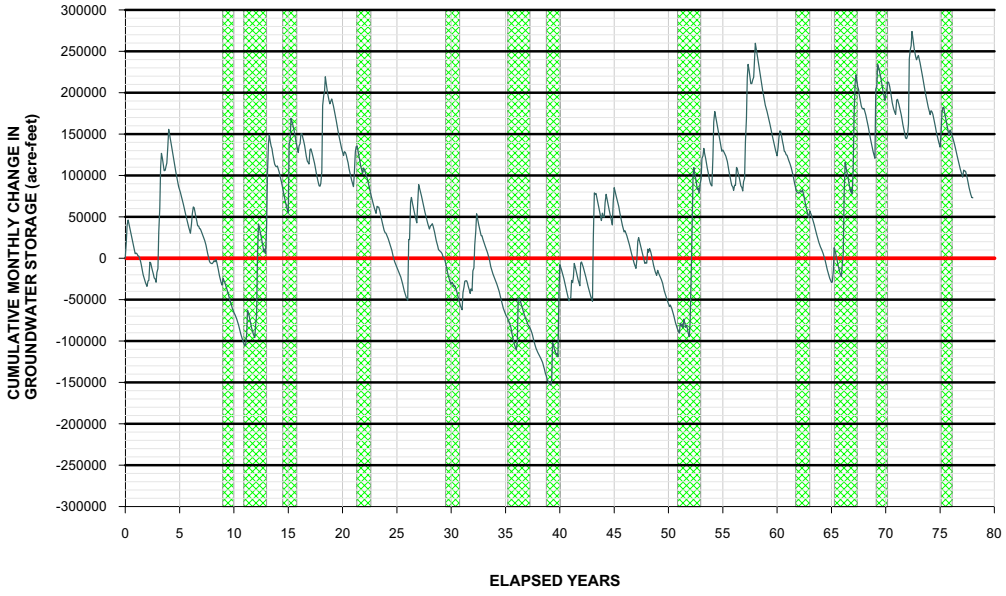

FIGURE 4-10 (PAGE 2 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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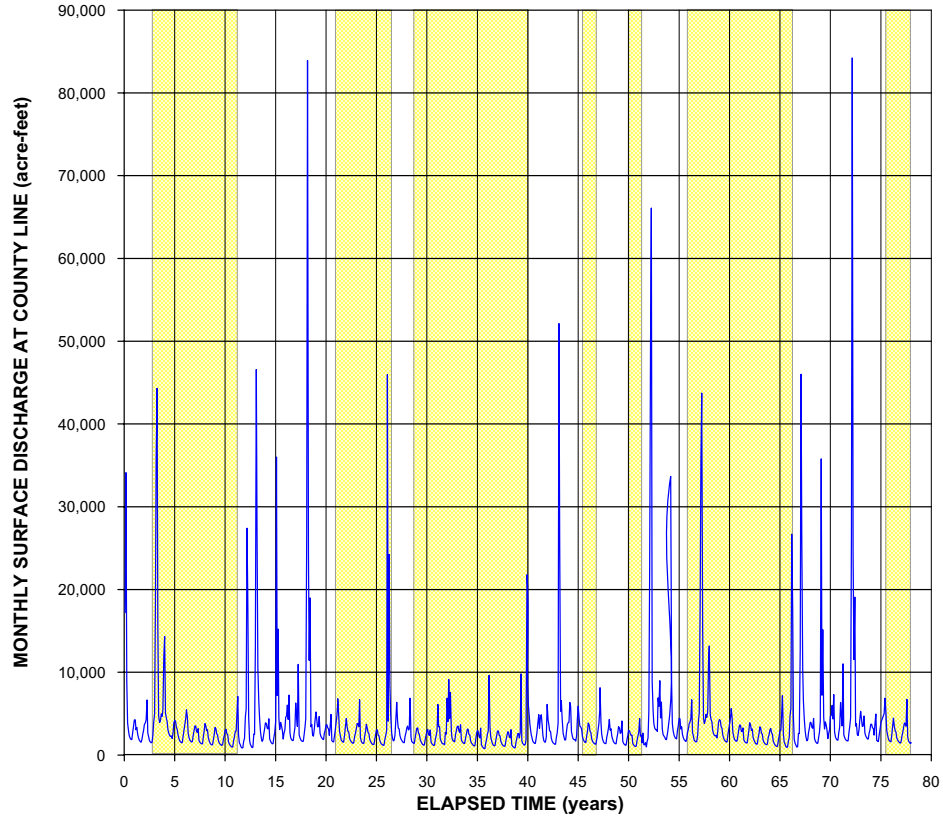

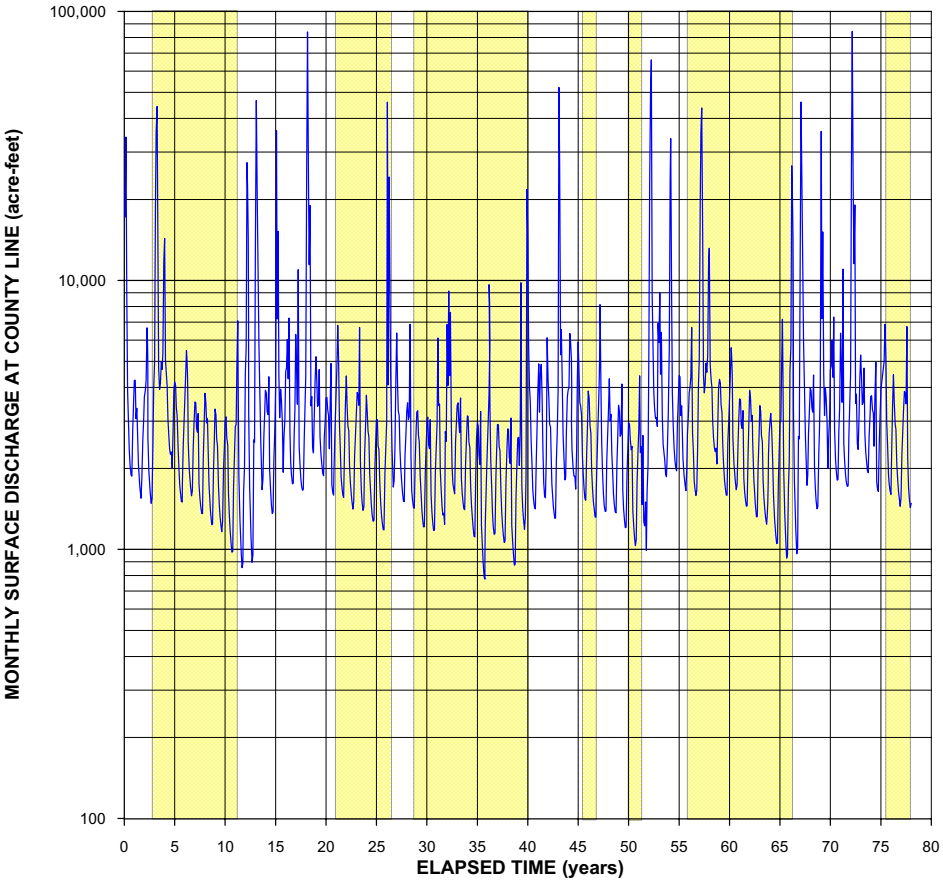

LEGEND

LOCAL DRY YEARS

FIGURE 4-11
SIMULATED SANTA CLARA RIVER FLOW AT COUNTY LINE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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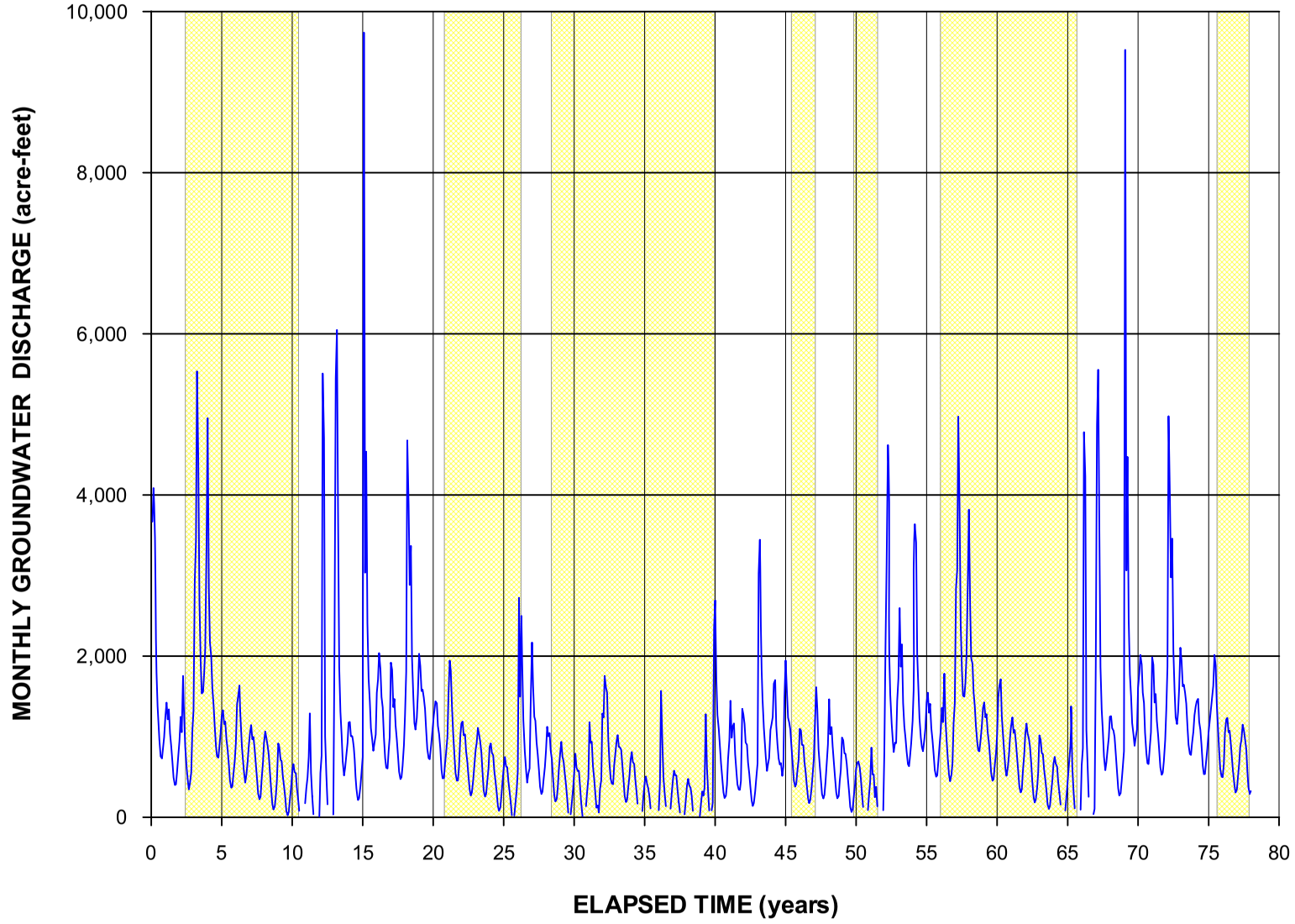

FIGURE 4-12
SIMULATED GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 5

Conclusions

This section discusses the principal findings from the analyses of historical data and numerical modeling results and the implications of these findings for both groundwater management and water supply in the Santa Clarita Valley.

5.1 Principal Findings

The primary objective of the groundwater basin yield evaluation was to use the Regional Model to examine the groundwater operating plan under a range of potential hydrologic conditions to determine whether the groundwater resources in the valley could be expected to respond to such operations in a sustainable fashion. For the purposes of this evaluation, as in other settings, sustainability is defined in terms of renewability (recharge) of groundwater as reflected by the following indicators:

1. Lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions

2. Maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions

Regarding maintenance of surface water flows, although the development and use of groundwater in a sustainable manner necessitates the inducement of recharge from surface water, sustainability, in this case, does not rely on inducing groundwater recharge by eliminating surface water flows. Rather, it retains and, as supported by increased supplemental water importation, generally increases surface water outflow. Regarding both indicators of sustainability, the range of analyzed hydrologic conditions is a long-term period that includes anticipated occurrences of the types of years and groups of year types that have historically occurred in the basin.

The primary conclusion from the modeling analysis is that the current operating plan for the groundwater basin in the Santa Clarita Valley will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the valley and is, therefore, sustainable. The modeling analysis, along with the historical data described in this report, result in the following specific conclusions regarding the sustainability of the operating plan:

1. The groundwater basin has historically been, and continues to be, in good operating condition and not in overdraft conditions, as indicated by historical data.

2. The operating plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for 1 or more years without

creating long-term adverse impacts to the groundwater system and the Santa Clara River.

3. Yields from the Alluvial Aquifer and the Saugus Formation during wet and dry years can be used for long-term water supply planning purposes. In particular, although increased pumping from the Saugus Formation during years of reduced SWP deliveries can be expected to cause short-term declines in groundwater levels during such pumping, it is not projected to cause permanent declines in groundwater discharges or streamflow. Additionally, Saugus groundwater levels will rapidly recover to pre-drought conditions.

4. The strategy around which the plan was designed (maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus pumping during years when SWP supplies are significantly reduced because of drought conditions) is viable on a long-term basis.

5. The historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the current groundwater operating plan described in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005), the Groundwater Management Plan (CLWA, 2003), and the annual water reports (LSCE, 2005a).

In summary, the groundwater basin can be expected to respond to the operating plan in a manner similar to what has been experienced over approximately the last 50 years: use of water from groundwater storage during drier periods, mostly reflected by small to large fluctuations in Alluvial Aquifer groundwater levels from the middle to the eastern part of the basin, followed by full to near-full recovery in wet years or periods of years. A notable difference from historically experienced conditions is in the Saugus Formation. Greater Saugus pumping during periods of significantly reduced imported water supplies is projected to cause larger fluctuations in groundwater levels during such pumping, with full to near-full recovery of Saugus water levels in subsequent years, when the availability of imported water supplies returns to normal.

5.2 Groundwater Management and Water Supply Implications

The primary focus of the MOU and a key focus of the Groundwater Management Plan is basin yield; specifically, whether a groundwater operating yield could be developed whereby some defined amount of groundwater could be pumped on a sustainable basis. The evaluation described in this report addresses that question. The MOU did not envision impacts from groundwater contamination such as have recently impacted a number of municipal water supply wells. Fortunately, the Regional Model could be used, and has been used, to also examine the effectiveness of the operating plan in containing groundwater contaminants while concurrently pumping (with appropriate treatment at contaminated wells) for municipal water supply (CH2M HILL, 2004b). Thus, in addition to the water supply and groundwater management findings derived from the original intent of the MOU, as discussed below, an additional significant finding derived from the

development and application of the model is that groundwater supply and the control of groundwater contamination migration can be concurrently accomplished without having to modify or, more importantly, compromise the operating yield of the basin.

In addition to the preceding contamination-related findings, there are other findings that directly relate to the original intent of the MOU and can be classified as findings related to the yield of the basin and/or the long-term water supply in the valley. First, the long-term yield of the basin can be considered, for the present, to be equivalent to the operating plan for the basin, based on the simulated projections of groundwater levels, storage, and stream flows. In other words, with the existing and planned distribution of wells and pumping capacities in the operating plan, the basin can be expected to sustainably yield the annual volumes of groundwater in the operating plan for ongoing municipal and agricultural water supply. Additionally, other pumpers in the basin, such as small private well owners, can expect to experience Alluvial Aquifer groundwater conditions generally similar to what they have experienced in the past. This expression of basin yield, based on the existing and planned distribution of wells and pumping capacities, should not be considered or interpreted as a limit to the yield of the basin. It is possible that some alternate configurations of well locations and pumping capacities, potentially complemented by other management actions (e.g., artificial recharge activities), could increase the yield of the basin in the future. The Regional Model, developed for analysis of the current operating plan, can be used to examine potential changes in the operating plan and associated changes in basin yield if that is ever desirable. For the present, however, the main finding of the current groundwater operating plan is that basin conditions can be expected to generally repeat what has been experienced over the last several decades, with some increase in Saugus groundwater level fluctuations if dry-year increases in pumping are actually needed as planned, all resulting in no long-term depletion of groundwater.

From a water supply perspective, the main finding of the operational yield analysis is that it supports the groundwater component of overall water supply for the Santa Clarita Valley as described in the 2000 UWMP, and as expected to be carried forward in the 2005 UWMP.

As discussed in Section 5.1, the Saugus Formation has not been historically pumped at the dry-year rates described in the operating plan. Consistent with the ongoing water resource management, data collection, data management, data evaluation, and reporting activities that have been ongoing in the basin for the past several years, the Purveyors will closely monitor the effects of the greater-than-historical Saugus Formation pumping when it occurs. Depending on the findings from monitoring activities during the first period of increased Saugus pumping, the conjunctive use program that currently relies on SWP deliveries could potentially expand to include artificial recharge activities to enhance Saugus water level recovery after periods of increased Saugus pumping.

In conclusion, through the UWMP, the MOU, the Groundwater Management Plan, and other related water resource management activities, the Purveyors have developed an ongoing process for groundwater resource management in the Santa Clarita Valley that results in a sustainable operating plan for the local groundwater basin. As discussed in the annual water reports (including LSCE, 2005a), the ongoing process of groundwater management relies not only on the historical evaluations and numerical modeling analyses, but also on other program elements identified in the MOU—data gathering, database maintenance, and annual reporting—as well as other activities, such as implementing

conservation measures, increasing the use of recycled water, planning for water reliability, updating the UWMP on a regular schedule, and administering the Groundwater Management Plan. The development and implementation of the UWMP, the MOU, and the Groundwater Management Plan have resulted in a significantly improved understanding of the local water resources, and, in particular, have demonstrated that the current groundwater operating plan results in a reliable, long-term component of water supply for the valley. Ongoing monitoring and interpretation of actual groundwater conditions, as discussed in the MOU and the Groundwater Management Plan, will allow (1) continued assessment of basin responses to future pumping; (2) verification that, as public and private development increase with time, both within and adjacent to the basin, the groundwater basin responds in the same general manner as described herein; and (3) identification of whether adjustments to the operating plan might be warranted to achieve its primary objective of a sustainable groundwater resource.

SECTION 6

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Appendix A
Memorandum of Understanding

Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation**. The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights**. Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

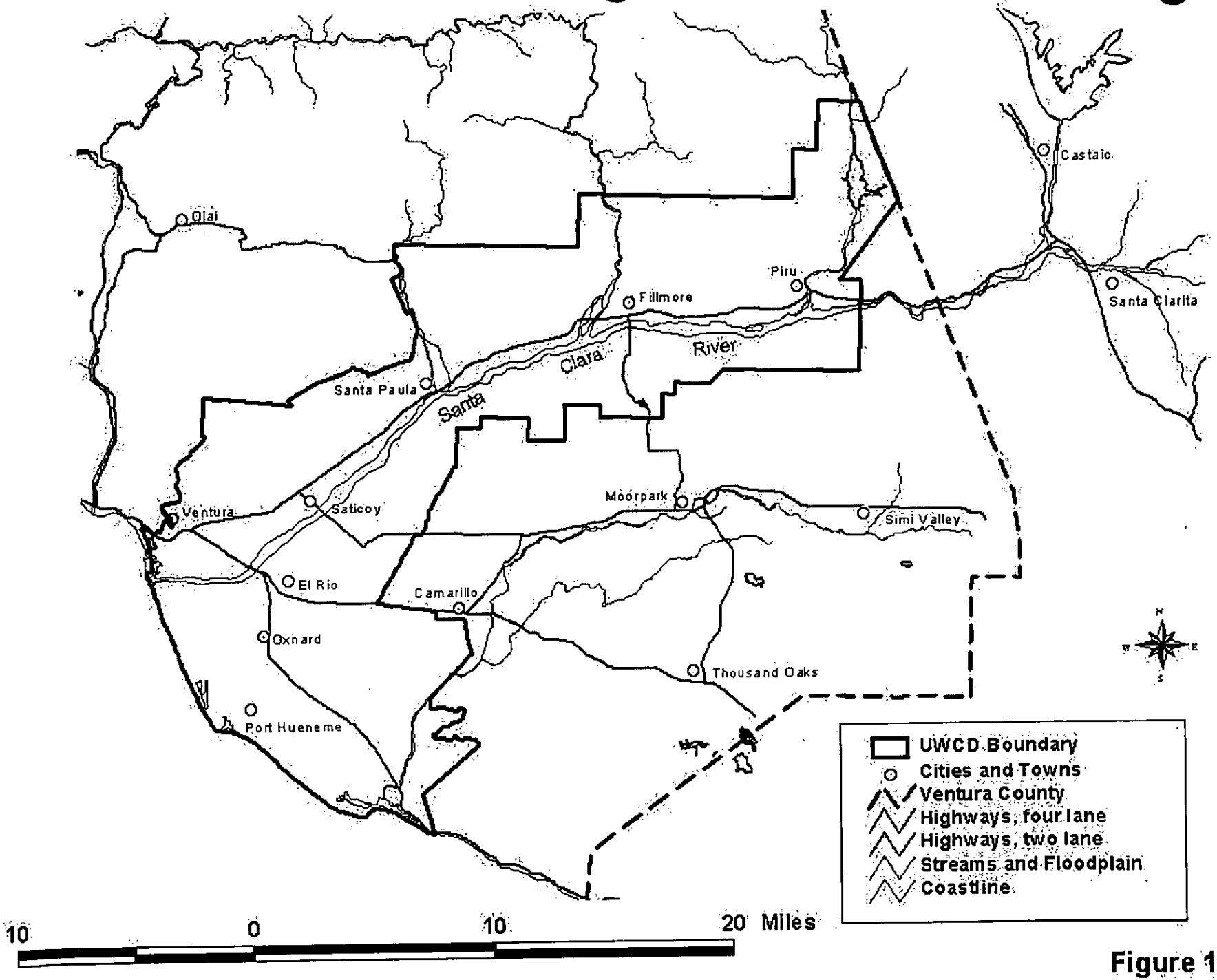


Figure 1-1

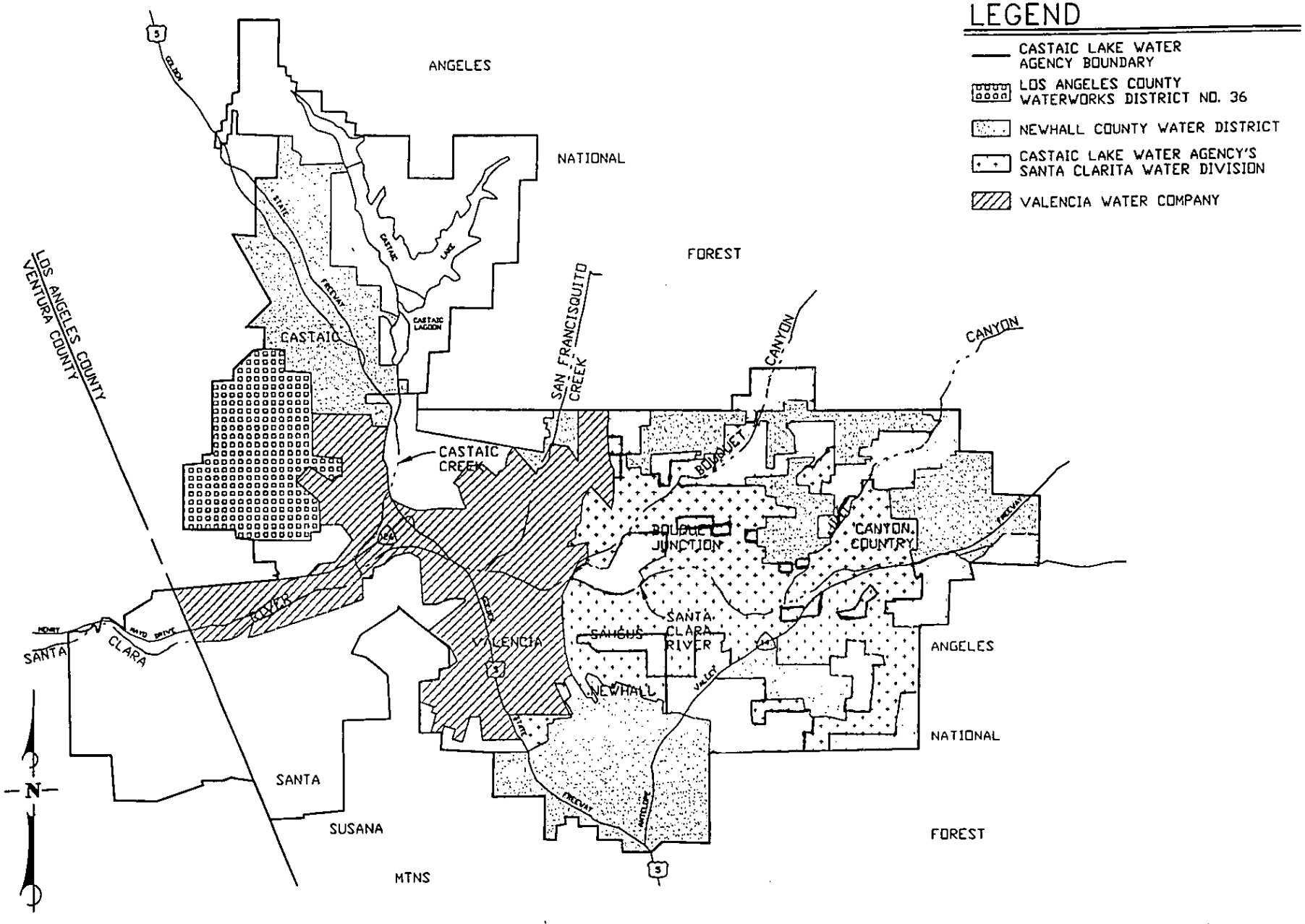


FIGURE 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

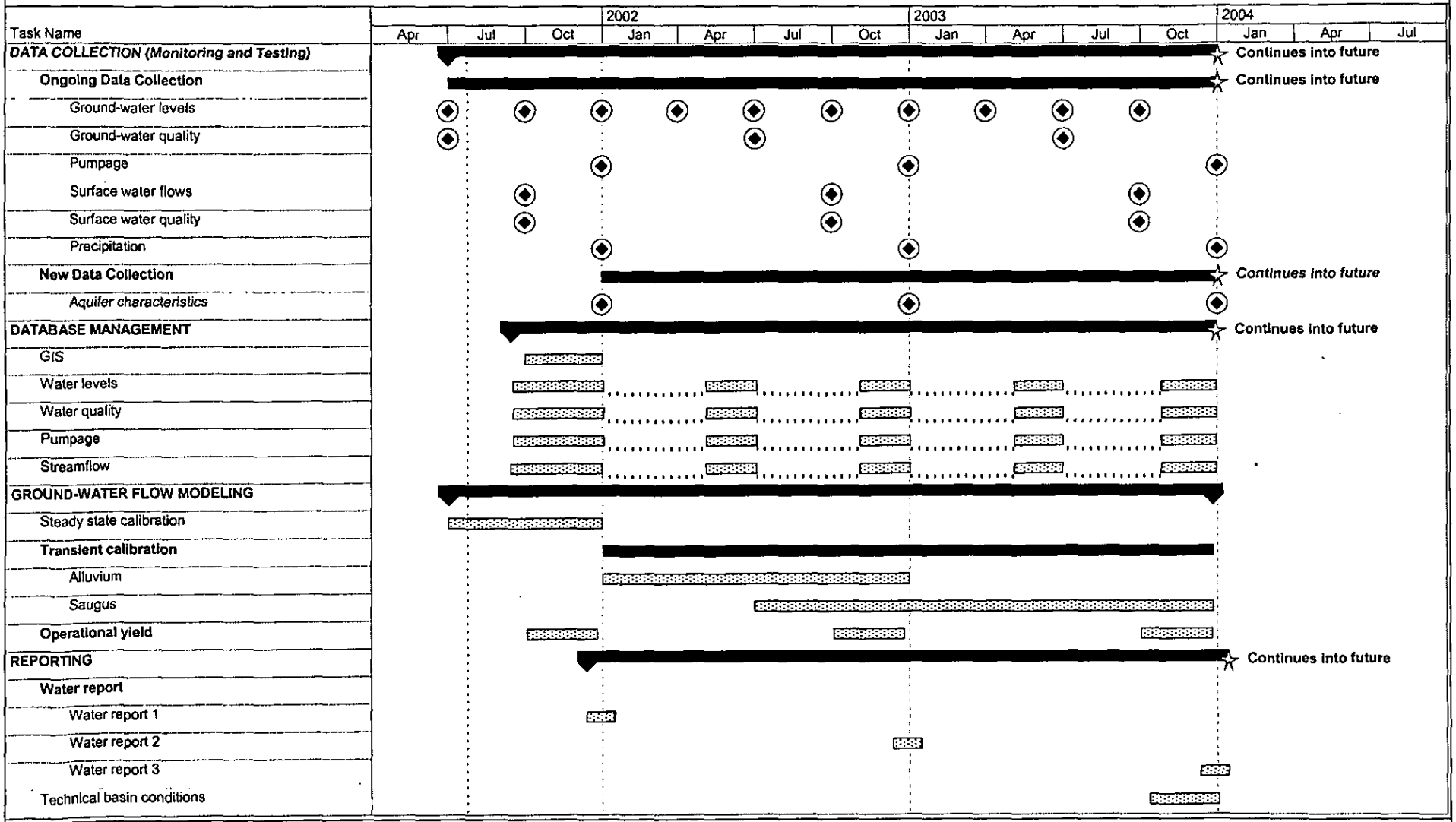
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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Appendix B
Description of the Santa Clarita Valley Regional Groundwater Flow Model

APPENDIX B

Description of the Santa Clarita Valley Regional Groundwater Flow Model

B.1 Introduction

The Santa Clarita Valley Regional Groundwater Flow Model (hereafter referred to as the Regional Model) is a three-dimensional, numerical model of groundwater flow that covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. A Surface Water Routing Model (SWRM) was also developed specifically for this basin as a pre- and post-processor for the Regional Model.

The approach to developing the Regional Model included the following steps:

1. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system
2. Creating a variety of data sets to conduct steady-state and transient calibrations
3. Constructing the Regional Model using the MicroFEM® finite-element groundwater flow code (Hemker and de Boer, 2003), and also using the available database and geographic information system (GIS) information for the Santa Clarita Valley
4. Calibrating the Regional Model
5. Performing sensitivity tests on the Regional Model

This appendix provides an overview of the Regional Model's construction and calibration. The construction and calibration of the Regional Model and the SWRM are described in detail in the *Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California* (CH2M HILL, 2004a).

B.2 Model Construction

B.2.1 Software

The Regional Model was constructed using the three-dimensional, finite-element groundwater modeling software MicroFEM® (Hemker and de Boer, 2003). MicroFEM® operates in a Windows™ environment and can be used to solve groundwater flow problems for unconfined, semi-confined, or confined aquifer systems. This software simulates steady-state or transient flow conditions in up to a 20-layer aquifer system; the finite-element mesh may contain as many as 50,000 nodes in each model layer. The software contains several different methods for simulating groundwater/surface water interactions. MicroFEM® is based on software developed in the Netherlands during the 1980s for use in evaluating the effects of groundwater pumping in areas with complicated meandering rivers. Further

details regarding this software's design, capabilities, and functionality can be found on the Internet at www.microfem.com and in two reviews of the software by Diodato (1997, 2000).

B.2.2 Model Grid

The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. The nodes are spaced 500 feet apart in the majority of the modeled area. However, a finer node spacing (150 feet) was used along the Santa Clara River and its tributaries to allow a more exact simulation of surface water/ groundwater exchanges. Additionally, specific nodes were placed within this regional grid at the locations of production and monitoring wells.

B.2.3 Layering

The upper model layer simulates the Alluvial Aquifer, or the upper portion of the Saugus Formation wherever the Alluvial Aquifer is not present. The six underlying layers simulate the underlying freshwater Saugus Formation and the Sunshine Ranch Member. The northern and southern edges of the model domain are defined by the geologic contacts mapped by Richard C. Slade and Associates, LLC (2002), formerly known as Richard C. Slade, Consulting Groundwater Geologist (both hereafter referred to as RCS), for the Alluvial Aquifer and the Saugus Formation.

The saturated thickness of the Alluvial Aquifer was defined from the average base elevation of the aquifer and the water level elevations measured during the fall of 1985 and the spring of 2000, as described by RCS (1986 and 2002). Along the Santa Clara River, the typical saturated thickness of the Alluvial Aquifer is as much as 130 feet in the western (down-gradient) portion of the basin and between 80 and 90 feet in the eastern (upgradient) portion of the basin, though it can be notably less in this area during droughts. Saturated thicknesses can be less than 60 feet in some tributary canyons, particularly along the South Fork Santa Clara River, where all production wells are constructed in the Saugus Formation, rather than the alluvium (RCS, 2002).

The Saugus Formation is generally a bowl-shaped structure that thins at its margins and has its greatest thickness (about 5,500 feet) in the center of the basin. The upper, freshwater-bearing portion of the Saugus Formation was simulated using 500-foot-thick model layers to depths as great as 2,500 feet in the center of the basin (RCS, 1988 and 2002). The deepest active model layer at any given location represented the Sunshine Ranch Member of the Saugus Formation, which is of marine origin and is, therefore, more saline and thought to have lower water-bearing potential than the overlying Saugus Formation deposits that are terrestrial in origin.

B.2.4 Boundary Conditions

The following boundary conditions were used in the Regional Model:

1. **Specified flux for precipitation within the model grid.** Deep percolation of precipitation was simulated using the precipitation top-system package contained in MicroFEM®.
2. **Specified flux for irrigation.** Deep percolation of agricultural irrigation and urban irrigation in developed areas was simulated using the precipitation top-system package contained in MicroFEM®.

3. **Specified flux and head-dependent flux along ephemeral streams**. With respect to groundwater discharges to streams, the Santa Clara River was modeled as an ephemeral, predominantly losing stream at and upstream of the mouth of San Francisquito Canyon, and as a perennial, predominantly gaining stream downstream of San Francisquito Canyon. The tributaries to the Santa Clara River were modeled as ephemeral streams, using the precipitation top-system package to specify stream leakage to groundwater. For these tributaries and the ephemeral reach of the Santa Clara River, groundwater recharge rates were estimated from precipitation records, stream-flow records, watershed maps, topographic maps, and aerial photography using the SWRM, which was developed specifically to calculate time-varying recharge at each stream node from these data. Aerial photos and historical observations indicated that under high water table conditions, groundwater can locally discharge into Castaic Creek and the ephemeral reach of the Santa Clara River wherever Alluvial groundwater levels rise above the riverbed elevation. Consequently, the drain package in MicroFEM® was used in these streams to allow for drainage of any groundwater that was calculated by MicroFEM® to be above the riverbed elevation in any given river node at any given time step.

4. **Specified flux and head-dependent flux along perennial Santa Clara River**. The perennial reach of the Santa Clara River was modeled using the wadi top-system package contained in MicroFEM®. The wadi package allows groundwater to discharge to the river whenever groundwater elevations are higher than the specified river stage. When groundwater levels are below the river stage, the river recharges the Alluvial Aquifer. The rate of recharge is proportional to the difference between the river stage elevation and the model-calculated groundwater elevation. However, after the groundwater elevation drops below the streambed sediments, the rate of leakage from the stream is constant (i.e., does not vary as the groundwater elevation fluctuates). For the Regional Model, each node along the perennial reach of the Santa Clara River was assigned a river stage 1 foot higher than the mapped bed elevation of the river. The riverbed permeability, or conductance, which helps control the model-calculated groundwater/surface water exchange rates, was adjusted during model calibration by calibrating to streamflow data collected at the County Line gage.

5. **Specified flux for pumping**. Pumping rates and locations for wells completed in the Alluvial Aquifer and the Saugus Formation were directly imported into the Regional Model from the Upper Santa Clara River Groundwater Basin database. For model calibration, pumping rates were assigned from water use records maintained by the Upper Basin Water Purveyors; estimates of monthly water demand for urban water use and agricultural water use; and well construction records, which were needed to determine which model layers at each individual well should be assigned pumping

6. **Specified flux at upgradient Alluvial Aquifer boundaries.** Where there is Alluvial groundwater flow into the study area from beneath Castaic Dam, the magnitude of the specified flux was adjusted during the model calibration process using groundwater elevations and gradients published by RCS (1986 and 2002).

7. **Specified groundwater elevation in the Alluvial Aquifer at the county line.** The groundwater elevation (805 feet) was obtained from water level contour maps for the

Alluvial Aquifer prepared by RCS (1986, 2002). (See Figure 2-7 in the main text for groundwater elevation contours during Spring 2000, as mapped by RCS [2002].)

8. **Specified groundwater elevation in the Alluvial Aquifer at the Lang gage.** The groundwater elevation (1,746 feet) was derived from topographic maps of the elevation of the Santa Clara River bed. As discussed in CH2M HILL in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (2004b), the boundary condition at this location was converted to a constant-head boundary shortly after completion of the model development report. This change was made based on results from field reconnaissance that was performed in April and May of 2004, when the Santa Clara River was dry at the Lang gage. At that time, groundwater was locally discharging from the bed of the Santa Clara River in isolated locations where the riverbed intersects the water table, then seeping back into the riverbed nearby. Significant phreatophyte growth was also present along the riverbed in this same area (just downstream of the Lang gage). Additionally, water was present and actively flowing in the river east (upstream) of the Santa Clarita Valley (in the area between the Santa Clarita Valley and the upstream Acton Basin). Based on these observations, a specified groundwater elevation of 1,746 feet was established in the Alluvial Aquifer at the eastern boundary of the Regional Model to simulate subsurface flow beneath the channel of the Santa Clara River at the Lang gage. This specified elevation was held constant throughout the simulation period.

9. **Head-dependent flux for evapotranspiration (ET).** ET from the water table by riparian vegetation was simulated using the evaporation top-system package contained in MicroFEM®. This package requires specification of the maximum rooting depth for the riparian vegetation, the maximum potential ET rate, and the ground surface elevation.

10. **No-flow boundaries**. In general, the outermost line of nodes that form the model boundary and the bottom of the model are no-flow boundaries. The exceptions are the western model boundary (specified head) and the specified-flux nodes representing underflow into the Alluvial Aquifer from beneath Castaic Dam. Also, all nodes on the model boundary are assigned specified fluxes due to precipitation and, in some cases, ephemeral streamflow.

B.2.5 Aquifer Parameters

The selection of the aquifer parameter values (horizontal and vertical hydraulic conductivity, storage coefficients, streambed conductance, and ET parameters) is described in detail in Sections 4 and 5 of the Regional Model development report (CH2M HILL, 2004a). Initial estimates of, and ranges of values for, these parameters were defined during initial model development and adjusted on an as-needed basis, and within certain limits, during model calibration. Additionally, the calibration process adjusted the coefficients for an empirical power-function equation (Turner, 1986) that was used in the SWRM to define the relationship between precipitation, stormwater flow, and the amount of stormwater flow available for potential infiltration to groundwater.

B.3 Model Calibration

B.3.1 Calibration Process

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation. The steady-state calibration was performed for calendar years 1980 through 1985, and the transient calibration was performed for calendar years 1980 through 1999. The goals of the initial calibration process were generally to match groundwater flow directions, groundwater gradients, and groundwater elevations that were measured throughout the 20-year simulation period at wells across the valley. An additional calibration goal was to match the patterns of total flow in the Santa Clara River and estimated groundwater discharge rates to the river. The Alluvial Aquifer and the Saugus Formation were each subdivided into zones to facilitate parameter selection and model calibration. Model variables were adjusted in a manner that sought to honor independent estimates of parameter values while resulting in the best possible calibration.

B.3.2 Calibration Quality

The Regional Model meets most of the qualitative and quantitative goals that were established for the calibration process. For the steady-state model, statistical goals for the head residuals, which are equal to the modeled minus measured groundwater elevations, were easily met for the Alluvial Aquifer and adequately met for the Saugus Formation. For the transient model, trends in groundwater elevations were generally well matched, and groundwater discharges to the river were simulated well for both the steady-state and transient models. However, during the middle and late 1990s, the model tended to simulate too much decline in Alluvial Aquifer groundwater elevations in the eastern-most portion of the valley. This is the area where local droughts have the greatest effect on the Upper Basin Water Purveyors' ability to pump groundwater, so this deviation is acceptable because predictive simulations of various groundwater pumping strategies will not overestimate the degree to which groundwater can be pumped from the Alluvial Aquifer in this area during periods of below-normal rainfall.

The groundwater budget for the 20-year transient calibration period showed that recharge from precipitation and streamflows varied considerably from year to year, ranging from less than 15,000 acre-feet per year (AF/yr) in the driest years to as much as 270,000 AF/yr in the wettest years. In contrast, total groundwater discharges were less variable, ranging from approximately 61,000 AF/yr at the end of the late 1980s/early 1990s drought to 116,000 AF/yr during 1998. This variability in groundwater discharge did not follow the year-to-year pumping patterns, but instead was caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlated well with groundwater recharge patterns. During the 20-year transient calibration period, changes in the volume of groundwater stored in the combined Alluvial-Saugus aquifer system varied primarily according to year-to-year variations in regional rainfall. No long-term decline in groundwater storage was observed in the field or simulated by the Regional Model during the calibration period.

B.3.3 Calibration Update

In a recent technical memorandum (CH2M HILL, 2005), the calibration of the Regional Model was extended an additional 62 months (from January 2000 through February 2005) to update and test the model's calibration against an independent data set consisting of recently observed hydrologic and pumping conditions in the basin. Examination of groundwater elevation hydrographs for the Alluvial Aquifer and the Saugus Formation indicated that the model showed a similar overall ability to simulate conditions during the recent 5-year period, as was the case for the preceding 20-year period to which the model was originally calibrated.

B.4 Model Sensitivity

Sensitivity analyses were performed to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the Regional Model. Variables that were tested were the hydraulic properties (horizontal and vertical hydraulic conductivities and storage coefficients) for the Alluvial Aquifer and the Saugus Formation, the riverbed leakage terms for the Santa Clara River and Castaic Creek, and the ET parameters. The sensitivity analysis indicated that the Regional Model is calibrated well and that it is sensitive to the choices of horizontal hydraulic conductivity in both aquifers and the vertical hydraulic conductivity values in the Saugus Formation. The model is also sensitive to the surface water parameters, specifically the choice of empirical coefficients used by the Turner (1986) equation to estimate stormwater flows from rainfall data and the riverbed leakage terms in both the eastern (groundwater recharge) and western (groundwater discharge) portions of the basin. The model is relatively insensitive to the choice of ET parameters.

B.5 Model Applicability

The process of developing the conceptual model of the local groundwater basin, developing a detailed numerical model, calibrating the model to a 20-year period of groundwater elevation and streamflow data, and independently testing the calibration against a recent set of basin conditions has resulted in a groundwater flow model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary design and calibration attributes that make the Regional Model appropriate for its intended uses are as follows:

1. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased State Water Project water imports (from outside the valley), and associated changes in land use and water use
2. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property)
3. Its use of an integrated model of the watershed to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system

B.6 References

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State of California
The Resources Agency
Department of Water Resources

The State Water Project Delivery Reliability Report 2007

August 2008

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Foreword

The water delivery reliability of the State Water Project (SWP) is at a crossroads. Future water deliveries to millions of Californians throughout the state will be affected by many factors, including two significant changes: Delta pumping restrictions and climate change.

This report provides a glimpse of our current path if no action is taken to address these and other factors. The report also identifies many other factors that could be changed to positively affect our water future.

Estimating the delivery reliability of the SWP depends on many issues, including possible future regulatory standards in the Delta, population growth, water conservation and recycling efforts, and water transfers. The impact of climate change on hydrology, consumptive use of water, fisheries and sea level rise must also be considered. This report evaluates the impacts of potential changes in hydrology of climate change. These other factors, also need to be considered: the stability of Delta levees, and therefore, SWP water deliveries, are threatened by earthquakes, land subsidence and floods.

On the positive side, there are significant and promising processes under way that could take us to a much more reliable and sustainable Delta water conveyance system for the SWP.

In this report, a possible future for these factors is presented. However, to the extent that these factors can be and are changed by actions over the next few years, this estimate of water delivery reliability will also change.

In spring 2007, the state saw the first voluntary shutdown of the SWP pumps in the Delta to protect fish. Delta smelt and some other pelagic (open water) fishes have been in decline since the early 2000s for reasons that likely include the presence of invasive species, which have altered the basic food web in the Delta, and the impacts of toxics and water project operations. In 2007, water project operations changes in the Delta costing over 500,000 acre-feet were taken to help protect the endangered Delta smelt with the use of the Environmental Water Account. Unfortunately, these actions did not result in an increase in the abundance of Delta smelt in the fall of 2007 suggesting that more than just water project operational changes in the Delta are needed to increase Delta smelt abundance. In addition, another pelagic fish, the long-fin smelt, is now also being considered for listing under the State Endangered Species Act. Clearly, a more comprehensive approach to address the decline in pelagic fish is needed.

In December 2007, a federal court imposed interim rules that will significantly restrict the operations of both the SWP and the Central Valley Project while a new federal biological opinion for Delta smelt is written in 2008.

During 2007, new Delta planning efforts — including Delta Vision established by Gov. Arnold Schwarzenegger and the Bay-Delta Conservation Planning process — have reached important conclusions about the need to change the way water is conveyed across or around the Delta to better protect fish and provide a

sustainable and reliable water supply for the state. Those efforts will continue into 2008.

This report on water delivery reliability of the SWP represents the current state of water affairs and future delivery scenarios if no action is taken. It shows a continued eroding of SWP water delivery reliability under the current method of moving water through the Delta and assumed near-term effects of climate change.

The estimates for current deliveries show that, when compared to the estimates in the *2005 State Water Project Delivery Reliability Report,* total annual SWP deliveries decrease in 93 percent of the years based on the historical data used in the analysis. Water deliveries estimated for 20 years into the future are also presented as a range of values to capture the variability in the results of the climate change studies.

When compared to the future estimates in the 2005 report, total annual deliveries for 2027 show even greater decreases in most of years if no action is taken to address the factors causing this decrease in water delivery reliability. That is why DWR is, and will continue to be, at the forefront of efforts to improve conditions in the Delta that will protect the ecosystem and water supply reliability for 25 million Californians.

Lester A. Snow
Director
California Department of Water Resources
December 2007

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Introduction 1

The State Water Project (SWP) is primarily a water storage and delivery system intended to help close the gap in California between when and where precipitation primarily falls and when and where most water demands occur. Water from the SWP is a critical component of water supply for the 29 state water contractors, who may also receive water from other sources. While each of the water supply contracts defines the maximum amount of water to be delivered annually, the amount of water actually delivered may be less due to such factors as variable precipitation and runoff, physical and institutional limits on storage and conveyance, and contractors' variable water demands. For communities receiving SWP water, the reliability of SWP water deliveries is a key factor for local planners and government officials estimating their own water supply reliability.

Since the *2005 SWP Delivery Reliability Report*, DWR has updated its estimate of current (2007) and future (2027) SWP delivery reliability and has expanded the conditions under which reliability is quantified. The additional conditions are changes in hydrology due to potential climate change and restrictions on SWP and CVP pumping in accordance with the interim operation rules imposed by the December 2007 federal court order.

This report first briefly describes the SWP and the Sacramento-San Joaquin Delta (Delta), the hub of water deliveries in California. Next, it discusses the general topic of water delivery reliability and how DWR calculates delivery reliability for the SWP. Then it summarizes key planning activities that may affect future SWP delivery reliability. These activities are Delta Vision, the Bay Delta Conservation Plan, the Delta Risk Management Strategy, and the CALFED Ecosystem Restoration Program Conservation Strategy. The report presents three areas of significant uncertainty to SWP delivery reliability: the recent and significant decline in pelagic organisms in the Delta (open-water fish such as delta smelt and striped bass), climate change and sea level rise, and the vulnerability of Delta levees' to failure. Next, the report discusses the general approach to simulating SWP operations by CALSIM II for this report.

The report presents results of CALSIM II studies that assume future climate change scenarios and SWP operations under high and low flow restrictions in the Delta. The assumed flow restrictions are designed to estimate the operation restrictions to be put in place by the federal court to protect delta smelt for water year 2008 and until replaced by new federal biological opinions.

Finally, the report provides guidance on how to apply the delivery estimates to water management plans. Presented in appendixes are detailed CALSIM II simulation assumptions and results and recent SWP deliveries.

This report does not include analyses of how specific water agencies should integrate SWP water supply into their water supply equation. This topic requires extensive information about local facilities, local water resources, and local water use, which is beyond the scope of this report.

Moreover, such an analysis would require decisions about water supply and use that traditionally have been made locally. DWR believes that local officials should continue to fill this role.

Background

Purpose

This report on SWP delivery reliability is intended to help local agencies, cities, and counties that use SWP water while planning integrated water resources management to develop adequate and affordable water supplies for their communities. These activities are usually conducted in the course of preparing a water management plan such as the Urban Water Management Plans required by Water Code Section 10610. The information in this report can be used by local agencies in preparing or amending their water management plans and identifying the new facilities or programs that may be necessary to meet future water demands. Local agencies and governments will also find in this report useful information for conducting analyses mandated by laws requiring water retailers to demonstrate whether their water supplies are sufficient for certain proposed subdivisions and development projects subject to the California Environmental Quality Act.

This report can be used with published guidelines that explain how to integrate SWP supply information with supply information from other sources to develop an overall reliability assessment of each contractor's total water portfolio. DWR has published two documents addressing this topic. *Guidebook for Implementation of Senate Bill 610 and Senate Bill 221 of 2001* (October 2003) includes suggestions on how local water suppliers can integrate supplies from various sources, such as the SWP, into their analyses. Another document is *Guidebook to Assist Water Suppliers in the Preparation of a 2005 Urban Water Management Plan* (January 2005). Both documents can be found on DWR's Office of Water Use Efficiency home page at **http://www.owue.water.ca.gov**.

Reporting Requirements

As a result of a court-approved settlement agreement executed by the Planning and Conservation League, DWR, state water contractors and other entities in the wake of the 3rd Circuit Court of Appeal's ruling in the "Monterey Amendments" case in 2000, DWR has a legal duty to prepare State Water Project delivery reliability reports every two years. In that agreement, DWR committed to the following:

> Commencing in 2003, and every two years thereafter, the Department of Water Resources (DWR) shall prepare and deliver to all State Water Project (SWP) contractors, all city and county planning departments, and all regional and metropolitan planning departments within the project service area a report which accurately sets forth, under a range of hydrologic conditions, the then existing overall delivery capability of the project facilities and the allocation of that capacity to each contractor. The range of hydrologic conditions shall include the historic extended dry cycle and long-term average. The biennial report shall also disclose, for each of the ten years immediately preceding the report, the total amount of project water delivered and the amount of project water delivered to each contractor. The information presented in each report shall be presented in a manner readily understandable by the public. (Settlement Agreement Attachment B).

Previous Reports

The *2007 SWP Delivery Reliability Report* is the third report of this type. The previous reports in 2003 and 2005 defined and calculated delivery reliability the same manner as in this report with output from DWR's CALSIM II model. This report differs from those earlier reports because it includes estimates of reductions to SWP delivery reliability due to the pelagic organism decline (POD) and future climate changes. This report also discusses the risk of conveyance disruption due to Delta levee failure.

Context

The State Water Project

The SWP is a water storage and delivery system of reservoirs, aqueducts, power plants, and pumping plants that extends for more than 600 miles. Its main purpose is to divert and store surplus water during wet periods and distribute it to areas in Northern California, the San Francisco Bay area, the San Joaquin Valley, the Central Coast, and Southern California. It is also used for recreation and to control floods, generate power, protect fish and wildlife, and manage water quality in the Sacramento-San Joaquin Delta.

The keystone of the SWP is Lake Oroville, which conserves water from the Feather River watershed. It is the SWP's largest storage facility with a capacity of about 3.5 million acre-feet. Releases from Lake Oroville flow down the Feather River into the Sacramento River, which drains the northern portion of California's Central Valley. The Sacramento River flows into the Sacramento-San Joaquin Delta, comprised of 738,000 acres of land interlaced with channels that receive runoff from about 40 percent of the state's land area. The SWP and the federal Central Valley Project (CVP) rely on Delta channels as a conduit to move water from the Sacramento River inflow to the points of diversion in the south Delta. Thus, the Delta is actually part of the SWP conveyance system, making the Delta a key component in SWP deliveries. The significance of the Delta to SWP deliveries is described in more detail below.

From the northern Delta, Barker Slough Pumping Plant diverts water for delivery to Napa and Solano counties through the North Bay Aqueduct. Near Byron in the southern Delta, the SWP diverts water into Clifton Court Forebay for delivery south of the Delta. Banks pumping plant lifts water from Clifton Court Forebay into the California Aqueduct, which channels the water to Bethany Reservoir. The water delivered to Bethany Reservoir from Banks Pumping Plant is either delivered into the South Bay Aqueduct for use in the San Francisco Bay Area or continues down the California Aqueduct to O'Neil Forebay, Gianelli Pumping-Generating Plant, and San Luis Reservoir.

San Luis Reservoir is jointly operated by DWR and the Bureau of Reclamation and has a storage capacity of more than 2 million acre-feet (maf). DWR's share of gross storage in the reservoir is about 1.062 maf. Generally, water is pumped into San Luis Reservoir during late fall through early spring, and is temporarily stored for release back to the California Aqueduct to meet summertime peaking demands for SWP and CVP contractors.

SWP water not stored in San Luis Reservoir and water eventually released from San Luis continues to flow south through the San Luis Canal, a portion of the California Aqueduct jointly owned by DWR and the Bureau of Reclamation. As water flows through the San Joaquin Valley, deliveries of CVP water are made through numerous turnouts to farmlands in the service areas of the CVP. Near Kettleman City, the Coastal Branch Aqueduct splits from the California Aqueduct for water delivery to agricultural areas to the west and municipal and industrial water users in San Luis Obispo and Santa Barbara counties.

The remaining water conveyed by the California Aqueduct travels farther in the San Joaquin Valley to agriculture users such as Kern County Water Agency before reaching Edmonston Pumping Plant, which raises the water high enough to travel across the Tehachapi Mountains into Antelope Valley. In Antelope Valley, the Aqueduct divides into the East and West Branches. The East Branch carries water into Silverwood Lake and Lake Perris. Water in the West Branch flows to Quail Lake, Pyramid Lake, and Castaic Lake.

Twenty-nine state water contractors have signed long-term water supply contracts with DWR for 4.173 million acre-feet (maf) per year. Signed in the 1960s, all contracts are in effect to at least 2035 and are essentially uniform. Each contract contains a schedule of the maximum amount of water the

contractor can receive annually. This schedule is contained in SWP Table A. The annual amount was designed to increase each year, with most contractors reaching their maximum amount in 1990. In most cases, SWP water is an important component of local water supplies. Five contractors use SWP water primarily for agricultural purposes and the remaining 24 contractors use SWP water primarily for municipal purposes. All available water is allocated annually in proportion to each contractor's annual SWP Table A amount. Appendix C contains additional information about SWP Table A.

The Sacramento-San Joaquin Delta

The Sacramento-San Joaquin Delta is a network of natural and artif cial channels and reclaimed islands at the conf uence of the Sacramento and San Joaquin rivers. The Delta forms the eastern portion of the San Francisco estuary, receiving runof from more than 40 percent of the state's land area. It is a low-lying region where over the years sediment from the Sacramento, San Joaquin, Mokelumne, Cosumnes, and Calaveras rivers mingled with organic matter deposited by marsh plants. Covering 738,000 acres interlaced with hundreds of miles of waterways, much of the land is below sea level and relies on more than 1,100 miles of rather fragile levees for protection against f ooding.

Because the SWP and the CVP use Delta channels to convey water to the southern Delta for diversion, the Delta is the focal point for water distribution throughout the state. In fact, the Delta is one of the few estuaries in the world that is used as a major source of drinking water supply: about one-quarter of California's drinking water comes from the Delta; two-thirds of Californians get some portion of their drinking water from the Delta. The Delta also provides a unique estuarine habitat for many resident and migratory f sh and birds, some of which are listed as threatened or endangered. Most of the native f sh either migrate through the Delta or move into it for spawning. Resident native f sh are mainly present in areas strongly inf uenced by the Sacramento River inf ows.

The CVP pumps at Jones Pumping Plant have a capacity of 4,600 cubic feet per second (cfs) and divert water directly from Old River. The CVP has contracts to divert 3.3 maf annually from the Delta for primarily agricultural use south of the Delta. The SWP pumps at Banks Pumping Plant have a combined pumping capacity of 10,300 cfs; however, diversions into the buf ering Clifton Court Forebay are restricted to 13,870 acre-feet (af) daily and 13,250 af per day over a three-day average. A rate of 13,250 af per day equates to an average pumping of 6,680 cfs.

CVP and SWP reservoir releases and Delta exports are coordinated according to the Coordinated Operating Agreement (COA), which sets guidelines for the sharing of supply and responsibility for meeting water quality standards in the Delta. Most of the water exported by the SWP depends on water rights derived from Lake Oroville storage; however, the SWP can also divert water considered in excess in the Delta. These excess conditions in the Delta usually result when there is suf cient inf ow to meet all benef cial needs and the SWP is not required to make supporting releases from Lake Oroville. Diversions during excess Delta conditions are still governed by various determinations and rules.

In addition to the state and federal projects' diversions, irrigation water for use in the Delta is taken from channels and sloughs through approximately 1,800 diversions which can total more than 5,000 cfs in July and August.

Delta water quality is primarily governed by the 1995 Water Quality Control Plan for the San Francisco Bay/Sacramento-San Joaquin Delta (1995 Bay-Delta Plan). This plan established benef cial uses, associated water quality objectives, and an implementation program. The State Water Resources Control Board (SWRCB) in Water Rights Decision 1641 assigned primary responsibility for meeting many of the Delta water quality objectives to the SWP and CVP. Key factors in determining water quality in the western Delta are the quality of important Delta inf ows and the intrusion of

ocean-derived salts associated with daily tides. The extent of this intrusion is primarily determined by the magnitude of Delta inflows, export pumping rates, and operation of the Delta Cross Channel. Delta inflows are normally at least partially regulated by upstream reservoir operations.

The water flowing in Delta channels is constrained by an extensive levee system that protects Delta islands from flooding. This protection is critical because land subsidence in the Delta, primarily due to the consuming oxidation of aerated peat soils, has placed most of the land in the Delta below sea level. In fact, the elevation of Delta islands can be more than 20 feet below sea level. The resulting difference between the elevations of Delta lands and the water surface in adjacent channels makes Delta levees vulnerable to failure. Land subsidence in the Delta is expected to continue, which will increase the vulnerability of levees to failure and subsequent island flooding.

Water Delivery Reliability

2

As mentioned in the Introduction, estimates of SWP delivery reliability are intended to help local SWP water users assess their water supply reliability, a key measure of a system's ability to match water supplies with demand. Just how water delivery reliability is assessed is critical to whether it is a meaningful guide for such an analysis. This chapter presents DWR's method for calculating SWP delivery reliability, the factors affecting SWP delivery reliability, and the limitations to estimating future water delivery reliability.

Calculating SWP Delivery Reliability

For this report, "water delivery reliability" is defined as the annual amount of water that can be expected to be delivered with a certain numeric frequency. SWP delivery reliability is calculated using computer simulations based on 82 years of historical data. The annual amounts of SWP water deliveries are ranked from smallest to largest and a probability is calculated for each amount. These results are often displayed as a graph, commonly referred to as an exceedence plot. They can also be presented in a table.

Factors Affecting Water Delivery Reliability

The amount of the SWP water supply delivered to the state water contractors in a given year depends on the demand for the supply, amount of rainfall, snowpack, runoff, and water in storage, pumping capacity from the Delta, and legal constraints on SWP operation. Expressed in more general terms, water delivery reliability depends on three general factors: the availability of water at the source, the ability to convey water from the source to the desired point of delivery, and the magnitude of demand for the water.

Availability of Source Water

The availability of water at the source depends on the amount of rain and snow and water use in the source areas. For the SWP, the size of the April 1 snowpack in the Feather River watershed and the storage in Lake Oroville are key components of the annual estimation of the SWP's delivery capabilities from April through September.

Factors of Uncertainty The inherent yearly variable location, timing, amount, and form of precipitation in California introduce some uncertainty to the availability of future SWP source water and hence future SWP deliveries. The approach of analysis of SWP deliveries by simulating an 82-year sequence based on historical weather patterns restricts the subsequent simulation to no more extreme droughts or severe storms than have historically occurred. However, the 82-year sequence of weather patterns does produce a wide range of hydrologic events with which to evaluate the ability of the SWP to deliver water.

The second source of uncertainty in source water is due to climate change. Current literature suggests that global warming is likely to significantly

affect the hydrologic cycle, changing California's precipitation pattern and amount from that shown by the record. In fact, there is evidence that some changes have already occurred, such as an earlier beginning of snowmelt in the Sierra, an increase in winter runoff as a fraction of the total runoff, and an increase in winter flooding frequency. More variability in rainfall, wetter at times and drier at other times, would place more stress on the reliability of existing flood management and water supply systems, such as the SWP.

Treating Availability of Source Water Issues in CalSim II Studies The State Water Project operation analyses contained in this report are based upon operation simulations under an extended record of historical precipitation and adjusted historical runoff. The 82-year record of 1922-2003 runoff patterns in the studies simulating 2007 and 2027 levels of development have been adjusted as needed to reflect the current and future levels of development in the source areas by analyzing land use patterns and projecting future land and water use. These series of data are then used to forecast the amount of water available to the SWP under Current and Future (2027) conditions.

Potential changes in climate patterns are becoming better defined and studies have been done on potential impacts to SWP deliveries due to associated changing hydrology. In a 2006 DWR report, *Progress on Incorporating Climate Change into Management of California's Water Resources*, broad-brush estimates are made of the potential impact upon the SWP around the year 2050 if no additional conveyance facilities or upstream reservoirs are built. These climate change studies adjusted the 73-year historical record (1922-1994) of rainfall and runoff according to four scenarios: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0. These studies have been updated for this report by expanding the simulation period to 82 years (1922-2003).

DWR has estimated potential deliveries at the 2027 level. However, these estimates are based on the assumption that no changes will be made in either the way water is conveyance across the Delta or in the interim operating rules defined by the recent court order to protect delta smelt. These assumptions are not a prediction of the future but an assessment of the future if these factors do not change. In addition, these estimates must be viewed with caution given the uncertainty of the effects of climate change in the future and the simplifying assumptions required for the analyses.

Ability to Convey Source Water to the Desired Point of Delivery

The ability to convey source water to the desired point of delivery refers to the availability of facilities to capture and convey water and any institutional limitations placed upon the facilities. Uncertainty in SWP deliveries may be in part due to uncertainty in the ability to convey water. For the SWP, this uncertainty centers on the Delta.

Factors of Uncertainty In general, SWP operations are closely regulated by Delta water quality standards established by the State Water Resources Control Board (SWRCB) and set forth in Water Rights Decision 1641. Even in the times SWP operations are left to the discretion of DWR, actions often require consultation with federal and state fish and wildlife agencies under its Endangered Species Act provisions. The evolving response to the continuing unexplained decline in many pelagic fish species since the early 2000's, and the legal challenges to SWP operation and ongoing planning activities related to the Delta's future are sources of uncertainty for SWP delivery reliability related to water conveyance.

On May 25, 2007, a federal judge found that the 2005 USFWS Biological Opinion for delta smelt was not consistent with the requirements of the Federal Endangered Species Act and must be

rewritten. On Aug. 31, 2007, the same judge established interim operating rules to protect delta smelt until USFWS rewrites the biological opinion. The interim operating rules set in-Delta flow targets in Old and Middle rivers from late December through June that will restrict CVP and SWP pumping in 2008 and until the delta smelt biological opinion is rewritten. In Chapter 4, this report discusses the process used to rewrite this biological opinion.

Another potential uncertainty for SWP water conveyance through the Delta is the risk of interruptions in SWP diversions from the Delta due to levee failure. SWP source water enters the Delta through the Sacramento River and is conveyed to Banks Pumping Plant via Delta channels lined with fragile levees. If a levee fails, depending on the location and the size of the adjacent island, the flow of water from nearby channels onto the affected island can draw saline water from Suisun and San Pablo bays into the central Delta. In such an incident, SWP pumping at Banks Pumping Plant may have to be curtailed or ceased for a period to prevent drawing saline water into the south Delta. Additional releases from Lake Oroville may also be necessary to flush the Delta of the saline water. As discussed in Chapter 4, the likelihood of levee failures in the future is expected to increase.

Finally, future sea level rise associated with climate change could increase the salinity in the Delta as higher ocean tides push saline water farther inland. If Delta water quality standards remain the same, SWP pumping could become more restricted, at least under some hydrologic conditions.

Treating SWP Conveyance Issues in CalSim II Simulations The 2007 base study in this report assumes current facilities and institutional limitations, which include Water Rights Decision 1641, export curtailments for the Vernalis Adaptive Management Plan (VAMP) as described in a 2004 new Operating Criteria and Plan (OCAP) developed by DWR and U.S. Bureau of Reclamation for the SWP and Central Valley Project, and court-ordered in-Delta flow targets in Old and Middle rivers to protect delta smelt. This report examines two levels of Old River and Middle River flow targets. Chapter 6 has a more detailed description of these assumptions. For comparison, the 2027 studies in this report assume the same institutional limitations as the 2007 simulations regarding Delta water quality requirements, fish protection, and Delta flows will be in place 20 years in the future; no facility improvements, expansions, or additions will be made to the SWP; and conveying water through the Sacramento-San Joaquin Delta will not be significantly interrupted by levee failures. These assumptions are not a prediction of the future but an assessment of the future if these conditions are not changed. As discussed in Chapter 3, there are several processes under way to further the discussion on the need for changes in water conveyance around the Delta to address many of the issues. The 2027 studies also incorporate assumptions about climate change, but do not account for sea level rise or the expected accompanying increase in Delta salinity because the tools to evaluate this impact of climate change have not yet been completed.

Also not included in this report are CALSIM II studies that reflect risk of levee failure. The impact on SWP deliveries due to a single or multiple levee failure is highly dependent on where the levees fail and the Delta conditions at the time. As the Draft DRMS Phase 1 Summary Report indicates, the effect on SWP deliveries can range from relatively minor to catastrophic for a large earthquake with extensive levee failures, depending on whether the earthquake occurs under dry or wet Delta conditions. However, the same report points out that if multiple Delta islands are left flooded with openings to adjacent channels after a large-scale levee failure, the volume of water that would move into and out of the Delta over a tidal cycle could actually increase, resulting in higher salinities in the west Delta. If Delta water quality standards remain unchanged, releases from Lake Oroville would then most likely need to increase above current levels to enable the same level of SWP pumping. The DRMS

report also indicates that multiple levee failures and Delta island flooding due to flood flows may not significantly affect SWP deliveries due to the fresh water Delta-wide conditions that would exist at the time of flood flows. Chapter 4 addresses Delta levee vulnerability to failure in detail.

Demand for System Water

Water demand in the delivery service area is affected by such factors as the magnitude and types of water demands, the extent of water conservation measures, local weather patterns, and water costs. Supply from a water system may be sufficiently reliable at a low level of demand but become less reliable as the demand increases. In other cases, the reliability of a water supply system to meet a higher demand may be maintained at its past level because new facilities have been added or the operation of the system has been changed. In general, the higher and the more time-concentrated the water demands, the more need for storage and conveyance capacity to achieve the same delivery reliability. For example, if the demand occurs only three months in the summer, a water system with a sufficient annual supply but insufficient water storage may not be able to reliably meet the demand. If, however, the same total amount of demand is distributed over the year, the same system could more easily meet the demand because the need for water storage is reduced.

Demand levels for the SWP water users in this report are derived from historical data and information from the SWP contractors. Demand on the SWP is nearing the maximum contract amount (in other words, "Maximum SWP Table A amount"). Each SWP contract contains a SWP Table A, which states the maximum annual delivery amount over the period of the contract. These annual amounts usually increase over time. Most contractors' SWP Table A amounts reached a maximum in 1990. The total of all contractors' maximum SWP Table A amounts is 4.173 million acre-feet (maf) per year. SWP Table A is used to define each contractor's portion of the available water supply that DWR will allocate and deliver to that contractor. The SWP Table A amounts in any particular contract are not guarantees of annual delivery amounts but are used to allocate individual contractors' portion of the total delivery amount available. Estimates of each contractor's amount of water delivered are determined by the factors described in this report. (See Appendix C for additional explanation and listing of the maximum SWP Table A amounts).

Of the 29 SWP contractors, Yuba City, Butte County, and the Plumas County Flood Control and Water Conservation District are north of the Delta. Their total maximum SWP Table A amounts is 0.040 maf. The total maximum SWP Table A amounts for the remaining 26 contractors, who all receive their supply from the Delta, is 4.133 maf. This report focuses on SWP deliveries from the Delta because the amount of water pumped from the Delta by SWP facilities is the most significant component of the total amount of SWP deliveries. The results presented in this report in terms of estimated delivered water supplies as a percent of SWP Table A deliveries apply to contractors north of the Delta in the same manner as those contractors receiving supply from the Delta.

Factors of Uncertainty Estimating future demand for SWP water requires assumptions be made about population growth, water conservation, recycling efforts, other sources of supply available to the SWP contractors, and climate change. The estimates also depend on the cost to the SWP contractor for each of the components of their integrated water management plan. These factors are considered by the SWP contractors in the estimates of their current and future demands.

Treating Water Demand Issues in CalSim II Simulations SWP Table A and Article 21 demands in the 2007 studies were assumed the same as those in the 2005 study from the *2005 SWP Delivery Reliability Report*. SWP Table A and Article 21 demands in the 2027 studies were assumed the same as those in the 2025 study from the *2005 SWP Delivery Reliability Report*. The demand values are assumed

to vary from year to year depending on the weather. Specif c values used in the CalSim II studies are contained in Appendix A.

Limitations to Estimating Future Water Delivery Reliability

Studies Must Rely on Assumptions

Actual, historical water deliveries cannot always be used with a signif cant degree of certainty to predict future water deliveries. As discussed earlier, there are continual, signif cant changes over time in the determinants of water delivery for a specif c water supply system. These changes include water storage and delivery facilities, water use in the source areas, water demand in the receiving areas, and the regulatory constraints on the operation of facilities for the delivery of water. Given the highly signif cant changes that have occurred for the SWP over the past 40 years, past deliveries are not a good predictor of SWP current deliveries, much less of future deliveries.

For example, the demand 30 years ago for water from the SWP was lower than it is now or expected to be in the future. Past lower demand for SWP water resulted in less water transported through the SWP during normal and wet times than could have been—or would have been if the demand for water had been higher. Less water was delivered then because less water was needed; the amount of source water and conveyance capabilities weren't limiting factors for deliveries. Conversely, the recent court-ordered restriction on SWP exports from the Delta is estimated to reduce annual deliveries from what has been delivered in the recent past. Analyses estimating future SWP deliveries must include assumptions about future (2027) conditions. Some assumptions are very important to the analyses and are key to understanding the resulting estimates of annual water deliveries. A discussion of the important assumptions for the studies in this report follows.

Studies Assume Repeating Historical Weather Patterns

One of the most signif cant assumptions for water planning in general is how wet, dry and variable the weather will be. Until recently, assuming the future weather pattern would be similar to the past was suf cient for many planning purposes. Given the evolving information on the potential ef ects of global climate change in the future, this approach is no longer adequate. Incorporating climate change into future projections is dif f cult because of the many ways the patterns of rain, snow and temperature could shift. A way to measure some of the uncertainty is to analyze many potential climate change scenarios in order to capture the range of water supply impacts.

This report contains estimates of future SWP deliveries under four future climate change scenarios. The scenarios are variations based upon the historical record of precipitation information for the Central Valley for the period 1922 through 2003. The amount and timing of rainfall and runof is adjusted but the sequence of dry years or wet years is the same for all scenarios. Evaluating how water management systems will respond under severely dry periods is limited to assuming the worst droughts in the period of historical record. The worst multiyear drought on record is 1928 through 1934, although the brief drought from 1976 through 1977 was more acutely dry.

Other Important Assumptions

To identify the assumptions with the most effect on the estimates of SWP deliveries, DWR conducted a sensitivity analysis for assumptions in CalSim II model studies. In a sensitivity analysis, an assumption such as the amount of water used in the watershed above Lake Oroville is varied over several studies and the results for SWP deliveries are compared. This is done to assess how each assumption af ects study results. The *2005 SWP Delivery Reliability Report* presents and discusses the results of DWR's study. The parameters having the largest net impact on SWP Delta deliveries are SWP Table

A demands and Banks Pumping Plant limits. The most elastic parameters (i.e., parameters causing the most percent change in SWP deliveries per percent change in value) are SWP Table A demands and Lake Oroville inf ow. The estimates for the future inf ow to Lake Oroville depend on what is assumed for climate change. Legal limitations are one of the factors def ning the rules for operating Banks Pumping Plant. Therefore, the assumptions for climate change and the court-ordered restrictions directly af ecting Banks Pumping Plant operations will signif cantly af ect SWP delivery estimates.

Status of Planning Activities That May Affect SWP Delivery Reliability

3

As discussed earlier, the Sacramento-San Joaquin Delta is an essential part of the conveyance system for the SWP. SWP pumping at Banks Pumping Plant is largely regulated to protect the many uses of the Delta. However, there is a growing recognition that today's uses in the Delta are not sustainable over the long term under current management practices and regulatory requirements. Four major concurrent Delta planning efforts are under way with objectives related to providing a sustainable Delta. These plans may propose changes to SWP operations which in turn could affect SWP delivery reliability. These efforts are Delta Vision, Delta Risk Management Strategy, the CALFED Ecosystem Restoration Program Conservation Strategy, and the Bay Delta Conservation Plan. Each could affect SWP and CVP operations in the Delta.

Delta Vision

On Sept. 28, 2006, in conjunction with the signing of SB 1574, Gov. Schwarzenegger signed an executive order to initiate Delta Vision and establish an independent Blue Ribbon Task Force to develop a durable vision for sustainable management of the Sacramento-San Joaquin Bay Delta. The Delta Vision process is looking more broadly at the sustainability of the Delta. The Blue Ribbon Task Force has prepared its vision for sustainable management of the Delta at **http://www.deltavision.ca.gov**. A strategic plan to implement the vision will be the focus of the Task Force during 2008.

Key points from the Task Force's vision are:

- The water system and the ecosystem of the Delta are co-equal values.
- The Delta is a unique place that has value in its own right.
- Future management must work with nature to achieve desired goals for the Delta.
- Design for resiliency by encouraging regional self sufficiency and developing alternative ways to move water among areas of the state.
- Separate water for human uses from water for the ecosystem.
- New storage and improved conveyance must be constructed to capture water at times least damaging to the environment.
- Over time, reliance on levees should be reduced. However, levees remain critical to the future of the Delta and new policies should match levels of protection provided to uses allowed.
- Assess dual conveyance systems as the preferred direction, to understand the optimal combination of through-Delta and isolated facility improvements against listed performance standards.

The Task Force also identified near-term actions that must be taken. These focus on preparing for disasters in or around the Delta, protecting the Delta ecosystem and water supply system

from urban encroachment, and quickly beginning work on short-term improvements to both the ecosystem and water supply system.

Delta Risk Management Strategy

The 2000 CALFED Record of Decision presented its Preferred Program Alternative describing actions, studies, and conditional decisions to help fix the Delta. Included in the Stage 1 implementation of the preferred alternative was the completion of a Delta Risk Management Strategy (DRMS) that would look at sustainability of the Delta and assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences and develop recommendations to manage the risk.

In 2005, the Legislature passed and the governor signed AB 1200, which requires DWR to evaluate the potential impacts on water supply derived from the Delta based on 50-, 100-, and 200-year projections for possible impacts on the Delta due to subsidence, earthquakes, floods, climate change, and combinations of these. DWR and The Department of Fish and Game (DFG) must determine the principal options for the Delta. DWR must then evaluate each option for addressing those impacts for its ability to, among other things, prevent the disruption of water supplies derived from the Delta, improve the water quality of drinking water supplies from the Delta, and maintain Delta water quality for Delta users. DFG is to evaluate and comparatively rate each option for its ability to restore salmon and other fisheries that use the Delta. The study is to be completed by January 1, 2008. The DRMS Project was developed, in part, to address the provision in AB 1200 and is a major source of scientific and technical information on the Delta and Suisun Marsh levees for other major studies and initiatives including the Delta Vision initiative, the Bay Delta Conservation Plan, and the CALFED End of Stage 1 Assessment.

Prior to the initiation of the DRMS study, no other levee risk assessment had been as comprehensive and complex. Due to the relatively short time for the assessment, DRMS made the best estimates possible based on existing data and models. While data gaps exist, there were no opportunities to gather new data in the course of the DRMS effort. Results should be considered on a regional basis rather than for any individual island or levee reach. The results should be used for a gaining broad understanding of the condition in the entire Delta, and should not be used as a basis for design for any specific location.

The DRMS preliminary findings have been reviewed by a CALFED scientific panel. The review has lead to a reevaluation of some of the initial DRMS analyses. The results of the reevaluation will be incorporated into the final report and will be completed in April 2008. Delta Vision, the CALFED Ecosystem Restoration Program and the Bay-Delta Conservation Planning effort depend on the best available information from DRMS to support their own processes. The findings discussed in Chapter 4 should be viewed as a progress report that is subject to refinement. While specific numbers may change, the essence of the findings is expected to remain the same.

CALFED Ecosystem Restoration Program Conservation Strategy

The Ecosystem Restoration Program (ERP) implementing agencies are developing a Conservation Strategy to guide ecosystem restoration implementation based on evaluation of past actions, new information, and changing understanding of the ecosystem. The Conservation Strategy is non-regulatory and based on willing seller participation. To date, the effort has focused on the Delta due to the emphasis placed on the pelagic organism decline (POD) and other planning efforts. In future versions, comparable conservation strategies will be developed for the entire ERP focus area including the Sacramento and San Joaquin rivers' watersheds.

The Conservation Strategy is a biological view of where restoration of important habitat types could occur to restore ecosystem form and processes to the maximum extent. Areas have been identified in the Conservation Strategy with potential for various kinds of habitat restoration in the Delta-Suisun Marsh based upon existing elevations, habitat, and natural process requirements of pelagic organisms and other native fishes. Elevation and soil type are the drivers for this preliminary depiction, which does not consider the constraints of water conveyance options, infrastructure, or land use patterns and ownership. As noted in the BDCP discussion that follows, new conveyance focuses on new diversion(s) north of the Delta from the Sacramento River, which would divert water for export around the Delta, offers the greatest potential for meeting ecosystem restoration objectives. The Conservation Strategy is also incorporating information from other Delta-related planning efforts (e.g., Delta Risk Management Strategy, Suisun Marsh Implementation Plan, the ERP End of Stage 1 Assessment, and recovery plans for Federally-listed species) and technical and public input.

The draft of the strategy focuses on five broad habitat categories for restoration or management in the Delta. These categories include managed wetland and wildlife-friendly agriculture (primarily subsided islands), inter-tidal, floodplain, upland transition, and grassland/vernal pool transition corridor.

Information on ecosystem processes, such as hydrodynamics, temperature, salinity, residence times, and productivity is being developed. Details of restoration actions that address flow and river operations — the primary drivers of aquatic systems and habitats — will be incorporated once the Delta Regional Ecosystem Restoration Implementation Plan conceptual models (January 2008) and the anadromous fish recovery plans (Spring 2008) are completed and coordinated with the BDCP process.

Bay-Delta Conservation Plan

The Bay-Delta Conservation Plan (BDCP) has a different and more specific purpose than do DRMS and Delta Vision. BDCP is being developed consistent with the federal Habitat Conservation Plan (HCP) and State Natural Community Conservation Planning (NCCP). The purpose of BDCP is to develop a conservation plan that resolves the conflict between fishery protection under state and federal Endangered Species acts and water operations of the State Water Project (SWP), Central Valley Project (CVP), and Mirant Power facilities in the legal Delta. The goal of BDCP is to develop a plan that satisfies both the conservation and water supply goals of the Planning Agreement signed in October 2006. The BDCP Steering Committee is composed of 19 groups that represent the state and federal water agencies and export contractors, non-governmental organizations representing environmental and farming interests, and Mirant Power, with state and federal fishery agencies serving as ex-officio members. BDCP is ultimately focused on satisfying permitting requirements for the water supply system in the Delta. Among other things, the plan will:

- Provide for conservation and management of at-risk fish species affected by the covered activities.
- Preserve, restore, and conserve aquatic, riparian, and associated terrestrial habitats.
- Provide clear expectations and regulatory assurances for Delta water operations and facilities (CVP, SWP, and Mirant Corp.).

The steering committee for BDCP has been actively working since April 2007 to set the scope and focus of this planning. The committee initially developed 10 options. These options were narrowed to four options for conveyance and opportunities that provide for habitat restoration and enhancement.

- **Option 1: Existing Through-Delta Conveyance.** This option includes use of existing through-Delta conveyance with physical habitat restoration in the north and west Delta and Suisun Marsh (about 28 percent of BDCP planning area).

- **Option 2: Improved Through-Delta Conveyance.** This option includes improving through-Delta conveyance with operable barriers on some channels, separating water supply conveyance flows from the San Joaquin River, and providing habitat restoration in the north, west, central, and south Delta and Suisun Marsh (about 35 percent of the BDCP planning area).

- **Option 3: Dual Conveyance.** This option is similar to Option 2 with the addition of an isolated conveyance facility from the Sacramento River to the south Delta export facilities.

- **Option 4: Peripheral Aqueduct.** This option includes construction of a peripheral aqueduct from the Sacramento River to the south Delta export facilities, which would allow habitat restoration throughout the Delta and Suisun Marsh (about 75 percent of the BDCP planning area).

Table 3.1 shows a summary of how a BDCP Steering Committee consultant ranked the options during the evaluations.

The BDCP plans to finish a draft of the conservation plan by the end of 2008 and the associated draft Environmental Impact Report/ Environmental Impact Statement available for public review at the end of calendar year 2009.

Table 3.1 Overall comparison of BDCP options by criteria category (rank)[1]

Evaluation Criteria Category	Conservation Strategy Option			
	Option 1 *Existing Through Delta*	**Option 2** *Improved Through Delta*	**Option 3** *Dual Conveyance*	**Option 4** *Peripheral Aqueduct*
Biological	★	★★	★★★	★★★★
Planning	★	★	★★★★	★★★★
Flexibility/Sustainability/Durability	★	★★	★★★	★★★★
Impacts on Other Resources	★★★★	★★★	★	★★

[1]/ Performance ranks are ★ (lowest-performing) to ★★★★ (best-performing). Some options receive equal rank.

Areas of Significant Uncertainty for SWP Delivery Reliability

4

Delta Vision's recognition that today's uses in the Delta are not sustainable in the long term is in large part based on three major growing concerns: the pelagic organism decline, possible impacts from climate change and sea level rise, and the vulnerability of Delta levees for failure. Each of these uncertainties for SWP delivery reliability is discussed below.

Pelagic Organism Decline

In late 2004 and early 2005, scientists became concerned about the numbers of many pelagic (open water) organisms including delta smelt that had been declining sharply since the early 2000s. Other pelagic fish with very low numbers in the Delta are striped bass, longfin smelt, and threadfin shad. By 2005, the decline was widely recognized as serious and became known as the Pelagic Organism Decline (POD). Hypothesized factors contributing individually or in concert to lower pelagic productivity are:

- toxic effects,
- exotic species effects, and
- water project effects.

Studies over the past three years are indicating that all these factors might be contributing to the decline in pelagic fishes, and their relative importance might vary depending on the year, season, and location in the Delta. Continued decline in the abundance of juvenile delta smelt led to a voluntary modification in 2007 in SWP and CVP operations to reduce the reversed flows in Middle and Old rivers — a modification made possible by the Environmental Water Account (discussed below). Subsequently on May 31, 2007, DWR ceased Delta pumping and the U.S. Bureau of Reclamation reduced pumping to the minimum operating level of 850 cubic feet per second (cfs). SWP pumping resumed on June 10 at a minimal level of 90 cfs and slowly ramped up to 5,000 cfs by July 1.

In 2007, the Pelagic Fish Action Plan (Resources Agency 2007), developed jointly by DWR and DFG, made several recommendations related to actions that could be taken to improve protection of pelagic fish, including delta smelt. These actions included ways to increase primary productivity in the Delta, reduce the effects of toxics, and possible changes in water project operations. The actions related to SWP and CVP operations guided the voluntary actions taken by DWR and USBR in 2007 as part of the Environmental Water Account.

Environmental Water Account and POD

The POD is occurring despite the operation since 2001 of the Environmental Water Account (EWA). This CALFED water management tool was created to provide added protection to at-risk fish species at no uncompensated costs to SWP and CVP water deliveries. The purpose of the EWA is to enable modifying water project operations in the Delta to provide protection for fish while also compensating for any water supply lost to SWP and CVP water users. Under EWA, fish protection is achieved by periodic curtailment of SWP and CVP water diversion from the Delta to water users south of the

Delta and later replacing any lost water supply. EWA achieves this through buying water from willing sellers or diverting surplus water when safe for fish, then banking, storing, transferring, and releasing the water as needed to protect fish and compensate water users. In its simplest terms, the EWA is aimed at adding flexibility to the state's water delivery system by providing water at critical times to meet environmental needs without reducing SWP and CVP water deliveries. Funding for the EWA is expected to continue through 2008. Without the compensation for the supply effects due to restricted pumping, SWP water supply reliability will be reduced. The studies in this report assume no EWA will be in place under the current and future scenarios.

Biological Assessment of the SWP and CVP Operating Criteria and Plan

In 2004, Reclamation and DWR developed a new Operating Criteria and Plan (OCAP) for the SWP and Central Valley Project (CVP). This plan documented many aspects of the SWP and CVP through: detailing project descriptions, explaining regulatory and legal requirements, listing changes in project operations since the last OCAP in 1992, and analyzing the present and proposed operations using computer simulations. OCAP provided the project descriptions required for a comprehensive biological assessment of SWP and CVP. The biological assessment analyzed existing and potential effects of SWP and CVP operations on listed species and led to Endangered Species Act (ESA) consultation with the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration (NOAA) to update biological opinions (BO) for delta smelt, winter-run salmon, and other species listed under the ESA. In 2004, USFWS issued a non-jeopardy BO with regards to impacts on delta smelt caused by revised operations of the CVP and SWP. This opinion was updated in 2005. USFWS concluded that any adverse effects from the CVP and SWP operations would be avoided or minimized by conservation and adaptive management measures included in the OCAP.

The USFWS's 2005 BO for delta smelt was challenged in U.S. District Court. This court ruled in May of 2007 that the OCAP BO for delta smelt was inconsistent with the Federal Endangered Species Act and needed to be rewritten. On Dec. 14, 2007, the court established interim operating rules to protect delta smelt while USFWS rewrites the BO. These interim operating rules are similar to the 2007 Pelagic Action Plan in that they include in-Delta flow limits in Old and Middle rivers that have the effect of restricting CVP and SWP pumping.

Assessment of Possible POD Impacts on SWP Delivery Reliability

As previously discussed in Chapter 2, a crucial impact of POD upon SWP delivery reliability is to cause additional restrictions on SWP operations. These constraints introduce uncertainty in the ability to convey SWP source water to the desired point of delivery. This uncertainty can be somewhat addressed in analyses by assuming two levels of restrictions. The 2007 and 2027 studies in this report assume constraints to Old and Middle rivers flow in accordance to the August 2007 court ruling on interim actions to protect delta smelt. These simulations are described in more detail in Chapter 6.

Climate Change and Sea Level Rise

Climate change is identified in the 2005 update of the *California Water Plan (Bulletin 160-05)* as a key consideration in planning for the state's future water management. This is because climate change may seriously affect the state's water resources, particularly the SWP's ability to deliver water. In fact, the 2005 report by the University of California, Berkeley, for the California Energy Commission, *Climate Change and Water Supply Reliability*, asserts that climate change in California "is likely to affect water users primarily through its impact on supply reliability and uncertainty" (p. 4).

For the SWP, climate change has the potential to simultaneously affect the availability of source water,

the ability to convey water, and users' demands for water. These potential changes are described below.

Three climate warming scenarios prepared by the California Climate Change Center predict slightly warmer winters with less winter snowpack. Some changes in hydrology due to climate change may already be noticeable, such as an earlier beginning of snowmelt in the Sierra, an increase in winter runoff as a fraction of the total runoff, and an increase in winter flooding frequency. Also, spring and summer runoff in the Sacramento River and San Joaquin River watersheds may be declining due to reduced snowpack.

In the future, average winter flood flows to the Delta are likely to become larger due to more intense storms with more precipitation occurring as rain instead of snow. This shift from snow to rain, particularly in the northern Sierra Nevada, is expected to shift the timing of the peak runoff toward the winter. This in turn may require adjustments to reservoir flood control operations — water managers may be forced to make changes in reservoir operations and flood-control rule curves — resulting in less spring and summer Delta inflows and an increase in Delta salinity.

Climate change experts believe that the timing and quantity of available water supplies in the coming decades may be less predictable due to changing climatic conditions (DWR's 2006 report, *Progress on Incorporating Climate Change into Management of California's Water Resources*). This may exacerbate the existing mismatch in California between where and when precipitation occurs and where and when people use water.

The sea level has been rising at an average rate of 0.08 inches per year and is now about 0.6 feet higher at the Golden Gate than it was in 1920. The Intergovernmental Panel on Climate Change estimates that sea level will rise by about 0.6 to 1.9 feet over the next 100 years (Intergovernmental Panel on Climate Change 2007). Even if Delta levees are fully upgraded, sea level rise could negatively affect water supply reliability through increased salinity intrusion in the Delta. A further tightening of drinking water quality standards or increases in salinity or other constituents could significantly increase the cost of treating Delta water for municipal use. Increased salinity in the Delta reduces the opportunity for exporters to blend the less saline Delta water with other sources higher in salinity. If current in-Delta water quality standards are maintained, re-operation of upstream reservoirs would be needed to provide more water for controlling the seasonal salinity intrusion in the Delta. This would likely result in generally lower reservoir levels, perhaps reducing the ability to meet water supply and water quality needs during dry periods.

Assessment of Possible Climate Change Impacts on SWP Delivery Reliability

As previously discussed in Chapter 2, climate change can potentially affect SWP delivery reliability by altering the timing and amount of source water. In 2006, DWR released a report on climate change and its potential impact on California's water resources. Entitled *Progress on Incorporating Climate Change into Management of California's Water Resources*, the report summarizes recent research into changes in precipitation, air temperatures, snow levels, and rainfall and snowmelt runoff. The report also evaluates possible future impact on California water supply through CalSim II simulations with hydrologic sequences, which reflect different scenarios of climate change. In order to account for the uncertainty in future climate change, four scenarios are examined:

1. weak temperature warming and weak precipitation increase in California under model PCM;
2. modest warming and modest drying under model PCM;
3. modest warming and modest drying under model GFDL v. 2.0; and
4. weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0.

Some of the main results of the 2006 climate change report related to estimated impacts on the SWP and Delta around the year 2050 are:

- Estimated changes in annual average SWP south-of-Delta SWP Table A deliveries range from a slight increase of about 1 percent for a wetter scenario to about a 10 percent reduction for one of the drier climate change scenarios.
- Estimated increased winter runoff and lower SWP Table A allocations result in slightly higher annual average Article 21[1] deliveries in the three drier climate change scenarios. However, the boosts in Article 21 do not offset losses to SWP Table A. The wetter scenario with higher SWP Table A allocations result in fewer Article 21 delivery opportunities and slightly lower annual average Article 21 deliveries.
- Estimated SWP carryover storage is reduced in the drier climate change scenarios and is somewhat increased in the wetter climate change scenario.

Sea level rise effects on water project operations to repulse a greater salt water intrusion under these conditions were not examined due to lack of existing tools for that type of analysis.

For this report, the Calsim II simulations were updated to incorporate an extension of the hydrologic simulation sequence to 2003 and operation of the SWP to meet the interim operating rules of the August 31, 2007, court order related to delta smelt. The same four scenarios of future climate change were simulated. It should be noted that these scenarios assume greenhouse emissions for 2050, not at the 2027 level assumed for Future Conditions. This report estimates climate change impact to SWP deliveries by interpolating between future studies that assume no climate change and studies that assume 2050 emissions. This approach is detailed in Appendix B. These studies are the best available estimates for future SWP water deliveries. Chapter 6 describes these simulations along with all other simulations presented in this report.

[1] Article 21 water is interruptible water allocated under certain conditions: SWP's share of San Luis Reservoir is full or projected to fill in the near term; other SWP reservoirs are full or at their storage targets, or conveyance capacity to fill these reservoirs is maximized; releases from upstream reservoirs plus unregulated inflow exceed the water supply needed to meet Sacramento Valley in-basin uses; SWP Table A deliveries are being fully met; and Banks Pumping Plant has spare capacity.

Vulnerability of Delta Levees for Failure

Delta levees provide constant protection from flooding because most lands in the Delta are below sea level. Most of the Delta's levees, however, do not meet modern engineering standards and are highly susceptible to failure. Levees are subject to failure at times of high flood flows, but also at any time of the year due to seepage or the piping of water through the levee, slippage or sloughing of levee material, or sudden failure due to an earthquake. According to the URS Corp./Jack R. Benjamin & Associates report, *Draft Summary Report, Phase 1: Risk Analysis, Delta Risk Management Strategy (DRMS)*, June 2007, the risk of levee failure in the Delta is significant, as shown by the fact that virtually all levees in the Delta have failed at least once over the past 100 years, with about half failing at least twice. Since 1900, there have been 166 levee failures.

A breach of one or more levees and island flooding will affect Delta water quality and water operations. Depending on the hydrology and the size and locations of the breaches and flooded islands, a significant amount of saline water may be drawn into the interior Delta from Suisun and San Pablo bays. At the time of island flooding, exports may be drastically reduced or ceased to evaluate the salinity distribution in the Delta and to avoid drawing higher saline water toward the pumps. The introduced salinity then could become dispersed and degrade Delta water quality for a prolonged period because of complex relationships between Delta inflows, tidal mixing, and the time taken to repair the breaches.

A large earthquake in the Delta causing signif-

cant levee failures and island flooding could lead to multiyear disruptions in water supply, significant water quality degradation, as well as permanent flooding of several islands. Such permanent multi-island flooding would probably lead to increased salt water intrusion into the Delta during seasonal low inflows. Maintaining Delta water quality when several islands are flooded and breaches are open would require additional Delta inflow because the volume of water coming into the Delta on the flood tide would increase, requiring more fresh water from the rivers to prevent the saline water from extending into the Delta. When SWP and CVP pumping is restarted, Delta inflow would need to increase again beyond the pumping amount in order to prevent water quality degradation in the Delta. This chain of events would significantly affect water supply reliability by limiting pumping and requiring additional reservoir releases to generate the needed higher Delta inflows. A worst case scenario for water supply impacts would be a moderate or large earthquake causing extensive levee failure in the late summer or fall of a dry year.

The levee break on Middle River and subsequent flooding of Upper Jones Tract in 2004 is a small-scale example of this phenomenon. Following the break, Delta pumping was curtailed for several days to prevent seawater intrusion. Water shipments down the California Aqueduct were continued through unscheduled releases from San Luis Reservoir. Also, Shasta and Oroville reservoir releases were increased to provide for salinity control in the Delta.

A growing concern about the long-term viability of the Delta's levee system led to the initiation of the Delta Risk Management Strategy (DRMS).

Delta Risk Management Strategy

The 2000 CALFED Record of Decision presented its Preferred Program Alternative to help fix the Delta that described actions, studies, and decisions contingent upon subsequent environmental and engineering analyses. Included in the Stage 1 implementation of the preferred alternative was the completion of a Delta Risk Management Strategy (DRMS) that would look at sustainability of the Delta and assess major risks to the Delta resources from floods, seepage, subsidence, and earthquakes. DRMS would also evaluate the consequences and develop recommendations to manage the risk.

Assembly Bill 1200, passed in 2005, directs DWR to evaluate the potential effects of subsidence, earthquakes, floods, and climate change to Delta-based water supply. After determining principal options for the Delta, DWR must then evaluate each option according to its ability to prevent the disruption of water supplies from the Delta, improve the water quality of drinking water supplies from the Delta, and maintain Delta water quality for Delta users. By providing important information on levees in the Delta and Suisun Marsh, the DRMS Project is intended to support other major studies and initiatives including the Delta Vision initiative, the Bay Delta Conservation Plan, and the CALFED End of Stage 1 Assessment.

DWR defined Phase 1 of DRMS as the risk analysis of levee failures and associated potential economic, environmental, and public health and safety impacts and Phase 2 as the development and evaluation of strategies to reduce risks from levee failures. Risk analysis includes the likely occurrence of earthquakes of varying magnitudes in the region, future rates of subsidence given continued farming practices, the likely magnitude and frequency of storms, and the potential effects associated with global climate change (sea level rise, climate change, temperature change). Estimated risks to the Delta were made for 50-, 100-, and 200-year projections since risk can be expected to increase with time.

One reason for conducting a risk analysis is to quantitatively consider the uncertainties that relate to the performance of levees. Sources of uncertainty that affect any analysis can be fundamentally different. Events in nature such as precipitation are inherently random and this uncertainty cannot be reduced by simply collect-

ing more information; rather, this uncertainty can be predicted in terms of probability.

The Draft DRMS Phase 1 Report looked at several hazards to levees: seismic events that cause levee failures, flood flows that can overtop levees or cause levee failure by increased pressure and seepage, undetected problems during non-flood flow periods, and erosion due to high wind waves. The level of risk of failure of Delta levees was determined by considering: the frequency of different magnitudes of hazards that can challenge the integrity of Delta levees, how vulnerable different levee reaches are to hazards, how hazards and levee vulnerabilities combine to produce levee failure, and the economic and ecosystem impacts due to levee failure. The analysis assumes that existing regulatory and management practices will continue.

Potential Interruption/Disruption of SWP Deliveries Due to Earthquakes A strong earthquake affecting the Delta could cause simultaneous levee failures on several islands, and there is a real possibility of several simultaneous island flooding. DRMS considered scenarios that consisted of different combinations of flooded islands, ranging from one island to 30 islands flooded. **Table 4.1** summarizes impacts of various scenarios of island flooding associated with a single seismic event as presented in the URS/Jack R. Benjamin & Associates report, *Draft Summary Report, Phase 1: Risk Analysis, Delta Risk Management Strategy (DRMS)*, June 2007.

Preliminary analysis indicates that some water may not be treatable by municipal agencies for many months beyond those listed in **Table 4.1** due to high organic carbon concentrations. This would extend the period that Delta water supply would be unavailable for urban users.

Key findings of the Draft Phase 1 DRMS report on possible impacts on SWP deliveries due to earthquakes are:

- When the probability of all seismic levee breaches under existing conditions is considered, about 115 levee failures can be expected during 100 years.
- There is about a 28 percent chance of 30 or more islands simultaneously failing during a major earthquake in the next 25 years.
- A moderate to large earthquake capable of causing multiple levee failures could happen in the next 25 years. Under such an earthquake, extensive levee failure would most likely occur in the west and central Delta. Levee repairs could take up to 6.5 years and exports from the Delta could be disrupted for up to two years with a loss of up to 9.3 maf of water.
- By 2050, the frequency of island flooding from seismic events is expected to increase by 12 percent over 2005 conditions, if a seismic event has not occurred.

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specific numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Table 4.1 Expected impact on Delta exports due to salinity intrusion from various seismic events

Seismic Case	Flooded islands	Months to repair levees	Months without pumping	Water not exported (maf)
1	1	up to 20	up to 2	up to 0.7
2	3	19	1 to 3	0.1 to 1.0
3	3	23	1 to 4	0.1 to 1.2
4	10	45	2 to 10	0.7 to 2.5
5	20	62	11 to 21	6.3 to 6.5
6	30	81	16 to 23	6.5 to 9.3

Potential Interruption/Disruption of SWP Deliveries Due to Floods During an average year, about 85 percent and 10 percent of the total Delta inf ow comes from the Sacramento and San Joaquin rivers respectively. The remaining Delta inf ow primarily comes from three eastside tributaries. Inf ow from the Sacramento and San Joaquin rivers depends on reservoir releases, precipitation, and snowmelt. Over the long-term, many dif erent combinations of high f ood f ows in the Sacramento and San Joaquin rivers are possible because of the large geographical extent of the two rivers' watersheds and the variability in storm paths. DRMS considered magnitude and frequency of f ooding in dif erent parts of the Delta from different sources to evaluate the probability of these high f ows. This approach allows the inclusion in the risk analysis of f oods that, while possible, are larger than have been historically recorded. The DRMS report views an analysis which relies only on historical data as likely to underestimate risk.

Potential disruption of Delta exports due to f oods and levee failures would depend on the number of f ooded islands, the timing and size of the f ood f ows, and the water quality in the Delta and Suisun Bay at the time of the f ood. However, during such high f ows, there would normally be little or no impact on water quality on the exports due to levee failures and DRMS assumes no signif cant ef ect on Delta exports.

Key f ndings of the Draft Phase 1 DRMS report on possible impacts on SWP deliveries due to f ood f ows are:

- By 2050, Delta f ood hazard is expected to increase 200 percent due to sea level rise and more frequent high f ows.
- By 2050, the frequency of island f ooding from f oods is expected to increase over 2005 conditions.
- By 2050, f ood fragility of levees is expected to increase 10 percent due to subsidence, and overall Delta island f ood frequency is expected to increase 230 percent.
- By 2050, the frequency of f oods is expected to increase by 50 percent and levees are expected to become 20 percent more vulnerable to f ooding due to increased seepage and stability problems associated with more subsidence and sea level rise.
- By 2050, the combined ef ects of increased levee vulnerability and f ood f ows indicates an 80 percent expected increase in island f ooding from f ood f ows.

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specif c numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Potential Interruption/Disruption of SWP Deliveries Due to "Sunny Day" Event A "sunny day" levee failure is a failure that occurs during non-f ood times and is not caused by an earthquake. Possible causes of levee failure include wave action, animal activity, and seepage. DRMS reports that, on average, there will be about 5.4 sunny-day breaches with 50 years of exposure in the Delta. These types of levee failures are not expected to involve the potential of simultaneous multilevee events as could happen with high f ood f ows and a large earthquake.

Combined Potential Interruption/Disruption of SWP Deliveries DRMS evaluated combined risk of levee failure due to earthquakes, f oods, and "sunny day events" as well as how risks may change in the future. Key f ndings by DRMS are:

- Taking into account the probability of all levee breaches from all hazards under 2005 conditions, the number of levee failures in the Delta can be expected to about double over the next 100 years.
- Levee hazards are expected to grow in the future due to such factors as sea level rise and more frequent f ood f ows that will put more pressure on the levees.

- The overall likelihood of a major Delta event causing extensive levee failure is increasing as is the magnitude of the consequences from a given event.
- There is a possible range of sea level rise of from 0.7 to 4.6 feet over the next 100 years, depending on the assumed future greenhouse gas emissions and the forecast model used. Current estimates by the Intergovernmental Panel on Climate Change indicate that sea level will rise from 0.6 to 1.9 feet over the next 100 years. The CALFED Independent Science Board (ISB) has recommended that planning that incorporates sea level rise, should use the full range of variability of 20-55 inches.

The Draft DRMS Phase 1 report is being reviewed as recommended by the CALFED Independent Science Board evaluation of the draft report. Based on the review conducted to date the specific numbers in the Draft Phase 1 report may change but the overall conclusions of the report are not likely to change.

Emergency Operations Plan

As part of its efforts to reduce impacts to the SWP should a levee failure occur, DWR has initiated the development of an Emergency Operations Plan (EOP). This plan will provide procedures for emergency preparedness and incident management typically necessary for a jurisdiction or organization with emergency response roles and responsibilities. While DWR has current general procedures for emergency response, the EOP will ultimately enhance the state's ability to prepare for, respond to, and recover from a Delta levee failure disaster and will provide DWR with a plan focused specifically on a catastrophic levee failure disaster. The EOP will be a blueprint for coordinating the protection of life and property with its local, state, and federal partners in taking the steps necessary to protect the state's water system.

DWR has completed the first of two phases of engineering design work intended to enhance the state's ability to respond to large-scale levee failures or floods in the Delta. In the first phase, DWR conducted a discovery process to analyze previously developed plans and procedures and to identify current DWR capabilities for response to emergencies and disasters in the Delta. This phase included: developing plans to determine the quantity and gradation of rock needed to repair several levee breaches and block certain river channels to minimize salinity intrusion into the interior of the Delta, securing strategic joint stockpile-transfer facilities, completing design requirements and contracting for the construction of a new belt conveyor system, and establishing new procurement contracts for rock to be placed at the stockpile-transfer facilities. Through this process, DWR has categorized response actions that can be taken to reduce the impact of a Delta levee failure disaster. The first phase, now complete, has resulted in a DWR report, *Delta Emergency Operations Plan Concept Paper April 2007*. This report can be accessed at **http://www.dfm.water.ca.gov/er/**.

In the second phase, DWR will engage its partners in local, state, and federal government, and in the private sector, to develop a detailed EOP for responding to levee failure events, stabilizing the system, and facilitating recovery. The EOP will be consistent with and in compliance with California's Standardized Emergency Management System (SEMS)[2] and with the National Incident Management System (NIMS)[2]. By developing the EOP, DWR will improve preparedness capabilities for response and recovery.

[2]/ SEMS is an emergency management system required by California Government Code Section 8607(a) for managing incidents involving multiple jurisdictions and agencies. NIMS is a nationwide, federal emergency management approach, for managing incidents with all levels of government, private-sector, and nongovernmental organizations working together. For more SEMS/NIMS information, please visit: **www.oes.ca.gov.**

General Approach for Assessing SWP Delivery Reliability

5

CalSim II, a computer model jointly developed by DWR and U.S. Bureau of Reclamation, simulates much of the water resources infrastructure in the Central Valley and Delta region of California. CalSim II models all areas that contribute f ow to the Delta. The geographical coverage includes the Sacramento River Valley, the San Joaquin River Valley, the Sacramento-San Joaquin Delta, the Upper Trinity River, and the CVP and SWP service areas. CalSim II simulates operation of the CVP-SWP system using a monthly time step. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over this period.

General Solution Techniques and Incorporating Operational Constraints

CalSim II routes water through a CVP-SWP system network representation. The network includes more than 300 nodes and over 900 arcs, representing 24 surface reservoirs and the interconnected f ow system. The physical description of the system is expressed through a user interface with tables outlining the system characteristics. CalSim II uses logic for determining deliveries to north-of-Delta and south-of-Delta CVP and SWP contractors. The delivery logic uses runof forecast information, which incorporates uncertainty and standardized rule curves (i.e., Water Supply Index versus Demand Index Curve). The rule curves relate forecasted water supplies to deliverable demand, and then use deliverable demand to assign subsequent delivery levels to estimate the water available for delivery and carryover storage. Updates of delivery levels occur monthly from January 1 through May 1 for the SWP and March 1 through May 1 for the CVP as runof forecasts become more certain. The south-of-Delta SWP delivery is determined based on water supply parameters and operational constraints. The CVP system-wide delivery and south-of-Delta delivery are also determined using water supply parameters and operational constraints with specif c consideration for export constraints.

Hydrology

The historical f ow record is adjusted for the inf uence of land-use change and upstream f ow regulation in order to represent the possible range of water supply conditions. The hydrology used by CalSim II was developed jointly by DWR and U.S. Bureau of Reclamation. Water diversion requirements (demands), stream accretions and depletions, rim basin inf ows, irrigation ef ciency, return f ows, non-recoverable losses, and groundwater operation are components that make up the hydrology used by CalSim II. Sacramento Valley and tributary basin hydrologies are developed using a process designed to adjust the historical sequence of monthly stream f ows to represent a sequence of f ows at a future level of development. Adjustments to historical water supplies are determined by imposing future level land use on historical meteorological and

hydrologic conditions. San Joaquin River basin hydrology is developed using fixed annual demands and regression analysis to develop flow accretions and depletions. The resulting hydrology represents the water supply available from Central Valley streams to the CVP and SWP at a future level of development. Groundwater has only limited representation in CalSim II. This resource is modeled as a series of interconnected lumped-parameter basins. Groundwater pumping, recharge from irrigation, stream-aquifer interaction and interbasin flow are calculated dynamically by the model.

Demands

SWP demands are preprocessed independent of CalSim II and vary according to the specified scenario (e.g., 2007, 2027) and according to hydrologic conditions. Agricultural land-use-based demands are calculated from an assumed cropping pattern and a soil moisture budget. Urban demands are typically set to contract amount, but with reductions in wet years based on recent historical data. Both land-use-based demands and estimated contract amounts serve as upper bounds on deliveries. Environmental demands such as minimum reservoir storage requirements, minimum in-stream flows and deliveries to national wildlife refuges, and wildlife management areas are as stipulated in current regulatory requirements and discretionary interagency agreements.

Meeting Delta Water Quality Standards

CalSim II uses DWR's Artificial Neural Network (ANN) model to simulate the flow-salinity relationships for the Delta. The ANN model correlates DSM2 model-generated salinity at key locations in the Delta with Delta inflows, Delta exports, and Delta Cross Channel operations. The ANN flow-salinity model estimates electrical conductivity at the following four locations for modeling Delta water quality standards: Old River at Rock Slough, San Joaquin River at Jersey Point, Sacramento River at Emmaton, and Sacramento River at Collinsville. In its estimates, the ANN model considers antecedent conditions up to 148 days, and considers a "carriage-water" type of effect associated with Delta exports.

CalSim II Priorities in Water Deliveries

CalSim II allocates water according to the four priorities shown in **Table 5.1**. Highest priority is given to prior-right water users, minimum in-stream flow requirements and water quality requirements. While CVP and SWP contractor deliveries take precedence over next year's storage, a balance between the two is struck in the allocation decision to ensure that enough water is left in storage at the end of the year in case of impending drought.

SWP Table A and Article 21 Deliveries

The CalSim II simulations in this report estimate SWP delivery amounts for SWP Table A and Article 21. As mentioned in Chapter 2, SWP Table A is the contractual method for allocating available supply, and the total of all maximum SWP Table A amounts for deliveries from the Delta is 4.133 million acre-feet (maf) per year. Article 21 refers to a provision in the contract for delivering water that is available in addition to SWP Table A amounts. (See Appendices A and B for more discussion.) Article 21

Table 5.1 CalSim II water use prioritization

1	Prior-right water users, minimum in-stream flow requirements, water quality requirements
2	SWP Table A contractors, CVP contractors
3	Reservoir storage for the next year (carryover)
4	SWP Article 21 deliveries

of SWP contracts allows contractors to receive additional water deliveries only under specif c conditions. These conditions are:

1. The water is available only when it does not interfere with SWP Table A allocations and SWP operations;
2. The water is available only when excess water is available in the Delta;
3. The water is available only when conveyance capacity is not being used for SWP purposes or scheduled SWP deliveries; and
4. The water cannot be stored in the SWP system. In other words, the contractors must be able to use the Article 21 water directly or be able to store it in their own system.

Water supply under Article 21 becomes available only during wet months of the year, generally December through March. Because an SWP contractor must have an immediate use for Article 21 supply or a place to store it outside of the SWP, not all SWP contractors can take advantage of this additional supply.

The importance of Article 21 water to local water supply is tied to how each contractor uses its SWP supply. For those SWP contractors who are able to store their wet weather supplies, Article 21 supply can be stored by being put directly into a reservoir or by of setting other water that would have been withdrawn from storage, such as local groundwater. In the absence of storage, Article 21 water is not likely to contribute signif cantly to local water supply reliability. Incorporating supplies received under Article 21 into the assessment of water supply reliability is a local decision based on specif c local circumstances, facts, and level of water supply reliability required. This report presents information on Article 21 water separately so local agencies can determine whether it is appropriate to incorporate this supply into their analyses.

CalSim II Performance

Some of the comments to the *Draft 2003 SWP Delivery Reliability Report* expressed concern about the accuracy of CalSim II and the credibility of conclusions about SWP delivery reliability that are based on CalSim II simulations. In order to respond to these concerns, DWR conducted several CalSim II studies. In one study, results from a CalSim II simulation using historical input from 1975 to 1998 were compared to historical operations. This study is documented in the report, *CalSim-II Simulation of Historical SWP/CVP Operations, Technical Memorandum Report, November 2003* and was provided in Appendix E of the *2005 SWP Delivery Reliability Report*. In a second study, a sensitivity analysis was performed to quantify the ef ects of various inputs on CalSim II results. Two performance measures were used, a Sensitivity Index and Elasticity Index, to quantify the sensitivity of 12 model output responses to 12 dif erent model input parameters. This sensitivity study was also provided in Appendix E of the *2005 SWP Delivery Reliability Report*.

In a follow-up study, DWR staf conducted a more detailed analysis of the sensitivity results, focusing on the delivery reliability of SWP system. The results of this analysis are documented in an internal memorandum report, dated April 30, 2007. The purpose of this analysis was to assist SWP contractors and other interested parties in evaluating the impact of model input parameters on SWP deliveries (SWP Delta deliveries, SWP north-of-Delta deliveries, and SWP deliveries under Article 21) with respect to a selected subset of input parameters. This memorandum report is available via the internet at **http://baydeltaof ce.water.ca.gov/** by clicking on the announcement of the *Draft 2007 SWP Delivery Reliability Report* under "Items of Interest."

Recent Improvements to CalSim II Simulations

The SWP operation simulations in this report use the CalSim II model developed for the 2004 Long-Term Central Valley Project Operations Criteria and Plan (OCAP) that was then modified specifically for these studies. In addition to the modifications needed for the 2007 U.S. District Court Judge Oliver Wanger's decision, the 2004 OCAP version was modified to include the improvements listed below. A complete list of model assumptions is included in Appendix A. The new enhancements to CalSim II are:

- **Improved representation of the San Joaquin River Basin** The previous San Joaquin River Basin representation was replaced by the San Joaquin River Water Quality Module version 1.00 (SJRWQM) developed by U.S. Bureau of Reclamation Mid-Pacific Region. The SJRWQM is an update to previous versions that has gone through extensive agency review and a formal peer review.

- **Improved modeling of flow-salinity relationships in the Delta** The previous Artificial Neural Network (ANN) used to estimate flow-salinity relationships has been replaced with a newer more accurate version. The new ANN and its accompanying implementation to the CalSim II model produces salinities that match more closely the Delta Simulation Model 2 (DSM2) salinities.

- **An extended hydrologic sequence** The Hydrologic sequence of 74 simulated years has been extended to 82 years, from water years 1922 through 1994 to water years 1922 through 2003.

Assessment of Present and Future SWP Delivery Reliability

6

CalSim II simulations were conducted to evaluate current (2007) SWP delivery reliability and incorporate actions to protect delta smelt defined by the 2007 federal court ruling. Simulations to evaluate future (2027) SWP delivery reliability incorporate the current interim court-ordered operating rules related to delta smelt and a range of possible climate change impacts to hydrology in the Central Valley. The interim operating rules for delta smelt are simulated at both a more-restricted level and a less-restricted level for Delta exports to provide a range of estimated water deliveries. Therefore, for 2007, two studies are conducted. For 2027, 10 simulations are used to reflect the four assumed scenarios for climate change and the two levels of operation rules. By using these interim court-ordered operating rules in the studies, DWR is not making an assumption about the results of the ongoing discussions to revise the delta smelt Biological Opinion. The studies are simply an indication of the near-term impacts of these interim operating rules. An update of this report for 2009 will be done using operating rules defined by the revised delta smelt Biological Opinion.

Results of these updated CalSim II simulations are presented alongside results from the *2005 SWP Delivery Reliability Report* to help identify and explain impacts to delivery reliability due to actions to protect delta smelt and future climate change. At the end of the chapter, the information is presented in a way to easily compare the estimated SWP deliveries under Current (2007) Conditions to those under Future (2027) Conditions.

This chapter contains tables summarizing the updated estimated delivery amounts of the studies for the entire study period (1922-2003), dry years, and wet years and presents information on the estimated probability of SWP Table A delivery amounts currently and 20 years in the future. While two CalSim II simulations were made to estimate current delivery reliability (bookends for delta smelt protection) and 10 simulations were made to estimate future delivery reliability (combinations of flow constraints and climate change scenarios), simulation results in this chapter for Future (2027) Conditions are presented in terms of ranges in values for ease of analysis. The annual values for SWP deliveries estimated by all the CalSim II simulations are listed in tables in Appendix B. These tables also show the annual SWP Table A demands assumed for each study.

The results indicate potentially significant differences between the updated studies and studies done for the 2005 report under both current and future conditions for estimated deliveries during multiple-year dry periods. In general, updated estimates of both current and future SWP Table A deliveries are less than the deliveries presented in the 2005 report, particularly during multiple dry years. For a given probability of exceedence, current and future SWP Table A deliveries are also less than were presented in the 2005 report. For future conditions, the probability of an annual SWP Table A delivery exceeding 1.7 maf is substantially less than was presented in the 2005 report. The updated studies show generally higher SWP Table A deliveries under Future (2027)

Conditions compared to Current (2007) Conditions, but decreases in deliveries in the future are possible during multiple dry year periods, depending on which climate change scenario is assumed. In comparison, the 2005 report showed more frequent and greater increases in future deliveries.

Assessment of SWP Delivery Reliability under Current (2007) Conditions

Current Conditions refer to those conditions believed in effect in 2007. These conditions, described below, include Old River and Middle River flow targets from the current court-ordered interim operating rules. Results from CalSim II simulations for the *2005 SWP Delivery Reliability Report* under the 2005 study are presented throughout this section for comparison. Appendix A presents a detailed list of the study assumptions for this report.

Availability of Source Water

The 2005 level of development (level of water use in the source areas) is assumed representative of 2007. The hydrologic sequence of simulated years is based on historical precipitation and runoff patterns and is from water years 1922 through 2003. The hydrologic sequence for the 2005 report is shorter, from water years 1922 through 1994. For comparison purposes, these differences are not significant.

Demand for Delta Water

The SWP Table A demands for deliveries from the Delta assumed for 2007 are shown in **Table 6.1**. The assumed demands for the studies were developed in discussions with SWP water contractors and stakeholders involved in the development of the analyses associated with DWR's 2007 document, *Draft Environmental Impact Report: Monterey Amendment to the State Water Project Contracts (Including Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)*. A range in SWP Table A demands is shown because the demand is assumed to vary each year with the weather.

Table 6.1 presents key demand values. Differences between the values in updated studies and the 2005 study in the 2005 report are due to the longer simulation period for the current report. SWP Article 21 demands for water are the same as assumed in the *2005 SWP Delivery Reliability Report* and are shown in **Table 6.2**.

Ability to Convey Source Water to the Desired Point of Delivery

The CalSim II simulations assume that current Delta water quality regulations (contained in the

Table 6.1 SWP Table A demands from the Delta under Current Conditions

Study of Current Conditions	Average Demand		Maximum Demand		Minimum Demand	
	taf /year	maximum SWP Table A[1]	taf /year	maximum SWP Table A[1]	taf /year	maximum SWP Table A[1]
2005 SWP Delivery Reliability Report, Study 2005	3290	80%	3862	93%	2321	56%
Updated Studies (2007)	3308	80%	3864	94%	2323	56%

[1]/ 4,133 taf /year.

Table 6.2 Article 21 demands from the Delta under Current Conditions

Study of Current Conditions	Average Article 21 demand (taf)		Total (taf/year)
	December - March	April - November	
2005 SWP Delivery Reliability Report, Study 2005	704	607	1311
Updated Studies (2007)	699	598	1297

State Water Resources Control Board's Decision 1641) are in place for the 2007 studies. The simulations also incorporate flow restrictions of the recent court-ordered interim operating rules related to delta smelt. Two CalSim II simulations were run to evaluate a lower level and a higher level of flow restrictions to give a range of potential SWP water delivery estimates. The specific rules for these flows are contained in **Table 6.3**. The lower- and higher-level restrictions are the same for Dec. 25 through Feb. 20 and April 15 through May 15. They are significantly different during Feb. 21 through April 14 and May 16 through June 30. Additional information on the characterization of the potential court decision in the model is found in Appendix A. The amount of exports allowed while achieving the Old River and Middle River flow targets are assumed shared equally between the CVP and the SWP. Combined CVP and SWP exports also are assumed constrained according to the June 30, 2004, Long-Term Central Valley Project Operations Criteria and Plan during April 15 to May 15. This operation is part of the Vernalis Adaptive Management Plan. The specific rules for this restriction are included in Appendix A.

The simulation of Current Conditions in the 2005 report also assumed D-1641 Delta standards and combined SWP and CVP pumping restrictions according to the 2004 Long-Term Central Valley Project Operations Criteria and Plan. However, the 2005 report assumed no Old River and Middle River flow targets.

Presentation of CalSim II Results

For the purpose of describing SWP deliveries under Current (2007) Conditions in this chapter, the annual deliveries from the two CalSim II simulations, which assumed a higher and a lower level of Old River and Middle River flow targets, are averaged. The annual SWP Table A and Article 21 deliveries for the two 2007 simulations are presented in Appendix B.

SWP Table A Deliveries under Different Hydrologic Scenarios

Table 6.4 contains the average, maximum, and minimum estimates of SWP Table A deliveries from the Delta under Current Conditions from the *2005 SWP Delivery Reliability Report* and under 2007 assumptions that include Old River and Middle River flow targets. As previously mentioned, SWP deliveries under 2007 conditions are the result of averaging annual deliveries from two scenarios of Old River and Middle River flow targets. The estimated probabilities for a given amount of annual SWP delivery under Current (2007) Conditions are presented in **Figure 6.1**.

Table 6.4 shows that under updated Current (2007) Conditions, average SWP delivery amounts may decrease 5 percent of maximum SWP Table A when compared to the earlier estimate, from 68 percent to 63 percent. Since SWP Table A demands are the same between the earlier and updated studies, this decrease in deliveries is primarily due to the Old River and Middle River flow targets to

Table 6.3 Old and Middle River flow target scenarios assumed in CalSim II studies

Period	Combined Average Old River and Middle River flow[1]	
	Less Restrictive	More Restrictive
Dec 25 – Jan 3	Less than 2,000 cfs flow upstream	Less than 2,000 cfs flow upstream
Jan 4 – Feb 20	Less than 5,000 cfs flow upstream	Less than 5,000 cfs flow upstream
Feb 21 – April 14	Less than 5,000 cfs flow upstream	Less than 750 cfs flow upstream
Apr 15 – May 15	No Old and Middle River flow constraint; VAMP controls exports	No Old and Middle River flow constraint; VAMP controls exports
May 16 – May 31	Less than 5,000 cfs flow upstream	Less than 750 cfs flow upstream
Jun 1 – Jun 30	Less than 5,000 cfs flow upstream	Less than 750 cfs flow upstream

[1]/ Where: OMR flow = (0.58 * flow at Vernalis) – (0.913 * total export)

protect delta smelt reducing the amount of Delta water available for export by the SWP. The maximum delivery of 93 percent for the 2005 study is reduced to 90 percent for the updated study. The estimate of minimum SWP Table A delivery actually increases slightly. This is primarily due to the larger amount of storage available in Lake Oroville at the beginning of the year. The higher amount of storage is due to the fish-protection restrictions on SWP Delta pumping for the previous year reducing the need to release water from Lake Oroville.

Table 6.5 includes estimates of SWP Table A deliveries for Current (2007) Conditions under an assumed repetition of historical drought periods. The years are identified as dry by the Eight River Index, a good indicator of the relative amount of water supply available to the SWP. The Eight River Index is the sum of the unimpaired runoff from the four rivers in the Sacramento Basin used to define water conditions in the basin plus the four rivers in the San Joaquin Basin, which correspondingly define water conditions in that basin. The eight rivers are the Sacramento, Feather, Yuba, American, Stanislaus, Tuolumne, Merced, and San Joaquin. **Table 6.5** also includes the average deliveries for comparison purposes. Once again, deliveries under Current (2007) Conditions are the result of averaging annual deliveries from two scenarios of Old River and Middle River flow targets.

Table 6.5 shows that estimates of updated SWP deliveries under Current (2007) Conditions during dry periods are less than were earlier estimated. SWP deliveries may be reduced to 34 percent of maximum SWP Table A during the two-year drought of 1976-1977. The six-year drought of 1987-1992 is estimated to provide 35 percent of maximum SWP Table A, a reduction of 289 taf/year when compared to the 2005 estimate. The four-year drought of 1931-1934 is an exception with SWP deliveries estimated to increase 3 percent of maximum SWP Table A, from 32 percent to 35 percent.

Table 6.6 summarizes SWP Table A deliveries under an assumed repetition of historical wet periods under Current (2007) Conditions. As with drought years, the Eight River Index is used to identify wet years. **Table 6.6** shows that estimates of SWP

Table 6.4 SWP Table A delivery from the Delta under Current Conditions

Study of Current Conditions	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]
2005 SWP Delivery Reliability Report, Study 2005	2818	68%	3848	93%	159	4%
Updated Studies (2007)[3]	2595	63%	3711	90%	243	6%

[1]/ 4,133 taf /year
[2]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[3]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3.

Table 6.5 Average and dry period SWP Table A deliveries from the Delta under Current Conditions

Study of Current Conditions	SWP Table A delivery from the Delta (in percent of maximum SWP Table A[1])					
	Long-term Average[2]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Delivery Reliability Report, Study 2005	68%	4%	41%	32%	42%	37%
Updated Studies (2007)[3]	63%	6%	34%	35%	35%	34%

[1]/ 4,133 taf /year
[2]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[3]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3

deliveries under updated Current (2007) Conditions do not signif cantly change from earlier estimates during wet years. Decreases in SWP deliveries for these wet periods generally range from 0 to 2 percent of maximum SWP Table A (0 to 83 taf/year).

Article 21 Deliveries under Different Hydrologic Scenarios

State Water Project water delivery is a combination of both SWP Table A deliveries and the use of Article 21 by some contractors to store water locally at times when extra water and capacity is available beyond that needed by normal SWP operations. **Table 6.7** contains the average, maximum, and minimum SWP Article 21 deliveries over the 1922-1994 period for the earlier study and the 1922-2003 period for the updated simulations. Comparing the estimates of SWP Article 21 deliveries, the updated estimates show signif cantly less delivery amounts on average and for maximum delivery over the simulation period. Estimated average Article 21 deliveries are 175 taf less under the updated Current (2007) Conditions than was estimated in the 2005 report. Estimated maximum Article 21 delivery is reduced 520 taf. These reductions are primarily due to the storage in San Luis Reservoir being lower in the 2007 studies. The reservoir is lower because Delta pumping is restricted by the court-ordered operation rules for delta smelt. To assure SWP Table A deliveries for the coming year are not reduced, the SWP portion of San Luis Reservoir must be very close to full, if not completely full, before Article 21 deliveries are made.

As noted above, water available for Article 21 occurs only in wet periods and it is dif cult to evaluate impacts except to look at specif c years. **Table 6.8** shows the updated and earlier estimates of Article 21 deliveries by year during dry periods. Under the updated current (2007) conditions, Article 21 deliveries are estimated to be signif cantly reduced during the dry periods 1929-1934, 1976-1977, and 1987-1992.

Table 6.9 shows the updated and earlier estimates of Article 21 deliveries by year during the 1978-1987 wet period. Under Current (2007) Conditions, updated estimated Article 21 delivery can decrease up to 550 taf in an individual year, compared to earlier estimates. In only one year, 1980, does the estimated Article 21 deliveries increase when compared to earlier estimates.

Table 6.6 Average and wet years SWP Table A delivery from the Delta under Current Conditions

Study of Current Conditions	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Long-term Average[1]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Delivery Reliability Report, Study 2005	68%	60%	65%	69%	75%	72%
Updated Studies (2007)[2]	63%	60%	66%	68%	73%	71%

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[2]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3

Table 6.7 Annual SWP Article 21 delivery from the Delta under Current Conditions

Study of Current Conditions	Average delivery[1] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Delivery Reliability Report, Study 2005	260	1110	0
Updated Studies (2007)[2]	85	590	0

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[2]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3

SWP Table A Delivery Probability

The probability that a given level of SWP Table A amount will be delivered from the Delta is shown for Current (2007) Conditions in **Figure 6.1**. Results from the *2005 SWP Delivery Reliability Report* and updated estimates for 2007 are shown. Updated estimates of probability for Current (2007) Conditions are shown as a single line which results from ranking the averaged deliveries from the two scenarios of Old River and Middle

Table 6.8 Average and dry year SWP Article 21 delivery under Current Conditions (taf per year)

Year	*2005 SWP Reliability Report*, Study 2005	Updated Studies (2007)[2]
1929	0	0
1930	120	0
1931	0	0
1932	240	0
1933	510	40
1934	210	0
1976	190	5
1977	0	0
1987	550	0
1988	0	0
1989	0	0
1990	0	0
1991	0	0
1992	0	0
Long-term average[1]	260	85

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[2]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3

Table 6.9 Average and wet year SWP Article 21 delivery under Current Conditions (taf per year)

Year	*2005 SWP Reliability Report*, Study 2005	Updated Studies (2007)[2]
1978	300	100
1979	160	0
1980	140	190
1981	550	0
1982	800	490
1983	400	400
1984	550	460
1985	0	0
1986	120	30
1987	550	0
1978-87 Average	360	170
Long-term Average[1]	260	85

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2007)
[2]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3

River flow targets. Probability values for each of these two scenarios are presented in Appendix B. To use **Figure 6.1**, one would first locate the percent exceedence of interest along the horizontal axis (x-axis) of the graph, move vertically upward to the curve, then horizontally to the vertical axis (y-axis) and read the annual delivery. For example, for an 80 percent exceedence, corresponding annual SWP Delta deliveries would be 2,277 taf from previous estimates and 1,990 taf for the updated estimates. The numerical data for this figure is included in Appendix B and should be referenced for specific values corresponding to specific exceedences.

Figure 6.1 shows that under Current (2007) Conditions, for probabilities of exceedence above 40 percent, updated annual SWP Table A deliveries can be 250 taf to 500 taf less than the earlier estimates. Annual SWP Table A deliveries associated with exceedences below 40 percent are much less different than the 2005 study. **Table 6.10** contains the values for SWP Delta deliveries corresponding to 25 percent, 50 percent, and 75 percent exceedence. The information in **Table 6.10** can be stated as follows: For any given year,

- There is a 25 percent chance that SWP deliveries will be at or above 3,218 taf.
- There is an equal chance that SWP deliveries will be above or below 2,976 taf.
- There is 75 percent chance that SWP deliveries will be above 2,168 taf. Another way to state this is that there is a 25 percent chance that deliveries will be below this value.

Impact on Total SWP Deliveries under Current (2007) Conditions Due to Flow Restrictions to Protect Delta Smelt

As previously discussed, the updated estimates of current SWP deliveries in this report incorporate

Figure 6.1 Average and wet years SWP Table A delivery from the Delta under Current Conditions

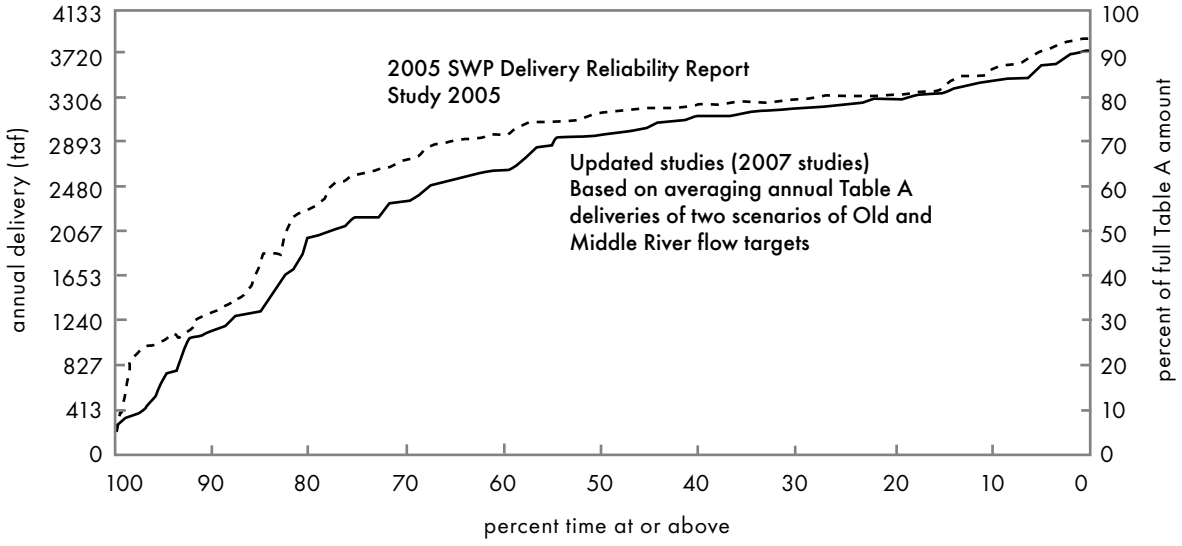


Table 6.10 Highlighted SWP Table A delivery percent exceedence values under Current Conditions

Exceedence	Annual SWP Table A Delivery (taf)		Reduction in delivery compared to 2005 report (taf)
	2005 SWP Reliability Report, Study 2005	Updated Studies (2007)[1]	
25%	3323	3218	105 (3%)
50%	3173	2976	197 (6%)
75%	2588	2168	420 (16%)

[1]/ Values reflect averaging annual deliveries from the two scenarios of Old and Middle River flow targets described in Table 6.3.

effects on SWP deliveries caused by new restrictions in Old River and Middle River flows ordered by the federal court in December 2007. **Tables 6.4, 6.5, 6.7, and 6.8** indicate that both SWP Table A and Article 21 deliveries under the updated studies tend to be less overall and in particular during dry periods compared to the results presented in the previous 2005 report. This section further characterizes the change in combined SWP Table A and Article 21 SWP deliveries due to the federal court order.

For the updated delivery estimates, CalSim II simulations were run assuming a lower level and a higher level of flow restrictions to give a range of potential SWP water delivery estimates. The lower- and higher-level restrictions are significantly different during Feb. 21 through April

Figure 6.2 Distribution of changes in total annual SWP deliveries under Current Conditions due to implementation of flow restrictions to protect delta smelt

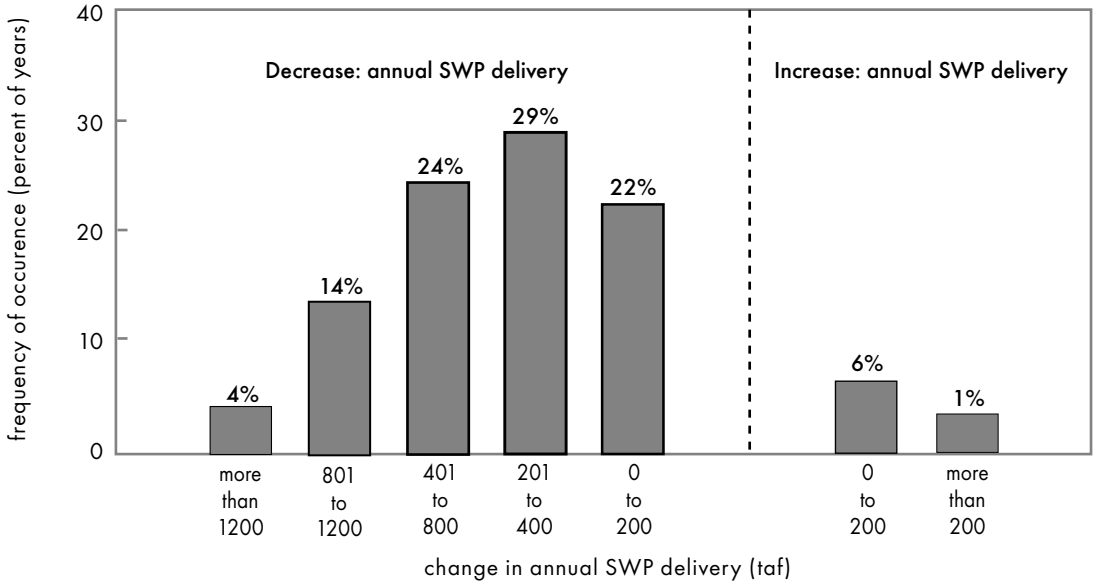
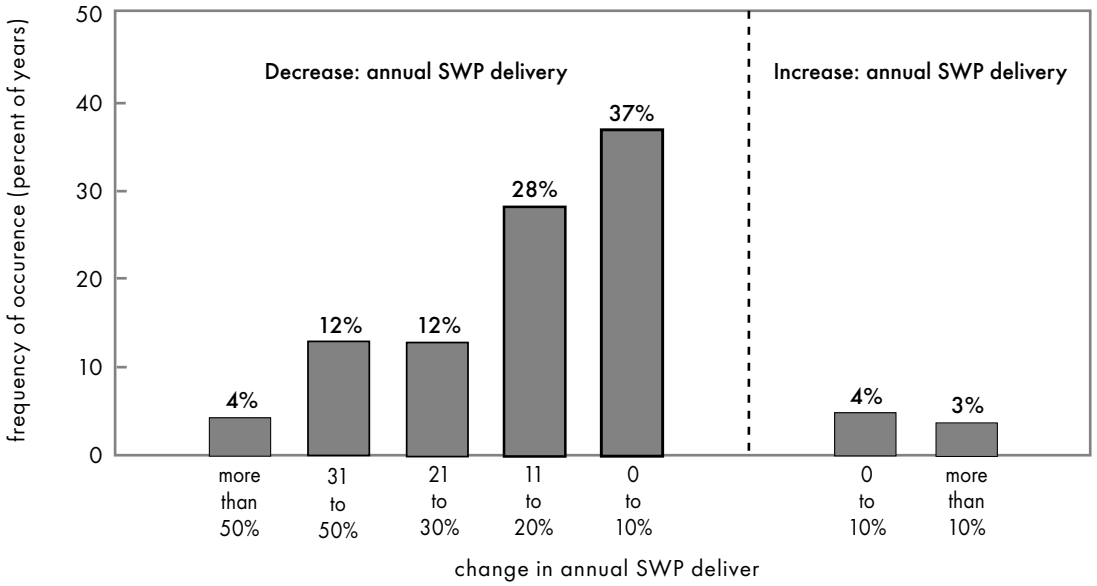


Figure 6.3 Distribution of percent changes in total annual SWP deliveries under Current Conditions due to implementation of flow restrictions to protect delta smelt



14 and May 16 through June 30. The specif c rules for these f ows are contained in **Table 6.3**. For presentation of combined SWP deliveries, annual SWP Table A and Article 21 deliveries from the two simulations are averaged.

Figures 6.2 and 6.3 show the distribution of changes in total annual SWP deliveries between updated estimates and estimates from the 2005 report over the common 1922 through 1994 simulation period. **Figure 6.2** shows the distribution of changes in total annual delivery in terms of thousand acre-feet and frequency of occurrence while **Figure 6.3** shows the distribution of changes in terms of percent change from the 2005 report estimates and frequency of occurrence. Any dif erences in SWP deliveries are nearly entirely due to the new f ow restrictions for delta smelt in the updated studies. The total annual SWP deliveries which are used to generate **Figures 6.2 and 6.3** are presented in **Table B.22**.

Figures 6.2 and 6.3 show that out of the 73 years of simulation (1922-1994), total annual SWP deliveries decrease 93 percent of the time under the updated estimates. Annual deliveries decrease from 0 to 400 taf over 50 percent of the time and from 401 taf to 1,200 taf 38 percent of the time. In terms of percent decrease in deliveries, total annual SWP deliveries decrease more than 30 percent 16 percent of the time.

Table 6.7 shows that, on average, Article 21 delivery is about 175 taf less under the 2007 study than under the 2005 study. When this is combined with the dif erence in average SWP Table A delivery projections presented in **Table 6.4**, the dif erence in total average SWP delivery is about 400 taf, for an overall decrease of about 13 percent in delivery capability from the 2005 to the 2007 study

Assessment of SWP Delivery Reliability under Future (2027) conditions

Future Conditions refer to conditions that are assumed in ef ect in the year 2027. These conditions as described below include ef ects of climate change and the same Old River and Middle River f ow targets that are assumed under Current (2007) Conditions. Results from the CalSim II simulation for the *2005 SWP Delivery Reliability Report* under 2025 future scenario (Study 2025) are presented throughout this section for comparison purposes. A detailed list of the study assumptions for this report is presented in Appendix A.

Availability of Source Water

DWR's 2006 report, *Progress on Incorporating Climate Change into Management of California's Water Resources*, evaluates possible future impact on California water supply through CalSim II simulations with hydrologic sequences that ref ect dif erent scenarios of climate change. The four climate change scenarios consist of two greenhouse gas emissions scenarios, A2 and B1, and two global climate models, the Geophysical Fluid Dynamic Lab model (GFDL) and the Parallel Climate model (PCM). The A2 emissions scenario assumes high growth in population, regional based economic growth, and slow technological changes, which collectively result in signif cantly higher greenhouse gas emissions. The B1 scenario represents low growth in population, global based economic growth, and sustainable development all of which results in a low increase in greenhouse gas emissions. Both the GFDL model and PCM predict future warming although the GFDL model indicates a greater warming trend than does the PCM. These four scenarios are assumed for the analysis in this report in order to generate the 82-year hydrologic sequence. It should be noted that these scenarios, although focusing on potential water supply conditions in 2050, include the assumption that water use in the water supply basins is at a 2020 level of development, not a 2050 level of development. In this respect, the studies span assumed temporal points of reference. They are, however, the best available estimates for future SWP water deliveries.

Demand for Delta Water

The SWP contractors' SWP Table A demands for deliveries from the Delta assumed for 2027 are shown in **Table 6.11**. The assumed demands for the studies were developed through discussions with SWP water contractors and stakeholders involved in the development of DWR's *Draft Environmental Impact Report (Draft EIR) for the Monterey Amendment to the State Water Project Contracts, including the Kern Water Bank Transfer and associated actions as part of a Settlement Agreement (Monterey Plus)*. Maximum and minimum SWP Table A demand is shown because the demand is assumed to vary each year with the weather. SWP Article 21 demands for water are the same as assumed in the 2005 SWP Delivery Reliability Report and are shown in **Table 6.12**.

Ability to Convey Source Water to the Desired Point of Delivery

One of the most signif cant assumptions regarding SWP conveyance is that the rules and facilities related to Delta conveyance will remain at the status quo. That is, no new facilities are assumed to be in place to convey water through, around, or through and around the Delta. As noted in Chapter 3, there are several processes under way to identify modif cations to the existing method of conveying water through the Delta to reduce the conf ict between f shery concerns and water supply reliability. However, these programs are not at a stage where such changes can be used in this report. The CalSim II simulations for 2027 scenarios assume the current Delta water quality regulations (contained in the State Water Resources Control Board's Decision 1641) are in place as well as the f ow restrictions for Old River and Middle rivers set forth in the federal court-ordered interim action related to delta smelt. The studies evaluate a lower level and a higher level of f ow restrictions to give a range of potential SWP water delivery estimates. The specif c rules for these f ows are contained in **Table 6.3**. The exports resulting from meeting Old River and Middle River f ow targets related to delta smelt are again assumed shared equally between the CVP and the SWP.

The simulation of Future Conditions in the 2005 report (Study 2025) also assumed D-1641 Delta water quality requirements and combined SWP and CVP pumping restrictions according to the 2004 Long-Term Central Valley Project Operations Criteria and Plan. It did not assume the f ow restrictions for Old River and Middle Rivers were in place.

To simulate the assumed 2027 conditions, 10 CalSim II simulations are needed: the two levels of f ow restrictions combined with four climate change scenarios and a scenario assuming no climate change. SWP deliveries derived from these 10 simulations were modif ed as explained below before

Table 6.11 SWP Table A demands from the Delta under Future Conditions

Study of Future Conditions	Average Demand		Maximum Demand		Minimum Demand	
	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]
2005 SWP Delivery Reliability Report, Study 2025	4110	99%	4133	100%	3898	94%
Updated Studies (2027)	4111	99%	4133	100%	3935	95%

[1]/ 4,133 taf /year.

Table 6.12 Article 21 demands from the Delta under Future Conditions

Study of Future Conditions	Average Article 21 demand (taf)		Total (taf)
	December - March	April - November	
2005 SWP Delivery Reliability Report, Study 2025	704	607	1311
Updated Studies (2027)	699	598	1297

being used to describe Future (2027) Conditions.

Presentation of CalSim II Results

For the purpose of describing SWP deliveries under Future Conditions in this chapter, the annual deliveries under the four scenarios of climate change simulated by CalSim II were adjusted to better estimate deliveries reflecting 2027 conditions. As previously mentioned, the climate change scenarios for Future Conditions assume projections of climate and hydrology for 2050. Currently, 2027 climate change projections are not available. In order to estimate SWP deliveries 20 years in the future with potential changes in climate, annual SWP deliveries were interpolated between deliveries from a CalSim II simulation of a particular climate change scenario under the low or high operation restrictions for Old River and Middle River flows and deliveries from the corresponding CalSim II simulation which assumes no climate change. All CalSim II simulations for Future Conditions assume a 2027 SWP demand level.

Each climate change scenario then consists of two sequences of modified (interpolated) SWP deliveries, one sequence for each of the two levels of Old River and Middle River flow targets. For each climate change scenario, these two sequences of annual deliveries were then averaged to yield a single sequence designed to reflect a climate change projection to 2027 with an averaged Old River and Middle River flow target operation. The following tables and graph of SWP Table A delivery probability are based on these four sequences of annual SWP deliveries. The annual SWP Table A and Article 21 deliveries for the 10 simulations on which the information in this section is based are presented in Appendix B.

SWP Table A Deliveries under Different Hydrologic Scenarios

Table 6.13 contains the average, maximum, and minimum estimates of SWP Table A deliveries from the Delta under Future Conditions from Study 2025 from the *2005 SWP Delivery Reliability Report* and under updated 2027 assumptions. The deliveries under 2027 conditions are shown as a range to account for the four climate change scenarios. The estimated probabilities for a given amount of annual SWP delivery under Future (2027) Conditions are presented in **Figure 6.4**.

Table 6.13 shows that under the updated Future (2027) Conditions, average SWP delivery amounts may decrease from 8 to 11 percent of maximum SWP Table A amounts compared to earlier estimates. Since SWP Table A demands are the same in the earlier and updated studies, this decrease in deliveries is primarily due to the incorporation of the Old River and Middle River flow targets related to delta smelt reducing the amount of Delta water available for export by SWP and the assumed hydrologic changes associated with climate change. The estimate of minimum annual SWP Table A delivery for the updated study ranges from 6 to 7 percent of maximum SWP Table A amounts.

Table 6.14 includes estimates of SWP Table A deliveries for a single-year and multiyear droughts. It also includes the average of the SWP Table A

Table 6.13 SWP Table A delivery from the Delta under Future Conditions

Study of Future Conditions	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]	taf / year	% of maximum SWP Table A[1]
2005 SWP Delivery Reliability Report, Study 2025	3178	77%	4133	100%	187	5%
Updated Studies (2027)[3]	2724–2850	66 – 69%	4133	100%	255–293	6 – 7%

[1]/ 4,133 taf /year
[2]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[3]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

deliveries for comparison purposes. Estimates of updated SWP deliveries under Future (2027) Conditions during dry periods can range 5 percent of maximum SWP Table A (32 percent to 37 percent for 1931-1934). This is a range of almost 210 taf/year. With the period 1931-1934 being the exception, all other multiyear droughts show reduced deliveries. The reductions range from 2 percent to 13 percent of maximum SWP Table A amounts, or from 83 taf/yr to 540 taf/yr.

Table 6.15 summarizes SWP Table A deliveries under an assumed repetition of historical wet periods under Future Conditions. As with drought years, the Eight River Index is used to identify wet years. The estimated deliveries for the updated future (2027) condition during wet periods do not generally range as much as those for the dry periods. The maximum range is 3 percent of maximum SWP Table A for the six-year and 10-year wet periods. This equates to a range of 120 taf/yr. Reductions in delivery amounts are signif cant for the four-, six-, and 10-year wet periods. For example, average annual SWP Table A deliveries decrease to a range of 86 to 87 percent of maximum SWP Table A for the 1980-1983 period. The estimate for the 2025 study for this period is 93 percent. This corresponds to a reduction of 250 taf/yr to 290 taf/yr.

Article 21 Deliveries under Different Hydrologic Scenarios

Table 6.16 contains the average, maximum, and minimum SWP Article 21 deliveries over the

Table 6.14 Average and dry period SWP Table A deliveries from the Delta under Future Conditions

Study of Future Conditions	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Long-term Average[1]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Delivery Reliability Report, Study 2025	77%	5%	40%	33%	42%	38%
Updated Studies (2027)[2]	66 – 69%	7%	26 – 27%	32 – 37%	33 – 35%	33 – 36%

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6.15 Average and wet period SWP Table A deliveries from the Delta under Future Conditions

Study of Future Conditions	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Long-term Average[1]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Delivery Reliability Report, Study 2025	77%	95%	97%	93%	93%	89%
Updated Studies (2027)[2]	66 – 69%	94%	97%	86 – 87%	84 – 87%	80 – 83%

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6.16 Annual SWP Article 21 delivery from the Delta under Future Conditions

Study of Current Conditions	Average delivery[1] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Delivery Reliability Report, Study 2025	120	550	0
Updated Studies (2027)[2]	30	410 – 420	0

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

1922-1994 period for earlier studies and the 1922-2003 period for the updated simulations of Future (2027) Conditions. Comparing the estimates of SWP Article 21 deliveries, the updated estimates show less delivery amounts on average and for the maximum annual delivery over the simulation period. Estimated average Article 21 deliveries are 90 taf less under updated Future (2027) Conditions than was estimated in the *2005 SWP Delivery Reliability Report*. Estimated maximum

Table 6.17 Average and dry year SWP Article 21 delivery under Future Conditions (taf per year)

Year	2005 SWP Reliability Report, Study 2025	Updated Studies (2007)[2]
1929	0	0
1930	140	0
1931	0	0
1932	110	0 – 40
1933	550	20 – 90
1934	240	0 – 10
1976	0	0
1977	0	0 - 10
1987	180	0
1988	0	0
1989	90	0
1990	0	0
1991	0	0
1992	100	0
Long-term Average[1]	120	30

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6.18 Average and wet year SWP Article 21 delivery under Future Conditions (taf per year)

Year	*2005 SWP Reliability Report*, Study 2025	Updated Studies (2027)[2]
1978	300	40 - 150
1979	140	0
1980	90	90 - 130
1981	70	0
1982	170	0
1983	360	270 – 290
1984	490	410 – 420
1985	0	0
1986	80	0 – 10
1987	180	0
1978-87 Average	190	90 – 100
Long-term Average[1]	120	30

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Article 21 delivery is reduced 120 to 130 taf.

Table 6.17 contains the estimates for Article 21 deliveries during historical dry periods. No Article 21 delivery is estimated for the lower range of the updated Future (2027) Conditions for any of the years. For the higher range, some Article 21 deliveries are shown for 1932 through 1934 and 1977. The availability of Article 21 deliveries during dry periods is greatly reduced in the analysis of the updated future (2027) condition.

Table 6.18 shows updated and earlier estimates of Article 21 deliveries by year during the 1978-1987 wet period. The availability of Article 21 deliveries is also reduced for this wet period. The average Article 21 delivery for the 1978 - 1987 period under Future (2027) Conditions ranges from 90 taf/yr to 100 taf/yr, compared to 190 taf/yr for the 2025 study.

SWP Table A Delivery Probability

The probability that a given level of SWP Table A amount will be delivered from the Delta is shown for Future (2027) Conditions in **Figure 6.4**. Results from both the 2025 study from the *2005 SWP Delivery Reliability Report* and the updated 2027 studies are shown. Probabilities for 2027 conditions are shown as a shaded area to reflect the range in SWP Table A deliveries resulting from the four climate change scenarios analyzed.

Figure 6.4 shows that under Future (2027) Conditions, for probabilities of exceedence under 80 percent, updated annual SWP Table A deliveries can be significantly less than the earlier estimates. For example, given a 60 percent time at or above, an earlier estimate of about 3,400 taf annually decreases to about 2,670 taf to 2,890 taf annually for the updated estimates. Displaying delivery

Figure 6.4 *SWP Table A* delivery probability under future conditions

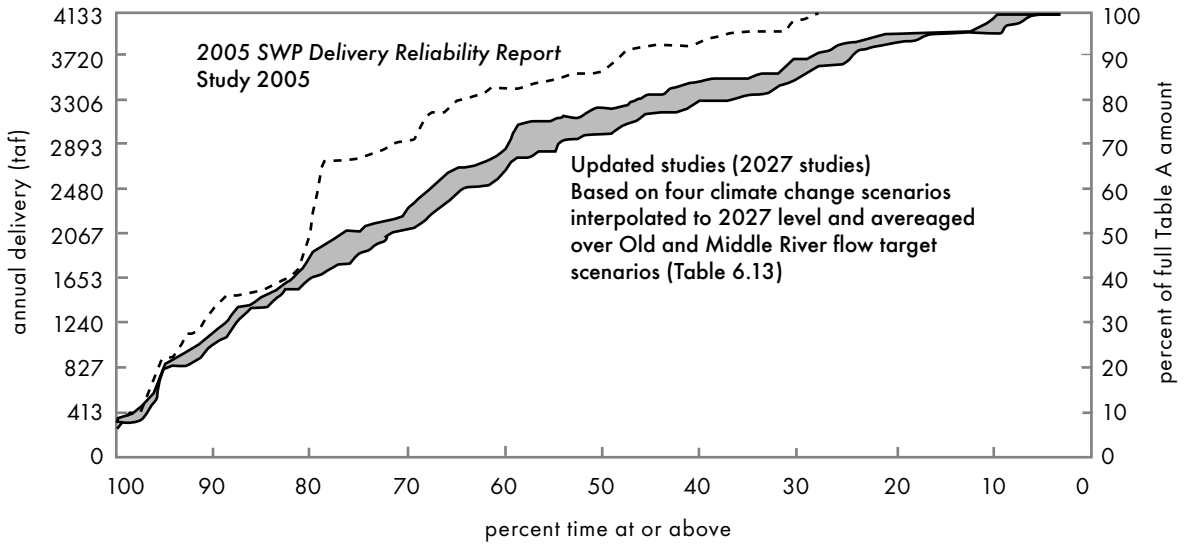


Table 6.19 Highlighted SWP Table A delivery percent exceedence values under Future Conditions

Exceedence	Annual SWP Table A Delivery (taf)		Reduction in delivery in updated studies compared to 2005 report (taf)
	2005 SWP Delivery Reliability Report, Study 2025	Updated Studies (2027)[1]	
25%	4133	3687 - 3815	318 - 446 (8 - 11%)
50%	3565	2967 - 3205	360 - 598 (10 - 17%)
75%	2738	1860 - 2077	661 - 878 (24 - 32%)

[1]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets

probabilities as a shaded area on **Figure 6.4** shows the impact of uncertainty on probabilities associated with a given future SWP Table A delivery. The information on which **Figure 6.4** is based is contained in **Tables B.12 through B.15** in Appendix B.

Table 6.19 presents the SWP Table A annual deliveries associated with 25, 50, and 75 percent exceedence from **Figure 6.4**. The information in this table can be stated as follows: For any given year,

- There is 1 chance in 4 that SWP deliveries will be at or above the range of 3,687 taf to 3,815 taf.
- There is an equal chance that SWP deliveries will be above or below the range of 2,967 taf to 3,205 taf.
- There is 75 percent chance that SWP deliveries will be above the range of 1,860 taf to 2,077 taf. Another way to state this is that there is a 25 percent chance that deliveries will be below this range.

Comparing Current and Future SWP Delivery Reliability

CalSim II simulation-based results presented earlier in this chapter compare updated delivery projections with those contained in the *2005 SWP Delivery Reliability Report* and generally show that deliveries are projected to be less than projected in the 2005 report due to adding f ow restrictions for Old River and Middle rivers set forth in the recent federal court-ordered interim action related to delta smelt and potential climate change scenarios. This section presents the same CalSim II simulation-based results in a way to facilitate comparing current reliability to future reliability. Results from the *2005 SWP Delivery Reliability Report* are presented as a reference.

SWP Table A Deliveries under Different Hydrologic Scenarios

Tables 6.20, 6.21, and 6.22 contain summaries and highlights of estimated SWP Table A deliveries from the Delta under current and Future (2027) Conditions from the *2005 SWP Delivery Reliability Report* and as derived from updated CalSim II simulations for this report. In the 2005 report, future SWP deliveries on average tended to increase over current deliveries. The updated estimates of future SWP deliveries also tend to increase compared to updated estimated current deliveries. An exception is for dry periods. The 2005 report indicated that future SWP Table A deliveries for dry periods would be approximately the same as for current dry periods. The updated estimates indicate that future SWP Table A deliveries under a two-year drought condition (1976-1977) could be lower by as much as 8 percent of maximum SWP Table A than under Current (2007) Conditions (**Table 6.21**).

Article 21 Deliveries under Different Hydrologic Scenarios

Tables 6.23, 6.24, and 6.25 contain summaries and highlights of estimated SWP Article 21 deliveries

Table 6.20 SWP Table A delivery from the Delta under current and Future Conditions

Study of Future Conditions	Average Delivery[2]		Maximum Delivery[2]		Minimum Delivery[2]	
	taf /year	SWP Table A[1] maximum	taf /year	SWP Table A[1] maximum	taf /year	SWP Table A[1] maximum
2005 SWP Delivery Reliability Report Current (2005) Future (2025)	 2818 3178	 68% 77%	 3848 4133	 93% 100%	 159 187	 4% 5%
Update Studies Current (2007) Future (2027)[3]	 2595 2724–2850	 63% 66 – 69%	 3711 4133	 90% 100%	 243 255 – 293	 6% 6 – 7%

[1]/ 4,133 taf /year

from the Delta under current and Future Conditions from the *2005 SWP Delivery Reliability Report* and as derived from updated CalSim II simulations for this report. Overall, the CalSim II simulations from the 2005 report and the updated simulations for 2007 and 2027 conditions tend to show less Article 21 deliveries in the future. Depending on the climate change scenario, updated estimates of future SWP Article 21 deliveries may increase over updated current values for specif c years; however, the long-

Table 6.21 Average and dry period SWP Table A deliveries from the Delta under current and Future Conditions

Study of Future Conditions	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Long-term Average[2]	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2005 SWP Delivery Reliability Report						
Current (2005)	68%	4%	41%	32%	42%	37%
Future (2025)	77%	5%	40%	33%	42%	38%
Update studies						
Current (2007)	63%	6%	34%	35%	35%	34%
Future (2027)[3]	66 – 69%	7%	26 – 27%	32 – 37%	33 – 35%	33 – 36%

Table 6.22 Average and wet period SWP Table A deliveries from the Delta under current and Future Conditions

Study of Future Conditions	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Long-term Average[2]	Single wet year 1983	2-year wet 1982-1983	4-year wet 1980-1983	6-year wet 1978-1983	10-year wet 1978-1987
2005 SWP Delivery Reliability Report						
Current (2005)	68%	60%	65%	69%	75%	72%
Future (2025)	77%	95%	97%	93%	93%	89%
Update studies						
Current (2007)	63%	60%	66%	68%	73%	71%
Future (2027)[3]	66 – 69%	94%	97%	86 – 87%	84 – 87%	80 – 83%

Table 6.23 Annual SWP Article 21 delivery from the Delta under current and Future Conditions

Study of Current Conditions	Average delivery[2] (taf)	Maximum delivery[1] (taf)	Minimum delivery[1] (taf)
2005 SWP Delivery Reliability Report			
Current (2005)	260	1110	0
Future (2025)	120	550	0
Update studies			
Current (2007)	90	590	0
Future (2027)[3]	30	410 – 420	0

For Tables 6.20 - 6.23:
[2]/ 1922-1994 for 2005 *SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[3]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6.24 Average and dry year SWP Article 21 delivery under current and Future Conditions (taf per year)

Year	*2005 SWP Delivery Reliability Report*		Updated Studies	
	Current (2005)	Future (2025)	Current (2007)	Current (2027)[2]
1929	0	0	0	0
1930	120	140	0	0
1931	0	0	0	0
1932	240	110	0	0 – 40
1933	510	550	40	20 – 90
1934	210	240	0	0 - 10
1976	190	0	5	0
1977	0	0	0	0 - 10
1987	550	180	0	0
1988	0	0	0	0
1989	0	90	0	0
1990	0	0	0	0
1991	0	0	0	0
1992	0	100	0	0
Long-term Average[1]	260	120	85	30

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Table 6.25 Average and wet year SWP Article 21 delivery under Current and Future Conditions (taf per year)

Year	*2005 SWP Delivery Reliability Report*		Updated Studies	
	Current (2005)	Future (2025)	Current (2007)	Current (2027)[2]
1978	300	300	100	40 - 150
1979	160	140	0	0
1980	140	90	190	90 - 130
1981	550	70	0	0
1982	800	170	490	0
1983	400	360	400	270 – 290
1984	550	490	460	410 – 420
1985	0	0	0	0
1986	120	80	30	0 – 10
1987	550	180	0	0
1978-87 Average	360	190	170	90 – 100
Long-term Average[1]	260	120	85	30

[1]/ 1922-1994 for *2005 SWP Delivery Reliability Report*; 1922-2003 for Updated Studies (2027)
[2]/ Range in values reflects four modified scenarios of climate change: annual *Table A* deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

term average future Article 21 delivery is less than half of the estimate for the current (2007) scenario.

SWP Table A Delivery Probability

The current and future probability that a given level of SWP Table A amount will be delivered from the Delta is shown in **Figure 6.5** from the *2005 SWP Delivery Reliability Report* and in **Figure 6.6** for update studies for this report. In the 2005 report, future SWP Table A deliveries exceeded current deliveries at the 80 percent exceedence level. Under the updated simulations for this report, future SWP Table A deliveries exceed current deliveries at approximately the 60 percent exceedence level. Above this exceedence, future deliveries are larger than current deliveries,

Figure 6.5 Current and future *SWP Table A* delivery probability from the *2005 SWP Delivery Reliability Report*

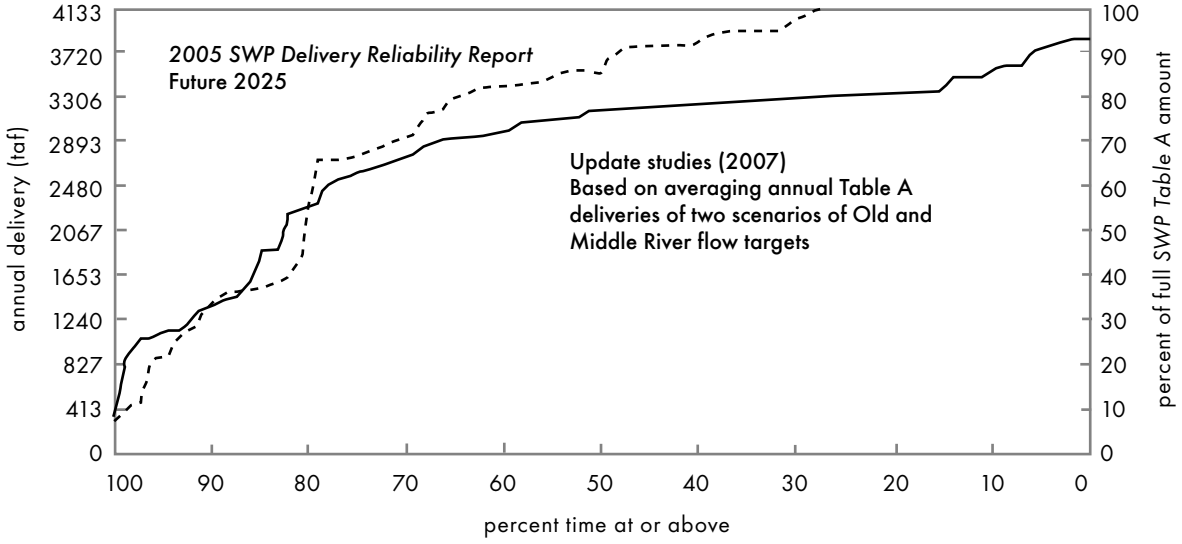
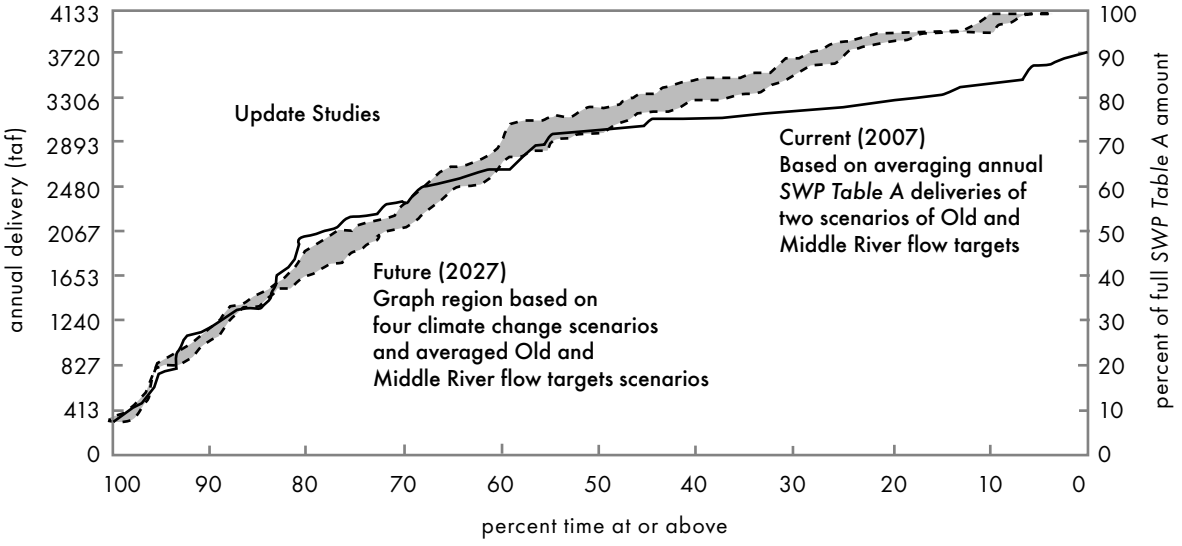


Figure 6.6 Updated current and future *SWP Table A* delivery probability



with the difference in delivery amount depending upon which climate change scenario is assumed.

Table 6.26 presents SWP Table A delivery values which correspond to 25, 50, and 75 percent exceedence for Current and Future Conditions. Previously in the 2005 report, future annual SWP deliveries were estimated to be larger than current deliveries by approximately 900 taf, 400 taf, and 150 taf for 25 percent, 50 percent, and 75 percent exceedences respectively. For the updated studies, future SWP Table A deliveries associated with a given percent exceedence may also be higher than for the deliveries at the current level (2007), but this difference is significantly less. In fact, future deliveries associated with an exceedence level of above 50 percent may be less than under Current (2007) Conditions for certain climate change scenarios.

Table 6.26 Highlighted SWP Table A delivery percent exceedence values under Current and Future Conditions

Exceedence	Annual SWP Table A Delivery (taf)			
	2005 SWP Delivery Reliability Report		Updated Studies	
	Current (2005)	Future (2025)	Current (2007)	Future (2027)[1]
25%	3323	4133	3218	3687 – 3815
50%	3173	3565	2976	2967 – 3205
75%	2588	2738	2168	1860 – 2077

[1] Range in values reflects four modified scenarios of climate change: annual SWP Table A deliveries were first interpolated between full 2050 level and no climate change scenarios, then averaged over the two scenarios of Old and Middle River flow targets.

Interpreting and Applying the Results for Local Planning Use

7

Chapter 6 presents a single set of estimates for current-level deliveries and a range of results for deliveries 20 years in the future. Chapter 6 and Appendix B explain how these estimates are developed. This chapter provides guidance on how to apply the delivery estimates to water management plans.

All results in this report are presented as percentages of the maximum SWP Table A amount for SWP deliveries from the Delta of 4.133 maf/yr. Estimates of deliveries for a specif c SWP contractor can be converted to acre-feet/year by multiplying the percentages by that contractor's maximum SWP Table A amount. It is possible that the SWP Table A amount for a specif c contractor may not be at the ultimate maximum value, but it should be very close to it. The Delta SWP Table A value for 2007 is 4.127 maf/yr, 99.9 percent of the maximum Delta SWP Table A value of 4.133 maf/yr. Therefore, for almost all purposes, this approach should be suff cient for these analyses. In addition, the percentages may also be used to estimate the SWP Table A deliveries to SWP contractors in Butte and Plumas counties and Yuba City. The deliveries to these contractors would be calculated using the same method.

The following two examples are taken from Chapter 6 of the *2005 State Water Project Delivery Reliability Report* and updated with the data from this report. These examples are developed for a hypothetical SWP contractor with a maximum SWP Table A amount of 100,000 acre-feet per year. Hypothetical examples illustrating applications of the delivery probability curves and adjustments to the data for a SWP contractor that cannot convey its maximum SWP Table A amount are provided in *The State Water Project Delivery Reliability Report 2002*. Questions regarding the use of the information contained in these reports may be directed to the Department of Water Resources' Bay-Delta Of ce at (916) 653-1099.

Example 1

This example uses data directly from **Table 6.21** for updated current and future estimates of SWP Table A deliveries during dry periods and employs allocation methods that provide a simple means of estimating supplies to each contractor. The analysis includes high and low estimates of the range of values for year 2027. In order to estimate deliveries between current (2007) and Future (2027) Conditions, the data in the table is interpolated for f ve-year increments and contained in **Table 7.1**. **Table 7.1** shows the average percentage of maximum Delta SWP Table A deliveries for average, single-dry year, and two-, four- and six-year multiple dry year scenarios from 2007 to 2027 in f ve-year increments.

The maximum SWP Table A amounts of each contractor are listed in Appendix C. SWP Table A amounts can be amended and a contractor's SWP Table A amount over the next 20 years may be less than its maximum over some or all of this period. In this case, the contractor should use the amended SWP Table A amounts for the corresponding years during this period. To use dry years other than those presented in **Table 7.1**, or

to show year-to-year supplies instead of averages over a multiple-dry year period, see Example 2.

How to Calculate Supplies

In order to estimate delivery amount for the average and drought periods for each five-year increment from 2007 to 2027, multiply the contractor's SWP Table A amount for a particular year by the corresponding delivery percentages for that year from **Table 7.1**.

Tables 7.2 through 7.4 show the SWP Table A deliveries projected to be available to a hypothetical contractor with a maximum SWP Table A amount of 100,000 af, on average and for the various drought periods. For this example, the supplies shown for the multiple-dry year period are average supplies over the four-year drought from 1931-1934. Data from other year types, although not required in an urban water management plan, could also be presented this way.

Example 2

This example is similar to Example 1 but allows a contractor to select alternative single-year or multiple-dry year sequences other than those presented in **Table 7.1**. This option might be selected if analyzing different hydrologic year(s) makes more sense given a contractor's other supply sources, or given the locally acceptable risk level for water delivery shortages.

This example can also be used to identify supplies projected to be available in each year of a multiple-dry year period. While the Water Code does not specifically require this, the *Urban Water Management Plan Guidebook* suggests showing year-to-year supplies (see the *UWMP Guidebook*, Section 7, Step 3).

Where to Find the Data

Choose a single-year or multiple-year sequences from **Tables B.3 and B.12 through B.15** to represent single-dry year and multiple-dry year scenarios. **Table B.3** contains the percent of maximum SWP Table A deliveries under all 82 hydrologic years in the updated model study for 2007. **Tables B.12 through B.15** contains the percent of maximum SWP Table A deliveries under all 82 hydrologic years in the updated model studies for 2027.

How to Calculate Supplies

Multiply the contractor's SWP Table A amount for a particular year by the percent of maximum SWP Table A deliveries for the selected years, to get an estimated delivery amount for the years selected, for 2007 and 2027. Values for years between 2007 and 2027 can be linearly interpolated.

Tables 7.5 through 7.8 show the SWP Table A deliveries projected to be available to a hypothetical contractor with a maximum SWP Table A amount of 100,000 af, in a single dry year and year-to-year over a multiple dry-year period. For this example, the single dry year selected is for 1988 conditions, and the multiple dry-year period selected is the three-year period from 1990-1992. In showing year-to-year supplies for the multiple-dry year period, these year-to-year supplies should be shown for each five-year increment during the 20-year projection period.

Table 7.1 SWP average and dry year SWP Table A delivery from the Delta in five-year intervals for studies 2007 and 2027

Year	Percent of maximum (4,133 taf /year) SWP Table A delivery from the Delta					
	Average 1922 -2003	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
2007	63%	6%	34%	35%	35%	34%
2012	64 - 65%	6%	32%	34 - 36%	35%	34 - 35%
2017	65 - 66%	7%	30 - 31%	34 - 36%	34 - 35%	34 - 35%
2022	66 - 68%	7%	28 - 29%	33 - 37%	34 - 35%	33 - 36%
2027	66 - 69%	7%	26 - 27%	32 - 37%	33 - 35%	33 - 36%

Table 7.2 Average annual SWP deliveries assuming a maximum SWP Table A amount of 100,000 acre-feet (acre-feet)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	63,000	64,000 – 65,000	64,000 - 66,000	65,000 - 68,000	66,000 - 69,000
State Water Project (Article 21)[1]					
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

[1]/ Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local supply. See discussion of Article 21 supply in Chapter 4.

Table 7.3 Single dry year SWP delivery (1977 conditions) assuming a maximum SWP Table A amount of 100,000 acre-feet (acre-feet)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	6,000	6,000	7,000	7,000	7,000
State Water Project (Article 21)[1]	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

[1]/ Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local supply. See discussion of Article 21 supply in Chapter 4.

Table 7.4 Average SWP Delivery over a multiple dry year period assuming a maximum SWP Table A amount of 100,000 acre-feet 1931-1934 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	35,000	34,000 – 36,000	34,000 – 36,000	33,000 – 37,000	32,000 – 37,000
State Water Project (Article 21)[1]					
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

[1]/ Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local supply. See discussion of Article 21 supply in Chapter 4.

Table 7.5 Annual SWP delivery over single dry year (1988 conditions), assuming a maximum Table A amount of 100,000 acre-feet (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	11,540	11,490 – 12,000	11,440 – 12,460	11,370 – 12,920	11,320 – 13,380
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7.6 Annual SWP delivery over multiple dry year period 1990-1992, assuming a maximum Table A amount of 100,000 acre-feet 1990 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	8,710	8,080 – 8,590	7,450 – 8,470	6,800 – 8,320	6,170 – 8,200
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7.7 Annual SWP delivery over multiple dry year period 1990-1992, assuming a maximum SWP Table A amount of 100,000 acre-feet 1991 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	17,640	17,980 – 18,485	18,290 – 19,360	18,630 – 20,200	18,950 – 21,050
State Water Project (Article 21)[1]	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Table 7.8 Annual SWP delivery over multiple dry year period 1990-1992, assuming a maximum SWP Table A amount of 100,000 acre-feet 1992 conditions (acre-feet per year)

Water Supply Source	2007	2012	2017	2022	2027
State Water Project (Table A)	26,300	26,180 – 26,880	26,030 – 27,460	25,910 – 28,040	25,770 – 28,620
State Water Project (Article 21)	0	0	0	0	0
Groundwater					
Local Surface Water					
Transfers					
Exchanges					
Reclaimed Water					
Other (identify)					
Total					

Appendix A. 2007 Delivery Reliability Report

CalSim II Modeling Assumptions

The CalSim II model developed for the 2004 Long-Term Central Valley Project Operations Criteria and Plan (OCAP) was modified specifically for the studies in this report. The model for this report assumes a D-1641 regulatory environment and implements the 2007 federal court decision on remedy actions for the Delta smelt. Two of the proposed actions in that decision, actions 6 and 8, specify a range in upstream flow targets for Old River and Middle River (OMR). The model studies for this report consider both the high and low remedy actions for actions 6 and 8 to bookend the potential effects. The assumptions for the remedy actions are shown in the following table.

The remedy actions incorporate the Vernalis Adaptive Management Plan (VAMP) export curtailments for the period April 15 – May 15 with impacts borne by the projects. The VAMP criteria applied in the model are as follows:

Vernalis flow (cfs)	Combined exports (cfs)
< 5700	< 1500
= 5700	< 2250
> 5700 and = < 8600	< 1500 or < 3000 (alternating standard)
> 8600	< 0.5 * flow at Vernalis

Action	Period	OMR Standard (flow upstream in cfs)	
		Remedy Action High	Remedy Action Low
4	December 25 – January 3	< 2000	< 2000
5	January 4 – February 20	< 5000	< 5000
6	February 21 – April 14	< 750	< 2000
7	April 15 – May 15	No OMR standard. VAMP controls export.	No OMR standard. VAMP controls export.
8	May 16 – June 30	< 750	< 5000

Where: OMR flow = (0.58 * flow at Vernalis) – (0.913 * total export)

The 2004 OCAP model version was also modified to include the three improvements listed below.

1. The previous San Joaquin River Basin representation was replaced by the San Joaquin River Water Quality Module version 1.00 (SJRWQM) developed by U.S. Bureau of Reclamation Mid-Pacific Region. The SJRWQM is an update to previous versions that has gone through extensive agency review and a formal peer review.

2. The previous Artificial Neural Network (ANN) used to estimate flow-salinity relationships has been replaced with a newer more accurate version. The new ANN, and its accompanying implementation to the CalSim II model, produces salinities that match more closely to Delta Simulation Model 2 (DSM2) salinities.

3. The Hydrologic sequence of simulated years has been extended to include the water years 1995 – 2003. The new simulation period spans water years 1922 – 2003 whereas the previous sequence covered water years 1922- 1994.

All studies assume current SWP Delta diversion limits (often referred to as "Banks Pumping Plant capacity"), existing conveyance capacity of the upper Delta-Mendota Canal/California Aqueduct system, and current SWP/CVP operations agreements. **Table A.1** lists key study assumptions. **Table A.2** presents the assumptions behind American River demands.

Table A.1 2007 Delivery Reliability Report CalSim II modeling assumptions

	Period of Simulation: 82 years (1922-2003)	
	Updated Studies (2007)	**Updated Studies (2027)**
HYDROLOGY		
Level of Development (Land Use)	2005 Level, *DWR Bulletin 160-98*[1]	2020 Level, *DWR Bulletin 160-98*[2]
North of Delta (except American River) Demands		
CVP	Land Use based, limited by Full Contract	
SWP (FRSA)	Land Use based, limited by Full Contract	
Non-Project	Land Use based	
CVP Refuges	Firm Level 2	
American River Basin Demands		
Water rights	2001 Level[3]	2020 Level[4]
CVP	2001 Level[3]	2020 Level[4]
San Joaquin River Basin Demands		
Friant Unit	Limited by contract amounts, based on current allocation policy	
Lower Basin	Land-use based, based on district level operations and constraints.	
Stanislaus River Basin	Land-use based, based on New Melones Interim Operations Plan	
South of Delta Demands		
CVP	Full Contract	
CCWD	151 taf/yr	
SWP (with North Bay Aqueduct)	2.3-3.9 maf/yr	3.9-4.1 maf/yr
SWP Article 21 Demand	MWDSC up to 100 taf/month, Dec-Mar, others up to 84 taf/month	
FACILITIES		
Freeport Regional Water Project	None	Included
Banks Pumping Capacity	6680 cfs	
Tracy Pumping Capacity	4200 cfs + deliveries upstream of DMC constriction	

	Period of Simulation: 82 years (1922-2003)	
	Updated Studies (2007)	**Updated Studies (2027)**
REGULATORY STANDARDS		
Trinity River		
Minimum Flow below Lewiston Dam	369-453 taf/yr	Trinity EIS Preferred Alternative (369-815 taf/yr)
Trinity Reservoir End-of-September Minimum Storage	Trinity EIS Preferred Alternative (600 taf as able)	
Clear Creek		
Minimum Flow below Whiskeytown Dam	Downstream water rights, 1963 USBR Proposal to FWS and NPS, and FWS use of CVPIA 3406(b)(2) water	
Upper Sacramento River		
Shasta Lake End-of-September Minimum Storage	SWRCB WR 1993 Winter-run Biological Opinion (1900 taf)	
Minimum Flow below Keswick Dam	Flows for SWRCB WR 90-5 and 1993 Winter-run Biological Opinion temperature control, and FWS use of CVPIA 3406(b)(2) water	
Feather River		
Minimum Flow below Thermalito Diversion Dam	1983 DWR, DFG Agreement (600 cfs)	
Minimum Flow below Thermalito Afterbay outlet	1983 DWR, DFG Agreement (750 – 1700 cfs)	
Yuba River		
Minimum flow below Daguerre Point Dam	Interim D-1641 operations	Lower Yuba River Accord
American River		
Minimum Flow below Nimbus Dam	SWRCB D-893 (see accompanying Operations Criteria), and FWS use of CVPIA 3406(b)(2) water	
Minimum Flow at H Street Bridge	SWRCB D-893	
Lower Sacramento River		
Minimum Flow near Rio Vista	SWRCB D-1641	
Mokelumne River		
Minimum Flow below Camanche Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (100 – 325 cfs)	
Minimum Flow below Woodbridge Diversion Dam	FERC 2916-029, 1996 (Joint Settlement Agreement) (25 – 300 cfs)	
Stanislaus River		
Minimum Flow below Goodwin Dam	1987 USBR, DFG agreement , and FWS use of CVPIA 3406(b)(2) water	
Minimum Dissolved Oxygen	SWRCB D-1422	
Merced River		
Minimum Flow below Crocker-Huffman Diversion Dam	Davis-Grunsky (180 – 220 cfs, Nov – Mar), and Cowell Agreement	
Minimum Flow at Shaffer Bridge	FERC 2179 (25 – 100 cfs)	
Tuolumne River		
Minimum Flow at Lagrange Bridge	FERC 2299-024, 1995 (Settlement Agreement) (94 – 301 taf/yr)	
San Joaquin River		
Maximum Salinity near Vernalis	SWRCB D-1641	
Minimum Flow near Vernalis	SWRCB D-1641, and Vernalis Adaptive Management Program per San Joaquin River Agreement	
Sacramento River-San Joaquin River Delta		
Delta Outflow Index (Flow and Salinity)	SWRCB D-1641	
Delta Cross Channel Gate Operation	SWRCB D-1641	
Delta Exports	SWRCB D-1641, FWS use of CVPIA 3406(b)(2) water and CALFED Fisheries Agencies use of EWA assets	

	Period of Simulation: 82 years (1922-2003)	
	Updated Studies (2007)	**Updated Studies (2027)**
OPERATIONS CRITERIA		
Subsystem		
Upper Sacramento River		
Flow Objective for Navigation (Wilkins Slough)	3,250 – 5,000 cfs based on CVP Ag allocation levels	
American River		
Folsom Dam Flood Control	SAFCA, Interim re-operation of Folsom Dam, Variable 400/670 (without outlet modifications)	
Flow below Nimbus Dam	Operations criteria corresponding to SWRCB D-893 required minimum flow	
Sacramento Water Forum Mitigation Water	None	Sacramento Water Forum (up to 47 taf/yr in dry years)
Feather River		
Flow at Mouth	Maintain the DFG/DWR flow target above Verona or 2800 cfs for Apr– Sep dependent on Oroville inflow and FRSA allocation	
Stanislaus River		
Flow below Goodwin Dam	1997 New Melones Interim Operations Plan	
San Joaquin River		
Flow near Vernalis	San Joaquin River Agreement in support of the Vernalis Adaptive Management Program	
System-wide		
CVP Water Allocation		
CVP Settlement and Exchange	100% (75% in Shasta Critical years)	
CVP Refuges	100% (75% in Shasta Critical years)	
CVP Agriculture	100% - 0% based on supply (reduced by 3406(b)(2) allocation)	
CVP Municipal & Industrial	100% - 50% based on supply (reduced by 3406(b)(2) allocation)	
SWP Water Allocation		
North of Delta (FRSA)	Contract specific	
South of Delta	Based on supply; Monterey Agreement	
CVP/SWP Coordinated Operations		
Sharing of Responsibility for In-Basin-Use	1986 Coordinated Operations Agreement	
Sharing of Surplus Flows	1986 Coordinated Operations Agreement	
Sharing of Restricted Export Capacity	Equal sharing of export capacity under SWRCB D-1641	
Transfers		
Dry Year Program	None	
Phase 8	None	
MWDSC/CVP Settlement Contractors	None	
CVP/SWP Integration		
Dedicated Conveyance at Banks	None	
NOD Accounting Adjustments	None	

[1]/ The 2005 Level of Development for the Sacramento Valley is defined by linearly interpolated values from the 1995 Level of Development and 2020 Level of Development from *DWR Bulletin 160-98*. The San Joaquin Valley hydrology reflects 2005 land-use assumptions developed by U.S. Bureau of Reclamation to support its studies.
[2]/ The 2020 Level of Development for the Sacramento Valley is from *DWR Bulletin 160-98*. The San Joaquin Valley hydrology reflects draft 2030 land-use assumptions developed by U.S. Bureau of Reclamation to support its studies.
[3]/ Presented in attached table of 2007 Study American River Demand Assumptions.
[4]/ Presented in attached table of 2027 Study American River Demand Assumptions.
[5]/ CalSim II model representation for the Stanislaus River does not necessarily represent U.S. Bureau of Reclamation's current or future operational policies.
[6]/ Delta diversions include operations of Los Vaqueros Reservoir and represents average annual diversion.
[7]/ Includes modified EBMUD operations of the Mokelumne River.
[8]/ This is implemented only in the PCWA Middle Fork Project releases used in defining the CalSim II inflows to Folsom Lake.

Table A.2 2007 Study American River demand assumptions

Location / Purveyor	ALLOCATION TYPE (MAXIMUM)					
	CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total
Auburn Dam Site (D300)						
Placer County Water Agency	0	0	0	8,500	0	**8,500**
Total	**0**	**0**	**0**	**8,500**	**0**	**8,500**
Folsom Reservoir (D8)						
Sacramento Suburban	0	0	0	0	0	**0**
City of Folsom (includes P.L. 101-514)	0	0	0	20,000	0	**20,000**
Folsom Prison	0	0	0	2,000	0	**2,000**
San Juan Water District (Placer County)	0	0	0	10,000	0	**10,000**
San Juan Water District (Sac. County) (includes P.L. 101-514)	0	11,200	0	33,000	0	**44,200**
El Dorado Irrigation District	0	7,550	0	0	0	**7,550**
El Dorado Irrigation District (P.L. 101-514)	0	0	0	0	0	**0**
City of Roseville	0	32,000	0	0	0	**32,000**
Placer County Water Agency	0	0	0	0	0	**0**
Total	**0**	**50,750**	**0**	**65,000**	**0**	**115,750**
Folsom South Canal (D9)						
So. Cal WC/ Arden Cordova WC	0	0	0	3,500	0	**3,500**
California Parks and Recreation	0	100	0	0	0	**100**
SMUD (export)	0	0	0	15,000	0	**15,000**
South Sacramento County Agriculture (export, SMUD transfer)	0	0	0	0	0	**0**
Canal Losses	0	0	0	1,000	0	**1,000**
Total	**0**	**100**	**0**	**19,500**	**0**	**19,600**
Nimbus to Mouth (D302)						
City of Sacramento	0	0	0	63,335	0	**63,335**
Arcade Water District	0	0	0	2,000	0	**2,000**
Carmichael Water District	0	0	0	8,000	0	**8,000**
Total	**0**	**0**	**0**	**73,335**	**0**	**73,335**
Sacramento River (D162)						
Placer County Water Agency	0	0	0	0	0	**0**
Total	**0**	**0**	**0**	**0**	**0**	**0**
Sacramento River (D167/D168)						
City of Sacramento	0	0	0	38,665	0	**38,665**
Sacramento County Water Agency (SMUD transfer)	0	0	0	0	0	**0**
Sacramento County Water Agency (P.L. 101-514)	0	0	0	0	0	**0**
EBMUD (export)	0	0	0	0	0	**0**
Total	**0**	**0**	**0**	**38,665**	**0**	**38,665**
Total from the American River	**0**	**50,850**	**0**	**166,335**	**0**	**217,185**

Table A.3 2027 Study American River demand assumptions

Location / Purveyor	ALLOCATION TYPE (MAXIMUM)					
	CVP AG	CVP MI	CVP Settlement / Exchange	Water Rights / Non-CVP / No Cuts	CVP Refuge	Total
Auburn Dam Site (D300)						
Placer County Water Agency	0	0	0	35,500	0	**35,500**
Total	**0**	**0**	**0**	**35,500**	**0**	**35,500**
Folsom Reservoir (D8)						
Sacramento Suburban	0	0	0	29,000	0	**29,000**
City of Folsom (includes P.L. 101-514)	0	7,000	0	27,000	0	**34,000**
Folsom Prison	0	0	0	2,000	0	**2,000**
San Juan Water District (Placer County)	0	0	0	25,000	0	**25,000**
San Juan Water District (Sac County) (includes P.L. 101-514)	0	24,200	0	33,000	0	**57,200**
El Dorado Irrigation District	0	7,550	0	0	0	**7,550**
El Dorado Irrigation District (P.L. 101-514)	0	7,500	0	0	0	**7,500**
City of Roseville	0	32,000	0	30,000	0	**62,000**
Placer County Water Agency	0	0	0	0	0	**0**
Total	**0**	**78,250**	**0**	**146,000**	**0**	**224,250**
Folsom South Canal (D9)						
So. Cal WC / Arden Cordova WC	0	0	0	5,000	0	**5,000**
California Parks and Recreation	0	5,000	0	0	0	**5,000**
SMUD (export)	0	15,000	0	15,000	0	**30,000**
South Sacramento County Agriculture (export, SMUD transfer)	35,000	0	0	0	0	**35,000**
Canal Losses	0	0	0	1,000	0	**1,000**
Total	**35,000**	**20,000**	**0**	**21,000**	**0**	**76,000**
Nimbus to Mouth (D302)						
City of Sacramento	0	0	0	96,300	0	**96,300**
Arcade Water District	0	0	0	11,200	0	**11,200**
Carmichael Water District	0	0	0	12,000	0	**12,000**
Total	**0**	**0**	**0**	**119,500**	**0**	**119,500**
Sacramento River (D162)						
Sacramento Suburban	0	0	0	29,000	0	**29,000**
Total	**0**	**0**	**0**	**29,000**	**0**	**29,000**
Sacramento River (D167/D168)						
City of Sacramento	0	0	0	34,300	0	**34,300**
Sacramento County Water Agency (SMUD transfer)	0	30,000	0	0	0	**30,000**
Sacramento County Water Agency (P.L. 101-514)	0	15,000	0	0	0	**15,000**
EBMUD (export)	0	133,000	0	0	0	**133,000**
Total	**0**	**178,000**	**0**	**34,300**	**0**	**212,300**
Total from the American River	**35,000**	**98,250**	**0**	**322,000**	**0**	**455,250**

Folsom Unimpaired Inflow (FUI) FUI = Total taf (Mar – Sep) + 60 taf			Notes
> 1600	**> 950**	**< 400**	
35,500	35,500	35,500	
35,500	**35,500**	**35,500**	
29,000	0	0	4,5,10
34,000	34,000	20,000	1,2,3
2,000	2,000	2,000	
25,000	25,000	10,000	
57,200	57,200	44,200	1,2,3
7,550	7,550	7,550	1,2,3
7,500	7,500	1,450	1,2,3
54,900	54,900	39,800	
0	0	0	10
217,150	**188,150**	**125,000**	
5,000	5,000	5,000	
5,000	5,000	5,000	
30,000	30,000	15,000	1,2,3
35,000	0	0	4,5
1,000	1,000	1,000	
76,000	**41,000**	**26,000**	
96,300	96,300	50,000	6,7,8
11,200	11,200	3,500	12
12,000	12,000	12,000	
119,500	**119,500**	**65,500**	
0	29,000	29,000	4,5
0	**29,000**	**29,000**	
34,300	34,300	80,600	8
0	0	0	9
0	0	0	9
0	0	0	
34,300	**34,300**	**80,600**	
448,150	**384,150**	**252,000**	

[1]/ Wet/average years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is greater than 950,000 af.
[2]/ Drier years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 950,000 af but greater than 400,000 af.
[3]/ Driest years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 400,000 af.
[4]/ Wet/average years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is greater than 1,600,000 af.
[5]/ Drier years for this diverter are defined as those years when the projected March through November unimpaired inflow to Folsom Reservoir is less than 1,600,000 af.
[6]/ Wet/average years as it applies to the City of Sacramento are time periods when the flows bypassing the E. A. Fairbairn Water Treatment Plant diversion exceed the "Hodge flows."
[7]/ Drier years are time periods when the flows bypassing the City's E.A. Fairbairn Water Treatment Plant diversion do not exceed the "Hodge flows."
[8]/ For modeling purposes, it is assumed that the City of Sacramento's total annual diversions from the American and Sacramento River in year 2030 would be 130,600 af.
[9]/ The total demand for Sacramento County Water Agency would be up to 78,000 af. The 45,000 af represents firm entitlements; the additional 33,000 af of demand is expected to be met by intermittent surplus supply. The intermittent supply is subject to Reclamation reduction (50%) in dry years.
[10]/ Water Rights Water provided by releases from PCWA's Middle Fork Project; inputs into upper American River model must be consistent with these assumptions.
[11]/ Demand requires "Replacement Water" as indicated below
[12]/ Arcade WD demand modeled as step function: one demand when FUI > 400, another demand when FUI < 400.

Appendix B. Results of Report CalSim II Studies

The supply reliability of the State Water Project is estimated in studies by using a computer program that simulates the operation of the SWP on a monthly basis over an 82-year historical record of rainfall and runoff (1922–2003). The simulation model integrates all the relevant water resource components and calculates key water management parameters, such as:

- the amount of water released from reservoirs in the Sacramento-San Joaquin valleys,
- the amount of water required to maintain Delta water quality standards,
- the amount of water to be pumped from the Delta by the SWP and the Central Valley Project (CVP), and
- the amount of water that can be delivered by each of these projects.

The information required to run the simulation is referred to as the "model input." The most significant categories of input are:

- the physical description of the water system facilities (maximum pumping or release capacity, maximum reservoir storages, etc.);
- institutional requirements (delivery contract requirements, Delta water quality standards, the operations agreement between the SWP and CVP, endangered species requirements, and other requirements of federal and state laws, etc);
- hydrology (river and stream flows adjusted for water use in the source areas); and
- the level of SWP water demand.

CalSim II is the current version of the computer simulation model used to estimate SWP delivery reliability. All versions of CalSim employ commercially available linear programming software as a solution device. The application of the software, graphical user interface, and input/output devices are discussed in the documentation for CalSim which is available at **http://baydeltaoffice.water.ca.gov/modeling/hydrology/CalSimII/.**

The model studies selected for this report are intended to estimate current SWP delivery reliability and future SWP delivery reliability in the year 2027. Estimating current SWP delivery reliability assumes the SWP and CVP operate to meet Old River and Middle River flow targets specified in the 2007 federal court ruling on interim measures to protect delta smelt. Estimating future SWP delivery reliability in 2027 assumes an altered hydrology due to climate change, no new facilities or improvements to existing facilities, an increased SWP water demand, and existing institutional requirements, including the 2007 federal court ruling.

As listed in **Table B.1**, 12 CalSim II simulations were used in this report: two for estimating current (2007) SWP delivery reliability and 10 for estimating future (2027) SWP delivery reliability. Two simulations were needed for estimating current reliability due to uncertainty in which Old River

and Middle River flow target might apply. The 2007 proposed federal court ruling gave discretion to USFWS to determine whether at times a more or less restrictive flow target should be met based upon USFWS's assessment of the vulnerability of delta smelt at that time. The yearly annual SWP deliveries from these two studies were averaged to yield a single sequence of annual SWP deliveries to describe Current Conditions while incorporating average impacts to deliveries due to Old River and Middle River flow targets contained in the federal court ruling.

Ten CalSim II simulations were needed to estimate future (2027) reliability due to three factors:

1. uncertainty in how climate change may affect the source water for SWP,
2. the need to adjust CalSim II results to account for the climate change scenarios assuming a 2050 level of emissions, and
3. uncertainty in which Old River and Middle River flow target might apply.

The ten simulations consist of four climate change scenarios and a no-climate-change scenario which each assume two scenarios of Old River and Middle River flow targets. The four climate change scenarios are defined by the climate change model used and the assumed greenhouse gas emissions scenario. One emissions scenario, referred to as "A2," assumes high growth in population, regional based economic growth, and slow technological changes, which results in significantly higher greenhouse gas emissions. The other emissions scenario, "B1," represents low growth in population, global based economic growth and sustainable development that results in a low increase in greenhouse gas emissions. The climate change models used are the Geophysical Fluid Dynamic Lab model (GFDL) and the Parallel Climate model (PCM). Both models project future warming although the GFDL model indicates a greater warming tread than the PCM.

Table B.1 Summary of CalSim II simulations used to update SWP delivery estimates

Time Frame	Climate Change Model	Greenhouse Gas Emissions Scenario	Old River and Middle River flow target targets[1]
Current	None	None	Less restrictive
			More restrictive
Future	None	None	Less restrictive
			More restrictive
Future	Geophysical Fluid Dynamic Lab Model	A2	Less restrictive
			More restrictive
		B1	Less restrictive
			More restrictive
Future	Parallel Climate Model	A2	Less restrictive
			More restrictive
		B1	Less restrictive
			More restrictive

Note: The Geophysical Fluid Dynamic Lab model and PCM refers to the Parallel Climate model. The GFDL model indicates a greater warming tread than the PCM. A2 emissions scenario assumes high growth in population, regional based economic growth, and slow technological changes, which results in significantly higher greenhouse gas emissions. B2 emissions scenario represents low growth in population, global based economic growth and sustainable development that results in a low increase in greenhouse gas emissions.
1/ Less restrictive Old River and Middle River flow targets refer to combined Old River and Middle River flow not more than 5,000 cfs in upstream direction in February 21 – April 14; June 1-30. More restrictive Old River and Middle River flow targets refer to combined Old River and Middle River flow being not more than 750 cfs in upstream direction during February 21 – April 14 and June 1 – 30 (see Table 6.3). maf = million acre-feet; taf = thousand acre-feet

The climate change scenarios used in this report to describe future SWP delivery reliability then are:

1. A2 emissions scenario with the GFDL model,
2. B1 emissions with the GFDL model,
3. A2 emissions with the PCM model,
4. B1 emissions with the PCM model.

Each climate change scenario generates two sequences of future SWP deliveries due to each assuming two scenarios of Old River and Middle River flow targets.

The ten CalSim II simulations were used to generate four sequences of future (2027) SWP deliveries which are used to describe future SWP delivery reliability in Chapter 6 of this report. This process consisted of first interpolating between sequences to estimate SWP deliveries under climate change affects for 2027 instead of 2050, then averaging each pair of sequences differentiated by Old River and Middle River flow targets scenario. The A2 and B1 greenhouse gas emissions scenarios assume a 2050 level of emissions. Scenarios for 2027 were not available at the time of composing this report. A key assumption in estimating 2027 SWP delivery reliability for this report is that SWP deliveries for a CalSim II simulation which assumes 2027 SWP demands and 2027 climate change, would fall somewhere between CalSim II simulations which assume 2027 SWP demands and no climate change and 2027 SWP demands and climate change corresponding to 2050 emissions. Just where these SWP deliveries would fall is estimated in this report by interpolating between each sequence from a scenario which assumes 2050 emissions and a scenario which assumes no climate change. The interpolation is as follows:

Future (2027) annual SWP delivery = NCC + (20/43) (CC – NCC)

Where
NCC = annual SWP delivery for future, no climate change scenario
CC = annual SWP delivery for future with climate change scenario, which assumes 2050 emission levels

The ratio of 20/43 corresponds to the ratio of calendar years: (2027-2007)/(2050-2007)

The key study assumptions are described in detail in Chapter 3 and Appendix A. Additional discussions of the Operations Criteria and Plan (OCAP) studies are on the US Bureau of Reclamation's website at **http://www.usbr.gov/mp/cvo/ocap_page.html**.

Study Results

The annual delivery amounts estimated by the twelve CalSim II simulations are contained in **Tables B.3 through B.15**. The tables show the demand level, the amount of delivery from the Delta, and percent of maximum total SWP Table A amounts for the SWP contractors receiving water from the Delta. Of the 29 SWP contractors, 26 receive their deliveries from the Delta. The total maximum SWP Table A amount for all SWP contractors is 4.173 maf/year. Of this amount, 4,133 taf/yr is the maximum Delta SWP Table A amount. Also presented are the results of interpolating and averaging SWP delivery sequences which provide the information used in Chapter 6 in assessing current and future SWP delivery reliability. Current and future SWP deliveries are presented both in time sequence and by ranking to correspond to the data presented in the summary/highlight tables and used to generate the probability curves in Chapter 6.

These values must be interpreted within the context of the assumptions upon which they are calculated. For example, for the year 1958 in the 2027 study which assumes PCM model with high emissions and less restrictive Old River and Middle River flow targets, the annual delivery is calculated to be 4,133 taf or 100 percent of maximum Delta SWP Table A (see **Table B.8**). This result should be stated as follows under the assumptions of:

1. rainfall that was similar to what it was in 1958 but modified to reflect climate change effects as predicted by PCM model under assumed higher emissions;
2. the level of water use in the source area is increased to the level it would be in 2027;

3. SWP facilities and operation requirements are the same as they are today with less restrictive Old River and Middle River flow targets in effect;
4. SWP contractor demands are at their maximum Delta SWP Table A level, then SWP would deliver approximately 4,133 taf or 100 percent of the maximum Delta SWP Table A.

Actually, the conditional statement associated with the result for any particular year is even more complicated than this because the result is also dependent upon the rainfall that has occurred in previous years. For example, if the previous year (1957) was wet, runoff for 1958 for the same amount of rainfall would be greater than if 1957 were dry. In addition, reservoir storage for the beginning of 1958 varies depending upon the weather conditions in 1957. Thus, each year's simulation is dependent on the previous year's simulation and, hence, any year in the entire historical sequence is linked to all previous years.

Table B.2 summarizes the delivery estimates for the SWP for important dry sequences computed in the studies for current (2007) and Future (2027) Conditions. The percentages of maximum SWP Table A amounts are based on averaging current deliveries and interpolating and then averaging future annual SWP Table A deliveries as previously discussed. This information can be helpful in analyzing the delivery reliability of a specific water system that receives a portion of its water supply from the SWP. The series of data contained in **Tables B.3 through B.15** are also helpful in analyzing longer periods of time that contain not only dry periods but wetter periods which can replenish water supplies.

Table B.16 presents the annual SWP Article 21 deliveries under Current Conditions and **Tables B.17 through B.20** present annual SWP Article 21 deliveries under the four climate change scenarios under Future Conditions for both the higher and lower Old and Middle River flow targets.

Probability distribution curves derived from the CalSim II simulations used in this report are presented in **Figures B.1 through B.4** to visually show the estimated percentage of years a given annual delivery is equaled or exceeded. In this report, this value represents the probability of receiving at least a given level of delivery in any particular year. As a reference, probability distribution curves for the 2005 and 2025 studies from the 2005 State Water Project Delivery Reliability Report are presented along with the curves from the 2007 and 2027 studies in this report. SWP Table A delivery values for 25%, 50%, and 75% exceedences are shown for all scenarios in **Table B.21**.

Finally, the combined SWP Table A and Article 21 amounts under current conditions as calculated in the 2005 Reliability Report and the 2007 updated report are presented in **Table B.22** to show the estimated impact on total SWP deliveries due to flow restrictions to protect delta smelt.

Table B.2 SWP average and dry year SWP Table A delivery from the Delta (in percent of maximum SWP Table A amounts[1])

Time Frame	Climate Change Model	Emissions Scenario	Average 1922 - 2003	Single dry year 1977	2-year drought 1976-1977	4-year drought 1931-1934	6-year drought 1987-1992	6-year drought 1929-1934
Current 2007	none	none	63%	6%	34%	35%	35%	34%
Future 2027	Geophysical Fluid Dynamic Lab Model	A2	66%	7%	26%	32%	34%	34%
		B1	66%	7%	27%	32%	33%	33%
	Parallel Climate Model	A2	67%	7%	26%	33%	33%	34%
		B1	69%	7%	27%	37%	35%	36%

[1]/ 4,133 taf/year

Table B.3 SWP Table A deliveries under Current (2007) Conditions
Derived values for estimating probability curve

Year	SWP Table A demands (taf)	SWP Table A deliveries for 2007 studies				Probability Curve[1]		
		lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Year	SWP Table A Delivery (taf)	Exceedence Frequency
1922	3,752	3,737	3,611	3,674	89%	1993	3,711	0%
1923	3,253	3,250	3,067	3,159	76%	1927	3,699	1%
1924	3,491	529	272	400	10%	1922	3,674	3%
1925	3,355	1,528	1,759	1,644	40%	1978	3,599	4%
1926	3,395	2,449	1,923	2,186	53%	1956	3,581	5%
1927	3,862	3,782	3,616	3,699	89%	1951	3,497	6%
1928	3,460	2,165	1,953	2,059	50%	1959	3,465	8%
1929	2,909	840	667	753	18%	2000	3,451	9%
1930	3,328	2,076	1,980	2,028	49%	1996	3,440	10%
1931	2,935	1,158	1,053	1,105	27%	1999	3,439	11%
1932	3,141	1,449	1,161	1,305	32%	1963	3,406	12%
1933	3,429	2,211	1,751	1,981	48%	1938	3,394	14%
1934	3,472	1,272	1,357	1,315	32%	1935	3,334	15%
1935	3,800	3,619	3,050	3,334	81%	1953	3,323	16%
1936	3,598	3,422	2,826	3,124	76%	1971	3,317	17%
1937	3,544	3,210	3,227	3,219	78%	1968	3,297	19%
1938	3,396	3,394	3,394	3,394	82%	1966	3,265	20%
1939	3,264	3,257	3,256	3,256	79%	1970	3,257	21%
1940	3,241	3,208	3,122	3,165	77%	1939	3,256	22%
1941	2,528	2,526	2,526	2,526	61%	1984	3,227	24%
1942	3,169	3,167	3,167	3,167	77%	1937	3,219	25%
1943	3,156	3,154	3,154	3,154	76%	1975	3,218	26%
1944	3,092	2,971	2,888	2,930	71%	1954	3,201	27%
1945	3,114	3,088	3,082	3,085	75%	1946	3,199	28%
1946	3,217	3,215	3,183	3,199	77%	1985	3,198	30%
1947	3,424	2,637	1,992	2,314	56%	1974	3,184	31%
1948	3,397	2,637	2,582	2,609	63%	1942	3,167	32%
1949	3,315	1,423	1,119	1,271	31%	1940	3,165	33%
1950	3,467	2,629	2,294	2,462	60%	1923	3,159	35%
1951	3,499	3,497	3,497	3,497	85%	1943	3,154	36%
1952	2,587	2,585	2,585	2,585	63%	1989	3,130	37%
1953	3,325	3,323	3,323	3,323	80%	1979	3,128	38%
1954	3,296	3,293	3,110	3,201	77%	1981	3,128	40%
1955	3,230	1,202	1,071	1,137	28%	1936	3,124	41%
1956	3,583	3,581	3,581	3,581	87%	1997	3,101	42%
1957	3,237	2,670	2,420	2,545	62%	1973	3,085	43%
1958	3,032	3,029	3,030	3,030	73%	1945	3,085	45%
1959	3,549	3,389	3,541	3,465	84%	1958	3,030	46%
1960	3,557	1,665	1,255	1,460	35%	1998	3,008	47%
1961	3,582	2,517	2,197	2,357	57%	1995	2,993	48%
1962	3,692	2,908	3,015	2,962	72%	1967	2,990	49%
1963	3,825	3,717	3,095	3,406	82%	1962	2,962	51%
1964	3,494	2,018	2,404	2,211	53%	2003	2,943	52%
1965	3,061	3,028	2,693	2,861	69%	1982	2,940	53%

Table B.3 (cont.) SWP water delivery from the Delta under Current (2007) Conditions
Derived values for estimating probability curve

Year	*SWP Table A* demands (taf)	SWP Table A deliveries for 2007 studies				Probability Curve[1]		
		lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Year	SWP Table A Delivery (taf)	Exceedence Frequency
1966	3,284	3,282	3,249	3,265	79%	1944	2,930	54%
1967	3,002	2,989	2,991	2,990	72%	1965	2,861	56%
1968	3,326	3,324	3,270	3,297	80%	1987	2,825	57%
1969	2,638	2,626	2,625	2,626	64%	1980	2,710	58%
1970	3,259	3,257	3,257	3,257	79%	1969	2,626	59%
1971	3,343	3,329	3,305	3,317	80%	1948	2,609	61%
1972	3,459	1,881	1,533	1,707	41%	1976	2,604	62%
1973	3,099	3,094	3,077	3,085	75%	1952	2,585	63%
1974	3,186	3,184	3,183	3,184	77%	1957	2,545	64%
1975	3,231	3,229	3,206	3,218	78%	1941	2,526	66%
1976	3,473	2,973	2,234	2,604	63%	1983	2,497	67%
1977	3,423	225	260	243	6%	1950	2,462	68%
1978	3,625	3,598	3,601	3,599	87%	1961	2,357	69%
1979	3,514	3,249	3,007	3,128	76%	1947	2,314	70%
1980	2,717	2,711	2,709	2,710	66%	1986	2,294	72%
1981	3,360	3,273	2,982	3,128	76%	1964	2,211	73%
1982	2,942	2,940	2,940	2,940	71%	1926	2,186	74%
1983	2,499	2,497	2,497	2,497	60%	2002	2,162	75%
1984	3,229	3,227	3,227	3,227	78%	1994	2,105	77%
1985	3,216	3,213	3,184	3,198	77%	1928	2,059	78%
1986	2,323	2,294	2,294	2,294	56%	1930	2,028	79%
1987	2,898	2,868	2,782	2,825	68%	1933	1,981	80%
1988	2,969	544	409	477	12%	1972	1,707	82%
1989	3,553	3,132	3,129	3,130	76%	1925	1,644	83%
1990	3,630	500	220	360	9%	1960	1,460	84%
1991	3,427	806	652	729	18%	1934	1,315	85%
1992	3,368	1,096	1,078	1,087	26%	1932	1,305	87%
1993	3,864	3,846	3,576	3,711	90%	1949	1,271	88%
1994	3,672	2,071	2,138	2,105	51%	2001	1,164	89%
1995	3,015	2,995	2,992	2,993	72%	1955	1,137	90%
1996	3,441	3,440	3,440	3,440	83%	1931	1,105	91%
1997	3,308	3,026	3,176	3,101	75%	1992	1,087	93%
1998	3,015	3,008	3,007	3,008	73%	1929	753	94%
1999	3,441	3,440	3,439	3,439	83%	1991	729	95%
2000	3,469	3,463	3,439	3,451	84%	1988	477	96%
2001	3,710	1,334	994	1,164	28%	1924	400	98%
2002	3,847	2,470	1,853	2,162	52%	1990	360	99%
2003	3,469	3,130	2,756	2,943	71%	1977	243	100%
Avg	**3,309**	**2,658**	**2,531**	**2,595**	**63%**		**2,595**	
Min	**2,323**	**225**	**220**	**243**	**6%**		**243**	
Max	**3,864**	**3,846**	**3,616**	**3,711**	**90%**		**3,711**	

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.4 SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with A2 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	4,057	98%	4,068	98%	4,062	98%
1923	4,133	3,114	75%	2,056	50%	2,622	63%
1924	4,133	438	11%	750	18%	583	14%
1925	4,133	1,628	39%	1,470	36%	1,554	38%
1926	4,133	2,414	58%	2,149	52%	2,291	55%
1927	4,133	4,133	100%	3,816	92%	3,986	96%
1928	4,133	2,109	51%	2,160	52%	2,133	52%
1929	4,133	847	20%	881	21%	863	21%
1930	4,133	2,357	57%	2,470	60%	2,410	58%
1931	4,133	1,098	27%	1,066	26%	1,083	26%
1932	4,133	1,512	37%	1,352	33%	1,437	35%
1933	4,133	2,274	55%	1,357	33%	1,847	45%
1934	4,133	1,327	32%	1,312	32%	1,320	32%
1935	4,133	3,734	90%	3,205	78%	3,488	84%
1936	4,133	3,569	86%	3,682	89%	3,622	88%
1937	4,133	3,510	85%	2,292	55%	2,943	71%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,488	60%	3,044	74%
1940	4,133	3,642	88%	3,749	91%	3,691	89%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,133	100%	3,633	88%	3,900	94%
1943	4,133	3,849	93%	3,535	86%	3,703	90%
1944	4,133	2,924	71%	2,131	52%	2,555	62%
1945	4,133	3,394	82%	3,354	81%	3,375	82%
1946	4,133	3,795	92%	3,283	79%	3,557	86%
1947	4,133	1,697	41%	2,004	48%	1,839	45%
1948	4,133	3,256	79%	2,393	58%	2,854	69%
1949	4,133	1,387	34%	1,504	36%	1,441	35%
1950	4,133	2,738	66%	2,569	62%	2,660	64%
1951	4,133	4,133	100%	3,983	96%	4,063	98%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,164	77%	3,660	89%
1954	4,133	3,079	74%	2,795	68%	2,947	71%
1955	4,133	980	24%	967	23%	974	24%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	2,002	48%	2,247	54%
1958	4,133	4,133	100%	4,132	100%	4,133	100%
1959	4,133	3,219	78%	2,268	55%	2,777	67%
1960	4,133	1,557	38%	2,077	50%	1,799	44%
1961	4,133	2,746	66%	2,092	51%	2,442	59%
1962	4,133	3,016	73%	2,962	72%	2,991	72%
1963	4,133	3,923	95%	3,629	88%	3,786	92%
1964	4,133	1,605	39%	1,557	38%	1,583	38%
1965	4,133	3,368	81%	3,285	79%	3,329	81%

Table B.4 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with A2 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,476	84%	2,984	72%	3,247	79%
1967	4,133	4,133	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,614	63%	2,814	68%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,971	96%	4,058	98%
1971	4,133	3,665	89%	3,456	84%	3,568	86%
1972	4,133	1,458	35%	1,563	38%	1,507	36%
1973	4,133	4,133	100%	3,571	86%	3,872	94%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,179	77%	3,417	83%
1976	4,133	2,167	52%	1,720	42%	1,959	47%
1977	4,133	287	7%	332	8%	308	7%
1978	3,898	3,905	94%	3,904	94%	3,905	94%
1979	4,133	3,292	80%	2,937	71%	3,127	76%
1980	3,898	3,766	91%	3,492	84%	3,639	88%
1981	4,133	2,737	66%	2,535	61%	2,643	64%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,025	97%	4,083	99%
1985	4,133	3,226	78%	2,518	61%	2,897	70%
1986	3,898	2,863	69%	2,957	72%	2,907	70%
1987	4,133	2,679	65%	2,551	62%	2,619	63%
1988	4,133	450	11%	628	15%	533	13%
1989	4,133	3,486	84%	3,060	74%	3,288	80%
1990	4,133	281	7%	514	12%	389	9%
1991	4,133	889	22%	869	21%	880	21%
1992	4,133	1,124	27%	1,091	26%	1,109	27%
1993	4,133	4,036	98%	3,989	97%	4,014	97%
1994	4,133	1,866	45%	1,193	29%	1,553	38%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,133	100%	3,653	88%	3,910	95%
1997	4,133	3,301	80%	3,235	78%	3,271	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,777	91%	3,967	96%
2000	4,133	3,960	96%	3,264	79%	3,636	88%
2001	4,133	769	19%	872	21%	817	20%
2002	4,133	2,586	63%	2,387	58%	2,493	60%
2003	4,133	3,213	78%	3,224	78%	3,218	78%
Avg	**4,106**	**2,947**	**71%**	**2,729**	**66%**	**2,846**	**69%**
Min	**3,898**	**281**	**7%**	**332**	**8%**	**308**	**7%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.5 SWP Table A from the Delta under Future (2027) Conditions
GFDL Model with A2 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	3,664	89%	3,597	87%	3,633	88%
1923	4,133	2,991	72%	2,312	56%	2,676	65%
1924	4,133	125	3%	437	11%	270	7%
1925	4,133	1,565	38%	1,350	33%	1,465	35%
1926	4,133	1,968	48%	1,727	42%	1,856	45%
1927	4,133	3,706	90%	3,688	89%	3,697	89%
1928	4,133	1,895	46%	1,754	42%	1,829	44%
1929	4,133	646	16%	702	17%	672	16%
1930	4,133	2,114	51%	2,461	60%	2,275	55%
1931	4,133	1,046	25%	804	19%	934	23%
1932	4,133	1,165	28%	1,350	33%	1,251	30%
1933	4,133	1,915	46%	885	21%	1,436	35%
1934	4,133	1,427	35%	1,315	32%	1,375	33%
1935	4,133	3,087	75%	2,933	71%	3,015	73%
1936	4,133	2,959	72%	3,552	86%	3,235	78%
1937	4,133	3,774	91%	2,391	58%	3,131	76%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,237	54%	2,730	66%
1940	4,133	3,136	76%	3,317	80%	3,220	78%
1941	3,898	3,798	92%	3,532	85%	3,674	89%
1942	4,133	3,626	88%	3,192	77%	3,424	83%
1943	4,133	3,466	84%	3,498	85%	3,481	84%
1944	4,133	2,550	62%	1,627	39%	2,121	51%
1945	4,133	3,315	80%	3,442	83%	3,374	82%
1946	4,133	3,430	83%	3,007	73%	3,233	78%
1947	4,133	1,819	44%	1,588	38%	1,711	41%
1948	4,133	2,891	70%	2,343	57%	2,636	64%
1949	4,133	1,096	27%	1,127	27%	1,110	27%
1950	4,133	2,232	54%	2,339	57%	2,282	55%
1951	4,133	4,133	100%	3,991	97%	4,067	98%
1952	3,898	3,907	95%	3,876	94%	3,893	94%
1953	4,133	3,163	77%	2,476	60%	2,843	69%
1954	4,133	3,034	73%	2,505	61%	2,788	67%
1955	4,133	998	24%	854	21%	931	23%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,770	43%	1,888	46%
1958	4,133	4,133	100%	3,627	88%	3,898	94%
1959	4,133	2,933	71%	2,399	58%	2,684	65%
1960	4,133	1,237	30%	1,680	41%	1,443	35%
1961	4,133	2,492	60%	2,077	50%	2,299	56%
1962	4,133	3,124	76%	2,927	71%	3,033	73%
1963	4,133	3,119	75%	2,835	69%	2,987	72%
1964	4,133	2,189	53%	1,864	45%	2,038	49%
1965	4,133	2,979	72%	3,041	74%	3,008	73%

Table B.5 cont SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with A2 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,376	82%	2,624	63%	3,026	73%
1967	4,133	4,047	98%	4,133	100%	4,087	99%
1968	4,133	2,368	57%	2,083	50%	2,235	54%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,645	88%	3,906	95%
1971	4,133	3,124	76%	3,117	75%	3,121	76%
1972	4,133	1,487	36%	1,463	35%	1,476	36%
1973	4,133	3,455	84%	2,916	71%	3,204	78%
1974	4,133	3,748	91%	3,850	93%	3,795	92%
1975	4,133	3,232	78%	2,602	63%	2,939	71%
1976	4,133	1,632	39%	1,866	45%	1,741	42%
1977	4,133	278	7%	279	7%	278	7%
1978	3,898	3,905	94%	3,904	94%	3,904	94%
1979	4,133	3,044	74%	2,635	64%	2,853	69%
1980	3,898	3,905	94%	3,584	87%	3,756	91%
1981	4,133	2,545	62%	2,298	56%	2,430	59%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,119	100%	4,127	100%
1985	4,133	3,030	73%	2,314	56%	2,697	65%
1986	3,898	2,841	69%	2,964	72%	2,898	70%
1987	4,133	2,280	55%	2,067	50%	2,181	53%
1988	4,133	427	10%	738	18%	572	14%
1989	4,133	3,197	77%	2,811	68%	3,017	73%
1990	4,133	191	5%	293	7%	238	6%
1991	4,133	733	18%	700	17%	718	17%
1992	4,133	1,100	27%	1,078	26%	1,090	26%
1993	4,133	3,504	85%	3,684	89%	3,588	87%
1994	4,133	2,283	55%	1,237	30%	1,797	43%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	3,383	82%	3,501	85%
1997	4,133	3,211	78%	3,344	81%	3,273	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,544	86%	3,859	93%
2000	4,133	3,316	80%	2,874	70%	3,110	75%
2001	4,133	982	24%	771	19%	884	21%
2002	4,133	2,063	50%	2,074	50%	2,068	50%
2003	4,133	2,836	69%	2,819	68%	2,828	68%
Avg	**4,106**	**2,734**	**66%**	**2,540**	**61%**	**2,643**	**64%**
Min	**3,898**	**125**	**3%**	**279**	**7%**	**238**	**6%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.6 SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with B1 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	4,057	98%	3,945	95%	4,005	97%
1923	4,133	3,114	75%	2,000	48%	2,596	63%
1924	4,133	438	11%	797	19%	605	15%
1925	4,133	1,628	39%	1,455	35%	1,548	37%
1926	4,133	2,414	58%	1,893	46%	2,172	53%
1927	4,133	4,133	100%	3,772	91%	3,965	96%
1928	4,133	2,109	51%	2,098	51%	2,104	51%
1929	4,133	847	20%	997	24%	917	22%
1930	4,133	2,357	57%	2,055	50%	2,217	54%
1931	4,133	1,098	27%	1,099	27%	1,098	27%
1932	4,133	1,512	37%	1,367	33%	1,445	35%
1933	4,133	2,274	55%	1,219	29%	1,783	43%
1934	4,133	1,327	32%	1,452	35%	1,385	34%
1935	4,133	3,734	90%	3,366	81%	3,563	86%
1936	4,133	3,569	86%	3,125	76%	3,363	81%
1937	4,133	3,510	85%	2,225	54%	2,912	70%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,620	63%	3,105	75%
1940	4,133	3,642	88%	3,565	86%	3,606	87%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,133	100%	3,494	85%	3,836	93%
1943	4,133	3,849	93%	3,567	86%	3,718	90%
1944	4,133	2,924	71%	2,070	50%	2,527	61%
1945	4,133	3,394	82%	2,823	68%	3,128	76%
1946	4,133	3,795	92%	3,449	83%	3,634	88%
1947	4,133	1,697	41%	1,910	46%	1,796	43%
1948	4,133	3,256	79%	2,427	59%	2,870	69%
1949	4,133	1,387	34%	1,397	34%	1,392	34%
1950	4,133	2,738	66%	2,514	61%	2,634	64%
1951	4,133	4,133	100%	4,012	97%	4,077	99%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,136	76%	3,647	88%
1954	4,133	3,079	74%	2,965	72%	3,026	73%
1955	4,133	980	24%	954	23%	968	23%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	1,973	48%	2,234	54%
1958	4,133	4,133	100%	4,132	100%	4,133	100%
1959	4,133	3,219	78%	2,330	56%	2,805	68%
1960	4,133	1,557	38%	1,809	44%	1,674	41%
1961	4,133	2,746	66%	2,308	56%	2,542	62%
1962	4,133	3,016	73%	2,937	71%	2,979	72%
1963	4,133	3,923	95%	3,710	90%	3,824	93%
1964	4,133	1,605	39%	1,554	38%	1,581	38%
1965	4,133	3,368	81%	3,277	79%	3,326	80%

Table B.6 cont SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with B1 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,476	84%	2,895	70%	3,206	78%
1967	4,133	4,133	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,570	62%	2,794	68%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,010	97%	4,076	99%
1971	4,133	3,665	89%	3,525	85%	3,600	87%
1972	4,133	1,458	35%	1,564	38%	1,507	36%
1973	4,133	4,133	100%	3,574	86%	3,873	94%
1974	4,133	4,133	100%	3,807	92%	3,981	96%
1975	4,133	3,624	88%	3,020	73%	3,343	81%
1976	4,133	2,167	52%	2,113	51%	2,142	52%
1977	4,133	287	7%	306	7%	296	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,292	80%	2,612	63%	2,976	72%
1980	3,898	3,766	91%	3,515	85%	3,649	88%
1981	4,133	2,737	66%	2,498	60%	2,626	64%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,057	98%	4,098	99%
1985	4,133	3,226	78%	2,471	60%	2,875	70%
1986	3,898	2,863	69%	2,976	72%	2,915	71%
1987	4,133	2,679	65%	2,378	58%	2,539	61%
1988	4,133	450	11%	602	15%	521	13%
1989	4,133	3,486	84%	3,225	78%	3,365	81%
1990	4,133	281	7%	484	12%	376	9%
1991	4,133	889	22%	924	22%	905	22%
1992	4,133	1,124	27%	1,014	25%	1,073	26%
1993	4,133	4,036	98%	3,975	96%	4,007	97%
1994	4,133	1,866	45%	1,169	28%	1,542	37%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,133	100%	3,579	87%	3,875	94%
1997	4,133	3,301	80%	3,244	78%	3,275	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,812	92%	3,984	96%
2000	4,133	3,960	96%	3,061	74%	3,542	86%
2001	4,133	769	19%	874	21%	818	20%
2002	4,133	2,586	63%	2,264	55%	2,436	59%
2003	4,133	3,213	78%	3,327	81%	3,266	79%
Avg	**4,106**	**2,947**	**71%**	**2,696**	**65%**	**2,830**	**68%**
Min	**3,898**	**281**	**7%**	**306**	**7%**	**296**	**7%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.7 SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with B1 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	3,664	89%	3,556	86%	3,614	87%
1923	4,133	2,991	72%	2,293	55%	2,666	65%
1924	4,133	125	3%	301	7%	207	5%
1925	4,133	1,565	38%	1,363	33%	1,471	36%
1926	4,133	1,968	48%	1,561	38%	1,779	43%
1927	4,133	3,706	90%	3,632	88%	3,671	89%
1928	4,133	1,895	46%	1,757	43%	1,831	44%
1929	4,133	646	16%	768	19%	703	17%
1930	4,133	2,114	51%	2,048	50%	2,083	50%
1931	4,133	1,046	25%	889	22%	973	24%
1932	4,133	1,165	28%	1,352	33%	1,252	30%
1933	4,133	1,915	46%	892	22%	1,439	35%
1934	4,133	1,427	35%	1,181	29%	1,313	32%
1935	4,133	3,087	75%	2,839	69%	2,972	72%
1936	4,133	2,959	72%	2,894	70%	2,929	71%
1937	4,133	3,774	91%	2,132	52%	3,010	73%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,358	57%	2,786	67%
1940	4,133	3,136	76%	3,075	74%	3,108	75%
1941	3,898	3,798	92%	3,433	83%	3,628	88%
1942	4,133	3,626	88%	3,107	75%	3,384	82%
1943	4,133	3,466	84%	3,499	85%	3,481	84%
1944	4,133	2,550	62%	1,547	37%	2,083	50%
1945	4,133	3,315	80%	3,018	73%	3,177	77%
1946	4,133	3,430	83%	3,166	77%	3,307	80%
1947	4,133	1,819	44%	1,484	36%	1,663	40%
1948	4,133	2,891	70%	2,426	59%	2,675	65%
1949	4,133	1,096	27%	1,085	26%	1,090	26%
1950	4,133	2,232	54%	2,162	52%	2,200	53%
1951	4,133	4,133	100%	3,928	95%	4,038	98%
1952	3,898	3,907	95%	3,841	93%	3,876	94%
1953	4,133	3,163	77%	2,539	61%	2,872	70%
1954	4,133	3,034	73%	2,683	65%	2,871	69%
1955	4,133	998	24%	838	20%	924	22%
1956	4,133	4,133	100%	4,040	98%	4,090	99%
1957	4,133	1,991	48%	1,796	43%	1,900	46%
1958	4,133	4,133	100%	3,720	90%	3,941	95%
1959	4,133	2,933	71%	2,347	57%	2,660	64%
1960	4,133	1,237	30%	1,291	31%	1,263	31%
1961	4,133	2,492	60%	2,313	56%	2,409	58%
1962	4,133	3,124	76%	2,786	67%	2,967	72%
1963	4,133	3,119	75%	3,101	75%	3,111	75%
1964	4,133	2,189	53%	1,676	41%	1,951	47%
1965	4,133	2,979	72%	3,063	74%	3,018	73%

Table B.7 cont SWP Table A deliveries from the Delta under Future (2027) Conditions
GFDL Model with B1 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,376	82%	2,551	62%	2,992	72%
1967	4,133	4,047	98%	4,006	97%	4,028	97%
1968	4,133	2,368	57%	2,121	51%	2,253	55%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	3,736	90%	3,948	96%
1971	4,133	3,124	76%	3,117	75%	3,121	76%
1972	4,133	1,487	36%	1,460	35%	1,475	36%
1973	4,133	3,455	84%	2,949	71%	3,219	78%
1974	4,133	3,748	91%	3,622	88%	3,689	89%
1975	4,133	3,232	78%	2,665	64%	2,968	72%
1976	4,133	1,632	39%	1,969	48%	1,789	43%
1977	4,133	278	7%	280	7%	279	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,044	74%	2,117	51%	2,613	63%
1980	3,898	3,905	94%	3,622	88%	3,773	91%
1981	4,133	2,545	62%	1,974	48%	2,280	55%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,013	97%	4,078	99%
1985	4,133	3,030	73%	2,281	55%	2,681	65%
1986	3,898	2,841	69%	3,046	74%	2,936	71%
1987	4,133	2,280	55%	1,865	45%	2,087	50%
1988	4,133	427	10%	689	17%	549	13%
1989	4,133	3,197	77%	3,064	74%	3,135	76%
1990	4,133	191	5%	198	5%	194	5%
1991	4,133	733	18%	681	16%	709	17%
1992	4,133	1,100	27%	1,010	24%	1,058	26%
1993	4,133	3,504	85%	3,614	87%	3,555	86%
1994	4,133	2,283	55%	1,154	28%	1,758	43%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	2,991	72%	3,319	80%
1997	4,133	3,211	78%	3,352	81%	3,276	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,348	81%	3,768	91%
2000	4,133	3,316	80%	2,900	70%	3,123	76%
2001	4,133	982	24%	635	15%	821	20%
2002	4,133	2,063	50%	2,064	50%	2,063	50%
2003	4,133	2,836	69%	2,879	70%	2,856	69%
Avg	**4,106**	**2,734**	**66%**	**2,482**	**60%**	**2,617**	**63%**
Min	**3,898**	**125**	**3%**	**198**	**5%**	**194**	**5%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.8 SWP Table A deliveries from the Delta under Future (2027) Conditions
PCM Model with A2 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	4,057	98%	4,062	98%	4,060	98%
1923	4,133	3,114	75%	2,377	58%	2,771	67%
1924	4,133	438	11%	568	14%	498	12%
1925	4,133	1,628	39%	1,473	36%	1,556	38%
1926	4,133	2,414	58%	1,907	46%	2,178	53%
1927	4,133	4,133	100%	4,107	99%	4,133	100%
1928	4,133	2,109	51%	1,909	46%	2,016	49%
1929	4,133	847	20%	970	23%	904	22%
1930	4,133	2,357	57%	1,974	48%	2,179	53%
1931	4,133	1,098	27%	1,164	28%	1,128	27%
1932	4,133	1,512	37%	1,353	33%	1,438	35%
1933	4,133	2,274	55%	1,378	33%	1,857	45%
1934	4,133	1,327	32%	1,381	33%	1,352	33%
1935	4,133	3,734	90%	3,527	85%	3,638	88%
1936	4,133	3,569	86%	3,562	86%	3,566	86%
1937	4,133	3,510	85%	2,518	61%	3,049	74%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	2,997	73%	3,280	79%
1940	4,133	3,642	88%	3,834	93%	3,731	90%
1941	3,898	3,908	95%	3,906	95%	3,907	95%
1942	4,133	4,133	100%	3,805	92%	3,981	96%
1943	4,133	3,849	93%	3,587	87%	3,727	90%
1944	4,133	2,924	71%	2,058	50%	2,521	61%
1945	4,133	3,394	82%	3,896	94%	3,627	88%
1946	4,133	3,795	92%	3,080	75%	3,463	84%
1947	4,133	1,697	41%	1,704	41%	1,700	41%
1948	4,133	3,256	79%	2,786	67%	3,037	73%
1949	4,133	1,387	34%	1,370	33%	1,379	33%
1950	4,133	2,738	66%	2,810	68%	2,771	67%
1951	4,133	4,133	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,373	82%	3,757	91%
1954	4,133	3,079	74%	2,962	72%	3,025	73%
1955	4,133	980	24%	929	22%	956	23%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	1,945	47%	2,221	54%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	3,219	78%	2,489	60%	2,880	70%
1960	4,133	1,557	38%	1,874	45%	1,705	41%
1961	4,133	2,746	66%	2,627	64%	2,691	65%
1962	4,133	3,016	73%	2,902	70%	2,963	72%
1963	4,133	3,923	95%	3,687	89%	3,813	92%
1964	4,133	1,605	39%	1,535	37%	1,572	38%
1965	4,133	3,368	81%	3,225	78%	3,301	80%

Table B.8 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions PCM Model with A2 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,476	84%	3,208	78%	3,352	81%
1967	4,133	4,133	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,743	66%	2,874	70%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,665	89%	3,452	84%	3,566	86%
1972	4,133	1,458	35%	1,422	34%	1,441	35%
1973	4,133	4,133	100%	3,758	91%	3,959	96%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,404	82%	3,521	85%
1976	4,133	2,167	52%	2,000	48%	2,089	51%
1977	4,133	287	7%	274	7%	281	7%
1978	3,898	3,905	94%	3,903	94%	3,904	94%
1979	4,133	3,292	80%	3,056	74%	3,182	77%
1980	3,898	3,766	91%	3,491	84%	3,638	88%
1981	4,133	2,737	66%	2,570	62%	2,659	64%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,226	78%	2,581	62%	2,926	71%
1986	3,898	2,863	69%	3,004	73%	2,928	71%
1987	4,133	2,679	65%	2,567	62%	2,627	64%
1988	4,133	450	11%	446	11%	448	11%
1989	4,133	3,486	84%	3,424	83%	3,457	84%
1990	4,133	281	7%	377	9%	325	8%
1991	4,133	889	22%	875	21%	883	21%
1992	4,133	1,124	27%	1,090	26%	1,108	27%
1993	4,133	4,036	98%	4,057	98%	4,046	98%
1994	4,133	1,866	45%	1,494	36%	1,693	41%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,133	100%	3,813	92%	3,984	96%
1997	4,133	3,301	80%	3,199	77%	3,254	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	3,960	96%	4,052	98%
2000	4,133	3,960	96%	3,602	87%	3,794	92%
2001	4,133	769	19%	824	20%	795	19%
2002	4,133	2,586	63%	1,996	48%	2,312	56%
2003	4,133	3,213	78%	3,241	78%	3,226	78%
Avg	**4,106**	**2,947**	**71%**	**2,782**	**67%**	**2,870**	**69%**
Min	**3,898**	**281**	**7%**	**274**	**7%**	**281**	**7%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.9 SWP Table A deliveries from the Delta under Future (2027) Conditions
PCM Model with A2 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	3,664	89%	3,545	86%	3,609	87%
1923	4,133	2,991	72%	2,850	69%	2,925	71%
1924	4,133	125	3%	150	4%	137	3%
1925	4,133	1,565	38%	1,394	34%	1,485	36%
1926	4,133	1,968	48%	1,463	35%	1,733	42%
1927	4,133	3,706	90%	3,736	90%	3,720	90%
1928	4,133	1,895	46%	1,701	41%	1,805	44%
1929	4,133	646	16%	712	17%	677	16%
1930	4,133	2,114	51%	1,849	45%	1,991	48%
1931	4,133	1,046	25%	1,051	25%	1,049	25%
1932	4,133	1,165	28%	1,286	31%	1,222	30%
1933	4,133	1,915	46%	1,172	28%	1,569	38%
1934	4,133	1,427	35%	1,264	31%	1,351	33%
1935	4,133	3,087	75%	3,437	83%	3,250	79%
1936	4,133	2,959	72%	3,265	79%	3,101	75%
1937	4,133	3,774	91%	2,662	64%	3,257	79%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,727	66%	2,958	72%
1940	4,133	3,136	76%	3,226	78%	3,178	77%
1941	3,898	3,798	92%	3,826	93%	3,811	92%
1942	4,133	3,626	88%	3,421	83%	3,531	85%
1943	4,133	3,466	84%	3,754	91%	3,600	87%
1944	4,133	2,550	62%	1,272	31%	1,955	47%
1945	4,133	3,315	80%	4,000	97%	3,634	88%
1946	4,133	3,430	83%	2,729	66%	3,104	75%
1947	4,133	1,819	44%	1,441	35%	1,643	40%
1948	4,133	2,891	70%	2,535	61%	2,726	66%
1949	4,133	1,096	27%	1,068	26%	1,083	26%
1950	4,133	2,232	54%	1,992	48%	2,120	51%
1951	4,133	4,133	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,906	95%	3,906	95%
1953	4,133	3,163	77%	2,660	64%	2,929	71%
1954	4,133	3,034	73%	2,938	71%	2,989	72%
1955	4,133	998	24%	676	16%	848	21%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,760	43%	1,883	46%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	2,933	71%	2,481	60%	2,722	66%
1960	4,133	1,237	30%	1,522	37%	1,370	33%
1961	4,133	2,492	60%	2,162	52%	2,339	57%
1962	4,133	3,124	76%	3,127	76%	3,126	76%
1963	4,133	3,119	75%	3,065	74%	3,094	75%
1964	4,133	2,189	53%	1,582	38%	1,907	46%
1965	4,133	2,979	72%	2,955	72%	2,968	72%

Table B.9 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions PCM Model with A2 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,376	82%	2,891	70%	3,150	76%
1967	4,133	4,047	98%	4,110	99%	4,077	99%
1968	4,133	2,368	57%	2,085	50%	2,236	54%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,124	76%	3,090	75%	3,108	75%
1972	4,133	1,487	36%	1,408	34%	1,450	35%
1973	4,133	3,455	84%	3,275	79%	3,371	82%
1974	4,133	3,748	91%	3,684	89%	3,718	90%
1975	4,133	3,232	78%	3,000	73%	3,124	76%
1976	4,133	1,632	39%	1,558	38%	1,598	39%
1977	4,133	278	7%	248	6%	264	6%
1978	3,898	3,905	94%	3,904	94%	3,904	94%
1979	4,133	3,044	74%	2,768	67%	2,915	71%
1980	3,898	3,905	94%	3,893	94%	3,899	94%
1981	4,133	2,545	62%	2,169	52%	2,370	57%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,030	73%	2,420	59%	2,746	66%
1986	3,898	2,841	69%	3,253	79%	3,032	73%
1987	4,133	2,280	55%	1,709	41%	2,014	49%
1988	4,133	427	10%	636	15%	524	13%
1989	4,133	3,197	77%	3,184	77%	3,191	77%
1990	4,133	191	5%	177	4%	184	4%
1991	4,133	733	18%	626	15%	683	17%
1992	4,133	1,100	27%	1,047	25%	1,075	26%
1993	4,133	3,504	85%	3,554	86%	3,527	85%
1994	4,133	2,283	55%	1,372	33%	1,859	45%
1995	3,898	3,902	94%	3,903	94%	3,903	94%
1996	4,133	3,604	87%	3,661	89%	3,631	88%
1997	4,133	3,211	78%	3,287	80%	3,246	79%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	4,112	99%	4,123	100%
2000	4,133	3,316	80%	3,237	78%	3,279	79%
2001	4,133	982	24%	617	15%	812	20%
2002	4,133	2,063	50%	1,845	45%	1,961	47%
2003	4,133	2,836	69%	2,831	69%	2,834	69%
Avg	**4,106**	**2,734**	**66%**	**2,592**	**63%**	**2,668**	**65%**
Min	**3,898**	**125**	**3%**	**150**	**4%**	**137**	**3%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	4,133	100%

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.10 SWP Table A deliveries from the Delta under Future (2027) Conditions
PCM Model with B1 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	4,057	98%	4,132	100%	4,092	99%
1923	4,133	3,114	75%	3,064	74%	3,091	75%
1924	4,133	438	11%	295	7%	371	9%
1925	4,133	1,628	39%	1,821	44%	1,718	42%
1926	4,133	2,414	58%	2,070	50%	2,254	55%
1927	4,133	4,133	100%	4,032	98%	4,086	99%
1928	4,133	2,109	51%	2,273	55%	2,186	53%
1929	4,133	847	20%	1,058	26%	945	23%
1930	4,133	2,357	57%	2,233	54%	2,299	56%
1931	4,133	1,098	27%	1,167	28%	1,130	27%
1932	4,133	1,512	37%	1,638	40%	1,570	38%
1933	4,133	2,274	55%	2,415	58%	2,340	57%
1934	4,133	1,327	32%	1,323	32%	1,325	32%
1935	4,133	3,734	90%	3,831	93%	3,779	91%
1936	4,133	3,569	86%	3,649	88%	3,606	87%
1937	4,133	3,510	85%	3,137	76%	3,337	81%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,527	85%	3,283	79%	3,414	83%
1940	4,133	3,642	88%	3,929	95%	3,775	91%
1941	3,898	3,908	95%	3,907	95%	3,907	95%
1942	4,133	4,133	100%	4,133	100%	4,133	100%
1943	4,133	3,849	93%	3,682	89%	3,772	91%
1944	4,133	2,924	71%	2,964	72%	2,943	71%
1945	4,133	3,394	82%	3,743	91%	3,556	86%
1946	4,133	3,795	92%	3,494	85%	3,655	88%
1947	4,133	1,697	41%	1,817	44%	1,752	42%
1948	4,133	3,256	79%	3,345	81%	3,297	80%
1949	4,133	1,387	34%	1,559	38%	1,467	35%
1950	4,133	2,738	66%	2,896	70%	2,812	68%
1951	4,133	4,133	100%	4,133	100%	4,133	100%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	4,091	99%	3,727	90%	3,922	95%
1954	4,133	3,079	74%	3,306	80%	3,184	77%
1955	4,133	980	24%	1,074	26%	1,024	25%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	2,460	60%	2,424	59%	2,443	59%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	3,219	78%	3,175	77%	3,199	77%
1960	4,133	1,557	38%	1,911	46%	1,722	42%
1961	4,133	2,746	66%	2,540	61%	2,650	64%
1962	4,133	3,016	73%	3,519	85%	3,250	79%
1963	4,133	3,923	95%	3,314	80%	3,640	88%
1964	4,133	1,605	39%	2,055	50%	1,814	44%
1965	4,133	3,368	81%	3,325	80%	3,348	81%

Table B.10 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions PCM Model with B1 Emissions and less restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,476	84%	3,497	85%	3,486	84%
1967	4,133	4,133	100%	4,133	100%	4,133	100%
1968	4,133	2,988	72%	2,991	72%	2,990	72%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,665	89%	3,651	88%	3,658	89%
1972	4,133	1,458	35%	1,525	37%	1,489	36%
1973	4,133	4,133	100%	3,847	93%	4,000	97%
1974	4,133	4,133	100%	4,133	100%	4,133	100%
1975	4,133	3,624	88%	3,776	91%	3,695	89%
1976	4,133	2,167	52%	2,296	56%	2,227	54%
1977	4,133	287	7%	315	8%	300	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,292	80%	3,462	84%	3,371	82%
1980	3,898	3,766	91%	3,596	87%	3,687	89%
1981	4,133	2,737	66%	2,745	66%	2,740	66%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,226	78%	3,369	82%	3,293	80%
1986	3,898	2,863	69%	2,726	66%	2,799	68%
1987	4,133	2,679	65%	2,520	61%	2,605	63%
1988	4,133	450	11%	521	13%	483	12%
1989	4,133	3,486	84%	3,526	85%	3,504	85%
1990	4,133	281	7%	466	11%	367	9%
1991	4,133	889	22%	1,052	25%	965	23%
1992	4,133	1,124	27%	1,380	33%	1,243	30%
1993	4,133	4,036	98%	3,943	95%	3,993	97%
1994	4,133	1,866	45%	1,884	46%	1,874	45%
1995	3,898	3,903	94%	3,903	94%	3,903	94%
1996	4,133	4,133	100%	3,893	94%	4,021	97%
1997	4,133	3,301	80%	3,285	79%	3,294	80%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	4,068	98%	4,103	99%
2000	4,133	3,960	96%	3,858	93%	3,913	95%
2001	4,133	769	19%	1,017	25%	884	21%
2002	4,133	2,586	63%	2,605	63%	2,595	63%
2003	4,133	3,213	78%	3,188	77%	3,201	77%
Avg	**4,106**	**2,947**	**71%**	**2,962**	**72%**	**2,954**	**71%**
Min	**3,898**	**281**	**7%**	**295**	**7%**	**300**	**7%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.11 SWP Table A deliveries from the Delta under Future (2027) Conditions
PCM Model with B1 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,133	3,664	89%	3,626	88%	3,647	88%
1923	4,133	2,991	72%	3,082	75%	3,033	73%
1924	4,133	125	3%	178	4%	150	4%
1925	4,133	1,565	38%	1,789	43%	1,669	40%
1926	4,133	1,968	48%	1,966	48%	1,967	48%
1927	4,133	3,706	90%	3,650	88%	3,680	89%
1928	4,133	1,895	46%	1,952	47%	1,921	46%
1929	4,133	646	16%	824	20%	729	18%
1930	4,133	2,114	51%	1,886	46%	2,008	49%
1931	4,133	1,046	25%	1,140	28%	1,090	26%
1932	4,133	1,165	28%	1,457	35%	1,301	31%
1933	4,133	1,915	46%	1,979	48%	1,944	47%
1934	4,133	1,427	35%	1,343	32%	1,388	34%
1935	4,133	3,087	75%	3,170	77%	3,126	76%
1936	4,133	2,959	72%	3,222	78%	3,081	75%
1937	4,133	3,774	91%	3,385	82%	3,593	87%
1938	4,133	4,133	100%	4,133	100%	4,133	100%
1939	4,133	3,158	76%	2,893	70%	3,035	73%
1940	4,133	3,136	76%	3,327	81%	3,225	78%
1941	3,898	3,798	92%	3,887	94%	3,839	93%
1942	4,133	3,626	88%	3,653	88%	3,639	88%
1943	4,133	3,466	84%	3,547	86%	3,503	85%
1944	4,133	2,550	62%	2,449	59%	2,503	61%
1945	4,133	3,315	80%	3,641	88%	3,467	84%
1946	4,133	3,430	83%	3,288	80%	3,364	81%
1947	4,133	1,819	44%	1,907	46%	1,860	45%
1948	4,133	2,891	70%	2,837	69%	2,866	69%
1949	4,133	1,096	27%	1,417	34%	1,245	30%
1950	4,133	2,232	54%	2,726	66%	2,462	60%
1951	4,133	4,133	100%	3,757	91%	3,958	96%
1952	3,898	3,907	95%	3,907	95%	3,907	95%
1953	4,133	3,163	77%	3,050	74%	3,110	75%
1954	4,133	3,034	73%	3,080	75%	3,056	74%
1955	4,133	998	24%	1,053	25%	1,024	25%
1956	4,133	4,133	100%	4,133	100%	4,133	100%
1957	4,133	1,991	48%	1,959	47%	1,976	48%
1958	4,133	4,133	100%	4,133	100%	4,133	100%
1959	4,133	2,933	71%	2,962	72%	2,946	71%
1960	4,133	1,237	30%	1,651	40%	1,430	35%
1961	4,133	2,492	60%	2,312	56%	2,408	58%
1962	4,133	3,124	76%	3,230	78%	3,174	77%
1963	4,133	3,119	75%	2,936	71%	3,034	73%
1964	4,133	2,189	53%	2,240	54%	2,213	54%
1965	4,133	2,979	72%	2,774	67%	2,884	70%

Table B.11 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions PCM Model with B1 Emissions and more restrictive Old River and Middle River flow targets

Year	SWP Table A demands (taf)	No Climate Change Lower flow target scenario[1]		GFDL with A2 Emissions Lower flow target scenario[1]		Estimated Delivery Interpolated to 2027[2]	
		SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	4,133	3,376	82%	3,376	82%	3,376	82%
1967	4,133	4,047	98%	4,050	98%	4,048	98%
1968	4,133	2,368	57%	2,357	57%	2,363	57%
1969	3,898	3,903	94%	3,903	94%	3,903	94%
1970	4,133	4,133	100%	4,133	100%	4,133	100%
1971	4,133	3,124	76%	3,149	76%	3,136	76%
1972	4,133	1,487	36%	1,503	36%	1,495	36%
1973	4,133	3,455	84%	3,381	82%	3,420	83%
1974	4,133	3,748	91%	3,837	93%	3,789	92%
1975	4,133	3,232	78%	3,211	78%	3,222	78%
1976	4,133	1,632	39%	1,631	39%	1,631	39%
1977	4,133	278	7%	284	7%	281	7%
1978	3,898	3,905	94%	3,905	94%	3,905	94%
1979	4,133	3,044	74%	3,002	73%	3,024	73%
1980	3,898	3,905	94%	3,855	93%	3,881	94%
1981	4,133	2,545	62%	2,549	62%	2,547	62%
1982	4,133	4,133	100%	4,133	100%	4,133	100%
1983	3,898	3,903	94%	3,903	94%	3,903	94%
1984	4,133	4,133	100%	4,133	100%	4,133	100%
1985	4,133	3,030	73%	3,035	73%	3,032	73%
1986	3,898	2,841	69%	2,775	67%	2,810	68%
1987	4,133	2,280	55%	2,379	58%	2,326	56%
1988	4,133	427	10%	484	12%	454	11%
1989	4,133	3,197	77%	3,351	81%	3,269	79%
1990	4,133	191	5%	449	11%	311	8%
1991	4,133	733	18%	826	20%	776	19%
1992	4,133	1,100	27%	1,152	28%	1,124	27%
1993	4,133	3,504	85%	3,434	83%	3,471	84%
1994	4,133	2,283	55%	2,228	54%	2,258	55%
1995	3,898	3,902	94%	3,903	94%	3,902	94%
1996	4,133	3,604	87%	3,647	88%	3,624	88%
1997	4,133	3,211	78%	3,380	82%	3,289	80%
1998	3,898	3,908	95%	3,908	95%	3,908	95%
1999	4,133	4,133	100%	4,133	100%	4,133	100%
2000	4,133	3,316	80%	3,408	82%	3,359	81%
2001	4,133	982	24%	1,050	25%	1,014	25%
2002	4,133	2,063	50%	2,176	53%	2,115	51%
2003	4,133	2,836	69%	2,803	68%	2,820	68%
Avg	**4,106**	**2,734**	**66%**	**2,760**	**67%**	**2,746**	**66%**
Min	**3,898**	**125**	**3%**	**178**	**4%**	**150**	**4%**
Max	**4,133**	**4,133**	**100%**	**4,133**	**100%**	**4,133**	**100%**

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.12 SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve GFDL Model with A2 emissions

Year	SWP Table A demands (taf)	SWP Table A deliveries for 2027 studies				Probability Curve[1]		
		lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Year	SWP Table A Delivery (taf)	Exceedence Frequency
1922	4,062	3,633	3,848	93%	0%	1938	4,133	100%
1923	2,622	2,676	2,649	64%	1%	1956	4,133	100%
1924	583	270	427	10%	3%	1982	4,133	100%
1925	1,554	1,465	1,510	37%	4%	1967	4,110	99%
1926	2,291	1,856	2,074	50%	5%	1984	4,105	99%
1927	3,986	3,697	3,842	93%	6%	1951	4,065	98%
1928	2,133	1,829	1,981	48%	8%	1958	4,015	97%
1929	863	672	767	19%	9%	1970	3,982	96%
1930	2,410	2,275	2,343	57%	10%	1974	3,964	96%
1931	1,083	934	1,008	24%	11%	1999	3,913	95%
1932	1,437	1,251	1,344	33%	12%	1998	3,908	95%
1933	1,847	1,436	1,641	40%	14%	1978	3,905	94%
1934	1,320	1,375	1,348	33%	15%	1969	3,903	94%
1935	3,488	3,015	3,252	79%	16%	1983	3,903	94%
1936	3,622	3,235	3,428	83%	17%	1995	3,903	94%
1937	2,943	3,131	3,037	73%	19%	1952	3,900	94%
1938	4,133	4,133	4,133	100%	20%	1922	3,848	93%
1939	3,044	2,730	2,887	70%	21%	1927	3,842	93%
1940	3,691	3,220	3,456	84%	22%	1993	3,801	92%
1941	3,907	3,674	3,791	92%	24%	1941	3,791	92%
1942	3,900	3,424	3,662	89%	25%	1996	3,705	90%
1943	3,703	3,481	3,592	87%	26%	1980	3,697	89%
1944	2,555	2,121	2,338	57%	27%	1942	3,662	89%
1945	3,375	3,374	3,375	82%	28%	1943	3,592	87%
1946	3,557	3,233	3,395	82%	30%	1973	3,538	86%
1947	1,839	1,711	1,775	43%	31%	1940	3,456	84%
1948	2,854	2,636	2,745	66%	32%	1936	3,428	83%
1949	1,441	1,110	1,276	31%	33%	1946	3,395	82%
1950	2,660	2,282	2,471	60%	35%	1963	3,387	82%
1951	4,063	4,067	4,065	98%	36%	1945	3,375	82%
1952	3,907	3,893	3,900	94%	37%	2000	3,373	82%
1953	3,660	2,843	3,252	79%	38%	1971	3,344	81%
1954	2,947	2,788	2,867	69%	40%	1997	3,272	79%
1955	974	931	952	23%	41%	1953	3,252	79%
1956	4,133	4,133	4,133	100%	42%	1935	3,252	79%
1957	2,247	1,888	2,068	50%	43%	1975	3,178	77%
1958	4,133	3,898	4,015	97%	45%	1965	3,169	77%
1959	2,777	2,684	2,731	66%	46%	1989	3,153	76%
1960	1,799	1,443	1,621	39%	47%	1966	3,137	76%
1961	2,442	2,299	2,371	57%	48%	1937	3,037	73%
1962	2,991	3,033	3,012	73%	49%	2003	3,023	73%
1963	3,786	2,987	3,387	82%	51%	1962	3,012	73%
1964	1,583	2,038	1,810	44%	52%	1979	2,990	72%
1965	3,329	3,008	3,169	77%	53%	1986	2,902	70%

Table B.12 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve GFDL Model with A2 emissions

		SWP Table A deliveries for 2027 studies				Probability Curve[1]		
Year	SWP Table A demands (taf)	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Year	SWP Table A Delivery (taf)	Exceedence Frequency
1966	3,247	3,026	3,137	76%	54%	1939	2,887	70%
1967	4,133	4,087	4,110	99%	56%	1954	2,867	69%
1968	2,814	2,235	2,525	61%	57%	1985	2,797	68%
1969	3,903	3,903	3,903	94%	58%	1948	2,745	66%
1970	4,058	3,906	3,982	96%	59%	1959	2,731	66%
1971	3,568	3,121	3,344	81%	61%	1923	2,649	64%
1972	1,507	1,476	1,491	36%	62%	1981	2,536	61%
1973	3,872	3,204	3,538	86%	63%	1968	2,525	61%
1974	4,133	3,795	3,964	96%	64%	1950	2,471	60%
1975	3,417	2,939	3,178	77%	66%	1987	2,400	58%
1976	1,959	1,741	1,850	45%	67%	1961	2,371	57%
1977	308	278	293	7%	68%	1930	2,343	57%
1978	3,905	3,904	3,905	94%	69%	1944	2,338	57%
1979	3,127	2,853	2,990	72%	70%	2002	2,281	55%
1980	3,639	3,756	3,697	89%	72%	1926	2,074	50%
1981	2,643	2,430	2,536	61%	73%	1957	2,068	50%
1982	4,133	4,133	4,133	100%	74%	1928	1,981	48%
1983	3,903	3,903	3,903	94%	75%	1976	1,850	45%
1984	4,083	4,127	4,105	99%	77%	1964	1,810	44%
1985	2,897	2,697	2,797	68%	78%	1947	1,775	43%
1986	2,907	2,898	2,902	70%	79%	1994	1,675	41%
1987	2,619	2,181	2,400	58%	80%	1933	1,641	40%
1988	533	572	552	13%	82%	1960	1,621	39%
1989	3,288	3,017	3,153	76%	83%	1925	1,510	37%
1990	389	238	314	8%	84%	1972	1,491	36%
1991	880	718	799	19%	85%	1934	1,348	33%
1992	1,109	1,090	1,099	27%	87%	1932	1,344	33%
1993	4,014	3,588	3,801	92%	88%	1949	1,276	31%
1994	1,553	1,797	1,675	41%	89%	1992	1,099	27%
1995	3,903	3,903	3,903	94%	90%	1931	1,008	24%
1996	3,910	3,501	3,705	90%	91%	1955	952	23%
1997	3,271	3,273	3,272	79%	93%	2001	850	21%
1998	3,908	3,908	3,908	95%	94%	1991	799	19%
1999	3,967	3,859	3,913	95%	95%	1929	767	19%
2000	3,636	3,110	3,373	82%	96%	1988	552	13%
2001	817	884	850	21%	98%	1924	427	10%
2002	2,493	2,068	2,281	55%	99%	1990	314	8%
2003	3,218	2,828	3,023	73%	100%	1977	293	7%
Avg	**2,846**	**2,643**	**2,745**	**66%**			**2,745**	
Min	**308**	**238**	**293**	**7%**			**293**	
Max	**4,133**	**4,133**	**4,133**	**100%**			**4,133**	

[1]/ See Table 6.3 [2]/ Values used to describe Current Conditions in Capter 6 [3]/ 4,133 taf/year

Table B.13 SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve GFDL Model with B1 Emissions

Year	deliveries derived from interpolating between "no climate change" and "GFDL + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,005	3,614	3,810	92%	0%	1938	4,133	100%
1923	2,596	2,666	2,631	64%	1%	1956	4,133	100%
1924	605	207	406	10%	3%	1982	4,111	99%
1925	1,548	1,471	1,509	37%	4%	1984	4,088	99%
1926	2,172	1,779	1,975	48%	5%	1967	4,081	99%
1927	3,965	3,671	3,818	92%	6%	1951	4,057	98%
1928	2,104	1,831	1,967	48%	8%	1958	4,037	98%
1929	917	703	810	20%	9%	1970	4,012	97%
1930	2,217	2,083	2,150	52%	10%	1998	3,908	95%
1931	1,098	973	1,036	25%	11%	1978	3,905	94%
1932	1,445	1,252	1,348	33%	12%	1969	3,903	94%
1933	1,783	1,439	1,611	39%	14%	1983	3,903	94%
1934	1,385	1,313	1,349	33%	15%	1995	3,903	94%
1935	3,563	2,972	3,267	79%	16%	1952	3,892	94%
1936	3,363	2,929	3,146	76%	17%	1999	3,876	94%
1937	2,912	3,010	2,961	72%	19%	1974	3,835	93%
1938	4,133	4,133	4,133	100%	20%	1927	3,818	92%
1939	3,105	2,786	2,945	71%	21%	1922	3,810	92%
1940	3,606	3,108	3,357	81%	22%	1993	3,781	91%
1941	3,907	3,628	3,768	91%	24%	1941	3,768	91%
1942	3,836	3,384	3,610	87%	25%	1980	3,711	90%
1943	3,718	3,481	3,600	87%	26%	1942	3,610	87%
1944	2,527	2,083	2,305	56%	27%	1996	3,600	87%
1945	3,128	3,177	3,152	76%	28%	1943	3,597	87%
1946	3,634	3,307	3,471	84%	30%	1973	3,546	86%
1947	1,796	1,663	1,729	42%	31%	1946	3,471	84%
1948	2,870	2,675	2,773	67%	32%	1963	3,467	84%
1949	1,392	1,090	1,241	30%	33%	1971	3,361	81%
1950	2,634	2,200	2,417	58%	35%	1940	3,357	81%
1951	4,077	4,038	4,057	98%	36%	2000	3,332	81%
1952	3,907	3,876	3,892	94%	37%	1997	3,276	79%
1953	3,647	2,872	3,260	79%	38%	1935	3,267	79%
1954	3,026	2,871	2,949	71%	40%	1953	3,260	79%
1955	968	924	946	23%	41%	1989	3,250	79%
1956	4,133	4,090	4,111	99%	42%	1965	3,172	77%
1957	2,234	1,900	2,067	50%	43%	1975	3,156	76%
1958	4,133	3,941	4,037	98%	45%	1945	3,152	76%
1959	2,805	2,660	2,733	66%	46%	1936	3,146	76%
1960	1,674	1,263	1,468	36%	47%	1966	3,099	75%
1961	2,542	2,409	2,476	60%	48%	2003	3,061	74%
1962	2,979	2,967	2,973	72%	49%	1962	2,973	72%
1963	3,824	3,111	3,467	84%	51%	1937	2,961	72%
1964	1,581	1,951	1,766	43%	52%	1954	2,949	71%
1965	3,326	3,018	3,172	77%	53%	1939	2,945	71%

Table B.13 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve GFDL Model with B1 Emissions

Year	deliveries derived from interpolating between "no climate change" and "GFDL + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	3,206	2,992	3,099	75%	54%	1986	2,926	71%
1967	4,133	4,028	4,081	99%	56%	1979	2,794	68%
1968	2,794	2,253	2,523	61%	57%	1985	2,778	67%
1969	3,903	3,903	3,903	94%	58%	1948	2,773	67%
1970	4,076	3,948	4,012	97%	59%	1959	2,733	66%
1971	3,600	3,121	3,361	81%	61%	1923	2,631	64%
1972	1,507	1,475	1,491	36%	62%	1968	2,523	61%
1973	3,873	3,219	3,546	86%	63%	1961	2,476	60%
1974	3,981	3,689	3,835	93%	64%	1981	2,453	59%
1975	3,343	2,968	3,156	76%	66%	1950	2,417	58%
1976	2,142	1,789	1,965	48%	67%	1987	2,313	56%
1977	296	279	287	7%	68%	1944	2,305	56%
1978	3,905	3,905	3,905	94%	69%	2002	2,250	54%
1979	2,976	2,613	2,794	68%	70%	1930	2,150	52%
1980	3,649	3,773	3,711	90%	72%	1957	2,067	50%
1981	2,626	2,280	2,453	59%	73%	1926	1,975	48%
1982	4,133	4,133	4,133	100%	74%	1928	1,967	48%
1983	3,903	3,903	3,903	94%	75%	1976	1,965	48%
1984	4,098	4,077	4,088	99%	77%	1964	1,766	43%
1985	2,875	2,681	2,778	67%	78%	1947	1,729	42%
1986	2,915	2,936	2,926	71%	79%	1994	1,650	40%
1987	2,539	2,087	2,313	56%	80%	1933	1,611	39%
1988	521	549	535	13%	82%	1925	1,509	37%
1989	3,365	3,135	3,250	79%	83%	1972	1,491	36%
1990	376	194	285	7%	84%	1960	1,468	36%
1991	905	709	807	20%	85%	1934	1,349	33%
1992	1,073	1,058	1,065	26%	87%	1932	1,348	33%
1993	4,007	3,555	3,781	91%	88%	1949	1,241	30%
1994	1,542	1,758	1,650	40%	89%	1992	1,065	26%
1995	3,903	3,903	3,903	94%	90%	1931	1,036	25%
1996	3,875	3,319	3,597	87%	91%	1955	946	23%
1997	3,275	3,276	3,276	79%	93%	2001	819	20%
1998	3,908	3,908	3,908	95%	94%	1929	810	20%
1999	3,984	3,768	3,876	94%	95%	1991	807	20%
2000	3,542	3,123	3,332	81%	96%	1988	535	13%
2001	818	821	819	20%	98%	1924	406	10%
2002	2,436	2,063	2,250	54%	99%	1977	287	7%
2003	3,266	2,856	3,061	74%	100%	1990	285	7%
Avg	**2,830**	**2,617**	**2,723**	**66%**			**2,723**	
Min	**296**	**194**	**285**	**7%**			**285**	
Max	**4,133**	**4,133**	**4,133**	**100%**			**4,133**	

[1]/ See Table 6.3 [2]/ 4,133 taf/year

Table B.14 SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve PCM Model with A2 Emissions

Year	deliveries derived from interpolating between "no climate change" and "GFDL + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,060	3,609	3,834	93%	0%	1938	4,133	100%
1923	2,771	2,925	2,848	69%	1%	1951	4,133	100%
1924	498	137	317	8%	3%	1956	4,133	100%
1925	1,556	1,485	1,521	37%	4%	1958	4,133	100%
1926	2,178	1,733	1,956	47%...	5%	1970	4,133	100%
1927	4,121	3,720	3,920	95%	6%	1982	4,133	100%
1928	2,016	1,805	1,910	46%	8%	1984	4,133	100%
1929	904	677	790	19%	9%	1967	4,105	99%
1930	2,179	1,991	2,085	50%	10%	1999	4,088	99%
1931	1,128	1,049	1,089	26%	11%	1974	3,926	95%
1932	1,438	1,222	1,330	32%	12%	1927	3,920	95%
1933	1,857	1,569	1,713	41%	14%	1998	3,908	95%
1934	1,352	1,351	1,352	33%	15%	1952	3,907	95%
1935	3,638	3,250	3,444	83%	16%	1978	3,904	94%
1936	3,566	3,101	3,334	81%	17%	1969	3,903	94%
1937	3,049	3,257	3,153	76%	19%	1983	3,903	94%
1938	4,133	4,133	4,133	100%	20%	1995	3,903	94%
1939	3,280	2,958	3,119	75%	21%	1941	3,859	93%
1940	3,731	3,178	3,454	84%	22%	1922	3,834	93%
1941	3,907	3,811	3,859	93%	24%	1996	3,807	92%
1942	3,981	3,531	3,756	91%	25%	1993	3,787	92%
1943	3,727	3,600	3,664	89%	26%	1980	3,769	91%
1944	2,521	1,955	2,238	54%	27%	1942	3,756	91%
1945	3,627	3,634	3,630	88%	28%	1973	3,665	89%
1946	3,463	3,104	3,283	79%	30%	1943	3,664	89%
1947	1,700	1,643	1,672	40%	31%	1945	3,630	88%
1948	3,037	2,726	2,881	70%	32%	2000	3,537	86%
1949	1,379	1,083	1,231	30%	33%	1940	3,454	84%
1950	2,771	2,120	2,446	59%	35%	1963	3,453	84%
1951	4,133	4,133	4,133	100%	36%	1935	3,444	83%
1952	3,907	3,906	3,907	95%	37%	1953	3,343	81%
1953	3,757	2,929	3,343	81%	38%	1971	3,337	81%
1954	3,025	2,989	3,007	73%	40%	1936	3,334	81%
1955	956	848	902	22%	41%	1989	3,324	80%
1956	4,133	4,133	4,133	100%	42%	1975	3,323	80%
1957	2,221	1,883	2,052	50%	43%	1946	3,283	79%
1958	4,133	4,133	4,133	100%	45%	1966	3,251	79%
1959	2,880	2,722	2,801	68%	46%	1997	3,250	79%
1960	1,705	1,370	1,537	37%	47%	1937	3,153	76%
1961	2,691	2,339	2,515	61%	48%	1965	3,135	76%
1962	2,963	3,126	3,044	74%	49%	1939	3,119	75%
1963	3,813	3,094	3,453	84%	51%	1979	3,049	74%
1964	1,572	1,907	1,739	42%	52%	1962	3,044	74%
1965	3,301	2,968	3,135	76%	53%	2003	3,030	73%

Table B.14 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve PCM Model with A2 Emissions

Year	deliveries derived from interpolating between "no climate change" and "GFDL + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	3,352	3,150	3,251	79%	54%	1954	3,007	73%
1967	4,133	4,077	4,105	99%	56%	1986	2,980	72%
1968	2,874	2,236	2,555	62%	57%	1948	2,881	70%
1969	3,903	3,903	3,903	94%	58%	1923	2,848	69%
1970	4,133	4,133	4,133	100%	59%	1985	2,836	69%
1971	3,566	3,108	3,337	81%	61%	1959	2,801	68%
1972	1,441	1,450	1,446	35%	62%	1968	2,555	62%
1973	3,959	3,371	3,665	89%	63%	1961	2,515	61%
1974	4,133	3,718	3,926	95%	64%	1981	2,515	61%
1975	3,521	3,124	3,323	80%	66%	1950	2,446	59%
1976	2,089	1,598	1,843	45%	67%	1987	2,320	56%
1977	281	264	273	7%	68%	1944	2,238	54%
1978	3,904	3,904	3,904	94%	69%	2002	2,137	52%
1979	3,182	2,915	3,049	74%	70%	1930	2,085	50%
1980	3,638	3,899	3,769	91%	72%	1957	2,052	50%
1981	2,659	2,370	2,515	61%	73%	1926	1,956	47%
1982	4,133	4,133	4,133	100%	74%	1928	1,910	46%
1983	3,903	3,903	3,903	94%	75%	1976	1,843	45%
1984	4,133	4,133	4,133	100%	77%	1994	1,776	43%
1985	2,926	2,746	2,836	69%	78%	1964	1,739	42%
1986	2,928	3,032	2,980	72%	79%	1933	1,713	41%
1987	2,627	2,014	2,320	56%	80%	1947	1,672	40%
1988	448	524	486	12%	82%	1960	1,537	37%
1989	3,457	3,191	3,324	80%	83%	1925	1,521	37%
1990	325	184	255	6%	84%	1972	1,446	35%
1991	883	683	783	19%	85%	1934	1,352	33%
1992	1,108	1,075	1,092	26%	87%	1932	1,330	32%
1993	4,046	3,527	3,787	92%	88%	1949	1,231	30%
1994	1,693	1,859	1,776	43%	89%	1992	1,092	26%
1995	3,903	3,903	3,903	94%	90%	1931	1,089	26%
1996	3,984	3,631	3,807	92%	91%	1955	902	22%
1997	3,254	3,246	3,250	79%	93%	2001	804	19%
1998	3,908	3,908	3,908	95%	94%	1929	790	19%
1999	4,052	4,123	4,088	99%	95%	1991	783	19%
2000	3,794	3,279	3,537	86%	96%	1988	486	12%
2001	795	812	804	19%	98%	1924	317	8%
2002	2,312	1,961	2,137	52%	99%	1977	273	7%
2003	3,226	2,834	3,030	73%	100%	1990	255	6%
Avg	**2,870**	**2,668**	**2,769**	**67%**			**2,769**	
Min	**281**	**137**	**255**	**6%**			**255**	
Max	**4,133**	**4,133**	**4,133**	**100%**			**4,133**	

[1]/ See Table 6.3 [2]/ 4,133 taf/year

Table B.15 SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve PCM Model with B1 Emissions

Year	deliveries derived from interpolating between "no climate change" and "PCM + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1922	4,092	3,647	3,869	94%	0%	1938	4,133	100%
1923	3,091	3,033	3,062	74%	1%	1956	4,133	100%
1924	371	150	261	6%	3%	1958	4,133	100%
1925	1,718	1,669	1,693	41%	4%	1970	4,133	100%
1926	2,254	1,967	2,111	51%	5%	1982	4,133	100%
1927	4,086	3,680	3,883	94%	6%	1984	4,133	100%
1928	2,186	1,921	2,054	50%	8%	1999	4,118	100%
1929	945	729	837	20%	9%	1967	4,091	99%
1930	2,299	2,008	2,154	52%	10%	1951	4,046	98%
1931	1,130	1,090	1,110	27%	11%	1974	3,961	96%
1932	1,570	1,301	1,436	35%	12%	1998	3,908	95%
1933	2,340	1,944	2,142	52%	14%	1952	3,907	95%
1934	1,325	1,388	1,357	33%	15%	1978	3,905	94%
1935	3,779	3,126	3,452	84%	16%	1969	3,903	94%
1936	3,606	3,081	3,344	81%	17%	1983	3,903	94%
1937	3,337	3,593	3,465	84%	19%	1995	3,903	94%
1938	4,133	4,133	4,133	100%	20%	1942	3,886	94%
1939	3,414	3,035	3,224	78%	21%	1927	3,883	94%
1940	3,775	3,225	3,500	85%	22%	1941	3,873	94%
1941	3,907	3,839	3,873	94%	24%	1922	3,869	94%
1942	4,133	3,639	3,886	94%	25%	1996	3,823	92%
1943	3,772	3,503	3,637	88%	26%	1980	3,784	92%
1944	2,943	2,503	2,723	66%	27%	1993	3,732	90%
1945	3,556	3,467	3,511	85%	28%	1973	3,710	90%
1946	3,655	3,364	3,509	85%	30%	1943	3,637	88%
1947	1,752	1,860	1,806	44%	31%	2000	3,636	88%
1948	3,297	2,866	3,082	75%	32%	1953	3,516	85%
1949	1,467	1,245	1,356	33%	33%	1945	3,511	85%
1950	2,812	2,462	2,637	64%	35%	1946	3,509	85%
1951	4,133	3,958	4,046	98%	36%	1940	3,500	85%
1952	3,907	3,907	3,907	95%	37%	1937	3,465	84%
1953	3,922	3,110	3,516	85%	38%	1975	3,458	84%
1954	3,184	3,056	3,120	75%	40%	1935	3,452	84%
1955	1,024	1,024	1,024	25%	41%	1966	3,431	83%
1956	4,133	4,133	4,133	100%	42%	1971	3,397	82%
1957	2,443	1,976	2,210	53%	43%	1989	3,387	82%
1958	4,133	4,133	4,133	100%	45%	1936	3,344	81%
1959	3,199	2,946	3,073	74%	46%	1963	3,337	81%
1960	1,722	1,430	1,576	38%	47%	1997	3,291	80%
1961	2,650	2,408	2,529	61%	48%	1939	3,224	78%
1962	3,250	3,174	3,212	78%	49%	1962	3,212	78%
1963	3,640	3,034	3,337	81%	51%	1979	3,197	77%
1964	1,814	2,213	2,013	49%	52%	1985	3,163	77%
1965	3,348	2,884	3,116	75%	53%	1954	3,120	75%

Table B.15 cont. SWP Table A deliveries from the Delta under Future (2027) Conditions, derived values for estimating probability curve PCM Model with B1 Emissions

	deliveries derived from interpolating between "no climate change" and "PCM + B1 emissions"				ranking of calculated SWP Table A deliveries for probability curve			
Year	lower flow target[2] (taf)	higher flow target[2] (taf)	average flow targets (taf)	percent of max SWP Table A[3]	Exceedence Frequency	Year	SWP Table A Delivery (taf)	percent of max SWP Table A[3]
1966	3,486	3,376	3,431	83%	54%	1965	3,116	75%
1967	4,133	4,048	4,091	99%	56%	1948	3,082	75%
1968	2,990	2,363	2,676	65%	57%	1959	3,073	74%
1969	3,903	3,903	3,903	94%	58%	1923	3,062	74%
1970	4,133	4,133	4,133	100%	59%	2003	3,011	73%
1971	3,658	3,136	3,397	82%	61%	1986	2,805	68%
1972	1,489	1,495	1,492	36%	62%	1944	2,723	66%
1973	4,000	3,420	3,710	90%	63%	1968	2,676	65%
1974	4,133	3,789	3,961	96%	64%	1981	2,644	64%
1975	3,695	3,222	3,458	84%	66%	1950	2,637	64%
1976	2,227	1,631	1,929	47%	67%	1961	2,529	61%
1977	300	281	291	7%	68%	1987	2,465	60%
1978	3,905	3,905	3,905	94%	69%	2002	2,355	57%
1979	3,371	3,024	3,197	77%	70%	1957	2,210	53%
1980	3,687	3,881	3,784	92%	72%	1930	2,154	52%
1981	2,740	2,547	2,644	64%	73%	1933	2,142	52%
1982	4,133	4,133	4,133	100%	74%	1926	2,111	51%
1983	3,903	3,903	3,903	94%	75%	1994	2,066	50%
1984	4,133	4,133	4,133	100%	77%	1928	2,054	50%
1985	3,293	3,032	3,163	77%	78%	1964	2,013	49%
1986	2,799	2,810	2,805	68%	79%	1976	1,929	47%
1987	2,605	2,326	2,465	60%	80%	1947	1,806	44%
1988	483	454	468	11%	82%	1925	1,693	41%
1989	3,504	3,269	3,387	82%	83%	1960	1,576	38%
1990	367	311	339	8%	84%	1972	1,492	36%
1991	965	776	870	21%	85%	1932	1,436	35%
1992	1,243	1,124	1,183	29%	87%	1934	1,357	33%
1993	3,993	3,471	3,732	90%	88%	1949	1,356	33%
1994	1,874	2,258	2,066	50%	89%	1992	1,183	29%
1995	3,903	3,902	3,903	94%	90%	1931	1,110	27%
1996	4,021	3,624	3,823	92%	91%	1955	1,024	25%
1997	3,294	3,289	3,291	80%	93%	2001	949	23%
1998	3,908	3,908	3,908	95%	94%	1991	870	21%
1999	4,103	4,133	4,118	100%	95%	1929	837	20%
2000	3,913	3,359	3,636	88%	96%	1988	468	11%
2001	884	1,014	949	23%	98%	1990	339	8%
2002	2,595	2,115	2,355	57%	99%	1977	291	7%
2003	3,201	2,820	3,011	73%	100%	1924	261	6%
Avg	**2,954**	**2,746**	**2,850**	**69%**			**2,850**	
Min	**300**	**150**	**261**	**6%**			**261**	
Max	**4,133**	**4,133**	**4,133**	**100%**			**4,133**	

[1]/ See Table 6.3 [2]/ 4,133 taf/year

Table B.16 *SWP Article 21* deliveries under Current (2007) Conditions

Year	Article 21 demands (taf)	Article 21 deliveries		
		less restrictive flow targets (taf)[1]	more restrictive flow targets (taf) [1]	average of flow targets (taf) [1]
1922	1,408	0	0	0
1923	1,408	0	0	0
1924	1,408	0	0	0
1925	1,408	0	0	0
1926	1,408	0	0	0
1927	1,408	0	0	0
1928	1,408	0	0	0
1929	1,408	0	0	0
1930	1,408	0	0	0
1931	1,408	0	0	0
1932	1,408	0	0	0
1933	1,408	77	0	38
1934	1,408	0	0	0
1935	1,408	0	0	0
1936	1,408	0	0	0
1937	1,408	0	0	0
1938	1,408	589	586	587
1939	1,408	124	59	92
1940	1,408	0	0	0
1941	652	100	0	50
1942	1,408	672	324	498
1943	1,156	555	471	513
1944	1,408	0	0	0
1945	1,408	0	0	0
1946	1,408	0	0	0
1947	1,408	0	0	0
1948	1,408	0	0	0
1949	1,408	0	0	0
1950	1,408	0	0	0
1951	1,408	308	134	221
1952	652	100	100	100
1953	1,408	90	90	90
1954	1,156	0	0	0
1955	1,408	0	0	0
1956	1,408	319	194	256
1957	1,408	0	0	0
1958	1,408	563	154	359
1959	1,408	50	42	46
1960	1,408	0	0	0
1961	1,408	0	0	0
1962	1,408	0	0	0
1963	1,408	0	0	0
1964	1,408	0	0	0
1965	1,408	0	0	0

Table B.16 cont. *SWP Article 21* deliveries under Current (2007) Conditions

Year	Article 21 demands (taf)	Article 21 deliveries		
		less restrictive flow targets (taf)	more restrictive flow targets (taf)	average of flow targets (taf)
1966	1,408	0	0	0
1967	1,408	270	0	135
1968	1,408	165	0	82
1969	652	199	199	199
1970	1,408	552	368	460
1971	1,156	0	0	0
1972	1,408	0	0	0
1973	1,408	0	0	0
1974	1,408	96	0	48
1975	1,408	346	0	173
1976	1,408	10	0	5
1977	1,408	0	0	0
1978	652	200	0	100
1979	1,408	0	0	0
1980	400	189	188	189
1981	1,408	0	0	0
1982	1,156	527	453	490
1983	652	400	400	400
1984	1,408	552	368	460
1985	1,156	0	0	0
1986	652	53	0	27
1987	1,408	0	0	0
1988	1,156	0	0	0
1989	1,408	0	0	0
1990	1,408	0	0	0
1991	1,408	0	0	0
1992	1,408	0	0	0
1993	1,408	0	0	0
1994	1,408	0	0	0
1995	652	100	35	67
1996	1,408	423	387	405
1997	1,156	458	227	342
1998	652	178	100	139
1999	1,408	469	285	377
2000	1,156	0	0	0
2001	1,408	0	0	0
2002	1,408	0	0	0
2003	1,408	0	0	0
Avg	**1,297**	**106**	**63**	**85**
Min	**400**	**0**	**0**	**0**
Max	**1,408**	**672**	**586**	**587**

[1]/ See Table 6.3

Table B.17 *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario GFDL with A2 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL-A2[2] (taf)*
		no climate change (taf)	GFDL with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	*no climate change* (taf)	GFDL with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	5	6	22	116	66	36
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	125	58	0	66	31	44
1933	1,408	87	0	47	0	0	0	23
1934	1,408	0	0	0	0	17	8	4
1935	1,408	0	273	127	0	121	56	92
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	22	10	0	0	0	5
1938	1,408	165	333	243	0	334	155	199
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	0	9	0	0	0	4
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	264	214	115	115	115	164
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	466	397	172	268	217	307
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	0	56	0	0	0	28
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	203	94	0	0	0	47

[1]/ See Table 6-3 [2]/ As described in Appendix B

Table B.17 cont. *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario GFDL with A2 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries GFDL-A2[2] (taf)
		no climate change (taf)	GFDL with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	*no climate change* (taf)	GFDL with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	124	90	62	95	77	84
1970	1,408	444	31	252	294	0	157	204
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	30	14	0	0	0	7
1978	652	106	300	196	0	200	93	145
1979	1,408	0	0	0	0	0	0	0
1980	400	131	155	142	63	97	78	110
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	371	355	423
1985	1,156	0	0	0	0	0	0	0
1986	652	0	49	23	0	0	0	12
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	157	157	0	126	59	108
1998	652	0	0	0	0	0	0	0
1999	1,408	284	153	223	117	0	63	143
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	**1,297**	**36**	**42**	**39**	**17**	**26**	**22**	**30**
Min	**400**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Max	**1,408**	**491**	**491**	**491**	**341**	**371**	**355**	**423**

[1]/ See Table 6-3 [2]/ As described in Appendix B

Table B.18 *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario GFDL with B1 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL*-B1[2] *(taf)*
		no climate change (taf)	GFDL with B1 emissions (taf)	*interpolated GFDL*-B1[2] *(taf)*	*no climate change* (taf)	GFDL with B1 emissions (taf)	*interpolated GFDL*-B1[2] *(taf)*	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	20	13	22	65	42	27
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	15	7	0	88	41	24
1933	1,408	87	0	47	0	0	0	23
1934	1,408	0	0	0	0	0	0	0
1935	1,408	0	142	66	0	225	105	85
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	112	52	0	0	0	26
1938	1,408	165	213	187	0	239	111	149
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	35	25	0	0	0	13
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	259	212	115	54	86	149
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	463	396	172	257	212	304
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	0	56	0	0	0	28
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	22	10	0	0	0	5

[1]/ See Table 6.3 [2]/ As described in Appendix B

Table B.18 cont. *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario GFDL with B1 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL*-B1[2] *(taf)*
		no climate change (taf)	GFDL with B1 emissions (taf)	*interpolated GFDL*-B1[2] *(taf)*	*no climate change* (taf)	GFDL with B1 emissions (taf)	*interpolated GFDL*-B1[2] *(taf)*	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	144	100	62	144	100	100
1970	1,408	444	43	257	294	0	157	207
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	247	171	0	54	25	98
1979	1,408	0	0	0	0	0	0	0
1980	400	131	174	151	63	168	112	131
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	326	334	413
1985	1,156	0	0	0	0	0	0	0
1986	652	0	54	25	0	0	0	13
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	229	191	0	115	53	122
1998	652	0	0	0	0	0	0	0
1999	1,408	284	332	306	117	0	63	184
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	**1,297**	**36**	**39**	**38**	**17**	**24**	**20**	**29**
Min	**400**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Max	1,408	491	491	491	341	326	334	413

[1]/ See Table 6.3 [2]/ As described in Appendix B

Table B.19 *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario PCM with A2 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries GFDL-A2[2] (taf)
		no climate change (taf)	PCM with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	*no climate change* (taf)	PCM with A2 emissions (taf)	*interpolated GFDL-A2[2] (taf)*	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	189	91	22	276	140	116
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	80	37	0	0	0	19
1933	1,408	87	270	172	0	0	0	86
1934	1,408	0	59	28	0	0	0	14
1935	1,408	0	160	75	0	125	58	66
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	133	62	0	0	0	31
1938	1,408	165	320	237	0	282	131	184
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	117	63	0	0	0	32
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	63	29	15
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	245	205	115	283	193	199
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	455	392	172	268	217	304
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	82	94	0	0	0	47
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	46	21	0	0	0	11

[1]/ See Table 6.3 [2]/ As described in Appendix B

Table B.19 cont. *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario PCM with A2 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL-A2*[2] *(taf)*
		no climate change (taf)	PCM with A2 emissions (taf)	*interpolated GFDL-A2* [2] *(taf)*	*no climate change* (taf)	PCM with A2 emissions (taf)	*interpolated GFDL-A2*[2] *(taf)*	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	61	61	62	61	62	61
1970	1,408	444	279	367	294	114	210	289
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	300	196	0	200	93	145
1979	1,408	0	0	0	0	0	0	0
1980	400	131	100	116	63	60	61	89
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	239	293	241	239	240	267
1984	1,408	491	491	491	341	341	341	416
1985	1,156	0	0	0	0	0	0	0
1986	652	0	49	23	0	0	0	11
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	0	20	0	0	0	10
1997	1,156	158	195	175	0	0	0	87
1998	652	0	0	0	0	0	0	0
1999	1,408	284	295	289	117	40	81	185
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	**1,297**	**36**	**51**	**43**	**17**	**29**	**23**	**33**
Min	**400**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Max	**1,408**	**491**	**491**	**491**	**341**	**341**	**341**	**416**

[1]/ See Table 6.3 [2]/ As described in Appendix B

Table B.20 *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario PCM with B1 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL*-B1 [2] *(taf)*
		no climate change (taf)	PCM with B1 emissions (taf)	*interpolated GFDL*-B1 [2] *(taf)*	*no climate change* (taf)	PCM with B1 emissions (taf)	*interpolated GFDL*-B1 [2] *(taf)*	
1922	1,408	0	0	0	0	0	0	0
1923	1,408	0	0	0	0	0	0	0
1924	1,408	0	0	0	0	0	0	0
1925	1,408	6	48	25	22	29	25	25
1926	1,408	0	0	0	0	0	0	0
1927	1,408	0	0	0	0	0	0	0
1928	1,408	0	0	0	0	0	0	0
1929	1,408	0	0	0	0	0	0	0
1930	1,408	0	0	0	0	0	0	0
1931	1,408	0	0	0	0	0	0	0
1932	1,408	0	0	0	0	0	0	0
1933	1,408	87	104	95	0	0	0	47
1934	1,408	0	0	0	0	0	0	0
1935	1,408	0	0	0	0	0	0	0
1936	1,408	0	0	0	0	0	0	0
1937	1,408	0	0	0	0	0	0	0
1938	1,408	165	0	88	0	0	0	44
1939	1,408	0	0	0	0	0	0	0
1940	1,408	0	0	0	0	0	0	0
1941	652	0	0	0	0	0	0	0
1942	1,408	0	0	0	0	0	0	0
1943	1,156	17	49	32	0	0	0	16
1944	1,408	0	0	0	0	0	0	0
1945	1,408	0	0	0	0	0	0	0
1946	1,408	0	0	0	0	0	0	0
1947	1,408	0	0	0	0	0	0	0
1948	1,408	0	0	0	0	0	0	0
1949	1,408	0	0	0	0	0	0	0
1950	1,408	0	0	0	0	0	0	0
1951	1,408	171	168	169	115	0	61	115
1952	652	0	0	0	0	0	0	0
1953	1,408	0	0	0	0	0	0	0
1954	1,156	0	0	0	0	0	0	0
1955	1,408	0	0	0	0	0	0	0
1956	1,408	338	325	331	172	176	174	253
1957	1,408	0	0	0	0	0	0	0
1958	1,408	105	122	113	0	0	0	57
1959	1,408	0	0	0	0	0	0	0
1960	1,408	0	0	0	0	0	0	0
1961	1,408	0	0	0	0	0	0	0
1962	1,408	0	0	0	0	0	0	0
1963	1,408	0	0	0	0	0	0	0
1964	1,408	0	0	0	0	0	0	0
1965	1,408	0	0	0	0	0	0	0

[1]/ See Table 6.3 [2]/ As described in Appendix B

Table B.20 cont. *SWP Article 21* deliveries under Future (2027) Conditions
Climate change scenario PCM with B1 emissions

Year	Article 21 demand (taf)	Article 21 deliveries under less restrictive flow targets[1]			Article 21 deliveries under more restrictive flow targets[1]			Averaged Article 21 deliveries *GFDL*-B1 [2] *(taf)*
		no climate change (taf)	PCM with B1 emissions (taf)	*interpolated GFDL*-B1 [2] *(taf)*	*no climate change* (taf)	PCM with B1 emissions (taf)	*interpolated GFDL*-B1 [2] *(taf)*	
1966	1,408	0	0	0	0	0	0	0
1967	1,408	0	0	0	0	0	0	0
1968	1,408	0	0	0	0	0	0	0
1969	652	61	75	67	62	62	62	65
1970	1,408	444	424	435	294	274	285	360
1971	1,156	0	0	0	0	0	0	0
1972	1,408	0	0	0	0	0	0	0
1973	1,408	0	0	0	0	0	0	0
1974	1,408	0	0	0	0	0	0	0
1975	1,408	0	0	0	0	0	0	0
1976	1,408	0	0	0	0	0	0	0
1977	1,408	0	0	0	0	0	0	0
1978	652	106	54	82	0	0	0	41
1979	1,408	0	0	0	0	0	0	0
1980	400	131	125	128	63	87	74	101
1981	1,408	0	0	0	0	0	0	0
1982	1,156	0	0	0	0	0	0	0
1983	652	340	340	340	241	239	240	290
1984	1,408	491	491	491	341	341	341	416
1985	1,156	0	0	0	0	0	0	0
1986	652	0	0	0	0	0	0	0
1987	1,408	0	0	0	0	0	0	0
1988	1,156	0	0	0	0	0	0	0
1989	1,408	0	0	0	0	0	0	0
1990	1,408	0	0	0	0	0	0	0
1991	1,408	0	0	0	0	0	0	0
1992	1,408	0	0	0	0	0	0	0
1993	1,408	0	0	0	0	0	0	0
1994	1,408	0	0	0	0	0	0	0
1995	652	0	0	0	0	0	0	0
1996	1,408	38	50	44	0	0	0	22
1997	1,156	158	255	203	0	0	0	102
1998	652	0	0	0	0	0	0	0
1999	1,408	284	310	296	117	115	116	206
2000	1,156	0	0	0	0	0	0	0
2001	1,408	0	0	0	0	0	0	0
2002	1,408	0	0	0	0	0	0	0
2003	1,408	0	0	0	0	0	0	0
Avg	**1,297**	**36**	**36**	**36**	**17**	**16**	**17**	**26**
Min	**400**	**0**	**0**	**0**	**0**	**0**	**0**	**0**
Max	**1,408**	**491**	**491**	**491**	**341**	**341**	**341**	**416**

[1]/ See Table 6.3 [2]/ As described in Appendix B

Figure B.1 SWP Table A delivery probability under Current Conditions

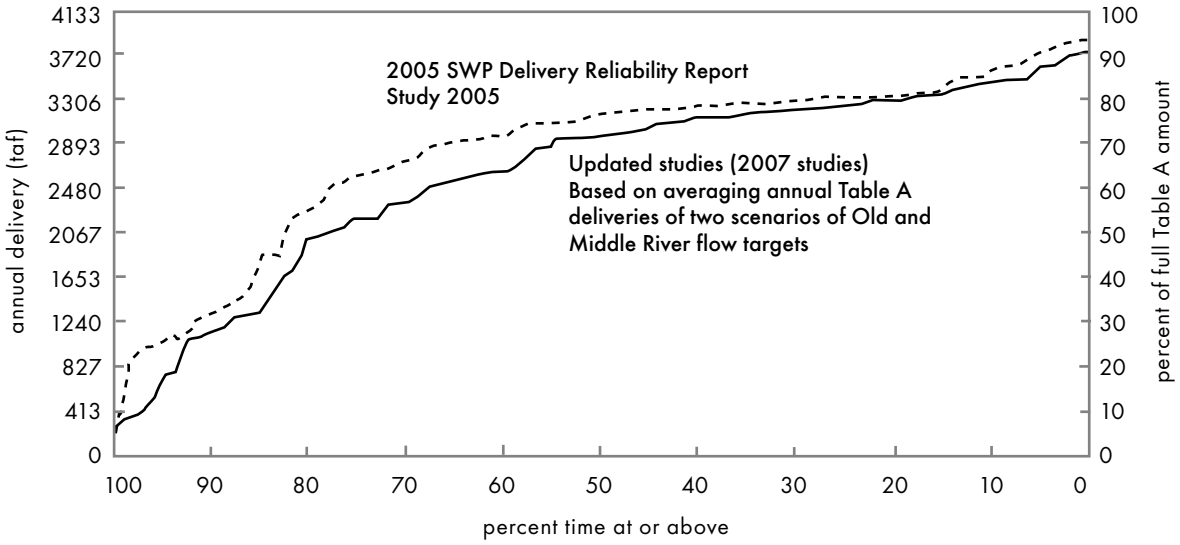


Figure B.2 SWP Table A delivery probability under Future Conditions

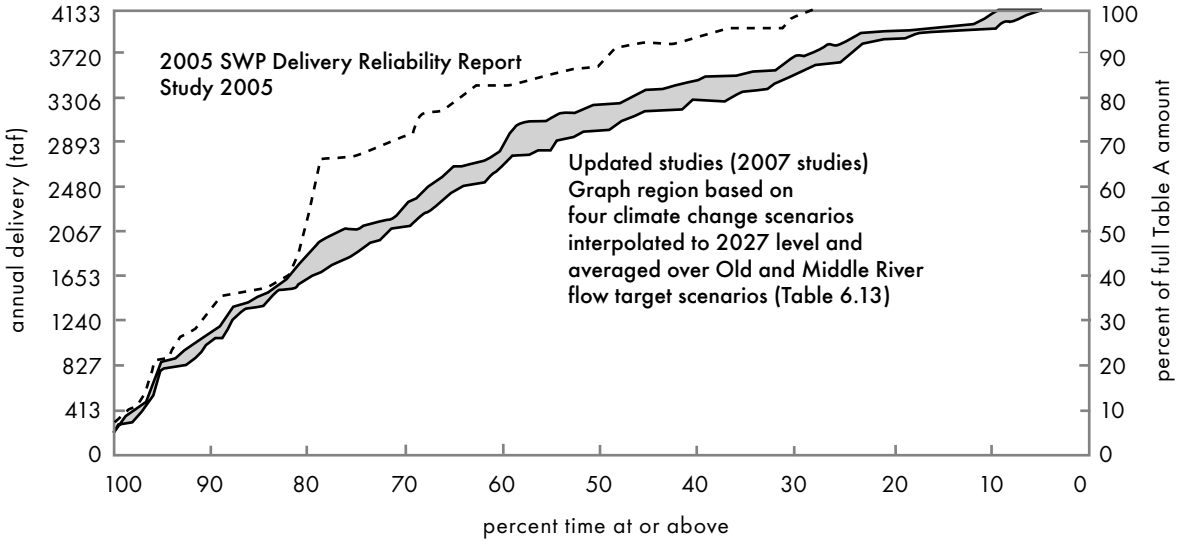


Figure B.3 SWP Table A delivery probability under Future Conditions for climate change scenarios with A2 emissions

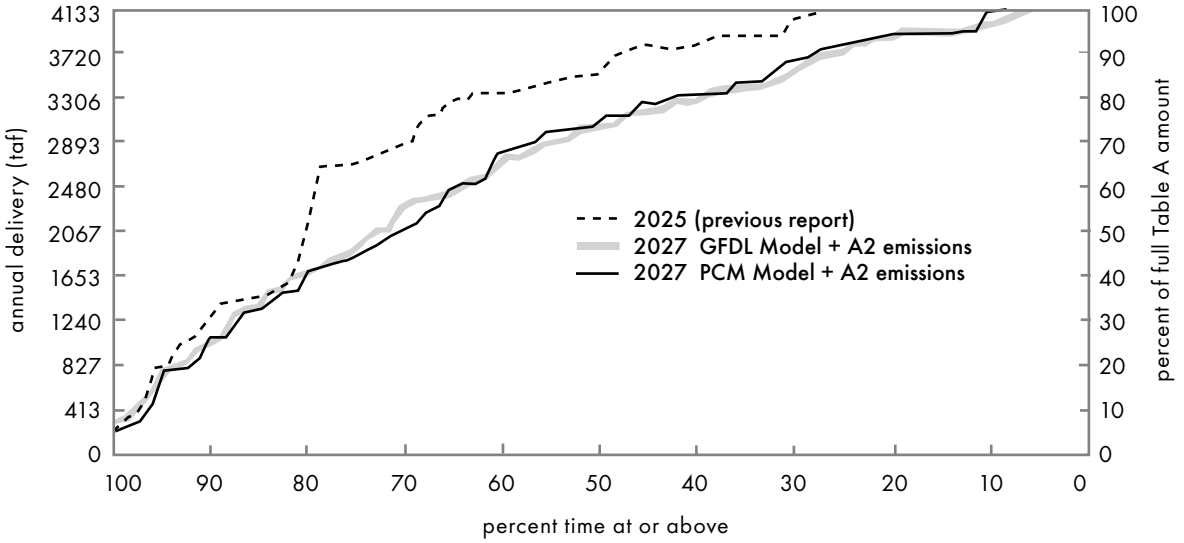


Figure B.4 SWP Table A delivery probability under Future Conditions for climate change scenarios with B1 emissions

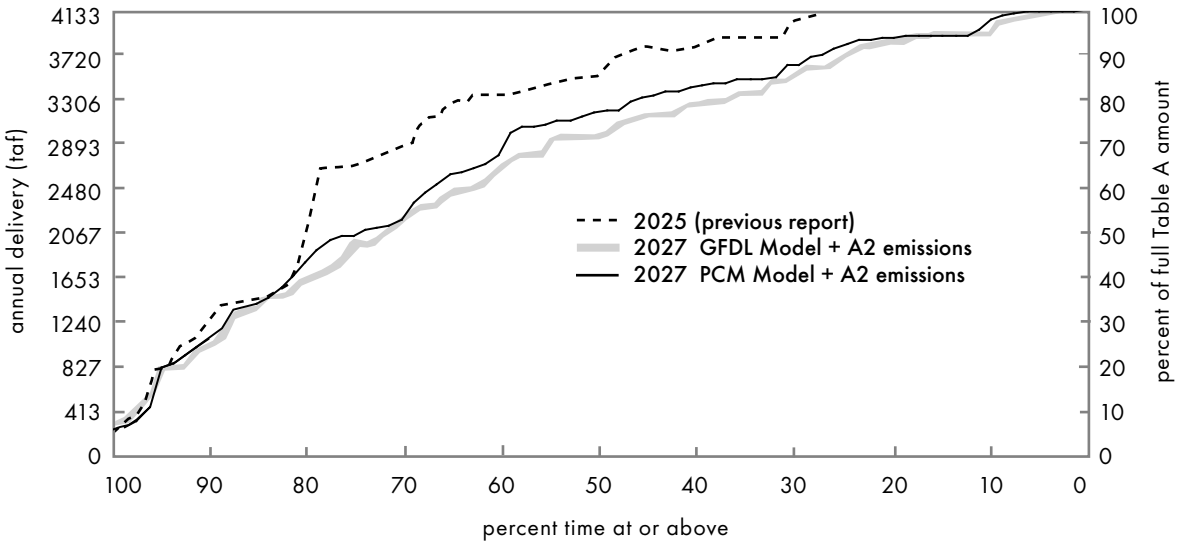


Table B.21 Highlighted SWP Table A delivery percent exceedence values under Current and Future Conditions

	Exceedence values (taf)		
	25%	**50%**	**75%**
2005 SWP Delivery Reliability Report			
Current (2005)	3323	3173	2588
Future (2025)	4133	3565	2738
Updated studies			
Current (2007)	3218	2976	2168
Future (2027)[1]			
GFDL+A2	3703	3017	1883
GFDL+B1	3686	2967	1966
PCM+A2	3782	3084	1860
PCM+B1	3813	3205	2077

1/ Based upon **SWP Table A** deliveries that have been interpolated between the "no climate change" scenario and the climate change scenarios determined by climate change model (GFDL or PCM) and greenhouse gas emissions scenario (A2 or B1). **SWP Table A** deliveries for two scenarios of Old River and Middle River flow targets were then averaged.

Table B.22 Comparing total SWP deliveries under Current Conditions from updated studies to deliveries from 2005 Report

Year	Total SWP Deliveries (Table A + Article 21)			Year	Total SWP Deliveries (Table A + Article 21)		
	study 2005 (2005 Report) (taf)	updated study 2007[1] (taf)	Change in total SWP deliveries (taf)		study 2005 (2005 Report) (taf)	updated study 2007[1] (taf)	Change in total SWP deliveries (taf)
1922	3,847	3,674	-173	**1963**	4,020	3,406	-614
1923	3,358	3,159	-199	**1964**	3,323	2,211	-1,113
1924	1,244	400	-844	**1965**	3,236	2,861	-376
1925	1,870	1,644	-226	**1966**	3,800	3,265	-534
1926	3,035	2,186	-849	**1967**	3,870	3,125	-745
1927	4,058	3,699	-359	**1968**	3,881	3,379	-501
1928	3,518	2,059	-1,459	**1969**	2,907	2,825	-82
1929	1,108	753	-355	**1970**	3,809	3,717	-92
1930	2,972	2,028	-944	**1971**	3,341	3,317	-24
1931	1,018	1,105	88	**1972**	3,756	1,707	-2,049
1932	1,649	1,305	-344	**1973**	3,476	3,085	-390
1933	1,842	2,019	177	**1974**	4,038	3,232	-806
1934	1,746	1,315	-432	**1975**	4,132	3,391	-741
1935	3,998	3,334	-663	**1976**	3,455	2,609	-846
1936	3,573	3,124	-449	**1977**	159	243	84
1937	3,442	3,219	-223	**1978**	3,903	3,699	-203
1938	4,058	3,982	-76	**1979**	3,661	3,128	-533
1939	3,612	3,348	-264	**1980**	2,847	2,898	52
1940	3,374	3,165	-209	**1981**	3,904	3,128	-777
1941	2,773	2,576	-197	**1982**	3,691	3,430	-260
1942	4,086	3,665	-420	**1983**	2,898	2,897	-1
1943	3,727	3,667	-60	**1984**	3,318	3,687	370
1944	3,091	2,930	-161	**1985**	3,214	3,198	-16
1945	3,460	3,085	-375	**1986**	2,417	2,321	-97
1946	3,464	3,199	-265	**1987**	3,442	2,825	-617
1947	3,292	2,314	-978	**1988**	856	477	-380
1948	2,942	2,609	-333	**1989**	3,174	3,130	-43
1949	2,264	1,271	-993	**1990**	1,099	360	-739
1950	3,199	2,462	-737	**1991**	1,052	729	-323
1951	3,886	3,718	-167	**1992**	1,426	1,087	-339
1952	2,863	2,685	-178	**1993**	4,007	3,711	-296
1953	3,836	3,413	-423	**1994**	3,306	2,105	-1,201
1954	3,817	3,201	-616	**1995**		3,061	
1955	2,207	1,137	-1,070	**1996**		3,845	
1956	3,911	3,838	-73	**1997**		3,443	
1957	3,492	2,545	-947	**1998**		3,147	
1958	4,086	3,388	-698	**1999**		3,816	
1959	3,846	3,511	-335	**2000**		3,451	
1960	1,865	1,460	-405	**2001**		1,164	
1961	2,756	2,357	-399	**2002**		2,162	
1962	3,262	2,962	-300	**2003**		2,943	

[1]/ Average of the two scenarios of Old River and Middle River flow targets described in Table 6-3.

Appendix C. State Water Project SWP Table A Amounts

The contracts between the Department of Water Resources and the 29 State Water Project water contractors def ne the terms and conditions governing the water delivery and cost repayment for the SWP. SWP Table A is an exhibit to these contracts. Comprehension of SWP Table A is important in understanding the information in this report. To understand the table, it is necessary to understand how the contracts work.

All water-supply related costs of the SWP are paid by the contractors, and SWP Table A serves as a basis for allocating some of the costs among the contractors. In addition, SWP Table A plays a key role in the annual allocation of available supply among contractors. When the SWP was being planned, the amount of water projected to be available for delivery to the contractors was 4.2 million acre-feet (maf) per year. This was referred to as the maximum project yield, and it was recognized that in some years the project would be unable to deliver that amount and in other years project supply could exceed that amount. The 4.2 maf number was used as the basis for apportioning available supply to each contractor and as a factor in calculating each contractor's share of the project's costs. This apportionment is accomplished by SWP Table A in each contract. SWP Table A lists by year and acre-feet the portion of the 4.2 maf deliverable to each contractor. Other contract provisions permit changes to an individual contractor's SWP Table A under special circumstances. The total of the maximums in all the contracts now equals 4.173 maf.

A copy of the consolidated SWP Table A from all the contracts is presented in **Table C.1**. The amounts listed in SWP Table A cannot be viewed as an indication of the SWP water delivery reliability, nor should these amounts be used to support an expectation that a certain amount of water will be delivered to a contractor in any particular time span. SWP Table A is simply a tool for apportioning available supply and cost obligations under the contract. In this report, reference to "SWP Table A amounts" means the amounts listed in SWP Table A. Contractors also receive other classif cations of water from the project, as distinguished from SWP Table A (for example, Article 21 water, and turnback pool water). These other contract provisions are discussed in Appendix D.

Table C.1 Maximum annual SWP Table A amounts (af)

SWP Contractors	Maximum SWP Table A
North Bay	
Napa County FC&WCD	29,025
Solano County WA	47,756
Subtotal	**76,781**
South Bay	
Alameda County FC&WCD, Zone 7	80,619
Alameda County WD	42,000
Santa Clara Valley WD	100,000
Subtotal	**222,619**
San Joaquin Valley	
Oak Flat WD	5,700
County of Kings	9,305
Dudley Ridge WD	57,343
Empire West Side ID	3,000
Kern County WA	998,730
Tulare Lake Basin WSD	95,922
Subtotal	**1,170,000**
Central Coastal	
San Luis Obispo County FC&WCD	25,000
Santa Barbara County FC&WCD	45,486
Subtotal	**70,486**
Southern California	
Antelope Valley-East Kern WA	141,400
Castaic Lake WA	95,200
Coachella Valley WD	121,100
Crestline-Lake Arrowhead WA	5,800
Desert WA	50,000
Littlerock Creek ID	2,300
Mojave WA	75,800
Metropolitan WDSC	1,911,500
Palmdale WD	21,300
San Bernardino Valley MWD	102,600
San Gabriel Valley MWD	28,800
San Gorgonio Pass WA	17,300
Ventura County FCD	20,000
Subtotal	**2,593,100**
Delta Subtotal	**4,132,986**
Feather River	
County of Butte	27,500
Plumas County FC&WCD	2,700
City of Yuba City	9,600
Subtotal	**39,800**
Grand Total	**4,172,786**

Appendix D. Recent State Water Project Deliveries

SWP Contract Water Types

The State Water Project contracts def ne several classif cations of water available for delivery to contractors under specif c circumstances. All classif cations are considered "project" water. Many contractors make frequent use of these additional water types to increase or decrease the amount available to them under SWP Table A.

SWP Table A Water

Each contract's SWP Table A amount is the value in acre-feet that is used to determine the portion of available supply to be delivered to that contractor. *Table A* water is water delivered according to this apportionment methodology and is given f rst priority for delivery.

Article 21 Water

Article 21 of the contracts permits delivery of water excess to delivery of SWP Table A and some other water types to those contractors requesting it. It is available under specif c conditions discussed in Chapter 4. Article 21 water is apportioned to those contractors requesting it in the same proportion as their SWP Table A.

Turnback Pool Water

Contractors may choose to of er their allocated SWP Table A water in excess to their needs to other contractors through two pools in February and March. Contributing contractors receive a reduction in charges, and taking contractors pay extra.

Carryover Water

Pursuant to the long-term water supply contracts, the Department of Water Resources (DWR) has of ered contractors the opportunity to carry over a portion of their allocated water approved for delivery in the current year for delivery during the next year. The carryover program was designed to encourage the most ef ective and benef cial use of water and to avoid obligating the contractors to use or lose the water by December 31 of each year. The water supply contracts state the criteria of carrying over SWP Table A water from one year to the next. Normally, carryover water is water that has been exported during the year, has not been delivered to the contractor during that year, and has remained stored in the SWP share of San Luis Reservoir to be delivered during the following year. Storage for carryover water no longer becomes available to the contractors if it interferes with storage of SWP water for project needs.

Updated Historical Deliveries

Table D.1 through D.10 list annual historical deliveries by various water classif cations for each contractor for 1997 through 2006. Similar delivery tables for years 1995 through 2004 are included in the *State Water Project Delivery Reliability Report 2005*. Amounts listed for 2004 are slightly dif erent due to accounting adjustments made by DWR's State Water Project Analysis Of ce.

Table D.1 Historical State Water Project Deliveries: 1997

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	185	0	0	0	**185**
Plumas County FC&WCD	231	0	0	0	**231**
City of Yuba City	1,005	0	0	0	**1,005**
Napa County FC&WCD	4,341	0	0	0	**4,341**
Solano County WA	35,530	0	0	0	**35,530**
Alameda County FC&WCD, Zone 7	27,522	0	0	0	**27,522**
Alameda County WD	24,063	0	0	0	**24,063**
Santa Clara Valley WD	95,601	0	0	0	**95,601**
Oak Flat WD	5,238	0	0	0	**5,238**
Dudley Ridge WD	51,623	7,141	12,544	0	**71,308**
Kern County WA	1,092,543	10,264	0	0	**1,102,807**
Tulare Lake Basin WSD	21,156	1,213	0	0	**22,369**
San Luis Obispo County FC&WCD	1,199	0	0	0	**1,199**
Santa Barbara County FC&WCD	7,439	0	0	0	**7,439**
Antelope Valley-East Kern WA	61,752	641	0	0	**62,393**
Castaic Lake WA (+Rch 31A, 5 & 7)	27,712	0	0	0	**27,712**
Coachella Valley WD	23,100	0	35,000	0	**58,100**
Crestline-Lake Arrowhead WA	651	0	0	0	**651**
Desert WA	38,100	0	15,000	0	**53,100**
Littlerock Creeck ID	444	0	0	0	**444**
Mojave WA	10,374	0	0	0	**10,374**
Metropolitan WDSC	738,990	0	0	0	**738,990**
Palmdale WD	11,861	0	0	0	**11,861**
San Bernardino Valley MWD	9,654	0	0	0	**9,654**
San Gabriel Valley MWD	16,002	2,173	0	0	**18,175**
Ventura County FCD	1,850	0	0	0	**1,850**
Totals	**2,308,166**	**21,432**	**62,544**	**0**	**2,392,142**
Total South of Delta	**2,306,745**	**21,432**	**62,544**	**0**	**2,390,721**

Table D.2 Historical State Water Project Deliveries: 1998

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	527	0	0	0	**527**
City of Yuba City	1,054	0	0	0	**1,054**
Napa County FC&WCD	5,359	0	0	0	**5,359**
Solano County WA	21,377	9,982	0	407	**31,766**
Alameda County FC&WCD, Zone 7	17,941	0	0	0	**17,941**
Alameda County WD	19,075	0	0	0	**19,075**
Santa Clara Valley WD	62,526	0	0	884	**63,410**
Oak Flat WD	4,401	0	0	0	**4,401**
County of Kings	3	12	0	0	**15**
Dudley Ridge WD	52,919	984	0	1,747	**55,650**
Empire West Side ID	0	0	0	542	**542**
Kern County WA	856,906	0	0	1,684	**858,590**
Tulare Lake Basin WSD	11,367	9,310	0	0	**20,677**
San Luis Obispo County FC&WCD	3,592	0	0	0	**3,592**
Santa Barbara County FC&WCD	18,618	0	0	0	**18,618**
Antelope Valley-East Kern WA	52,926	0	0	0	**52,926**
Castaic Lake WA (+Rch 31A, 5 & 7)	20,093	0	0	0	**20,093**
Coachella Valley WD	23,100	0	55,000	0	**78,100**
Crestline-Lake Arrowhead WA	187	0	0	0	**187**
Desert WA	38,100	0	20,000	0	**58,100**
Littlerock Creek ID	404	0	0	0	**404**
Mojave WA	3,925	0	0	0	**3,925**
Metropolitan WDSC	359,213	0	0	33,672	**392,885**
Palmdale WD	8,752	0	0	0	**8,752**
San Bernardino Valley MWD	1,878	0	0	0	**1,878**
San Gabriel Valley MWD	9,310	0	0	0	**9,310**
Ventura County FCD	1,850	0	0	0	**1,850**
Totals	**1,595,403**	**20,288**	**75,000**	**38,936**	**1,729,627**
Total South of Delta	**1,593,822**	**20,288**	**75,000**	**38,936**	**1,728,046**

Table D.3 Historical State Water Project Deliveries: 1999

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	286	0	0	0	**286**
City of Yuba City	1,096	0	0	0	**1,096**
Napa County FC&WCD	4,550	754	0	0	**5,304**
Solano County WA	37,753	0	0	0	**37,753**
Alameda County FC&WCD, Zone 7	46,000	2,910	0	0	**48,910**
Alameda County WD	34,871	2,781	0	0	**37,652**
Santa Clara Valley WD	67,465	15,480	0	0	**82,945**
Oak Flat WD	4,871	0	0	0	**4,871**
County of Kings	4,000	0	0	0	**4,000**
Dudley Ridge WD	51,870	4,990	6,566	0	**63,426**
Empire West Side ID	3,000	176	0	0	**3,176**
Kern County WA	1,077,755	58,241	42,154	0	**1,178,150**
Tulare Lake Basin WSD	118,500	49,898	121,337	0	**289,735**
San Luis Obispo County FC&WCD	3,743	0	0	0	**3,743**
Santa Barbara County FC&WCD	20,137	0	0	0	**20,137**
Antelope Valley-East Kern WA	69,073	0	0	0	**69,073**
Castaic Lake WA (+Rch 31A, 5 & 7)	32,899	0	0	0	**32,899**
Coachella Valley WD	23,100	0	27,380	0	**50,480**
Crestline-Lake Arrowhead WA	1,132	0	0	0	**1,132**
Desert WA	38,100	0	20,000	0	**58,100**
Littlerock Creek ID	342	0	0	0	**342**
Mojave WA	5,144	0	0	0	**5,144**
Metropolitan WDSC	829,777	22,840	0	0	**852,617**
Palmdale WD	13,278	0	0	0	**13,278**
San Bernardino Valley MWD	12,874	0	0	0	**12,874**
San Gabriel Valley MWD	18,000	0	0	0	**18,000**
Ventura County FCD	1,850	0	0	0	**1,850**
Totals	**2,521,466**	**158,070**	**217,437**	**0**	**2,896,973**
Total South of Delta	**2,520,084**	**158,070**	**217,437**	**0**	**2,895,591**

Table D.4 Historical State Water Project Deliveries: 2000

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	586	0	0	0	**586**
City of Yuba City	901	0	0	0	**901**
Napa County FC&WCD	3,136	297	0	1,525	**4,958**
Solano County WA	32,882	1,040	0	1,417	**35,339**
Alameda County FC&WCD, Zone 7	53,877	3,740	0	0	**57,617**
Alameda County WD	33,598	2,380	0	0	**35,978**
Santa Clara Valley WD	70,433	18,381	0	13,174	**101,988**
Oak Flat WD	4,494	0	0	14	**4,508**
County of Kings	3,600	0	0	0	**3,600**
Dudley Ridge WD	38,673	7,454	12,193	2,884	**61,204**
Empire West Side ID	1,271	528	0	0	**1,799**
Kern County WA	825,856	78,908	233,202	13,193	**1,151,159**
Tulare Lake Basin WSD	98,595	56,818	27,073	15,827	**198,313**
San Luis Obispo County FC&WCD	3,962	0	0	0	**3,962**
Santa Barbara County FC&WCD	22,741	0	0	0	**22,741**
Antelope Valley-East Kern WA	83,577	0	0	0	**83,577**
Castaic Lake WA (+Rch 31A, 5 & 7)	40,680	0	0	0	**40,680**
Coachella Valley WD	20,790	17,820	3,713	0	**42,323**
Crestline-Lake Arrowhead WA	1,194	0	0	0	**1,194**
Desert WA	34,290	17,820	6,124	0	**58,234**
Mojave WA	9,135	0	0	0	**9,135**
Metropolitan WDSC	1,273,729	103,124	0	169,529	**1,546,382**
Palmdale WD	8,221	0	0	839	**9,060**
San Bernardino Valley MWD	18,399	0	0	0	**18,399**
San Gabriel Valley MWD	14,000	475	0	0	**14,475**
Ventura County FCD	4,050	0	0	0	**4,050**
Totals	**2,702,670**	**308,785**	**282,305**	**218,402**	**3,512,162**
Total South of Delta	**2,701,183**	**308,785**	**282,305**	**218,402**	**3,510,675**

Table D.5 Historical State Water Project Deliveries: 2001

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	513	0	0	0	**513**
City of Yuba City	1,065	0	0	0	**1,065**
Napa County FC&WCD	4,293	996	82	1,723	**7,094**
Solano County WA	17,756	2,304	0	1,021	**21,081**
Alameda County FC&WCD, Zone 7	22,307	0	308	5,990	**28,605**
Alameda County WD	13,695	10	107	4,192	**18,004**
Santa Clara Valley WD	35,689	0	0	12,233	**47,922**
Oak Flat WD	2,089	0	22	101	**2,212**
County of Kings	1,560	0	0	0	**1,560**
Dudley Ridge WD	18,467	933	347	6,815	**26,562**
Empire West Side ID	0	253	0	1,107	**1,360**
Kern County WA	363,204	23,233	6,502	92,052	**484,991**
Tulare Lake Basin WSD	40,830	8,755	769	7,889	**58,243**
San Luis Obispo County FC&WCD	4,184	0	99	0	**4,283**
Santa Barbara County FC&WCD	14,285	396	296	0	**14,977**
Antelope Valley-East Kern WA	45,071	0	899	0	**45,970**
Castaic Lake WA (+Rch 31A, 5 & 7)	30,471	850	618	0	**31,939**
Coachella Valley WD	9,009	0	91	0	**9,100**
Crestline-Lake Arrowhead WA	1,057	0	0	0	**1,057**
Desert WA	14,859	0	151	0	**15,010**
Mojave WA	4,433	0	0	0	**4,433**
Metropolitan WDSC	686,545	10,415	7,949	200,000	**904,909**
Palmdale WD	8,170	0	0	2,257	**10,427**
San Bernardino Valley MWD	26,488	0	0	0	**26,488**
San Gabriel Valley MWD	6,534	0	0	0	**6,534**
Ventura County FCD	1,850	0	0	0	**1,850**
Totals	**1,374,424**	**48,145**	**18,240**	**335,380**	**1,776,189**
Total South of the Delta	**1,372,846**	**48,145**	**18,240**	**335,380**	**1,774,611**

Table D.6 Historical State Water Project Deliveries: 2002

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	419	0	0	0	**419**
City of Yuba City	1,181	0	0	0	**1,181**
Napa County FC&WCD	2,022	827	283	3,743	**6,875**
Solano County WA	28,223	2,242	0	0	**30,465**
Alameda County FC&WCD, Zone 7	40,707	1,484	556	8,113	**50,860**
Alameda County WD	24,250	83	862	2,331	**27,526**
Santa Clara Valley WD	55,896	202	2,053	3,311	**61,462**
Oak Flat WD	3,841	50	76	134	**4,101**
County of Kings	2,800	0	54	0	**2,854**
Dudley Ridge WD	38,688	1,861	1,177	1,994	**43,720**
Empire West Side ID	1,278	26	0	101	**1,405**
Kern County WA	670,884	21,951	20,543	15,680	**729,058**
Tulare Lake Basin WSD	73,785	3,749	2,289	5,385	**85,208**
San Luis Obispo County FC&WCD	4,355	0	0	0	**4,355**
Santa Barbara County FC&WCD	24,166	436	324	3,455	**28,381**
Antelope Valley-East Kern WA	53,907	0	1,008	3,256	**58,171**
Castaic Lake WA (+Rch 31A, 5 & 7)	61,880	280	0	6,657	**68,817**
Coachella Valley WD	16,170	111	474	0	**16,755**
Crestline-Lake Arrowhead WA	2,189	0	0	0	**2,189**
Desert WA	26,670	189	781	0	**27,640**
Mojave WA	4,346	0	0	0	**4,346**
Metropolitan WDSC	1,273,205	9,624	14,335	97,940	**1,395,104**
Palmdale WD	8,359	0	437	0	**8,796**
San Bernardino Valley MWD	68,268	0	0	3,801	**72,069**
San Gabriel Valley MWD	18,353	0	0	4,698	**23,051**
Ventura County FCD	4,998	0	0	0	**4,998**
Totals	**2,510,840**	**43,115**	**45,252**	**160,599**	**2,759,806**
Total South of the Delta	**2,509,240**	**43,115**	**45,252**	**160,599**	**2,758,206**

Table D.7 Historical State Water Project Deliveries: 2003

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	551	0	0	0	**551**
City of Yuba City	1,324	0	0	0	**1,324**
Napa County FC&WCD	6,026	376	180	1,055	**7,637**
Solano County WA	25,135	2,280	0	1,918	**29,333**
Alameda County FC&WCD, Zone 7	30,695	0	656	13,099	**44,450**
Alameda County WD	31,086	0	354	5,150	**36,590**
Santa Clara Valley WD	90,620	936	841	14,104	**106,501**
Oak Flat WD	4,059	19	48	140	**4,266**
County of Kings	3,600	58	34	0	**3,692**
Dudley Ridge WD	49,723	1,928	482	1,452	**53,585**
Empire West Side ID	1,074	175	0	187	**1,436**
Kern County WA	841,697	27,891	8,419	22,380	**900,387**
Tulare Lake Basin WSD	94,376	6,243	938	4,284	**105,841**
San Luis Obispo County FC&WCD	4,417	36	0	0	**4,453**
Santa Barbara County FC&WCD	24,312	339	43	2,274	**26,968**
Antelope Valley-East Kern WA	52,730	0	250	7,049	**60,029**
Castaic Lake WA (+Rch 31A, 5 & 7)	49,895	991	90	4,760	**55,736**
Coachella Valley WD	14,045	204	194	0	**14,443**
Crestline-Lake Arrowhead WA	1,563	0	0	0	**1,563**
Desert WA	23,168	330	321	0	**23,819**
Mojave WA	10,907	0	0	3,528	**14,435**
Metropolitan WDSC	1,550,356	17,622	16,920	134,845	**1,719,743**
Palmdale WD	9,701	0	0	1,846	**11,547**
San Bernardino Valley MWD	25,371	200	0	1,844	**27,415**
San Gabriel Valley MWD	13,034	200	0	0	**13,234**
San Gorgonio Pass WA	116	0	0	0	**116**
Ventura County FCD	5,000	0	0	0	**5,000**
Totals	**2,964,581**	**59,828**	**29,770**	**219,915**	**3,274,094**
Total South of the Delta	**2,962,706**	**59,828**	**29,770**	**219,915**	**3,272,219**

Table D.8 Historical State Water Project Deliveries: 2004

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	1,440	0	0	0	**1,440**
City of Yuba City	1,434	0	0	0	**1,434**
Napa County FC&WCD	5,030	1,450	52	1,602	**8,134**
Solano County WA	17,991	7,787	0	47	**25,825**
Alameda County FC&WCD, Zone 7	39,898	0	0	11,466	**51,364**
Alameda County WD	20,956	0	214	6,714	**27,884**
Santa Clara Valley WD	52,867	2,983	508	0	**56,358**
Oak Flat WD	4,324	0	29	276	**4,629**
County of Kings	5,850	3,157	46	0	**9,053**
Dudley Ridge WD	36,377	7,393	291	2,185	**46,246**
Empire West Side ID	1,310	626	0	1,626	**3,562**
Kern County WA	640,190	86,513	5,075	40,120	**771,898**
Tulare Lake Basin WSD	58,575	15,299	489	5,638	**80,001**
San Luis Obispo County FC&WCD	4,096	69	0	0	**4,165**
Santa Barbara County FC&WCD	29,566	0	122	0	**29,688**
Antelope Valley-East Kern WA	50,532	0	0	9,199	**59,731**
Castaic Lake WA (+Rch 31A, 5 & 7)	46,358	1,618	0	35,785	**83,761**
Coachella Valley WD	8,631	0	89	6,745	**15,465**
Crestline-Lake Arrowhead WA	2,006	0	0	0	**2,006**
Desert WA	9,966	0	102	11,122	**21,190**
Mojave WA	11,176	0	0	0	**11,176**
Metropolitan WDSC	1,195,807	91,601	10,223	215,000	**1,512,631**
Palmdale WD	10,549	0	0	1,613	**12,162**
San Bernardino Valley MWD	35,522	0	0	20,631	**56,153**
San Gabriel Valley MWD	15,600	0	0	0	**15,600**
San Gorgonio Pass WA	841	0	0	0	**841**
Ventura County FCD	5,250	0	0	0	**5,250**
Totals	**2,312,142**	**218,496**	**17,240**	**369,769**	**2,917,647**
Total South of the Delta	**2,309,268**	**218,496**	**17,240**	**369,769**	**2,914,773**

Table D.9 Historical State Water Project Deliveries: 2005

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	527	0	0	0	**527**
City of Yuba City	1,894	0	0	0	**1,894**
Napa County FC&WCD	5,322	606	0	1,741	**7,669**
Solano County WA	24,515	10,421	0	83	**35,019**
Alameda County FC&WCD, Zone 7	38,388	0	275	7,849	**46,512**
Alameda County WD	36,469	846	943	6,341	**44,599**
Santa Clara Valley WD	89,476	6,298	342	11,899	**108,015**
Oak Flat WD	4,067	0	127	0	**4,194**
County of Kings	8,100	11,504	202	0	**19,806**
Dudley Ridge WD	51,609	28,197	1,286	821	**81,913**
Empire West Side ID	1,448	1,799	0	587	**3,834**
Kern County WA	893,439	453,078	22,397	9,851	**1,378,765**
Tulare Lake Basin WSD	86,604	47,267	2,158	3,973	**140,002**
San Luis Obispo County FC&WCD	4,006	245	0	0	**4,251**
Santa Barbara County FC&WCD	22,981	0	155	0	**23,136**
Antelope Valley-East Kern WA	57,205	0	0	2,626	**59,831**
Castaic Lake WA (+Rch 31A, 5 & 7)	54,303	2,451	0	2,702	**59,456**
Coachella Valley WD	26,984	0	2,716	12,819	**42,519**
Crestline-Lake Arrowhead WA	807	0	0	0	**807**
Desert WA	33,168	0	1,122	14,799	**49,089**
Mojave WA	10,360	0	0	1,201	**11,561**
Metropolitan WDSC	1,269,291	168,300	6,530	106,032	**1,550,153**
Palmdale WD	10,174	0	0	1,538	**11,712**
San Bernardino Valley MWD	31,211	56	0	283	**31,550**
San Gabriel Valley MWD	10,500	0	0	0	**10,500**
San Gorgonio Pass WA	677	15	0	0	**692**
Ventura County FCD	1,665	0	0	0	**1,665**
Totals	**2,775,190**	**731,083**	**38,253**	**185,145**	**3,729,671**
Total South of the Delta	**2,772,769**	**731,083**	**38,253**	**185,145**	**3,727,250**

Table D.10 Historical State Water Project Deliveries: 2006

	SWP Table A	Article 21	Turnback	Carryover	Total
County of Butte	468	0	0	0	**468**
City of Yuba City	4,148	1,194	0	0	**5,342**
Napa County FC&WCD	7,312	300	0	172	**7,784**
Solano County WA	12,070	18,195	0	390	**30,655**
Alameda County FC&WCD, Zone 7	50,785	0	491	2,252	**53,528**
Alameda County WD	0	2,375	39,373	1,331	**43,079**
Santa Clara Valley WD	47,344	26,769	0	524	**74,637**
Oak Flat WD	4,118	0	107	17	**4,242**
County of Kings	8,991	366	173	0	**9,530**
Dudley Ridge WD	55,343	18,515	1,068	0	**74,926**
Empire West Side ID	1,500	1,124	0	658	**3,282**
Kern County WA	961,882	256,634	18,610	5,418	**1,242,544**
Tulare Lake Basin WSD	48,361	59,424	1,787	0	**109,572**
San Luis Obispo County FC&WCD	3,382	827	0	0	**4,209**
Santa Barbara County FC&WCD	19,255	4,020	0	0	**23,275**
Antelope Valley-East Kern WA	76,623	0	0	3,761	**80,384**
Castaic Lake WA (+Rch 31A, 5 & 7)	56,758	2,089	0	3,905	**62,752**
Coachella Valley WD	121,100	0	0	0	**121,100**
Crestline-Lake Arrowhead WA	257	0	0	0	**257**
Desert WA	50,000	0	0	0	**50,000**
Mojave WA	32,496	0	0	1,518	**34,014**
Metropolitan WDSC	1,103,538	238,478	11,638	136,424	**1,490,078**
Palmdale WD	10,374	1,653	130	335	**12,492**
San Bernardino Valley MWD	31,902	0	0	3,427	**35,329**
San Gabriel Valley MWD	13,524	0	0	0	**13,524**
San Gorgonio Pass WA	4,262	0	0	0	**4,262**
Ventura County FCD	1,850	0	0	0	**1,850**
Totals	**2,727,643**	**631,963**	**73,377**	**160,132**	**3,593,115**
Total South of the Delta	**2,723,027**	**630,769**	**73,377**	**160,132**	**3,587,305**

Appendix E. Comment Letters on the Draft Report and the Department's Responses

Written comments from the public on the *Draft State Water Project Delivery Reliability Report* (December 2007) were accepted through March 13, 2008. These letters and the responses to them are contained in this appendix.

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california water impact network

Carolee K. Krieger
president

Dorothy Green
secretary

Jim Edmondson
treasurer

Lloyd Carter
director

Malinda Chouinard
director

Yvon Chouinard
director

Joan Hartmann
director

Michael Jackson
director

Huey Johnson
director

Tom Stokely
director

March 11, 2008

California Department of Water Resources
SWP Delivery Reliability Report-Attn: Cynthia Pierson
PO Box 942836
Sacramento, CA 94236-0001

RE: Accuracy of SWP Delivery Reliability Report

Dear Sirs,

The California Water Impact Network (C-WIN) appreciates this opportunity to comment on the 2007 draft SWP Delivery Reliability Report. We believe the conclusion reached about the average reliability of the SWP at 66% is seriously misleading. Water agencies and planners will be relying on this number and could cause serious harm if this is not accurate.

How is the 66% reliability estimate in the draft Reliability Report, which purportedly takes the Wanger decision into consideration, consistent with assertions made in the most recent allocation estimate, which was issued just after snow surveys reported an above average snowpack.

The most recent estimates from DWR place the reliability of the SWP, even in this year's high snow pack scenario, at **35%**. In the DWR press release giving the 35% reliability figure for 2008, DWR also notes that without the Wanger decision, the figure from DWR would have been 50% delivery of Table A amounts.

C-WIN urges you to make sure that the final SWP Delivery Reliability Report accurately reflects the ability of the SWP to deliver water to the 29 SWP contractors who depend on it. The draft Reliability Report does not appear to be accurate.

Sincerely,

Carolee Krieger

Carolee Krieger, President

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Ms. Carolee Krieger, President
California Water Impact Network
808 Romero Canyon Road
Santa Barbara, CA 93108

Dear Ms. Krieger:

This letter responds to your letter dated March 11, 2008 providing comments of the California Water Impact Network on the draft of the State Water Project Delivery Reliability Report—2007 (DRR2007).

In your letter, you express concern for the accuracy of the reliability of SWP deliveries presented in the DRR 2007. You state that the report concludes that the average reliability of the SWP under interim export restrictions to protect Delta smelt is 66 percent. You contrast this value with an estimate done in February 2008 by the Department of Water Resources that, despite above normal snowpack in 2008, SWP deliveries in 2008 would be 35 percent of SWP Contractors' 2008 Table A amounts and would be 50 percent if the federal court-ordered 2008 Delta export restrictions to protect Delta smelt were not in-place.

I believe the average SWP delivery reliability of 66 percent you refer to in your letter is actually listed as 63 percent in Tables 6-4, 6-5, 6-6, 6-20, 6-21, 6-22, and 7-1. This value is the average annual SWP Table A delivery under current conditions over the 82-year simulation period, expressed in terms of percent of maximum Table A amounts. The value of 63 percent is the mathematical average of 82 values which range from 6 percent to 90 percent (Table 6-4). As shown in Table 6-5, average SWP deliveries over several multiple-year dry periods range from 34 to 35 percent of maximum Table A amounts. Thus, there is considerable variability in the annual SWP Table A deliveries presented in the draft report under current conditions. Year-to-year variability in simulated deliveries is attributed to several factors including varying precipitation and the amount of water stored in SWP conservation reservoirs.

DWR estimates of actual SWP contractors deliveries depend in part upon existing storage in SWP reservoirs, SWP operational constraints, and contractor demands. The SWP started the 2008 water year (October 1, 2007) with storage amounts in its reservoirs that were well below normal. Thus, while the February 28, 2008 DWR news release, which estimated SWP contractor deliveries at 35 percent of full Table A amounts, pointed to a normal or above-normal Sierra snowpack, that same news release quoted a DWR manager in its Hydrology Branch as cautioning that "additional precipitation is still needed to alleviate the deficits to water supply conditions that existed at the start of the [water supply] season."

Thus, an estimate of SWP contractor deliveries for an individual water year with under near-normal snowpack conditions is not comparable to a long-term average of simulated deliveries, which incorporates a wide range of precipitation and reservoir storage conditions.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

March 13, 2008

California Department of Water Resources
PO Box 942836
Sacramento, California 94236-0001

Attn: Cynthia Pierson

Subject: State Water Project (SWP) Delivery Reliability Project

The Draft SWP Delivery Reliability Report 2007 (Report) updates the Department of Water Resources (DWR) estimate of current (2007) and future (2027) SWP delivery reliability and expands the conditions under which reliability is quantified. The report is produced every two years. 2027 potential deliveries are based on the assumption that no changes will be made in either the way water is conveyed across the Delta or in the interim operating rules to protect Delta smelt. It shows a continued eroding of SWP water delivery reliability under the current method of moving water through the Delta.

The staff of the Delta Protection Commission (Commission) has reviewed the subject document dated January 2008. From the information provided, staff has determined that the proposed project is located within the Primary Zone of the Legal Delta and a apportion of the Secondary Zone , and is therefore subject to consistency with the Land Use and Resource Management Plan for the Primary Zone (Management Plan) and appeal to the commission.

The Delta Protection Act (Act) was enacted in 1992 in recognition of the increasing threats to the resources of the Primary Zone of the Delta from urban and suburban encroachment having the potential to impact agriculture, wildlife habitat, and recreation uses. Pursuant to the Act, a Management Plan was completed and adopted by the Commission in 1995.

The Management Plan sets out findings, policies, and recommendations resulting from background studies in the areas of environment, utilities and infrastructure, land use, agriculture, water, recreation and access, levees, and marine patrol/boater education/safety programs.

The policy from the Management Plan that is relevant to this project includes, but is not limited to the following:

Water

- Policy 3: "Water agencies at local, State, and federal levels shall work together to ensure that adequate Delta water quality standards are set and met and that beneficial uses of State waters are protected consistent with the CALFED (see Water code Section 12310(f) Record of Decision dated August 8, 2000."

The Recommendations in the Management Plan which are intended to help achieve the Policies , which are relevant to this project are as follows:

- ."Recommendation 1: "The Delta waterways should continue to serve as a primary transportation system moving water to the State's natural and developed water systems."
- Recommendation 2:"Delta water rights should be respected and protected."
- Recommendation 3: " Programs to enhance the natural values of the State's aquatic habitats and water quality will benefit the Delta and should be supported."

A copy of the Management Plan and the Act are available at the Commission's web site www.delta.ca.gov for your reference. Please contact me at (916) 776-2292 or lindadpc@citlink.net if you have any questions regarding the Commission or the comments provided herein.

Sincerely,

Linda Fiack
Executive Director

Cc: Kathy Kelly,
Chief, Bay-Delta Office, DWR

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Ms. Linda Fiack, Executive Director
Delta Protection Commission
14215 River Road
PO Box 530
Walnut Grove, CA 95690

Dear Ms. Fiack:

This letter responds to your letter dated March 13, 2008 providing comments of the Delta Protection Commission on the draft of the State Water Project Delivery Reliability Report—2007 (DRR(2007)).

In your letter, you state that the DRR (2007) is subject to consistency with the Delta Protection Commission's 1995 comprehensive long-term resource management plan, *Land Use and Resource Management Plan for the Primary Zone of the Delta.* As such, the DRR (2007) is subject to the Management Plan's Policy 3 which states that local,

State and federal water agencies "shall work together to ensure that adequate Delta water quality standards are set and met and that beneficial uses of State waters are protected consistent with CALFED." You also site three recommendations in the Management Plan for achieving its policies which you find to be relevant to the DRR (2007): Recommendation 1, which states that Delta waterways should continue to serve as a primary transportation system moving water to the State's natural and developed water systems; Recommendation 2, which states that Delta water rights should be respected and protected; and Recommendation 3, which states that programs to enhance the natural values of the State's aquatic habitats and water quality will benefit the Delta and should be supported.

The DRR (2007) is consistent with Policy 3 and Recommendations 1, 2, and 3 in the *1995 Land Use and Resource Management Plan for the Primary Zone of the Delta.* The SWP delivery reliability estimates in the DDR (2007) are based upon CalSim II simulations of both SWP and CVP operations. These simulations under both current and future conditions assume several factors including: existing Delta water quality standards protecting beneficial use of Delta water are met; existing Delta water rights continue; the 2007 federal court-ordered interim flow standards to protect delta smelt are in place; and Delta waterways and the means of conveying water to Banks and Jones Pumping Plants remain unchanged.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

Comments of the California Department of Water Resources'
Transmission Planning Branch
On the California Department of Water Resources'
"State Water Project Delivery Reliability Report 2007"
March 13, 2008

The Transmission Planning Branch of the California Department of Water Resources' Power Planning and Risk Management Office submits the following comments regarding the "State Water Project Delivery Reliability Report 2007":

The biennial report identifies factors that may impact water availability along with changes that can be made to improve future water supply reliability. The report updates DWR's estimate of the ability to maintain current (2007) and future (2027) State Water Project (SWP) delivery reliability.

The report identifies various factors that affect the SWP's ability to convey source water to the desired point of delivery. Among the factors identified as affecting Delta pumping operations were water quality constraints, fish and wildlife constraints, future sea level rise impacts associated with climate change, and levee failure impacts. However, the report did not, but should, address another important factor – potential restrictions on Banks Pumping Plant operation due to curtailment of energy transmission service to operate the pumps.

The SWP pumping plants in the Delta receive transmission service under the Comprehensive Agreement between DWR and Pacific Gas and Electric (PG&E). Under this agreement, which terminates on December 31, 2014, DWR has contractual rights for up to 275 megawatts (MW) of transmission service at the Banks Pumping Plant switchyard. However, only 157 MW is firm service; the remaining 118 MW is subject to curtailment by the California Independent System Operator (CAISO). Investor-owned utilities, such as PG&E, own most of the California high voltage transmission grid and, as a result of the electricity deregulation, has turned over the operation of these transmission facilities to the CAISO.

In June 2007, Banks Pumping Plant operation was severely restricted for much of the month to protect the Delta smelt. When the Delta smelt constraints were lifted in July 2007, DWR had intended to operate the plant continuously at full capacity to make up for June's pumping restriction. However, Banks Pumping Plant operation was curtailed due to curtailment of transmission service.

A recent operations study by DWR indicates that to make up for lost pumping opportunities and maximize water delivery reliability, Banks Pumping Plant and the expanded South Bay Pumping Plant will require a combined 305 MW of firm transmission service. To that end, DWR's Transmission Planning Branch is working with PG&E, CAISO, and the Western Area Power Administration to identify reinforcements needed to provide 305 MW of firm transmission service for these Delta

pumping facilities. It is anticipated that this level of service will occur no earlier than 2011 and could occur as late as 2015.

If you have any questions regarding the comments, please call Linda Quok, Chief of DWR's Transmission Planning Branch, at (916) 574-0617.

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Ms. Linda Quok, Chief
Transmission Planning Branch
California Department of Water Resources
Joint Operations Center
3310 El Camino Avenue, Room LL90
Sacramento, CA 95821-9000

Dear Ms. Quok:

This letter responds to your letter dated March 13, 2008 providing comments on the draft of the State Water Project Delivery Reliability Report—2007.

In your email, you state that the draft report should address potential restrictions on Banks Pumping Plant operations due to the energy transmission service to operate the pumps being subject to curtailment by the California Independent System Operator (CAISO).

As you point out in your letter, SWP pumping at Banks Pumping Plant may at times be in effect curtailed by CAISO, a situation that may persist until sometime between 2011 and 2015. While this may be true, this level of detail of concern exceeds the level of analysis in the report. The analysis is based upon results from CalSim II studies which assume a monthly time step. Watershed runoff, reservoir storage, reservoir releases, Delta inflow, Delta consumptive use, Delta exports, Delta outflow, and SWP Table A and Article 21 deliveries are all calculated on a monthly average basis over the 82-year simulation period. Banks Pumping Plant restrictions due to water quality and flow standards are also based upon monthly average data. For presentation of CalSim II results in the report, monthly average SWP Table A and Article 21 deliveries are summed for each year to generate 82 values of total annual deliveries. Considering the level of detail inherent in the report, temporary curtailments of the energy transmission service needed to operate the pumps at Banks Pumping Plant is not viewed as significant.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

MWD
METROPOLITAN WATER DISTRICT OF SOUTHERN CALIFORNIA

Executive Office

March 12, 2008

Ms. Cynthia Pierson
California Department of Water Resources
SWP Delivery Reliability Report- Attn: Cynthia Pierson
P.O. Box 942836
Sacramento, CA 94236-0001

Dear Ms. Pierson:

State Water Project Delivery Reliability Report 2007—December 2007 Draft

The Metropolitan Water District of Southern California (Metropolitan) has reviewed the Department's December 2007 draft of the State Water Project Delivery Reliability Report. The report updates estimates of the current (2007) and future (2027) State Water Project delivery reliability and incorporates (i) the December 2007 Federal Court ruling for Delta exports and (ii) potential impacts of future climate change. The utility of the draft Reliability Report could be enhanced if it is amended to include a second future conditions analysis that omits the projected effects of climate change.

The draft Reliability Report presumes that the restrictions on exports from the Delta put in place by the Federal Court for water year 2008 to protect the delta smelt are similar to the operational requirements that will result from the adoption of new federal biological opinions. While the Court ruling is only applicable until September 2008, when the new biological opinion is due to be issued, Metropolitan believes this to be a prudent assumption at this time. The forthcoming incidental take permit will incorporate operational requirements that may or may not be more stringent than the Wanger interim operations rules. Regardless, the present decrease in supply reliability underscores the need to provide improvements to the conveyance of Project water across the Delta.

The incorporation of projected effects due to climate change introduces a level of uncertainty in the assessment of the reliability of the State Water Project through 2027. While the draft Reliability Report states that, "Potential changes in climate patterns are becoming better defined..." (second paragraph, page 7), it also states that the potential effects of climate change in the future are "evolving" and that, "Incorporating climate change into future projections is difficult because of the many ways the patterns of rain, snow and temperature could shift" (second full paragraph, page 10). The analysis made use of the results of a 2006 report from the Department in which "broad-brush estimates are made of the potential impact upon the SWP around the year 2050...". The analysis converted the year 2050 conclusions contained in the

2006 report to year 2027 through interpolation. Given the high degree of uncertainty, it is unclear how the results should be used.

Recently, Metropolitan has joined with other major water agencies within the United States to form the Water Utility Climate Alliance (WUCA). Top among WUCA's list of research needs is to reduce the uncertainty in projections related to how climate may change by improving and refining global climate models and applying them at the regional or local level. To facilitate incorporation of continued research and refinements of the projected effects of climate change, Metropolitan requests that the final version of the Reliability Report include a second analysis of future conditions without the climate change assumptions. This would provide a baseline analysis for future conditions to which refined projections of the effects of climate change could be applied.

Very truly yours,

Stephen N. Arakawa
Manager, Water Resource Management

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STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Mr. Steve Arakawa, Manager
Water Resource Management
The Metropolitan Water District of Southern California
700 N. Alameda Street
Los Angeles, CA 90012

Dear Mr. Arakawa:

This letter responds to your letter dated March 12, 2008 providing comments of the Metropolitan Water District of Southern California on the draft of the State Water Project Delivery Reliability Report—2007 (DRR 2007).

In your letter, you refer to the relative uncertainty in the assessment of the future reliability of State Water Project deliveries under climate change assumptions, and request that the DRR

The relative uncertainty of the effects of climate change on SWP delivery reliability are appreciated. However, Governor Schwarzenegger's Executive Order S-3-05, signed on June 1, 2005, directs the Secretary of the California Environmental Protection Agency to coordinate with State agencies to report every two years on the impacts to California of global warming, including impacts to water supply. The Department of Water Resources identifies climate change in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management. This is because analysis has shown that climate change may in the future seriously affect the State's water resources, particularly SWP's ability to deliver water. The DRR (2007) recognizes the uncertainty of climate change projections by evaluating future State Water Project deliveries under four scenarios of climate change: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0. Simulated deliveries under these scenarios of climate change were then interpolated to estimate deliveries in the year 2027.

The estimated future (2027) SWP Table A and Article 21 deliveries under the climate change scenarios in the DRR (2007) are based upon interpolations of SWP deliveries under future conditions without climate change and climate change at the 2050 level. The annual SWP deliveries under future conditions with and without climate change are presented in Appendix B (tables B-4 through B-11) and are available electronically via the DRR (2007) website if any reader wishes to perform further analysis.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

NATURAL RESOURCES DEFENSE COUNCIL

March 13, 2008

Ms. Cynthia Pierson
California Department of Water Resources
P.O. Box 942836
Sacramento, CA 94236-0001
email: **comments-on-2007drr@water.ca.gov**

Re: Comments on the Draft State Water Project Delivery Reliability Report 2007 and OCAP Consultation

Dear Ms. Pierson:

We are writing on behalf of the Natural Resources Defense Council and its over 120,000 members and activists in California. We appreciate the opportunity to comment on the draft State Water Project Delivery Reliability Report 2007 ("Reliability Report" or "Report") and look forward to working cooperatively with the Department of Water Resources ("DWR") to address many of the issues raised by the Reliability Report, including improving conditions in the Delta to protect the ecosystem and water supply reliability for 25 million Californians. We also request that these comments and attachments be considered in the ongoing consultation regarding the Operating Criteria and Plan ("OCAP") for future joint operations of the State Water Project ("SWP") and Central Valley Project ("CVP").

We identify below some recommended changes to the final Report. Primary among these is the need for more discussion and analysis of demand management as a tool to improve reliability. Because reliability is a function of both water supply and water demand, reductions in demand can effectively improve reliability, as well as reduce the stresses on the Delta ecosystem caused by excessive water diversions. Governor Schwarzenegger recently released a new water plan, which includes a 20 percent reduction in per capita water use statewide by 2020. *See* Letter from Governor Schwarzenegger to Senators Perata, Steinberg, and Machado (February 28, 2008), appended as Attachment 1. This reduction in demand far exceeds the five percent reduction in average SWP Table A supplies that the Report projects for 2027. Report at 30. In fact, aggressive demand reduction measures could allow for far more significant reductions in SWP (and CVP) deliveries without adversely impacting reliability. We urge DWR to revise its modeling and analysis to address demand-side management for the final Report and in the ongoing OCAP consultations.

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I. THE REPORT SHOULD INCLUDE A DISCUSSION OF DEMAND MANAGEMENT

The draft Reliability Report recognizes that the concept of "reliability" measures "a system's ability to match water supplies with *demand*." Report at 6 (emphasis added). The Report asserts that reliability in the context of the SWP depends on three general factors: "the availability of water at the source, the ability to convey water from the source to the desired point of delivery, *and the magnitude of demand for the water*." *Id.* (emphasis added). Despite this recognition of the importance of water demand in the reliability equation, the draft Report omits any discussion of demand management, or the ability of SWP contractors to improve reliability by reducing their own demand, both overall and at different times of the year. Instead, the draft Report bases its analysis of reliability on demand values from previous years, which values are derived from historical data and information received from the SWP contractors. *Id.* at 9. This omission should be corrected in the final Report.

As explained in DWR's most recent State Water Plan update, and in the attached NRDC analysis and water district testimony, SWP contractors have considerable untapped capacity to improve the efficiency of their water use, to reduce their demand through improved groundwater management, and to reduce their demand through water recycling, stormwater capture, and other methods. Realizing this untapped capacity would reduce SWP contractor demand, reduce the need for diversions from the Delta, and improve SWP delivery reliability. *See* NRDC, *Effective Solutions to Meet California's Water Supply Reliability Needs* (February 25, 2008), appended as Attachment 2; Testimony of Jeffrey Kightlinger, General Manager, Metropolitan Water District of Southern California before the House Committee on Natural Resources, Subcommittee on Water and Power (January 29, 2008), appended as Attachment 3; Testimony of Richard W. Atwater, General Manager, Inland Empire Utilities Agency before the House Committee on Natural Resources, Subcommittee on Water and Power (January 29, 2008), appended as Attachment 4. The Report should be modified to include an analysis of the impact of these demand reduction measures on SWP reliability, as well as the impact of the Governor's call for a 20 percent reduction in per capita water use by 2020.

II. THERE IS NO EVIDENCE THAT NEW CONVEYANCE NORTH OF THE DELTA PROVIDES ECOSYSTEM BENEFITS

The draft Reliability Report picks up a refrain from the Bay Delta Conservation Plan ("BDCP") process that "a new North of Delta diversion(s) from the Sacramento River, which would divert water for export around the Delta, offers the greatest potential for meeting ecosystem restoration objectives." Report at 12. We are not aware of any specific proposal for a new North of Delta diversion(s), addressing such issues as proposed size, operational rules, total proposed diversions, governance and assurance mechanisms and mitigation plan. Nor are we aware of any analysis of the potential impacts of such a proposal. *See* Letter from NRDC to the Resources Agency Re: Comments on BDCP Points of Agreement (December 21, 2007), appended as

Attachment 5. In fact, there are myriad ways in which a new North of Delta diversion could cause greater harm to the Delta ecosystem than the management of the existing SWP and CVP conveyance facilities, including by increasing the amount of exports (either overall or seasonally), reducing downstream water quality, increasing migrating fish mortality (especially salmonids), increasing the relative concentration of toxic contaminants, increasing adverse Delta food web impacts, increasing the threat and growth of invasive species, reducing Delta agricultural productivity and more. If DWR has analyzed these potential impacts, we urge the agency to make that information publicly available. Otherwise, the statement that a theoretical North of Delta diversion(s) "offers the greatest potential for meeting ecosystem restoration objectives" (which objectives also remain undefined in the Report and the BDCP process) lacks any foundation and is premature.

III. THE ENVIRONMENTAL WATER ACCOUNT BENEFITS CONTRACTORS, NOT THE ENVIRONMENT

The draft Report incorrectly states that "decline in the abundance of juvenile delta smelt led to a voluntary modification in 2007 in SWP and CVP operations to reduce the reversed flows in Middle and Old Rivers – a modification made possible through the Environmental Water Account." Report at 15. In fact, the Environmental Water Account ("EWA") did not make this action "possible." Rather, DWR, the Bureau of Reclamation and the fisheries agencies are compelled to modify pumping operations when those operations adversely impact the survival, recovery and critical habitat of fish protected under the Endangered Species Act, such as the delta smelt. Indeed, a federal judge recently held, at DWR's urging, that "regardless of whether [EWA and similar 'environmental water'] programs are fully funded and/or remain functional mechanisms to provide water to the Delta, 'the burden … falls on the Projects, not the smelt.'" *NRDC v. Kempthorne*, case no. 05-CV-01207, Order on Summary Judgment, at 61 (May 25, 2007). If the fisheries agencies require the Projects to reduce pumping to protect listed fish, DWR and the Bureau must do so, whether or not EWA assets are available.

The history of the EWA demonstrates that, rather than aiding ecosystem recovery, the EWA has primarily functioned as an impediment to fish protection and recovery, by acting as an artificial constraint on the amount of water available for ecosystem needs. *See* Letter from NRDC to the Bureau of Reclamation Re: Comments on the Draft Supplemental EIS/EIR for Extending the Environmental Water Account and OCAP Consultations (December 10, 2007), appended as Attachment 6. The studies in the draft Report correctly assume that no EWA will be in place in the future. The text of the Report should be modified to correct the misconception that this outcome is bad for fish or constrains DWR's and the Bureau's ability and obligation to make sufficient water available for ecosystem protection.

IV. THE REPORT SHOULD CONFORM ITS SEA LEVEL RISE ASSUMPTIONS TO THE RECOMMENDATIONS OF THE CALFED INDEPENDENT SCIENCE BOARD

The draft Report estimates the effects of climate change on SWP delivery reliability by analyzing four different climate change scenarios developed in DWR's 2006 report entitled "Progress on Incorporating Climate Change into Management of California's Water Resources." Report at 18. However, the estimates of the impacts of climate change on California, and sea level rise in particular, have changed considerably since those four scenarios were developed. In particular, as the Report notes, the CALFED Independent Science Board has recommended that for planning purposes incorporating sea level rise, DWR should use the full range of variability of 50-140 cm (20-55 inches). Report at 22; *see also* Memorandum from Jeffrey Mount to Michael Healey re: Sea Level Rise and Delta Planning (Sep. 6, 2007), appended as Attachment 7. This range is considerably higher than DWR previously assumed in its 2006 report (a one-foot sea level rise), and will likely have considerably more significant water supply and ecosystem impacts. It is likely that other estimates of the impacts of climate change need to be updated as well, including projections of reduced Sierra snowpack and increased evaporation rates in watersheds and surface storage reservoirs. *See, e.g.,* NRDC, *In Hot Water, Water Management Strategies to Weather the Effects of Global Warming* (July, 2007), http://www.nrdc.org/globalWarming/hotwater/hotwater.pdf. The analysis should be redone incorporating the most recent sea level rise and other climate change analysis.

V. ARTICLE 21 WATER SHOULD BE OFFERED TO FISHERIES AGENCIES BEFORE BEING PROVIDED AS SURPLUS WATER TO CONTRACTORS

The Report assumes that DWR will continue to provide considerable amounts of Article 21 water to contractors in the future. It is within DWR's discretion whether or not to make Article 21 water available in any given year for delivery to SWP contractors. As we have urged DWR in the past, we request again that DWR implement a policy of foregoing Article 21 declarations and deliveries if state and federal fisheries agencies recommend that the water remain instream or available for ecosystem protection purposes. This small step to improve the Delta's ailing ecosystem would improve reliability for all water users by reducing the need for unplanned, emergency pumping restrictions to protect an ecosystem poised on the brink of collapse.

VI. REDUCED EXPORTS MEANS GREATER UPSTREAM RESERVOIR STORAGE

We note that one effect of reducing pumping from the historically high levels of recent years is that higher amounts of storage will be available in upstream reservoirs at the end of the year. Report at 30. Increased upstream reservoir storage should allow for improved coldwater management for salmon and steelhead below the dams. We urge DWR and the fisheries agencies to utilize the increase in carryover storage to increase

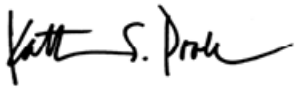
the protections for imperiled salmonids from the lessened protections in the most recent OCAP salmonid biological opinion, including the reduced Shasta carryover storage requirement and the more restrictive downstream temperature control point.

VII. REDUCED EXPORTS MEANS REDUCED YEILD FROM POTENTIAL SOUTH OF DELTA STORAGE

The current levels of Delta diversions, which are lower than those in the past, will also reduce the potential yield of proposed South of Delta storage facilities. This effect is due to the fact that there will be fewer times in the future when existing South of Delta storage is full. These reduced levels of diversion are likely to remain in place for the foreseeable future. The report should discuss the relationship between lower levels of diversions and proposed expansions in storage South of the Delta that would be dependant on Delta pumping as a water source.

Thank you again for the opportunity to comment. Please contact us with any questions.

Sincerely,



Katherine S. Poole
Senior Attorney

Barry Nelson
Senior Policy Analyst

Enc.

Cc: Cay Goude, USFWS
Maria Rea, NMFS

ATTACHMENT 1

Office of the Governor
ARNOLD SCHWARZENEGGER
THE PEOPLE'S GOVERNOR

PRESS RELEASE

02/29/2008 GAAS:112:08 FOR IMMEDIATE RELEASE

Governor Schwarzenegger Outlines Comprehensive Actions Needed to Fix Ailing Delta

Governor Schwarzenegger sent the following letter to Senators Perata, Steinberg, and Machado in response to their unfounded concerns that his administration is "unilaterally" beginning work on a so-called "peripheral canal." Consistent with the extensive work done by his administration over the last two years to gain consensus on a bipartisan legislative solution for a comprehensive plan to upgrade California's water infrastructure, Governor Schwarzenegger detailed his agenda in the following letter:

February 28, 2008

The Honorable Don Perata The Honorable Darrell Steinberg
President pro Tempore California State Senate
California State Senate State Capitol
State Capitol Room 4035
Room 205 Sacramento, California 95814
Sacramento, California 95814

The Honorable Mike Machado
California State Senate
State Capitol
Room 5066
Sacramento, California 95814

Dear Don, Mike and Darrell,

My administration has been working on solutions for addressing California's water supply and the environmental crisis in the Sacramento-San Joaquin Delta for more than two years. As you all have acknowledged during our negotiations on a comprehensive water infrastructure package over the last year, the heart of California's vital water supply system is in jeopardy of collapse without both immediate action and long term solutions to restore the ecosystem and protect water supplies.

I created the bipartisan Delta Vision Blue Ribbon Task Force by administrative action in 2006. The Task Force has issued its Vision and will develop a Strategic Plan to implement the Vision by the end of this year. In its recommendations, the Task Force identified a series of near-term actions that should be taken to protect the estuary, including studying the options for improving water transfer in the Delta. Far from acting unilaterally, my administration has been transparent in working with stakeholders and legislators on identifying both administrative and legislative actions that will be necessary to address the recommendations of the Task Force. As part of that effort, I will continue to negotiate in good faith with legislators on a comprehensive water infrastructure package.

To clarify the administrative actions we are considering as part of a comprehensive solution in the Delta, let me outline some of the key elements under development:

1. **A plan to achieve a 20 percent reduction in per capita water use statewide by 2020.** Conservation is one of the key ways to provide water for Californians and protect and improve the Delta ecosystem. A number of efforts are already underway to expand conservation programs, but I plan to direct state agencies to develop this more aggressive plan and implement it to the extent permitted by current law. I would welcome legislation to incorporate this goal into statute.
2. **Protection of floodplain in the Delta.** The Department of Water Resources (DWR) and other appropriate state agencies will expedite the evaluation and protection of critical floodplains. This action protects people and property, the existing water export system and the Delta ecosystem.
    - **Policy guidance on Delta land use.** The Blue Ribbon Task Force made it clear that changing land use patterns may limit our ability to address critical issues with the existing water export system and the Delta ecosystem. Accordingly, I will ask the Delta Protection Commission to update their Land Use and Resource Management Plan and direct the Governor's Office of Planning & Research and the State Architect to develop model Delta land use guidelines for distribution to local governments.
    - **Levee protection and standards.** DWR is actively involved in efforts to improve our flood protection and levee systems and, as part of this effort, should establish recommended standards for Delta levees.
3. **Multi-agency Delta disaster planning.** DWR, in coordination with the Office of Emergency Services, and other appropriate state agencies will develop and implement an emergency response plan and conduct a multi-agency disaster planning exercise in the Delta.
    - **Contract for emergency response equipment and services.** I will authorize DWR to continue its efforts to obtain equipment and services including barge services, sheet piling and other flood fighting materials to respond to disasters in the Delta. In addition to my previous orders, we must expedite the placement of materials and supplies in and near the Delta, to improve our emergency response capabilities.
4. **Expedite interim Delta actions.** The Resources Agency, DWR, Department of Fish and Game and the State Water Resources Control Board have already begun efforts to help protect and restore Delta habitat and help water users cope with supply interruptions.

I will direct the Resources Agency to expedite the completion of the Bay Delta Conservation Plan (BDCP), including the environmental review and permitting activities. Ongoing Delta actions, in conjunction with these efforts, will provide a foundation to help conserve at-risk species and improve water supply reliability.

5. **Water quality.** While additional storage and improved conveyance can allow greater control

of water flows that improve drinking water quality, more must be done. I will direct the State Water Resources Control Board to develop and implement a comprehensive program in the Delta to protect water quality.

6. **Improvements to Delta water conveyance.** DWR and other appropriate state agencies will soon begin the public process to study the alternatives available for improving the Delta water conveyance system. As part of this study, DWR must coordinate with BDCP efforts to recover at-risk species. DWR must also incorporate the issues of water supply reliability; seismic and flood durability; ecosystem health and resilience; water quality; and projected schedule, cost and funding in their options review, as suggested by the Task Force.

The Task Force recommended that we study a "dual conveyance facility" as a starting point. However I believe we must look at a full range of options for improving conveyance in the Delta.

Accordingly, I intend to direct DWR to proceed with the NEPA/CEQA analysis on at least four alternatives for Delta conveyance. They shall consider the following:

- The possibility of no new Delta conveyance facility;
- The possibility of a dual conveyance facility, as suggested by the Task Force;
- The possibility of an isolated facility;
- The possibility of substantial improvements and protections of the existing water export system, most often referred to as ‘armoring the Delta' or a "through-Delta" solution.

7. **Water storage.** DWR will complete the feasibility studies for the CALFED storage projects including Temperance Flat, Sites Reservoir, and the Los Vaqueros expansion. Each of these projects, depending on how they are built and operated, can provide substantial public benefits. Unlike in the past, when local entities built storage facilities for their own benefit and with little state investment, the current deteriorating condition of the Delta and the statewide water system demand public investment in exchange for the public benefit the entire state will realize.

In addition, I will direct DWR to expedite funding for groundwater storage projects throughout the state that will improve water supply reliability.

Please know that I will continue to work with the Legislature and all stakeholders to develop a comprehensive solution to the crisis in the Delta, and I will act on administrative measures in a transparent manner at the appropriate time.

California's history is filled with innovators and problem solvers. In 2006, with Democrats and Republicans working together for a common cause, we added to that legacy by building up our infrastructure. We showed leadership, not for the benefit of our own ambitions, but for the future of the state. That's something that Californians weren't used to, and they responded forcefully, approving all of the bonds. It's time for us to put the state first and add another chapter to the history books. It's time to secure a safe, clean and reliable water supply for the next generation of Californians. We have a great opportunity, and the people are counting on us. Let's not let it pass.

Sincerely,

Arnold Schwarzenegger

ATTACHMENT 2

EFFECTIVE SOLUTIONS TO MEET CALIFORNIA'S WATER SUPPLY RELIABILITY NEEDS

The Bay-Delta Estuary is facing a crisis. Numerous species are listed as threatened or endangered, or proposed for listing. The Delta smelt is on the verge of extinction. The status quo is not sustainable for any of the Delta's users, including farmers, commercial and sport fishermen, Delta residents and the 23 million Californians who rely on the Delta for a portion of their water supply. Investments to improve water supply reliability must also improve conditions in the Delta. By directing state funds to alternative water supplies, Delta flood protection and restoring a healthy ecosystem, the State will help improve water supply reliability, meet the needs of a growing population and protect imperiled fish species.

There is a broad consensus regarding the most effective tools to meet California's future water supply needs. The 2005 California Water Plan update contains extensive, detailed estimates of the water supply potential of a range of proven water supply tools. The bar chart below presents many of those totals, ranging from low to high yield estimates. We believe that the more ambitious estimates are realistic, and that aggressive targets and ambitious programs are required to assure Californians a reliable water future. DWR estimates that the three tools with the greatest potential – urban water conservation, wastewater recycling and improved groundwater management – could, together, produce more than six million acre-feet of new water. This represents approximately as much water as the CVP and SWP have diverted from the Delta in recent years, and more than enough to reduce Delta diversions and meet future growth needs.

NRDC believes that total Delta diversions must be reduced from the unsustainable record levels in recent years. We are working with other members of the environmental community to develop a science-based target for that reduction, which we will provide to the Task Force in the near future. Urban water use efficiency and other tools discussed below can provide the State with near-term and cost-effective supplies to offset any impacts from a reduction in Delta supplies.

Proven "Cornerstone" Water Supply Reliability Tools

Urban Water Use Efficiency: Currently, urban areas use over eight million acre-feet of water during a typical year. One-third or more of this water is used to irrigate urban landscapes. Urban water use efficiency could yield up to **3,500,000 acre-feet** of water per year according to the Pacific Institute's most recent projections. (This estimate is close to DWR's estimate of 3.1 million acre-foot high estimate of the potential of urban conservation at $230-522 per acre-foot.) Significant reductions in water use can be achieved through design, installation and maintenance of water efficient landscapes, along with indoor conservation measures in the commercial, industrial and residential sectors. These savings can be realized by investing in current, off-the-shelf technologies, reducing lost and unaccounted for water through system water audits, and increasing implementation of conservation pricing. New water efficient technologies will undoubtedly continue to emerge and contribute additional savings in the future.

Recycled Water: Recycling urban wastewater (also known as reclamation or re-use) is an important strategy to increase water supply. Recycled water is most frequently used for agricultural or landscape irrigation or groundwater recharge. DWR estimates water recycling can generate up to **1,500,000 acre-feet a year** by 2030 at average cost of $600 per acre-foot.

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Improved Groundwater Management: The Department of Water Resources estimates that improved groundwater management, such as the conjunctive use of surface and underground storage, has the potential to provide between 500,000 and 2 million acre-feet at costs ranging from $10-600. The average cost in a recent round of applications received by DWR for conjunctive use projects was $110 per acre-foot. The appropriate target for conjunctive use will be determined in part by decisions on water management in the Delta, which will influence potential yield from groundwater storage. Such investments are likely to yield greater benefits south of the Delta, where projects may be less constrained by Delta operations and provide greater independence from the Delta. This effort could also be coordinated with floodplain and habitat restoration efforts in the Central Valley.

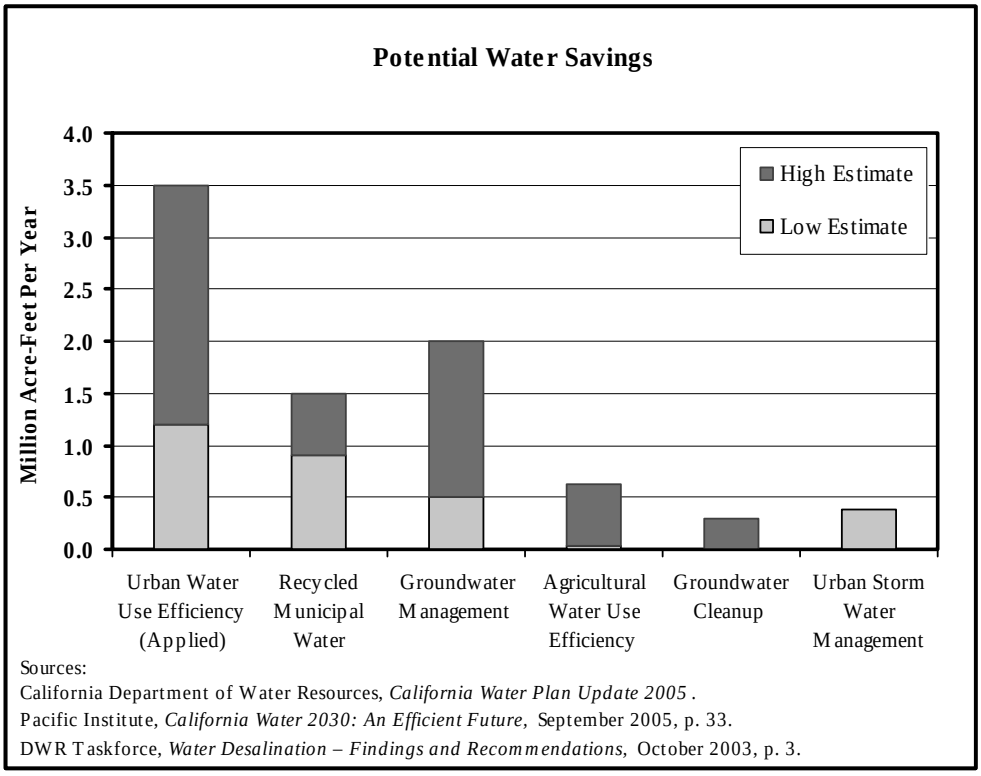
Additional Effective Strategies

In addition to the key tools discussed above, a number of additional water management tools can generate significant additional supplies.

Agricultural Water Use Efficiency: Eighty percent of California's annual water use goes to agriculture. Although in some areas considerable strides have been made in water use efficiency, farming methods are not as water-efficient as they can be. The California Bay-Delta Authority's Year Four report estimates up to **620,000 acre-feet** of water can be saved through agricultural water use efficiency, which includes installing micro-irrigation technology or other water management improvements, at a cost of $242 per acre-foot. We believe that these estimates understate the true potential of this tool.

Additionally, agricultural water is often highly subsidized. Pricing reform that sends clear, meaningful signals to agricultural water users can be very effective in encouraging increased water use efficiency.

Groundwater Clean-up: Removing salts, including nitrates, from groundwater can be a cost-effective means of producing clean water supplies, recharging stressed and contaminated aquifers, and increasing groundwater storage capacity without the need to build expensive surface storage projects. DWR estimates brackish groundwater desalination costs $250-500 per acre-foot, with a potential of yielding up to **290,000 acre-feet per year**.



Sources:
California Department of Water Resources, *California Water Plan Update 2005* .
Pacific Institute, *California Water 2030: An Efficient Future,* September 2005, p. 33.
DWR Taskforce, *Water Desalination – Findings and Recommendations,* October 2003, p. 3.

Urban Storm Water Management: Urban water agencies, particularly in Southern California, are increasingly recognizing the potential to provide multiple benefits by capturing, treating (where necessary), storing and using urban storm water. Use of low impact development techniques (LID) results in the diversion and capture of storm water and dry-weather runoff before it flows into surface waters. This water can then be used on- or off-site as an alternative water source for irrigation of parklands, sporting fields, cluster housing groups, or for fire-fighting. Such projects can provide water supply and flood management benefits, while reducing coastal pollution from urban runoff.

Nationally, research has repeatedly shown that LID has the potential to deliver vast quantities of useable water through recharge and infiltration, and that it is the most effective and cost-efficient means of managing storm water and abating water pollution. Further, LID uses common sense and simple technology – strategically placed beds of native plants, rain barrels, "green roofs," porous surfaces for parking lots and roads, and other tools – to retain rainfall on site or help rainfall soak into the ground, rather than polluting the nearest water body.

The Los Angeles Integrated Regional Water Management Plan indicates that proposed urban storm water management projects can generate **100,000 acre-feet** from urban storm water capture, and that the maximum potential is at least twice that amount. NRDC's preliminary estimate of the water savings from implementation of LID practices suggests that if LID were used in just 50% of all residential and commercial properties in Los Angeles, Riverside, and San Diego Counties, **377,000 acre-feet** annually could be infiltrated or otherwise reused. By offsetting energy-intensive imported water in like amounts, and after accounting for average energy requirements associated with pumping groundwater in these areas, LID could result in the reduction of up to 45,000 metric tons of CO_2 annually in Los Angeles County and an additional 55,000 metric tons of CO_2 in San Diego and Riverside Counties combined.

Transfers and Land Retirement. These tools must be carefully designed in order to avoid impacts to third parties. However, significant land retirement on the west side of the San Joaquin Valley is very likely and can generate significant water savings. For example, the Westlands Water District has advocated a land retirement program of up to 200,000 acres. Farming this land has historically required as much as 700,000 acre-feet of water.

Benefits of Alternative Water Management Strategies

A Healthier Bay-Delta and Other Ecosystems: Investments in surface storage could harm the Bay-Delta ecosystem by reducing flows to the Delta or increasing diversions from the Delta. In contrast, alternative water management tools would decrease our reliance on the Delta.

Energy Savings and Reduced Greenhouse Gas Emissions: Almost 20% of California's electricity use, and over 30% of its non-power plant natural gas use, is associated with the use of water. Water use efficiency and recycling can generate substantial energy savings and reductions in greenhouse gas emissions, and help the State meet AB 32 implementation targets.

Water Quality Benefits: Investing in water efficiency and groundwater cleanup will improve water quality by reducing urban runoff from lawns and gardens. In addition, investments in these tools will also help stretch limited state and federal funds available for water and wastewater treatment facility expansions and upgrades, by delaying or reducing the size of water system expansions. These investments will also improve drinking water quality, particularly for poorer communities in the Central Valley that rely on groundwater.

Reducing the Economic Risk from Delta Levee Failures: A massive levee failure in the Delta could jeopardize a critical water supply for 23 million Californians. Investments in alternative water management tools will reduce reliance on Delta diversions, thereby decreasing the risk to California's economy from potential Delta levee failures.

Strategies to Achieve Maximum Water Savings

This memo focuses on potential targets for a range of water management tools. The bullets below briefly outline key strategies that can maximize the water savings from these tools. We will present more details regarding these and other strategies in the future.

A Clear Conclusion Regarding Delta Diversion Totals: The single most effective thing the Delta Vision Task Force could do to encourage the development of alternative water supplies would be to make a clear, forceful recommendation regarding the need to reduce Delta diversions by a specified amount. Reducing Delta diversions will be a significant change from the trend over the last four decades. The likelihood that we will succeed in this transition will be greatly increased if the state has a clear goal to guide planning efforts and investments.

Learning from California's Energy Efficiency Success: California has emerged as a global leader in energy efficiency. We believe that the policy tools, such as a loading order and public benefits charges that have made this progress possible in the energy arena, can produce similar progress in encouraging water use efficiency. (See NRDC's white paper entitled: *Transforming Water Use: A California Water Efficiency Agenda for the 21st Century*.)

AB 32 Implementation: Reducing Delta diversions and investing in alternatives, such as water conservation, has the potential to significantly reduce energy use and greenhouse gas emissions. By integrating water planning with energy and climate change efforts, the state can take advantage of the synergies among these issues, including potential additional funding sources for less energy intensive alternatives to Delta diversions.

Integrated Regional Water Management: In recent years, IRWM has emerged as a key strategy to design water management solutions tailored to local needs, by considering local conditions, a full range of water management tools and a broad spectrum of potential benefits.

Credible Economics and Financing: Delta Vision should recommend that state and federal agencies carefully analyze the cost of alternative water supply strategies. Individual water agencies do this as a matter of course. However, state and federal agencies often fail to incorporate adequately basic economic analysis. For example, public funds dedicated to improving water supply reliability should be focused on the most cost-effective environmentally sound tools. The Delta Vision Task Force should develop recommendations to reduce water subsidies (e.g. by reforming renewed CVP contracts) and move toward real "beneficiary pays" financing.

ATTACHMENT 3

Testimony

Provided By

Jeffrey Kightlinger, General Manager
Metropolitan Water District of Southern California

On

The Immediate Federal and State Role in Addressing Uncertain Water Deliveries for California and Impacts on California Communities

Before the

Committee on Natural Resources
Subcommittee on Water and Power
United States House of Representatives

January 29, 2008

House Subcommittee on Water and Power
"The Immediate Federal and State Role in Addressing Uncertain Water Deliveries for California and Impacts on California Communities"

Oral Testimony by Jeffrey Kightlinger, General Manager
Metropolitan Water District of Southern California

Thank you Chairwoman Napolitano. I am pleased to give you and the subcommittee a brief survey of the impacts being felt throughout Southern California from the evolving water situation and Metropolitan's response. We face a new reality and new roles for Metropolitan and the state and federal governments to bringing more certainty to our water future.

At the moment we are roughly on track for an average rainfall year in both Southern California and Northern California. Traditionally this was good news. Traditionally this would mean that Metropolitan would likely receive enough water from the Sacramento-San Joaquin Delta to meet local demands and make modest additions to our storage reserves.

But not this year. Because of ongoing environmental problems in the Delta, there are court-ordered curtailments in water deliveries that started late last year and are expected to last into June. At the moment, the State Water Project has committed to delivering 25 percent of water supplies to its contractors throughout California. This percentage may increase, but Metropolitan is making preparations for a significant cutback in supplies. Metropolitan is responding by seeking to purchase additional supplies on the open market and funding a $6 million dollar water use efficiency outreach campaign to encourage conservation throughout our service area. In addition, Metropolitan's board of directors has approved over $30 million to aggressively implement water conservation and recycled hook-ups for public agencies and the commercial and industrial sectors.

Our tracking polls suggest that nearly half of the 18 million people in our service area have gotten the message and are taking steps to lower water use. This is helpful. Along with our efforts to creatively manage our resources, Metropolitan also invested in efforts to increase our storage capacity. In fact, today we have 10 times the amount of water in storage than we did during the last drought in the late 1980s and early 1990s. This includes a $2 billion capital investment in the building of Diamond Valley Lake, which alone nearly doubled the region's surface water storage capacity. Those reserves provide a cushion and give us some time. But, with the new restrictions in the Delta, we are now living on that borrowed time. That realization, and the uncertainties in the Delta, are beginning to create water supply impacts throughout the region.

Metropolitan, working with its member agencies, is developing a plan to equitably allocate our available State Water Project supplies from the Delta, the Colorado River Aqueduct and water stored in reserves. The primary objective of the plan is to minimize the impact on the overall regional economy. We are also striving to strike a balance recognizing needs from MWD, accounting for local supply and rewarding local districts that lower demands and increase supplies. A sterling example is Orange County. Last week it celebrated the opening of one of the largest water recycling facilities in the world. This facility will turn wastewater that used to drain into the Pacific Ocean into a reliable

high-quality drinking water supply that will help replenish the local groundwater basin. Metropolitan provided incentive funds to help make this project a reality. This is precisely the kind of strategic regional partnership that Metropolitan is working to replicate throughout our service area.

In the coming weeks and months, Metropolitan will review existing and new programs to lower demand and increase local supplies. We will be doing this despite rapidly rising costs from the State Water Project and other investments, which will likely require double-digit rate increases into the future. We continue to identify and implement new ways to lower demand and increase local supplies because we have seen the dramatic results of past efforts. And we are re-evaluating and updating our long-term water strategy, our Integrated Resources Plan, to determine if our conservation and local water supply targets should be even more ambitious.

To ensure our long-term plans are taking into account the impacts of climate change, Metropolitan has entered into a partnership with the RAND Corporation to develop appropriate planning models and protocols that would take into account long-term impacts on water supplies. The state has taken a leadership role with its energy policy, which is focused on landmark efforts to reduce greenhouse gases and working to ensure a better linkage between water and energy. Conserving water helps reduce the need to transport and treat water, which are energy-consumptive activities. Metropolitan is evaluating its carbon footprint in tandem with our water supply and planning efforts.

While there is much still to be done when it comes to water conservation, it is important to recognize how far Southern California has come. As an example, in the past 15 years Metropolitan has invested more than $200 million in water-conserving devices. These conservation investments, combined with plumbing code reforms, reduce our potential demands by about a million acre-feet per year. Had we not been this successful in lowering demand and simply expected the State Water Project to solve the region's problems, our demand on the Delta would be about 50 percent larger now. Given the multiple changing conditions due to climate change, endangered species rulings and other impacts in the Delta, Metropolitan has embarked upon a comprehensive update of its long-term Integrated Resources Plan. A renewed focus on the development of local resource projects will help decrease our dependency on the Delta. But we do need a more reliable supply from the Delta than the current system is providing. And we embrace the notion that restoring the health of this ecosystem is an essential ingredient to creating a more reliable water system.

How can the federal government help? We urge the federal agencies to remain active and engaged participants in the Delta. We need a new biological opinion from the U.S. Fish and Wildlife Service that will guide the operations of the State Water Project and the Central Valley Project. Metropolitan is actively seeking operational strategies that can help reduce conflicts between pumping operations and fish migration patterns. We also need the active participation of the federal wildlife agencies in coming up with a new Bay Delta Conservation Plan, which is exploring new and better ways to separate the movement of water supplies from the natural flows in the estuary. Yes, that may mean some form of a canal as one piece of a much larger solution. We need the feasibility studies and better science to understand new ways of moving water supplies. The deliberations ahead should be based on new facts and not old fears. Metropolitan has made a commitment to seek reliability from Delta supplies, and to find the water for new

growth from within our service area, a historic difference between the emerging Delta discussion and debates of the past. Metropolitan urges the federal government – our elected officials, federal agencies and staff – to support our local resource projects including recycling and other conservation programs.

As for assistance from the state, while we recognize the challenging fiscal situation, there are ways that the state can help. Metropolitan seeks to sponsor or support state legislation that would create a standard approach for regional water boards to authorize water recycling projects that seek to store supplies in groundwater basins. There are hundreds of millions of dollars from bonds that voters have already approved that are available to address parts of the Delta problem and to help regions become more self-sufficient.

Metropolitan remains a constructive and realistic participant to bring about dramatic and historic change in the Delta. We are very pleased to have the interest and involvement of both the state and federal governments to solve our problems and a collective recognition that the Delta as we know and manage it today is a broken ecosystem that needs fixing.

Thank you Chairwoman for today's hearing and I would be happy to respond to any questions.

ATTACHMENT 4

COMMITTEE ON RESOURCES
Subcommittee on Water and Power

"The Immediate Federal and State Role in
Addressing Waste Deliveries for California
and the Impacts in California Communities"
January 29, 2008

Testimony by
Richard W. Atwater
General Manager
Inland Empire Utilities Agency

I. Introduction

Thank you Chairwoman Grace Napolitano and members of the Subcommittee for Water and Power for the opportunity to testify before today regarding the water problems facing California. I am the General Manager of the Inland Empire Utilities Agency. The Subommittee has asked four important questions related to how address the critical water problems from Judge Wanger's court decision and how we develop regional and statewide strategies with the federal government to meet the challenges of having less water available from the Delta and the related issues with developing a sustainable ecosystem. The Inland Empire Utilities Agency in partnership with many other agencies in southern California and with financial assistance from the State of California and the Bureau of Reclamation is implementing a "Drought Proofing Strategy" that is a key element of a Delta Plan. We have recognized the challenges for a long time of meeting the statewide water needs in an environmentally responsible manner have committed over $500 million over the past seven years to implement projects that will develop new local supplies in southern California and reduce our need for Delta exports.

A. Inland Empire Utilities Agency/Chino Groundwater Basin

The Inland Empire Utilities Agency, a municipal water district under California law, was formed in 1950 by a popular vote of its residents. The service area of the Agency is entirely in San Bernardino County and has a current population of approximately 800,000. The IEUA service area is rapidly growing and will probably increase by 50 percent to 1.2 million within the next 20 years. The Chino Groundwater Basin was adjudicated in 1978 and is governed by a 9 member Watermaster Board. Overall water use is about 350,000 acre-feet annually, 70 percent of the supplies are from local sources within the Santa Ana Watershed. With the rapid growth, demand from MWD could increase from 70,000 acre-feet per year currently to 150,000 acre-feet in 2020 if we did business as usual! However IEUA, Chino

Basin Watermaster and in cooperation with many other agencies have developed a "Drought Proof Plan" that will develop over 100,000 acre-feet of new local supplies to minimize the need for additional imported water from MWD, thereby reduce our need for more Delta (SWP) water supplies.

B. History, Background and Interagency Relationships with CALFED Bay-Delta Program

The Agency has been a member agency of the Metropolitan Water District since 1950 and distributes about 70,000 acre-feet of imported water to the cities of Chino, Chino Hills, Fontana (through the Fontana Water Company), Ontario, Upland, Montclair, Rancho Cucamonga (through the Cucamonga County Water District), and the Monte Vista Water District. The Agency also provides wastewater treatment service (four regional water recycling plants that produce about 60 million gallons per day or 67,000 acre-feet per year). Excess recycled water flows downstream into the Santa Ana River where the Orange County Water District recharges that water into the Orange County groundwater basin for drinking water.

The Agency is also a member of the Santa Ana Watershed Project Authority (SAWPA) and is an active member of the Santa Ana River Watershed Group and the Chino Basin Watermaster. As a member agency of SAWPA, the Agency's water projects are closely coordinated with the SAWPA watershed wide planning and the funding of priority projects through the Water Bond Proposition 13 and Proposition 50 grants.

Public and Private Partnerships to Improve the Santa Ana Watershed

- Santa Ana Watershed Project Authority (SAWPA) has maintained an inclusive dialogue with all interested parties and is leading the update of the Santa Ana integrated regional watershed management plan through the "One Water-One Watershed" (OWOW) process;
- All local governments within the three counties (San Bernardino, Riverside and Orange) are working cooperatively together to manage growth and plan for the water/wastewater infrastructure needed to meet the needs of this rapidly urbanizing watershed;
- Partnerships with industry including dairies, manufacturing, and developers have resulted in creative solutions to local water quality problems (e.g. the Santa Ana brine sewer to the ocean) as well as producing new sources of renewable, cost effective energy;
- Industrial customers throughout the area are planning on using recycled water to reduce costs, ensure reliability, and to be excellent environmental stewards.

The Chino groundwater basin is one of the largest in Southern California. The Chino Basin Watermaster adopted an Optimum Basin Management Plan (OBMP) to protect the water

quality of the basin and to manage the local supplies effectively to the maximum benefit of the local ratepayers. A key element is the expansion of the conjunctive use operation of the Chino Basin to expand the storage and recovery by approximately 300,000 to 500,000 acre feet.

Other key components are the Inland Empire Utilities Agency regional water recycling project to develop new local supply of 100,000 acre-feet per year and the Chino Basin desalters that would develop an additional new local supply of 40,000 acre-feet per year.

The key benefits of the Chino Basin regional "OBMP" water plan are as follows:

Benefits

- *Provide a more dependable local water supply and reduce the likelihood of water rationing during future droughts and the impacts of climate change;*
- *Economic benefits of reliable water supply to industry and provide incentives to attract new industry and jobs in the Inland Empire region;*
- *Environmental protection – reduce wastewater discharges into Santa Ana River by 50 percent through local water recycling and protect Orange County drinking water supplies through implementation of comprehensive lower Chino Dairy area manure management strategy;*
- *Reduce imported water use in the rapidly growing Inland Empire region (upper Santa Ana River Watershed) and thereby contribute in a significant manner to the statewide CALFED Bay-Delta and Colorado River solutions through more efficient use of existing local supplies;*
- *Assist in solving multiple Endangered Species Act problems within the Santa Ana Watershed, the CALFED Bay-Delta program, and the Colorado River/Salton Sea;*
- *Implement a sustainable long-term water resources management program that maintains the salt balance of the Santa Ana River watershed;*
- *Reduce the energy intensity of the region's water supplies, helping to conserve energy and reduce greenhouse gas emissions that are contributing to climate change.*

II Chino Basin "Drought Proofing Strategy"

The IEUA Urban Water Management Plan, adopted in December 2005 and the Chino Basin Watermaster Optimum Basin Management Plan, document the overall strategy for improving the water supply reliability in the Chino Basin area.

- ✓ Water Conservation – 10% savings 35,000 AF
- ✓ Water Recycling – 100,000 AF
- ✓ Local Groundwater Storage and Conjunctive Use – 500,000 AF of new storage
- ✓ Chino Desalter 40,000 AF

- ✓ Stormwater – 25,000 acre-feet of new supplies
- ✓ Renewable Energy and Organics Recycling – Clean energy through biodigesters (using biosolids, dairy manure and food waste), solar power and wind power (goal of 15 megawatts)
- ✓ Water Quality Management – Establishment of Chino Creek Wetlands and Educational Park at IEUA and a continued partnership with Orange County Water District on Prado Wetlands implementation of the Chino Creek Integrated Watershed Plan.

A. Water Conservation- (35,000 acre-feet per year, 10 percent of overall use)

IEUA and its retail utilities are committed to implementing the Memorandum of Understanding (MOU) regarding Urban Water Conservation in California. IEUA is an active member of the California Urban Water Conservation Council (CUWCC). Currently, the Agency is expanding its conservation efforts to promote both water and *energy* conservation programs to our customers. IEUA's goal is to reduce water demands by 10 percent (35,000 acre-feet per year) through aggressive implementation of customer conservation programs. Innovative programs initiated by IEUA include the Inland Empire Landscape Alliance, in which elected officials from cities and water agencies within IEUA's service area are working to promote outdoor conservation including turf reduction rebates, use of California-friendly native plans and new regional model landscape ordinances that will promote water savings. Other programs include conservation rebates which are offered in partnership with the Metropolitan Water District of Southern California (ultra-low-flow toilets, weather-based irrigation controllers, synthetic turf, efficient sprinklers, water brooms X-Ray recirculation units and other water saving devices), landscape audits, and school education programs including the award-winning Garden In Every School program.

B. Water Recycling (50,000 acre-feet by 2010)

IEUA owns and operates four water recycling plants that produce high quality water that meets all state and federal requirements for non-potable landscape irrigation, industrial uses, and groundwater replenishment. Since 2000 the Agency has spent over $60 million expanding its recycled water distribution system and currently recycles about 15,000 acre-feet annually. Recently the IEUA Board approved an accelerated implementation plan to increase annual recycled water use to approximately 50,000 acre-feet within the next 3 years by constructing "purple" recycled water pipeline system to hookup existing large customers (schools, golf courses, city parks, groundwater recharge). IEUA's Board has approved a $140 million budget to expedite the construction of recycled water pipeline distribution system. The accelerated implementation plan was developed through a collaborative process with local cities, water districts, Chino Basin Watermaster and other stakeholders and represents a comprehensive evaluation of the infrastructure needed to maximize recycled water use in the region. In addition, IEUA and local cities have coordinated with developers to incorporate dual "purple" piping into new urban developments to maximize recycled water use for non-potable purposes.

The energy demands to produce and deliver recycled water are less than one third of the energy required to deliver water through the State Water Project. Additional energy savings are included in the plan by building new smaller water recycling plants in the northern part of our service area to provide recycled water to communities (Upland, Fontana, and Rancho Cucamonga) without the need to pump the water to them. The Cucamonga County Water District (CCWD) proposed satellite plant authorized by HR 2919 would be the prototype water recycling plant to reduce energy use of pumping recycled water to the higher elevations along the San Gabriel Mountains.

Approximately 25% of the recycled water will be used for groundwater replenishment within the Chino Groundwater basin to augment the potable water supply. IEUA and Chino Basin Watermaster recently got court approval to expand the artificial recharge of the Chino Basin Groundwater Basin. The plan is to blend recycled water with stormwater and imported water in a coordinated fashion with flood control district to ensure that all water sources are conserved in an optimal manner (targeted goal is an additional recharge of 80,000 acre-feet per year).

C. Local Groundwater Storage and Conjunctive Use (500,000 acre-feet of new storage)

The Chino Basin Watermaster is implementing an Optimum Basin Management Plan to enhance the conjunctive use storage of the Chino Basin. Today MWD has stored over 80,000 AF in the Basin and has funded $1.5 million in engineer feasibility studies to expand the storage to 150,000 AF. The Optimum Basin Management Program developed over the past two years by the Chino Basin Watermaster would implement a comprehensive water resources management strategy to drought proof the area and enhance the yield of the groundwater basin. The Chino Basin Watermaster has developed a conjunctive use program to store 300,000 – 500,000 acre-feet of imported water in wet years for drought year withdrawal for local, regional and statewide availability. In June, 2003 IEUA, Chino Basin Watermaster, Three Valleys MWD, Western MWD and the Metropolitan Water District executed an agreement for the initial 100,000 acre-feet of storage and recovery projects ($27.5 million funding from MWD and Calif. DWR). In June 2007 MWD agreed to fund studies to evaluate expanding this storage program.

D. Chino Desalination Projects (40,000 acre-feet annually by 2020)

Historically, Colorado River water (relatively high salinity) and "Route 66" agricultural practices have caused areas of the Chino Basin to have high salts that make the water unfit for domestic uses. To correct this problem and to recover this poor quality water, the Chino Basin Optimum Management Plan recommends implementation of groundwater cleanup projects to pump and treat poor quality groundwater to meet drinking water standards.
Additionally, the desalination projects of the lower Chino Basin area will protect and enhance the water quality of the Santa Ana River and the downstream use by Orange County. HR 813 (passed the House on October 22, 2007) would provide authorization under the Bureau of Reclamation's Title XVI program to provide funding for the third Chino desalter and brine line improvements with the SAWPA SARI brine system

recommended in the Southern California Comprehensive Water Reclamation and Reuse Study (USBR, 2003) and the joint MWD/USBR Salinity Management Study (1999). The third phase expansion is projected to cost $110 million and increase to approximately 40,000 AF.

E. Stormwater (25,000 acre-feet annual average of new stormwater capture percolation)

A critical issue facing the coastal plain of Southern California as the region continues to urbanize and hardscape our landscapes will be how to implement both small scale and larger scale projects for stormwater capture to allow percolation into our groundwater basins. IEUA in coordination with the Chino Basin Watermaster, the San Bernardino County Flood Control District and the Chino Basin Water Conservation District has developed an integrated recharge master plan to optimize the capture of stormwater with replenishment of imported water from MWD and our local recycled water to enhance the storage and recovery of water from the Chino Basin. During the past five years, IEUA has funded construction of over $50 million in improvements on the Groundwater Recharge Basin.

IEUA is also sponsoring innovative small scale, on-site (neighborhood development) storm water management projects to enhance percolation of rainfall to minimize runoff, reduce contamination of rainwater before it percolates into the ground and to cost effectively reduce flood control requirements while helping the cities and county meet regulatory requirements. This innovative program is being funded in partnership with the CALFED Bay-Delta Program, Metropolitan Water District of southern California, and the Southern California Concrete Association.

III. Climate Change Impacts on California Water Supplies

In the fall of 2006 IEUA collaborated with RAND on a study of the potential affects of Climate Change on the IEUA and Chino Basin area. This work has been recently completed and a Congressional briefing will held on January 31, 2008 to explain the findings of this report. Climate change will affect water supplies in California, but few water-management agencies in the state have formally included climate change in their water-management plans. RAND researchers have worked with Southern California's Inland Empire Utilities Agency to help it identify vulnerabilities related to climate change in its long-term water plans and to evaluate its most effective options for managing those risks. But in summary the RAND research project highlights the critical need to develop more local supplies in California (e.g., water recycling, local groundwater storage and stormwater replenishment programs, implement excellent water use efficiency/conservation programs) to avoid significant water shortages and economic impacts.

IV. Future Issues and Need for Federal Assistance

Southern California does have enormous water problems when you consider the following trends:

- ✓ *The current population is about 18.5 million and will likely double over the 50 years;*
- ✓ *The imported water infrastructure from MWD can optimistically only deliver 2.4 million acre-feet, assuming resolution State Water Project Delta issues and the Colorado River problems are successfully resolved;*
- ✓ *Climate change is expected to impact both amount and timing of future water supplies, increasing the likelihood of shortages during critical times;*
- ✓ *Importing water to southern California requires a large amount of electrical energy, substantially more than the alternative local supplies (recycled water, capturing stormwater, and groundwater recovery of poor quality water);*
- ✓ *The region faces significant shortages unless we develop a local supply strategy.*

The issue for the region as articulated in the MWD Integrated Water Resources Plan adopted in 2004, is to develop a balanced approach to multiple sources of supplies with a clear priority to local resources management and emphasis on less energy intensive uses of water that protect water quality and the wildlife habitats of the region.

Addressing the four questions asked in the letter inviting me to testify.? My response to these questions and suggestions are as follows:

The Committee should continue to examine the opportunities for State and Federal agency partnerships to promote water use efficiency programs recommended in the CALFED Bay-Delta Record of Decision (increase water conservation, water recycling and new local groundwater storage programs to reduce the need for Delta exports consistent with the California Water Plan.

The Committee has developed Views and Estimates in the past few years that strongly supports increased funding for the Bureau of Reclamation's Title XVI Program. For FY 2009 I recommend the Committee support an increase of $100 million increase in the funding of Title XVI Program expenditures.

A *coordinated approach to regional infrastructure planning for water supply, groundwater management, stormwater, wastewater reuse and recycling needs to be integrated on a watershed and regional scale. Regional leadership in the planning of flood control, wastewater and water facilities is an opportunity that can save billions over the next 5 decades as well as help address the serious challenge facing this nation through climate change. The federal government should be a partner in this process helping both to facilitate redirection of federal programs to support local planning and providing funding for projects that contribute to the nation's goals for water security and reduction of climate*

change impacts. EPA, Army Corps, US Bureau of Reclamation, the USDA Natural Resources and Conservation Service all have significant activities within the region.

A historic example of a state/federal partnership was the leadership of this committee in 1996 in drafting the CALEED Bay-Delta legislation that provided the authorization.

I would recommend that your Committee hold additional hearings on these opportunities to develop new regional, state and federal partnerships that address comprehensively watershed divide problems

In closing, thank you for the opportunity to testify. If I can provide any additional information on the current and future water problems facing California, please don't hesitate to contact me.

ATTACHMENT 5

NATURAL RESOURCES DEFENSE COUNCIL

December 21, 2007

Ms. Karen Scarborough
Resources Agency
1416 Ninth Street
Sacramento, CA 94814

Re: Comments on BDCP Points of Agreement

Dear Ms. Scarborough:

We are writing on behalf of the Natural Resources Defense Council ("NRDC") and its more than 120,000 members in California to express our concerns regarding the recent planning document approved by the Bay Delta Conservation Plan ("BDCP") Steering Committee: Points of Agreement for Continuing into the Planning Process (November 16, 2007) ("Points of Agreement"). These comments are supplementary to our previous comments. Unfortunately, with the one exception noted below, this document does not address the serious concerns we raised a year ago. *See* Letter from Barry Nelson and Katherine Poole to Scott Cantrell re Proposed Planning Agreement for the Bay Delta Conservation Plan (Oct. 2, 2006) (attached). In fact, in some areas, this document appears to be moving farther away from a balanced, legally sufficient and effective program.

I. PREMATURE DECISION REGARDING CONVEYANCE ISSUES

The Points of Agreement concludes that "the most promising approach for achieving the BDCP conservation and water supply goals involves a conveyance system with new points of diversion" including "the construction and operation of a new point (or points) of diversion in the north Delta on the Sacramento River and an isolated conveyance facility around the Delta" as well as "[m]odifications to existing south Delta facilities." *Id.* at 3. The document reaches this conclusion *before* the BDCP process has conducted the in-depth environmental review and comparison of alternatives under CEQA, NEPA, the ESA and the NCCPA that is necessary to support any scientifically-supportable and legally-defensible conservation plan. The BDCP has no basis for eliminating all other water conveyance and operations alternatives from serious consideration. This decision is premature, and should be revisited.

The Points of Agreement acknowledges that the Steering Committee has not yet begun the planning process for the development of the BDCP. Points of Agreement at 6. In fact, the BDCP has not yet defined the "preliminary biological goals and objectives to guide initial plan development." *Id.* at 7. If the goal of the BDCP process is truly to "develop a conservation plan for the Bay Delta pursuant to the Endangered Species Act (ESA) and the Natural Community Conservation Planning Act (NCCPA)", as the Points of Agreement asserts, then the biological goals and objectives should be driving the content of the plan, not water supply considerations. *Id.* at 1. For example, as in the

case of the Planning Agreement, this document does not commit to the recovery of listed species, and thus fails to meet the requirements of the NCCPA. That commitment should be one of the first and most fundamental commitments for a legitimate conservation plan.

Water conveyance facilities and their operations are one of the primary stressors on the Delta's ecosystem and aquatic species, and are ostensibly the focus of the BDCP. It stands to reason that the BDCP should consider the impacts of a wide array of alternative water conveyance facilities and operations on aquatic habitat, and consider alternative ways to revamp that water supply system to be compatible with fisheries conservation and recovery. The BDCP initially appeared to be pursuing this approach, identifying four "conservation strategy" options that would have allowed the agencies to analyze and compare the environmental impacts of a range of alternative water supply scenarios. Those options included:

- Option 1: use of existing facilities
- Option 2: improved through-Delta conveyance
- Option 3: dual conveyance
- Option 4: a new diversion on the Sacramento River

Points of Agreement at 5. By analyzing the benefits, costs and impacts of these alternative conveyance points, in combination with changes in operation that included various different diversion amounts, including significant reductions in total diversions, the BDCP could have garnered a great deal of useful data to inform a conservation plan.

Instead, the BDCP has prematurely narrowed its focus to Option 3, eliminating all other diversion and conveyance alternatives from consideration before fully analyzing the impacts of those alternatives. As explained in the Options Evaluation Report, this dual conveyance option will now "serve as the nucleus for the larger conservation plan and other major elements of the strategy will be formulated around it." BDCP Options Evaluations Report at ES-1 (Sept. 2007). As a result, any subsequent analysis will fail to provide decision makers with a meaningful comparison of critical policy alternatives, such as how the environmental impacts of reducing diversions from existing facilities would compare to the impacts of building a highly expensive new diversion facility on the Sacramento River.

Moreover, the BDCP's own Options Evaluation Report identified conveyance alternatives that it concluded were biologically preferable to the dual conveyance option, e.g. Option 4, but which the BDCP nevertheless rejected. While we do not endorse the analysis or conclusions of the Options Evaluation Report, it is telling that the BDCP stakeholders have already rejected an option that the federal fish agencies and their own internal analysis suggested was the biologically preferable option.

Simply put, we do not believe that it is justifiable to select a "plumbing" alternative without making any meaningful decisions regarding other key issues, such as endangered species recovery, ecosystem recovery goals, total diversions, annual operations, water quality impacts, impacts to Sacramento River fisheries, cost, financing, governance, and other issues central to the question of restoring the Delta. Some of these considerations could fundamentally affect decisions regarding conveyance strategies.

II. INCONSISTENCY WITH THE DELTA VISION BLUE RIBBON TASK FORCE VISION DOCUMENT

The imbalance in the Points of Agreement is particularly striking in comparison with the recently released Delta Vision document from the Delta Vision Blue Ribbon Task Force. The Delta Vision process was created through SB 1574 and Executive Order, representing an agreement between the legislature and the Governor. It is charged with developing a long term plan for the Delta that addresses more issues than are addressed by the BDCP process. Through the Stakeholder Coordination Group, this process also provides for the involvement of a broader range of stakeholders than the BDCP. Thus, the task force has broader support, broader involvement and a broader focus than the BDCP. Therefore, the BDCP should take care to ensure that its methodology, recommendations and timing are adapted to the Delta Vision process. Unfortunately, in the following respects, the Points of Agreement document is inconsistent with the Delta Vision document.

The Delta Vision document contradicts the conclusion of the BDCP regarding conveyance by recognizing that "not enough information is available at this point" to reach conclusions regarding conveyance. Instead, the Delta Vision document calls for an approach "recognizing the interdependence of all elements of a sustainable Delta vision and making decisions about conveyance and storage within that larger perspective." Delta Vision at 13. Unfortunately, the BDCP document has turned the sound approach of the Delta Vision document on its head, reaching a conclusion regarding the one issue for which the Task Force has most clearly recommended a cautious, comprehensive approach, and failing to reach conclusions regarding many other issues on which strong conclusions are clearly justified. The common thread among these decisions is an excessive focus on water supply issues, at the expense of other considerations.

The Delta Vision document is also far more direct in discussing the need for reductions in diversions, as well as the need for water in California to be managed "with significantly higher efficiency." Delta Vision at 2. This conclusion is supported by the CALFED Science Program, which recently stated that "opportunities for increasing supply to satisfy growing demand are becoming limited, and environmental problems are creating a growing need to reallocate water to the ecosystem. As California's population grows, increasing urban water needs will have to be met mainly by improving water management instead of by developing new supplies within the Sacramento-San Joaquin system." CALFED Science Program, State of the Science for the Bay-Delta System: Draft Summary for Policymakers and the Public at 9 *(*November 2007.) A reduction in diversions has also been mandated by the December 14 federal district court ruling regarding the protection of Delta smelt. The Points of Agreement should recognize this pressing need, which the Delta Vision document addresses more directly.

We recommend that the approach of the BDCP be modified to reflect the recommendations and approach of the Delta Vision Task Force.

III. LACK OF CONSIDERATION OF THE FAILURE OF THE ENVIRONMENTAL WATER ACCOUNT

The primary focus of this document appears to be to provide regulatory assurances for the CVP and SWP Delta facilities. Unfortunately, the Points of Agreement and the previous planning agreement do not clearly call for the analysis of the dramatic and fundamental failure of the previous assurances mechanism – the Environmental Water Account. We have described these failures in some detail. *See* Letter from Katherine Poole and Barry Nelson to Sammie Cervantes re the draft supplemental EIS/EIR for extending the EWA (Dec. 10, 2007) (attached). Indeed, the EWA has

contributed to the collapse of the Bay-Delta ecosystem and its fisheries. Clearly, this is a highly questionable tool for inclusion in a conservation plan for the Bay-Delta. It appears, however, based on the current proposal to extend the EWA, that state and federal agencies are attempting to extend temporarily this failed strategy until it can be made permanent by the BDCP. The BDCP can only avoid a full and fundamental evaluation of the EWA if this tool is permanently abandoned. The recovery of the Delta and listed species will require far more effective tools, including clear regulatory requirements and robust adaptive management measures that are not dependant on annual purchases and public funding, or on self-defeating increases in Delta pumping.

IV. ELIMINATION OF 8,500 AS AN INTERIM PROJECT

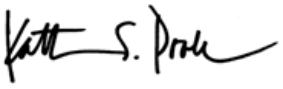
We are pleased that BDCP has responded to one of the recommendations in our previous letter – specifically by eliminating as an interim action the proposal to increase to 8,500 cfs the pumping limit for the SWP Delta pumps. Unfortunately however, other than this decision, the Points of Agreement document has not addressed the many fundamental concerns raised in that letter.

V. CONCLUSION

As you know, NRDC has reluctantly chosen not to participate in the BDCP process. We made this decision after raising concerns that the BDCP Planning Agreement failed to ensure that the final plan would conserve and recover affected listed species, while guaranteeing assurances to regulated entities "that neither the USFWS nor NMFS will require the commitment of additional land, water, or financial compensation or additional restrictions on the use of land, water, or other natural resources beyond the level otherwise agreed upon for Covered Species, without the consent of the affected Potential Regulated Entities." Planning Agreement, pp. 10-11. Our concerns have not been addressed. Indeed, the recently-issued Points of Agreement heightens our previous concerns regarding this effort, which is not yet a credible "conservation plan."

We urge you to reconsider this approach, make the BDCP consistent with the Delta Vision process and refocus it on conservation as its first priority. Thank you in advance for considering our comments.

Sincerely,



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Cc: Senator Dianne Feinstein
Senator Barbara Boxer
Congresswoman Grace Napolitano
Congressman George Miller
Senate President pro tem Don Perata
Senator Mike Machado
Assemblywoman Lois Wolk
Assemblyman Jared Huffman
Lester Snow, DWR
John Davis, BOR
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ATTACHMENT 6

NATURAL RESOURCES DEFENSE COUNCIL

December 10, 2007

Ms. Sammie Cervantes
Bureau of Reclamation
2800 Cottage Way, MP-140
Sacramento, CA 95825
scervantes@mp.usbr.gov

VIA ELECTRONIC AND U.S. MAIL

Re: Comments on the Draft Supplemental EIS/EIR for Extending the Environmental Water Account and OCAP Consultations

Dear Ms. Cervantes:

We are writing on behalf of the Natural Resources Defense Council ("NRDC") and its more than 120,000 members in California with regard to the draft supplemental EIS/EIR ("DSEIS/EIR") for the Environmental Water Account ("EWA"). The DSEIS/EIR proposes to extend the existing EWA program, which is currently set to expire at the end of 2007, for another four years, through 2011. The U.S. Bureau of Reclamation and the California Department of Water Resources, the co-lead agencies for the DSEIS/EIR, propose to take this action without providing any analysis of how the EWA has functioned since its inception in 2001 or whether the EWA has succeeded in achieving its stated fish protection purposes. In fact, the EWA has *not* functioned as envisioned and, by placing artificial restraints on the amount of water ostensibly available for fish protection, has contributed to the *decline* of imperiled fish in the Delta, most of which are in worse condition today than they were in 2001. For these reasons, we urge the agencies to discontinue the failed experiment of the EWA, and to devote the taxpayer resources currently dedicated to the EWA to actions that could provide a real benefit to imperiled fish.

In previous biological opinions on the joint operations of the Central Valley Project and State Water Project (i.e., the "Operating Criteria and Plan" or "OCAP"), the agencies have considered the EWA a central feature to mitigate the harmful impacts of the projects on listed fish. The Bureau has reinitiated consultation on those OCAP biological opinions, and those reconsultations are ongoing. Apparently, the agencies have not yet defined the "project" for this reconsultation and it is unclear whether the agencies are contemplating including the EWA in the new project description. Because the EWA has failed to function as a fish protective measure and should not be considered an effective mitigation or conservation tool in the new biological opinions, we seek consideration of these comments in those ongoing consultations as well. Likewise, we request that this information be incorporated, by DWR and DFG, into efforts to comply with the requirements of CESA.

I. THE EWA HAS NOT FUNCTIONED AS ENVISIONED

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There is no doubt that in past years the water promised for fish protection through both the Environmental Water Account and the CVPIA (b)(2) account has been significantly less than what was promised in the CALFED ROD. *Finding the Water: New Water Supply Opportunities to Revive the San Francisco Bay-Delta*, Environmental Defense, 2005 (appended as Exhibit 1). From 2001-2004, the EWA provided only 29% on average of the expected 195,000 acre-feet of operational assets. *Id.* at 12-13. Collectively, the EWA and b(2) have contributed as much as 500,000 acre-feet *less* water per year towards fish protection and restoration than anticipated in the CALFED ROD. These shortfalls have occurred while exports from the Delta have reached record high levels and the ecosystem has continued spiraling downward. Clearly, the EWA experiment has not performed as planned.

The failure of the EWA to function as envisioned is epitomized in the failure of the agencies to invoke Tier 3 this year – the intended backstop for any shortfall in EWA assets. EWA Tier 3 was supposed to ensure that if EWA was underfunded or failed to perform as anticipated (both of which have happened), sufficient water would be provided to ensure no jeopardy to listed fish. As explained in the Tier 3 Protocol, a copy of which is appended hereto as Exhibit 2:

> As part of the MSCS Conservation Agreement and the FWS and NMFS biological opinions, the CALFED agencies have provided a commitment, *subject to specified conditions and legal requirements,* that for the first four years of Stage 1, there will be no reductions, beyond existing regulatory levels, in CVP or SWP Delta exports resulting from measures to protect fish under FESA and CESA. *This commitment is based on the availability of three tiers of assets:*
> …
> Tier 3 is based upon the commitment and ability of the CALFED Agencies to make additional water available should it be needed.
> …
> Tier 3 is a fail-safe device, intended to be used only when Tier 1 and Tier 2 are insufficient to avoid jeopardy to the continued existence of an endangered or threatened species.
> …
> The State and Federal Projects will be responsible for making preparations for the activation of Tier 3.

(Emphasis added). This language makes clear that the assurances provided under CALFED, and the ESA and CESA compliance of the EWA, were dependent upon the existence and availability of these Tier 3 assets.

Unfortunately, when the time came to call upon this Tier 3 "fail-safe", the agencies failed to trigger it, ensuring that listed species rather than water users would suffer the consequences of the failure of the EWA to live up to its stated purpose. There can be no question that Tier 1 and Tier 2 have been and are insufficient to avoid jeopardy to the threatened delta smelt. A federal court held in May of this year that the "delta smelt is indisputably in jeopardy as to its survival and recovery." *NRDC v. Kempthorne*, Order on Summary Judgment at 119 (May 25, 2007). This finding echoes the findings of several expert fisheries biologists, including staff of many

state and federal agencies. *See, e.g.*, DSWG Briefing Statement (May 15, 2007) ("the species has become critically imperiled and an emergency response is warranted") (attached hereto as Exhibit 3); Statement Presented by Ryan Broddrick, Director, CDFG, to House Subcommittee on Water and Power (July 2, 2007) ("it is DFG's position that actions must be taken to protect as many individual smelt as can be through manipulation of the water projects. Each reproducing organism is important to the survival of the species.") (appended hereto as Exhibit 4). Despite these findings and the continued take of large numbers of delta smelt at the Project pumps this past summer, *see* delta smelt May, June and July take tables (appended hereto as Exhibit 5), the Project agencies obstinately refused to invoke Tier 3.

Inexplicably, the DSEIS/EIR makes no mention of this breakdown of the EWA's "fail-safe", nor does it describe or analyze the historical shortfalls of the EWA or the program's failure to function as envisioned. These shortcomings are far more relevant to the foreseeable impacts of extending the program than any of the purely hypothetical modeled impacts contained in the DSEIS/EIR. The DSEIS/EIR must be revised to address these issues. Further, these historical realities belie the statement in DSEIS/EIR that "[i]f pumping would be likely to put at risk the continued existence of a species listed as endangered or threatened under the Endangered Species Act (ESA), the Project Agencies would curtail pumping even if purchases already totaled 600,000 acre-feet and all assets were used." DSEIS/EIR at ES-5. This is precisely the situation that presented itself to the Project Agencies this summer, and the agencies failed to curtail pumping once EWA assets were depleted even though continued pumping threatened the continued existence of the delta smelt.

Moreover, the DSEIS/EIR seeks to utilize the ESA/CESA process for coverage of the EWA initially established in the CALFED ROD, without addressing any of these fundamental failures of the process to operate as envisioned and which were essential to the CALFED analysis. *See generally* DSEIS/EIR Appendix C.[1] For example, Tier 3 no longer exists as a viable "fail-safe device." Yet, the CALFED assurances were explicitly "based on the availability of three tiers of assets." Tier 3 Protocol. The DSEIS/EIR makes passing reference to this change, obliquely noting that "[b]ased on current circumstances, these three tiers are no longer an accurate way to describe EWA assets." DSEIS/EIR at 2-4. But the document fails to acknowledge the implications of omitting this critical "fail-safe device" or to describe the replacement structure of the EWA going forward.

In short, the DSEIS/EIR fails to adequately describe the project to decisionmakers and the public or to disclose the environmental impacts associated with the policy choice of extending the EWA. The document should be revised to correct these shortcomings. We believe that an accurate description and assessment of the EWA will demonstrate that the program should not be extended.

[1] The DSEIS/EIR also fails entirely to discuss the state court decision finding that DWR lacks the necessary CESA coverage for operation of the SWP, which also likely impacts the CESA analysis in Appendix C. It is unclear, for example, how EWA assets pumped through the SWP facilities at Clifton Court forebay and Banks pumping plant have CESA take authority when the court found that the SWP lacked any take authority for its pumping operations. The DSEIS/EIR must be revised to address this issue.

II. THE EWA HAS LIMITED, RATHER THAN EXPANDED, THE AMOUNT OF WATER AVAILABLE FOR IMPERILED FISH

Since shortly after the first EWA ROD was signed in 2004, the program has been used as an excuse by the agencies to deny needed water to imperiled fish rather than to help protect and recover imperiled fish. For example, in February 2005, when delta smelt populations were at then-record low levels, fishery biologists recommended that exports be curtailed to reduce entrainment. However, because EWA supplies were scarce, project managers did not curtail exports as much or as long as was requested. *Compare* "Data Assessment Team" call notes (Feb. 1, 2005) (recommending combined exports be reduced to 1500 cfs for one week) (appended hereto as Exhibit 6, without attachments) *with* CVO smelt report (February 2005) (showing much higher combined export levels) (appended as Exhibit 7). Hundreds of delta smelt were taken at the pumps as a result. *Id.* The lawful and proper course of action would have been for the agencies to fully implement the recommended action, and then use non-EWA project water to meet fish needs later in the year if EWA supplies ran short. Instead, the program has been implemented to turn this requirement on its head, and to short fish without any consideration given to imposing uncompensated reductions on project contractors and other water users.

Unfortunately, the agencies have continued this pattern of using limited EWA assets to deny needed fish protection actions. In 2006, as the delta smelt continued its unparalleled decline in abundance, the Delta Smelt Working Group ("DSWG") evaluated a range of protective actions that could be taken to lessen the impacts of water project operations. One action that was evaluated was to address fall (September-December) Delta salinity levels by making releases from upstream reservoirs to increase Delta outflows. The discussions and analyses of this proposed action are reported in DSWG notes for July 10 (see also the notes from August 21, and Sept 26 (appended hereto as Exhibits 8). The DSWG determined that the fall action had a high likelihood of being successfully implemented and that the scientific basis for the action was supported by statistically significant correlations.

Ultimately, the fall action was not taken because it was determined that "the amounts of water needed to demonstrably improve fall habitat quantity/quality [were] unavailable". Based on analyses provided by DWR, the amount of water necessary for maintaining net Delta outflows at 7000 cfs for the September-December period would range from only 170-433 TAF. DSWG notes (Aug. 21, 2006). As a result of not taking this action, Delta outflows steadily declined, falling below 6000 cfs in October, and salinity levels shifted upstream of 80 km, the critical threshold identified by the DSWG for delta smelt habitat quality and subsequent abundance. Delta smelt abundance plummeted to a new record low the following year, indicating that the fisheries agencies were not sufficiently addressing adverse habitat conditions in the Delta and other stressors to ensure the delta smelt's survival and recovery.

Perceived unavailability of water assets was also the reason behind the DSWG rejecting a protective action in winter 2006 intended to set net flows in Old and Middle Rivers to zero cfs to better protect pre-spawning adults. Low San Joaquin River inflows and negative flows on Old and Middle Rivers, concurrent with high export rates, are likely creating hydrodynamic conditions that draw greater numbers of fish to the pumps and correspond to significantly higher

salvage rates. Protection of these biologically valuable spawning adult fish is essential for recovery and sustainability of this at-risk species. Despite the expected benefit of taking this action, it was rejected because "DWR staff have derived estimates of the water costs of the potential actions in the Resources Agency POD Action Matrix and found that the proposed winter action could consume all available environmental water, leaving no assets for spring actions for larvae or juveniles." DSWG notes (Dec. 11, 2006) (appended as Exhibit 9); *see also* DSWG notes (Oct. 10, 2006) ("The Working Group notes that some of the weaknesses of the DFG plan included the potential to exhaust all EWA and B2 assets in winter, leaving nothing in reserve for spring actions") (appended as Exhibit 10).

More recently, NMFS' biologists testified against taking actions to protect delta smelt based on a similar misperception that the total amount of water available to protect imperiled salmonids was limited to a pot of "environmental water" defined by EWA and b(2) assets, and that water used to protect smelt would necessarily deplete the amount of water available to protect salmon. *See* Declaration of Bruce Oppenheim in *NRDC v. Kempthorne* ((June 15, 2007) (appended as Exhibit 11). For example, Mr. Oppenheim explained that "the use of environmental water after VAMP on the San Joaquin River may have consequences later in the year on the Sacramento River." *Id.* at 3. This statement is only true if there is a limited pot of "environmental water" available to meet all fisheries needs – a position that is contrary to numerous requirements of state and federal law.

All of these decisions are based on the incorrect assumption that the amount of water available to protect listed fish species is limited to the assets of the EWA, CVPIA b(2), and other sources of water "dedicated" to the environment. The Bureau has perpetuated this fallacy, asserting that it must meet the needs of CVP contractors before meeting the needs of listed fish species. *See* Declaration of Ronald Milligan in *NRDC v. Kempthorne* (June 21, 2007) ("Reclamation operates New Melones to meet … project needs of the East Side Division CVP contractors" which leaves "no additional water available for out of basin releases from New Melones Reservoir" even if needed to prevent jeopardy to listed delta smelt) (appended as Exhibit 12); *see also see also* Transcript of Hearing re Interim Remedies Day 7, *NRDC v. Kempthorne*, Testimony of Ronald Milligan at 1553-54 (Aug. 31, 2007) (explaining that the WOMT rejected some recommendations of the DSWG because of concerns regarding "the ability for the EWA to function in a manner that it could, in essence, pay back the projects for curtailments without impacting operations in the long term sense or allocations to contractors") (appended as Exhibit 13). Similarly, DWR has asserted that it has no additional water available for fish protection, while simultaneously making hundreds of thousands of acre-feet of surplus "Article 21" and "turnback pool" water available to water users and contractors.

This presumed EWA limitation on the amount of water available to protect fish is simply not correct. Numerous courts have made it abundantly clear that the Bureau and DWR must provide sufficient water to protect and recover listed fish species, whether it exceeds the amount of the water the agencies may have earmarked for that purpose or not. *See, e.g.*, *NRDC v. Kempthorne*, Order on Summary Judgment at 61 (May 25, 2007) ("The EWA is simply a means by which the SWP and CVP can obtain water by purchasing it from willing sellers. …If money is unavailable to fund the EWA, Defendants are nonetheless required to prevent smelt take from exceeding permissible take limits. … [I]f all else fails, [additional] assets may be brought to bear, which

include 'additional purchased or operational assets, funding to secure additional assets if needed, or project water if funding or assets are unavailable.'") (emphasis in original).

The agencies have turned the EWA on its head and, instead of using it to supplement the resources needed *and required* for fish protection, have used it as an excuse to short the environment and avoid committing those mandatory resources. Unless the agencies make very clear that limited EWA assets cannot be used as a reason not to take an action that would help protect or restore imperiled fish, it should be discontinued.

III. THE ANALYSIS FAILS TO DEMONSTRATE THAT THE EWA HELPS PROTECT AT-RISK FISH SPECIES AND CONTRIBUTE TO THEIR RECOVERY

In addition to the problems discussed above, the DSEIS/EIR fails to provide adequate support for its conclusion that extending the EWA would benefit fish protection and restoration.

First, the document recognizes in several places that a pumping "window" during which EWA assets may be pumped out of the Delta without increasing adverse impacts to listed fish no longer exists. The document explains that "[t]he EWA protects fish at the pumps by reducing pumping when it would help at-risk fish species, then transferring EWA assets across the Delta at other times to repay CVP and SWP users for water lost during pump reductions." DSEIS/EIR at 2-15. The DSEIS/EIR asserts that EWA assets should be used to reduce export pumping to protect fish from the months of December through July. DSEIS/EIR at 2-10 to 2-11. This proposal allows exports to increase to allow delivery of EWA water during the months of August through November. But several imperiled species are vulnerable to take at the pumps during this late summer/fall period. *See id.* at 2-13, 4-15. Moreover, the document notes that the alarming and continuing decline in four pelagic organisms in the Delta have corresponded to a period of "increased exports during June through December." DSEIS/EIR at 4-11. In addition, recent studies have indicated that decreased Delta inflows in late fall and winter may result in reductions in fall habitat quality and eastward movement of X2, which may result in adverse impacts to fish. DSEIS/EIR at 4-13. Thus, it is unclear when a safe pumping window exists for EWA to increase Delta exports. Instead, it is likely that an extended EWA would simply help sustain the current record high levels of exports pumped out of the Delta – export levels that have corresponded to many of the declining fish populations in the Delta. *See, e.g., id.* at B-3 to B-4 (Banks pumping would increase in July, August, and September to convey EWA assets).

Second, the DSEIS/EIR assumes with no support that "[w]hile the fish actions in … revised biological opinions [that are currently being developed for project operations] are unknown, they would likely be less than with the EWA program." DSEIS/EIR at ES-4. This statement reflects a fundamental misunderstanding of the nature of ESA and CESA requirements, which *mandate* that project operations cause no jeopardy to the existence *or recovery* of listed species, cause no adverse modification of critical habitat for survival *or recovery* of listed species, and that the impacts of project take be minimized and fully mitigated. In addition, Section 7 also imposes an affirmative obligation on federal agencies to "utilize their authorities in furtherance of the purposes of this chapter by carrying out programs for the conservation of endangered species and threatened species listed" under the Act. 16 U.S.C. § 1536(a)(1). A program of "conservation" is one that brings the species to the point of recovery and delisting. *Id*. § 1532(3). In short, the

project agencies are obligated to protect, recover and conserve listed species, whether or not the EWA is in place.

Third, the DSEIS/EIR explicitly bases its analysis of fish actions on the invalidated, reinitiated, and discredited OCAP biological opinions, claiming that it "would be speculative to assume that the fish actions in the BO will be the same as those described by Judge Wanger because the BO will be based on a comprehensive review of all available information and science." DSEIS/EIR at 1-6. In reality, Judge Wanger's decision is based on a more comprehensive and current review of the science regarding the delta smelt than the invalidated BO, which failed even to acknowledge the precipitous decline of the delta smelt in recent years. In addition, the OCAP BO on listed salmonids has been discredited by more than three independent science reviews, including a CALFED review panel, which concluded that the BO was not based on the best available science. The DSEIS/EIR's reliance on the fish actions encompassed in these discredited BOs for the basis of its analysis lacks a reasonable basis.

Fourth, the Bureau has reinitiated consultation with the U.S. Fish and Wildlife Service and the National Marine Fisheries Service on the OCAP. That consultation is ongoing. Until the Bureau meets the requirements of ESA §7 and, among other things, obtains a valid biological opinion at the conclusion of consultation, the ESA § 7(d) prohibition on making any irreversible and irretrievable commitment of resources applies to the Bureau's actions. Regional Director Kirk Rodgers has correctly recognized that reauthorization of the EWA during the pendency of the OCAP consultations would be a violation of §7(d), and has (twice) sworn to a federal court that such authorization would not occur before completion of the new BOs. *See* Declaration of Kirk Rodgers (Oct. 18, 2006), Declaration of Kirk Rodgers (July 9, 2007) (appended hereto as Exhibit 14). Reauthorization of the EWA as proposed in the DSEIS/EIR runs afoul of the 7(d) prohibition and contradicts Mr. Rodgers sworn statements in the pending OCAP lawsuits.

Finally, the DSEIS/EIR concludes that continuation of the EWA "would have a less than significant impact on X2 location during June through December." DSEIS/EIR at ES-9. However, as the document recognizes, emerging science indicates that moving X2 westward of its recent historic location in the fall could have a significant beneficial impact on listed species and their habitat. By reducing outflow in the fall, EWA could have a significantly detrimental impact on the ability of agencies to meet this new threshold.

IV. THE ANALYSIS FAILS TO EVALUATE THE EWA'S FAILURE TO ASSIST IN ECOSYTEM RESTORATION BEYOND ESA/CESA COMPLIANCE

To date, as discussed above, the EWA has primarily, even exclusively, been operated to limit protective ESA/CESA actions. However, the failure of the EWA extends even farther. The EWA was intended to "provide water for the protection and recovery of fish." CALFED Programmatic ROD at 54. Note that these benefits are not restricted to listed species. The ROD also states that the EWA will "acquire water for ecosystem and species recovery needs." CALFED ROD NCCP Determination at 21. Thus, the EWA was intended as a tool to provide restoration benefits beyond the requirements of ESA/CESA for listed species. These benefits were an important part of the Ecosystem Restoration Program and were the justification for

public funding for the EWA. The document does not analyze the failure of the EWA to provide these anticipated benefits.

Indeed, far from facilitating improved ecosystem health, by limiting ESA/CESA actions and by increasing diversions during the August to November period, the EWA has damaged ecosystem health. This failure is indicated by the fact that non-listed species, such as threadfin shad, are showing the same decline affecting listed species such as the delta smelt and that the Pelagic Organism Decline process has identified "water project operations" as a potential cause of the decline of Delta fishes. *See* Interagency Ecological Program 2006-2007 Work Plan to Evaluate the Decline of Pelagic Species in the Upper San Francisco Estuary (January 12, 2007) at 4 (appended hereto as Exhibit 15). The document does include one, inadequate mention of these impacts, by concluding that "(t)he entrainment indices for threadfin shad and American shad would be increase." DEIS/EIR at 4-36. Clearly, the EWA has undermined, rather than facilitated, the CALFED ecosystem restoration goal.

The document must be revised to fully and adequately evaluate the failure of the EWA to contribute to fisheries and ecosystem restoration beyond the requirements of ESA/CESA.

V. THE ANALYSIS FAILS TO EVALUATE THE EWA'S FUTURE USEFULNESS TO FACILITATE "REAL TIME" MANAGEMENT

The EWA was also intended to provide "real time diversion management" of Delta flows and the CVP and SWP Delta pumps. CALFED ROD NCCP Determination at 29. Such real time management assumes that the EWA has enough flexibility to modify Delta flows and the management of the projects beyond the relatively fixed prescriptive requirements of ESA/CESA compliance. The document fails to analyze the extent to which the EWA will provide such flexibility to achieve additional ecosystem or protective measures. Unless the management priorities or assets of the EWA are changed dramatically (a change that this document does not anticipate) it appears unlikely that the EWA will have much, if any, flexibility to provide additional protective measures. To the contrary, to the extent that the EWA provides real time management, this flexibility is designed to increase pumping, potentially causing additional impacts to the ecosystem, and designed solely to provide additional water supplies for South of Delta CVP and SWP contractors.

VI. THE FAILURE TO ANALYZE PAST PERFORMACE UNDERMINES A FUNDAMENTAL PURPOSE OF THE EWA -- TO FAILITATE ADAPTIVE MANAGEMENT

The CALFED ROD was designed with science-based adaptive management as a "central feature." CALFED Programmatic ROD at 4. This document repeats this assertion that "(a)daptive management is a key component of the EWA," and that "(a)daptive management provides a process to change fish actions or asset acquisitions." DSEIS/EIR at page 2-24. The careful evaluation of the past performance of management tools is the defining feature of adaptive management, in order to allow improved, adaptive future management. Indeed, the ROD explicitly commits CALFED agencies to "assess the success of EWA operations." CALFED ROD EWA Operating Principles Agreement at 4. Without such analysis, agencies

cannot "adapt" the management of the program in a manner that builds on past successes and responds to failures. The analysis of past performance of the EWA as an adaptive management tool is critical to the central purpose of this document – extending the EWA into the future. Such analysis is also important to agencies, such as the Delta Vision Task Force, the Bay-Delta Conservation Plan process, the Department of Fish and Game, NOAA Fisheries and the Fish and Wildlife Service, which may consider the merits of incorporating the EWA into future management for the Delta. Finally, such analysis is essential to the legislature and the Administration as they consider the justification for public funding for the EWA. An analysis of the past performance of the EWA will reveal that there is no justification for such continued public funding. As discussed above, the document fails to analyze past performance, a failure that cuts to the core of the purpose of the EWA as an adaptive management tool. The document must be revised to fully and accurately analyze the effectiveness of the EWA as an adaptive management tool.

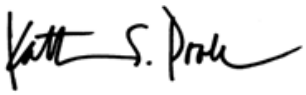
VII. THE DOCUMENT FAILS TO DESCRIBE ACCURATELY THE PROJECT PURPOSE

As discussed above, the document does not adequately analyze the EWA's failure to engage in real time management and adaptive management, to ensure ESA/CESA compliance and to contribute to broader ecosystem restoration. The document also does not include any meaningful provisions to address these failures. The document, however, largely maintains the old, inaccurate description of the purpose of the EWA. DSEIS/EIR at page 2-3. Thus, the document fails to adequately describe the purpose of the project. At the moment, the actual purpose of the EWA appears to be to limit protective actions under ESA and CESA, and to provide additional water supplies to south of Delta water contractors. The document should be revised to include an accurate description of the project.

VIII. CONCLUSION

In light of these many shortcomings in the operation of the EWA and the analysis of the DSEIS/EIR, we urge you to reject the proposal to extend the program beyond the end of 2007. In the alternative, we urge you to withdraw this document and issue a new, adequate draft that addresses the concerns outlined above.

Sincerely,



Katherine S. Poole
Senior Attorney

Barry Nelson
Senior Policy Analyst

Cc: Cay Goude, USFWS
Maria Rea, NMFS
John McCammon, DFG
Lester Snow, DWR

ATTACHMENT 7

Independent
Science
Board

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University of California, Davis

Vice Chair

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University of California, Berkeley

Duncan Patten, Ph. D.
Montana State University

Paul Smith, Ph. D.
University of California, San Diego

September 6, 2007

TO: Michael Healey, Lead Scientist
CALFED Bay-Delta Program

FROM: Jeffrey Mount, Chair
CALFED Independent Science Board

RE: Sea Level Rise and Delta Planning

In July of this year, you asked that the Independent Science Board (ISB) examine the array of sea level rise projections available in published reports and, based on current scientific understanding, advise the Science Program about which projections are most appropriate for incorporating into on-going planning for the Delta. The ISB discussed this issue at their August, 2007 meeting and have developed recommendations detailed in this memo. It is important to note that this is not an assessment of the state of sea level rise science, but is intended to highlight the large uncertainty in sea level rise projections and recommend ways to incorporate this uncertainty into planning.

Background

Sea level plays a dominant role in the San Francisco Bay-Delta. Water surface elevations and associated fluctuations due to tides, meteorological conditions and freshwater inflows drive Bay-Delta hydrodynamics. Hydrodynamics, in turn, dictate the location and nature of physical habitat, the quantity and quality of water available for export, and the design of the flood control/water supply infrastructure. Change in sea level has the potential to substantially alter Bay-Delta conditions and to constrain future management options.

Global sea level rise is a well-documented phenomenon, both in the paleoclimatic record as well as the historical record. Tidal gage records indicate that sea level during the 20th century has risen an average of 2mm/yr (.08 in) during a period of 0.7^{o}C warming. Recent studies suggest that since 1990, global sea level has been rising at a rate of approximately 3.5 mm/yr (.14 in/yr)[1]. The cause of sea level rise stems from two processes: 1) thermal expansion of sea water as the surface layer warms, and 2) increase in mass of sea water associated with melting of land-based glaciers, snowfields and ice sheets.

Recent research supported by the California Energy Commission[2] (CEC) and continued under the CALFED-sponsored CaSCADE program, shows that sea level

[1] Church, J.A and N.J. White 2006 *A 20th Century Acceleration in Global Sea-Level Rise* Geophysical Research Letters, v. 33, article no. L01602

[2] Cayan, D. *et al*. 2006 *Projecting Future Sea Level* California Climate change Center White Paper CEC-500-2005-202-SF Accessed at http://www.climatechange.ca.gov/research/climate/projecting.html

rise will impact the Delta principally by increasing the frequency, duration and magnitude of water level extremes. These extreme events occur at various periodicities and are associated with high astronomical tides and Pacific climate disturbances, such as El Niño. The CEC study showed that under moderate climate warming and a sea level rise of 3 mm/year (12 in./century), extreme high water events in the Delta--those that exceed 99.99% of historical high water levels and severely impact levees--increases from exceptionally rare today to an average of around 600 hours/year by 2100. This work also showed that roughly 100 of these hours would coincide with very high runoff conditions, further amplifying the impacts of sea level rise. In sum, even under modest sea level rise and climate warming projections, extreme high water levels that are considered rare today will likely be very common by the end of this century.

Sea Level Rise Projections

Early in 2007, the Intergovernmental Panel on Climate Change (IPCC) released its latest assessment of the scientific basis for projections of future climate conditions, including global average sea level rise[3]. As noted in the press, in comparison with the IPCC's 2001 assessment, the latest sea level rise projections appear to have narrowed the range of potential sea level rise and lowered the magnitude of projected sea level rise. This was viewed by some outside of the IPCC as indication that: 1) uncertainty regarding sea level rise had decreased and 2) the problem of sea level rise itself appeared to be less than originally stated. However, both the methods used to derive the IPCC 2007 sea level projections, along with extensive new published research in 2007 suggest that this more optimistic view of future sea level rise may be unwarranted.

The IPCC projections are based on physical models that attempt to account for thermal expansion of the oceans and storage changes in land-based glaciers and ice fields. These models, by necessity, simplify the complex processes of ocean circulation and ice melting. The IPCC midrange projection for sea level rise this century is 20-43 cm (8-17 inches), with a full range of variability of 18-59 cm (7-23 inches). The range of variability reflects model differences and uncertainties as well as differences in greenhouse gas emission scenarios. The IPCC model effort is consensus-based, reflecting the agreement of numerous international scientists.

During the past year, there have been major advances in the science of sea level rise. Paradoxically, these advances have increased the uncertainty of projections in sea level rise, at least temporarily. These advances have also led to strong criticism of the approach that the IPCC used in establishing its projections[4]. One criticism is that the models used to project sea level rise tend to under-predict historical sea level rises, most notably failing to capture recent increases. Indeed, models that use empirical historical relationships between global temperatures and sea level rise perform better

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[3] IPCC 2007 *Climate Change 2007: The Physical Basis—Summary for Policymakers* Accessed at http://www.ipcc.ch/SPM2feb07.pdf

[4] summary in Kerr 2007 *Science NOW* Accessed at http://Sciencenow.sciencemag.org/cgi/content/full/2007/215/2

than the IPCC 2007 models[5]. When applied to the range of emission scenarios used by IPCC 2007, empirical models project a mid-range rise this century of 70-100 cm (28-39 in.) with a full range of variability of 50-140 cm (20-55 in.), substantially higher than IPCC 2007 projections. However, foremost among the criticisms is the failure of the IPCC to include dynamical instability of ice sheets on Greenland and Antarctica in their projections for sea level rise.

Melting of the ice sheets of Greenland and Antarctica has the potential to raise sea level 70 m. For most of the 20th century, the ice sheets have remained relatively stable, with melting contributing a minor fraction to sea level rise. However, during the past year numerous studies have demonstrated that the mass balance (input from snowfall versus losses due to melting or detachment) of these ice sheets is shifting toward more rapid loss, most likely in response to warming of the atmosphere and oceans[6]. The recent rate of mass loss in these ice sheets exceeds current physical model predictions. As many authors have pointed out, increased rates of ice sheet flow involving meltwater lubrication of the ice sheet bed or the removal of buttressing ice shelves, may be accelerating the rate of ice loss on Antarctica and Greenland. The IPCC 2007 report explicitly chose not to incorporate the uncertainty associated with this process into their sea level projections. Recent publications that have examined this issue suggest that, under business as usual emissions scenarios, dynamical instability of ice sheets may add as much as 1 m (39.4 in) to sea level rise by 2100[7].

Recommendations

The ability of current physical models to project sea level rise are limited. This stems in part from our poor understanding of and current inability to model the response of Greenland and Antarctic ice sheets to atmospheric and oceanic warming. Given the costs associated with levee failure in the Delta, the ISB feels it would be a mistake for the various planning processes now underway (BDCP, Delta Vision, DRMS) to base their planning on the conservative 2007 IPCC estimates of sea level rise. Although there is some disagreement about mechanisms of ice sheet disintegration, current advances in understanding coupled with new physical measurements all point toward the same conclusion: dynamical instability of ice sheets will likely contribute significantly to future sea level rise, with the potential for very rapid increases of up to a meter (39.4 in.) by 2100 from ice sheets alone. For this reason, the range of sea level projections based on greenhouse gas emission scenarios contained in the IPCC 2007 report should be viewed, at best, as minima for planning purposes.

The board recommends that planning efforts use three approaches to incorporate sea level rise uncertainty. First, given the inability of current physical models to accurately simulate historic and future sea level rise, until future model refinements

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[5] Rahmstorf, S 2007 *A Semi-Empirical Approach to Projecting Sea-Level Rise* Science v. 315, pp. 368-370.

[6] Shepherd, A. and D. Wingham 2007 *Recent Sea-Level Contributions of the Antarctic and Greenland Ice Sheets* Science, v. 315, pp. 1529-1532.

[7] Hansen J *et al* 2007 *Dangerous human-made interference with climate: a GISS modelE study* Atmospheric Chemistry and Physics, v. 7, pp.2287-2312.

are available, it is prudent to use existing empirically-based models for short to medium term planning purposes. The most recent empirical models project a mid-range rise this century of 70-100 cm (28-39 in.) with a full range of variability of 50-140 cm (20-55 in.). It is important to acknowledge that these empirical models also do not include dynamical instability of ice sheets and likely underestimate long term sea level rise. Second, we recommend adopting a concept that the scientific and engineering community has been advocating for flood management for some time. This involves developing a system that can not only withstand a design sea level rise, but also minimizes damages and loss of life for low-probability events or unforeseen circumstances that exceed design standards. Finally, the board recommends the specific incorporation of the potential for higher-than-expected sea level rise rates into long term infrastructure planning and design. In this way, options that can be efficiently adapted to the potential for significantly higher sea level rise over the next century will be favored over those that use “fixed” targets for design. After all, the current debates over uncertainty in sea level rise are less about how much rise is going to occur and more about when it is going to occur.

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 25, 2008

Ms. Katherine S. Poole, Senior Attorney
Mr. Barry Nelson, Senior Policy Analyst
Natural Resources Defense Council
111 Sutter Street
San Francisco, CA 94104

Dear Ms. Poole and Mr. Nelson:

This letter responds to your letter dated March 13, 2008 providing comments of the Natural Resources Defense Council on the draft of the State Water Project Delivery Reliability Report—2007 (DRR(2007)). Your letter addresses the water demands of the State Water Project (SWP) contractors used in the report, the characterization of modified SWP and CVP operations in 2007 to reduce reversed flows in Old and Middle Rivers, and a statement in the report concerning north-of-Delta diversions. Your letter also makes several recommendations for improving the report and urges changes in SWP operations.

You recommend that the Department include more discussion and analysis of demand management as a tool to improve reliability. The DRR (2007) estimates of SWP contractor demands are based on historical data and information received from the SWP contractors. Those demands are used in the CALSIM studies to obtain the estimates for annual water supply deliveries. The information in the report is presented as the amount of risk associated with an annual quantity of SWP supply. The information is not presented as the amount of risk associated with meeting the assumed SWP contractors' demand. This allows the results from the DRR—2007 to be directly incorporated into an SWP contractor's water management plan to estimate the overall reliability of the district's supply. The greater the ability of the district to draw upon other water supply sources and implement demand management programs, the greater the ability of the water management plan to meet the local water needs.

Providing guidance to SWP contractors on how local and overall water supply reliability could be improved is beyond the intended scope of the DRR (2007). The purpose of the report is to present the Department's current information regarding the annual water delivery reliability of the SWP for existing and future conditions. A key objective of the California Water Plan is to provide guidance to local agencies and governments and regional partnerships on ways to increase regional self sufficiency in meeting their future water demands. The Water Plan includes a diverse set of resource management strategies that can be implemented in

different combinations to provide water supply reliability and to meet other water related resource management needs in different regions of the state.

You state that the DRR (2007) should also include an analysis of the impact on SWP delivery reliability of implementing the Governor's call for a 20 percent reduction in per capita water use by 2020. The Department strongly supports aggressively reducing per capita water use however it is not clear how the reduction will affect the demand for Delta exports. SWP contractors should review their current water demands and future demand scenarios to help determine the mix and amounts of water supply sources they will need (including SWP supplies) to meet their water demands and other water resource objectives. It would be advisable for them to consider a future demand scenario that assumes a 20% reduction in per capita water use because it could change how much they decide to invest in different water supply sources. These evaluations, and their implications to the demand for imported water from the SWP and other sources, is a responsibility of the SWP contractors and can be a part of their 2010 Urban Water Management Plans. Urban Water Management Plans will be updated in 2010 and will incorporate this mandate. Those plans will help to define the anticipated demand on Delta water supply. This information will be incorporated into future reports as appropriate.

You state that the conclusion presented in the draft report (page 12) about a new North of Delta diversion from the Sacramento River offering the greatest potential for meeting ecosystem restoration objectives is premature. This statement has been removed from the final report. The Department is proceeding with an evaluation under NEPA and CEQA of the impacts and benefits of implementing the Bay-Delta Conservation Plan. As part of this effort, alternatives for Delta conveyance will be evaluated and the most promising conveyance alternative identified. At least four configurations will be considered: 1) no new Delta conveyance facilities; 2) dual Delta conveyance facilities; 3) an isolated conveyance facility; and 4) an improved through-Delta conveyance system.

You state that the draft report on page 15 incorrectly states that "decline in the abundance of juvenile delta smelt led to a voluntary modification in 2007 in SWP and CVP operations to reduce the reversed flows in Middle and Old Rivers—a modification made possible through the Environmental Water Account." You also make the point that DWR, the U. S. Bureau of Reclamation, and the fisheries agencies are compelled to modify pumping operations when those operations adversely impact the survival, recovery and critical habitat of fish such as delta smelt which are protected under the Endangered Species Act. The Department agrees that it is required to follow a directive by a fish regulatory agency to reduce exports if that agency has determined the action is needed to protect an endangered fish. In this circumstance, the Department had not been directed to reduce exports and chose to reduce them to protect delta smelt.

You state that the DRR (2007) should be redone in order to incorporate the full range of variability of sea level rise recommended by the CALFED Independent Science Board and incorporate updated projections of reduced Sierra snowpack and increased evaporation rates in watersheds and surface storage reservoirs. The Department is a leader in applying climate change factors to projections for water supply and we will continue to take a leadership role in this endeavor. The DRR is published every two years and we will use the best information and analytical methods available to develop the latest projections for delivery capability under potential climate change scenarios.

The remaining comments in your letter go beyond the scope of the DRR (2007). They include requesting DWR to implement a policy of foregoing Article 21 declarations and deliveries if state and federal agencies recommend that the water remain instream or available for ecosystem protection purposes; that DWR use increased carryover storage resulting from reduced pumping to increase the protection for imperiled salmonids; and that a discussion be included in the report of the relationship between lower levels of diversions and proposed expansions in storage south of the Delta that would be dependent on Delta pumping as a water source.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

cc: Cay Goude
U. S. Fish & Wildlife Service
3310 El Camino Avenue Suite 130
Sacramento, California 95821-6340

Maria Rea
Sacramento Area Office Supervisor
National Marine Fisheries Service
650 Capitol Mall, Suite 8-300
Sacramento, California 95814-4706

From: Pennington, Bill
Sent: Tuesday, January 29, 2008 4:18 PM
To: 2007DRRComments
Cc: Fong, Frank C.; Waggoner, Michael G.; Wright, Jon
Subject: Reliability of Clifton Court Forebay

The reliability of the Forebay embankments and radial gates, etc., should be considered in the same manner as the reliability of the delta levees. Loss of control at the Forebay may be as likely as the expected levee failures over a 100-year period. Although the risk to individuals and real property might be small due to an embankment or gate failure at the Forebay, such failures may have a big, and long lasting, impact to delivery operations. Bill Pennington

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Mr. Bill Pennington
California Energy Commission
1516 Ninth Street, MS28
Sacramento, California 95814

Dear Mr. Pennington:

This letter responds to your email of January 29, 2008 providing comments on the draft of the State Water Project Delivery Reliability Report—2007.

In your email, you state that the reliability of Clifton Court Forebay features, such as the intake gates and forebay embankment, should be considered in the same manner as the reliability of Delta levees. You express concern that the risk of the loss of control at the Forebay may be as likely as the risk of levee failure over a 100-year period and would significantly impact water deliveries.

While a failure of one or more of Clifton Court Forebay's intake gates or a portion of its embankment would potentially disrupt pumping at Banks Pumping Plant, the Department of Water Resources doesn't view this risk to State Water Project deliveries as comparable to the risk posed by the extensive levee system in the Delta. One of the strategic planning goals of the Department is to plan, design, construct, operate, and maintain the State Water Project to achieve maximum flexibility, safety, and reliability. In order to meet this goal, the Department is committed to the maintenance and effective operation of Clifton Court Forebay.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

President
Bill Center

President Emeritus
Sage Sweetwood
John Van De Kamp

Senior Vice President
Kevin Johnson

Secretary/Treasurer
Bill Leimbach

PLANNING AND CONSERVATION LEAGUE

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Elisabeth Brown
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Rick Hawley
Fran Layton
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David Mogavero
Stephanie Pincetl
Lynn Sadler
Teresa Villegas
Terry Watt
Bill Yeates

March 16, 2008

Katherine Kelly, Chief
Bay-Delta Office
California Department of Water Resources
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California Department of Water Resources
SWP Delivery Reliability Report – Attn: Cynthia Pierson
P.O. Box 942836
Sacramento, CA 94236-0001

via facsimile to: (916) 653-6077
via email to: comments-on-2007drr@water.ca.gov

Re: Comments on the *Draft State Water Project Delivery Reliability Report 2007*

Ms. Kelly:

The Planning and Conservation League (PCL) submits the following comments on DWR's Draft State Water Project Delivery Reliability Report 2007 (2007 DRR). As an organization that advocates for wise investment in and sustainable use of the state's water resources, as well as a party to the settlement agreement that calls for preparation of these biennial reliability reports, PCL urges DWR to substantively address the comments below so that the final report fully meets the rigorous reporting requirements specified in that agreement, and that local planning decisions can be made based on a clear and complete analysis of water delivery reliability.

1. The 2007 DRR must be sufficiently clear and accurate for use in the 2010 Urban Water Management Plans (UWMPS).

As recognized in the 2007 DRR, the Delivery Reliability Report is an important planning document used by many of the SWP contractors, and in turn local water districts as the basis for Urban Water Management Plans (UWMPs), water supply assessment and verifications.

Despite the importance of the DRR, DWR has tended to release the Delivery Reliability Report past the deadlines outlined in the settlement agreement. Per the settlement agreement the DRR is due to be updated biennially, beginning in 2003. The previous DRR was due in 2005; however the final was not issued until June 2006. As a result, all water agencies depending on the DRR were forced to rely on a May 2005 draft document for preparation of their 2005 UWMP. The 2007 Draft DRR was not released to the public until December of 2007, and the final

will not be issued until sometime in 2008. The late release of the report is a disservice to the many water agencies which receive water from the State Water Project, as well as the many cities and counties that need the information contained in the report to assess the adequacy of water supply assessments and verifications. Indeed, by releasing these reports in such a manner, local water agencies and local planning entities are forced to rely on draft materials or significantly dated materials as the basis for legally challengeable decisions. Such situations expose these entities to significant risk.

Should DWR continue the trend of late releases of the DRR, the next report, the 2009 DRR, will be issued too late to be useful to urban water agencies for the preparation of the 2010 urban water management plans. Therefore, the accuracy and clarity of the 2007 DRR is even more crucial to water managers and planner entities. PCL respectfully recommends that DWR revise the 2007 DRR to ensure it provides the level of reliable information necessary for the purposes in which it will be used. PCL further respectfully requests that DWR commit to releasing the Draft 2009 DRR in June 2008, and the Final 2009 DRR by February 2009 in order to ensure local water agencies will have sufficient time to incorporate DWR's information into the 2010 UWMPs.

2. The 2007 DRR should provide additional explanation and clarification of data and results to ensure information is presented in a readily understandable manner.

In referring to the Delivery Reliability Report, the settlement agreement specifically states that "The information presented in each report shall be presented in a manner readily understandable by the public." While we recognize that information about the reliability of the SWP is complex, clearer explanations and specific guidance from DWR on particular points are necessary to meet the intent of the settlement agreement and assist readers in deciphering this complex information. PCL proposes the following specific recommendations to develop a more reality understandable document.

A. The DRR must fully disclose the reliability associated with water supplied from the SWP and disclose the implications associated with various levels of reliability.

While the Draft DRR includes the results of many model runs, it fails to provide a significant discussion regarding the implications of the level of *reliability* associated with SWP deliveries. In particular, the Draft DRR fails to articulate how reliability should be factored into water planning, and the DRR fails to disclose the implications of reliance on water that cannot be reliably delivered.

For instance, the DRR includes a very cursory explanation of Article 21. Through out Chapter 7 of the Draft DRR, DWR has listed an "Article 21" category within the water supply source table examples. The Draft DRR does include a footnote stating that, "Annual Article 21 amounts vary significantly from year to year. Without the ability to store Article 21 supply, it is not likely to contribute to local water supply." This statement is woefully inadequate and dangerously misleading. Indeed, a study of the actual model outputs reveals that in one case, for example in table B-20 no Article 21 could be delivered for a period of

over 20 consecutive years. Article 21 is reported to be available in only 3 years between 1922 and 1966 in Table B-20. Even when Article 21 is available, in this case 22 thousand acre-feet in a year like 1925, it is not in a quantity that would result in a significant additional local supply even if storage where available.

Even in outputs for more recent conditions, such as in Table B-16, there are long periods of 8 and 10 years when no Article 21 water would be available. Most storage facilities in the state are not designed or operated to store water for a period or 8 to 20 years.

Yet, readers would have to study the many tables in the appendices of the DRR in order to find this information. Readers would then have to interpret those tables further to understand the significance of the listed numbers.

Because Article 21 cannot be delivered in quantities sufficient enough to enhance storage or annual water supply on a consistent basis, it is not reliable and is not an appropriate water supply for those that uses that require a high degree of reliability. In fact, relying on Article 21 for permanent supply is part of the "paper water" problem that was at the heart of the original Monterey Amendments litigation. By masking the dismal reliability of Article 21 with an understated and misleading footnote, DWR facilitates use inappropriate use of Article 21 for purposes that require a higher degree of reliability.

Beyond Article 21, the DRR fails to clearly disclose the reliability of all deliveries from SWP in a substantive manner. While the DRR does include modeling runs reporting the estimated delivery of water to SWP contractors, those runs omit important information, including risk factors in the Delta, and the need to respond to environmental, water quality and area of origin legal requirements. The DRR fails to inform readers that the model runs very likely overestimate the reliability of the SWP. Further, the DRR fails to provide guidance to SWP contractors on how local and overall water supply reliability could be improved.

To remedy this, PCL recommends that DWR include a full discussion regarding the reliability of all types of water delivered from the SWP. That discussion should include a full discussion of the implications of mismatching various levels of water supply reliability with the various intended uses (i.e. urban and agricultural use, or permanent and annual crops). In addition, the Final DRR should omit Article 21 from the list of Water Supply Sources in all tables. The final DRR may include Article 21 is a separate table of "interruptible and unreliable water sources." Such tables should include a footnote that reads, "Article 21 should not be used to support a permanent economy."

B. The DRR should include Water Supply Source tables for each SWP contractor.

DWR should include a clear and understandable forecast of how much water (both Table A and Article 21) the SWP can delivered under current and future conditions for each SWP contractors. Although some of this information is in the draft DRR, it is split up and scattered in many tables, figures, and graphs, and in some cases must be derived from information in

the DRR by means of additional calculations. Inclusion of separate tables for each contractor would allow readers to clearly find information affecting the specific area of interest.

C. The DRR should provide estimates of SWP delivery reliability for the period required by the next UWMP.

As noted in the 2007 Draft DRR, the primary use of the DRR is by SWP contractors and their customers for use within the regional and local UWMPs. California law requires the UWMPs, and also water supply assessments and verifications to assess water supplies for 20 years into the future. In order to be useful to those water planners, DWR should extend the analysis included in the DRR to the period required by the following UWMPs, which in this case would be 2030. While this seems to be a technical detail, failing to extend the range of the DRR could result in significant legal vulnerability for water and land use planners who rely on the DRR to make legally challengeable decisions.

3. The 2007 DRR should clearly disclose the limitations of modeling outputs and the implications of the modeling assumptions in CALSIM II, and provide recommendations to water agencies for appropriate use of modeling outputs.

CALSIM II is the primary analytic tool used in estimating current and future water delivery reliability, yet it has known weaknesses that are not disclosed or discussed in the 2007 DRR. Of particular concern to PCL is the fact that, although local agencies will be using this document as a basis for developing local UWMPs there is no acknowledgement of the potential for CALSIM II to *over*estimate delivery reliability. This is a critical flaw in the document that must be addressed.

As participants in the Monterey Plus EIR Committee process, PCL has previously submitted comments to DWR expressing our concerns regarding the adequacy of CALSIM II for use in water management planning and deliveries assessment. Rather than resubmit those comments, we incorporate them by reference here, and highlight some particular issues below.

The Draft DRR reports water availability to the SWP and SWP deliveries through 2027 based on CALSIM II runs. While CALSIM II may be a sophisticated and useful modeling tool for certain purposes, it is inappropriate for determining absolute numbers for export and deliveries. It has been criticized by a panel of expert reviewers for several weaknesses, including its lack of amenability to proper calibration. (*See* A. Close, *et al.*, *A Strategic Review of CALSIM II and its Use for Water Planning, Management and Operations in Central California* submitted to California Bay Delta Authority Science Program, December 4, 2003.

One flaw with CALSIM II is that it fails to reflect the bimodal distribution of water years in California. Currently, the DRR reports CALSIM II runs for average years, a critical dry year, a period of dry years and wet years. Given the presentation in the DRR, it would be reasonable for a reader to assume that average years are the most likely occurrences, and therefore average deliveries are the most reliable. However, based on California's fluctuating hydrology, average years are the least likely to occur, and periods of dry years and wet years are much for likely.

CALSIM II is ill-suited to address bimodal distribution of water years because the model produces an exceedence chart that hides this reality. Arve Sjovold has commented extensively on this point. Mr. Sjovold's most recent comments are incorporated by reference and attached to this letter.

Throughout the 2007 Draft DRR, modeled predictions are presented as though certain, and discussion of possible error or of ranges of possible outcomes is almost entirely absent. The models used cannot possibly produce such certainty. CALSIM II includes hundreds of assumptions. There is a reasonable likelihood that one or more of the assumptions incorporated into CALSIM II will be incorrect.. However, DWR does not disclose these limitations in a clear and understandable manner, and the Draft DRR fails to provide a reasonable strategy for addressing this issue.

Rather than the near certain results presented in the DRR, at best, the model runs can predict, given a certain set of data and assumptions, a range of possible outcomes, with some outcomes potentially more probable than others, and with all predictions limited by both known and unknown sources of error. An accurate discussion of the DRR's modeling results therefore cannot provide certain predictions, and instead should show the range of possible outcomes. By omitting both possible sources of error and potential outcome ranges, the DRR projects a false certainty that reported deliveries are likely.

Because CALSIM II is an optimization model that does not necessarily reflect options available to water operators, or options that water managers *would* choose, it may overestimates SWP deliveries. Despite the optimistic CALSIM II outputs, federal and state water quality and endangered species laws and regulations probably prohibit such high export levels due endangered species requirements, water quality requirements and other regulatory requirements. Indeed, at a recent Bay Delta Conservation Plan meeting on Delta conveyance options, DWR Deputy Director Jerry Johns, noted that CALSIM II and CALSIM Lite tend to deliver "optimistic" outputs, indicating that CALSIM II may maximize potential deliveries when such deliveries would be difficult or impossible to produce in the real world.

Based on CALSIM II outputs, the DRR assumes that future water exports from the Delta will be much higher than the historic average. This DRR prediction fails to recognize that DWR has chronically failed to meet water quality standards in the Delta under historic operations, and significant environmental degradation has taken place under such operations, resulting in new regulatory actions.

In light of the recent pelagic organism declines in the Bay Delta Estuary, and resulting rulings invalidating the biological opinion for Delta smelt, it is prudent to ensure that the Final 2007 DRR modeling assumptions and predictions are conservative, rather than "optimizing." Such revisions would provide a much more realistic and reliable estimate of deliveries that are more consistent with requirements of the Federal Clean Water Act, the Federal or California Endangered Species Acts, or any other environmental permit condition, regulation, standard, or law.

The DRR should also provide reasonable recommendations to water agencies for addressing these modeling faults. In order to increase the likelihood that the estimates used in planning documents will be reasonably accurate and reliable, the DRR could recommend that water agencies consider reducing the amount of deliveries predicted by CALSIM II by certain reasonable percentage, such as10 to 20 percent, when planning for water management.

4. The 2007 DRR should include a more comprehensive analysis of the impacts of climate change on water delivery reliability.

While the DRR recognizes that climate change will have very widespread impacts on the SWP. Yet, the DRR analyzes only one aspect associated with climate change, hydrology, for impact on the SWP deliveries. Climate change is anticipated to affect water quality in the Delta, consumptive use of water in both SWP watershed and the area of use, availability of hydropower and flood safety needs. None of these factors is analyzed for potential impact on SWP delivery reliability in the 2007 Draft DRR.

The Draft DRR proposes that some tools that may be necessary for broader analyses of climate change impacts are not yet available. For instance, the DRR states that current modeling cannot account for the impact on SWP deliveries that may result due to increasing salinity in Delta due to sea level rise. However, at a recent Bay Delta Conservation Plan meeting, DWR provided a summary of CALSIM Lite. During the presentation, it was indicated that the model is capable of assessing and responding to various salinity levels in the Delta. This implies that, at the very least, anticipated salinity increases should be taken into account along with hydrology impacts for all model runs and outputs included in the DRR. Beyond that, the DRR should clearly articulate the full range of impacts anticipated to occur under climate change. The DRR should further disclose which impacts are omitted from estimates of deliveries under climate change scenarios. Finally, the DRR should provide guidance to water agencies on how these omitted impacts are likely to affect deliveries (i.e. whether increased consumption is likely to increase or decrease the amount of water available to the SWP).

5. The 2007 DRR should evaluate variable levels of demand and in particular the 20% reduction in per capita consumption called for in Governor Schwarzenegger's recent letter.

The 2007 DRR assumes 2027 demand for supplies to be the very similar to those used in demand modeled in the 2005 DRR, an approach which neglects (a) the potential for changes in demand (for Article 21 supplies, in particular) due to changes to the SWP contracts that may result from DWR's upcoming decision on the Monterey Plus EIR (see also Section C-1 (p. 7) of the attached comments by PCL to DWR on the Draft Monterey Plus EIR), and (b) the potential for shifts in the amount and pattern of demand based on the ongoing Delta Vision and Bay Delta Conservation Plan processes.

In commenting on the 2006 DRR, PCL recommended that DWR incorporate various levels of demand into model runs. PCL repeats that comment for the 2007 DRR. Indeed, the 2007 Draft DRR, like the 2005 DRR identifies water demand in the delivery service area as one of three

primary components that determine SWP reliability. However, like the 2005 DRR, the 2007 Draft DRR does not examine a significantly varied range of possible demand. That omission is important, for such analysis would likely show that reliability is inversely proportional to the level of demand.

Rather, the 2007 Draft DRR provides no clear disclosure of the demand assumptions included in the CALSIM II outputs. The 2007 Draft DRR, instead, states that demand assumptions are based solely on information provided by contractors. PCL requests that in addition to analysis based on information provided by SWP contractors, DWR provide analysis of SWP reliability under the three demand scenarios included in DWR"s 2005 California Water Plan. In addition, the DRR should include analysis that anticipates full implementation of the Governor's recent call for a 20% reduction in per capita water use.

6. The 2007 DRR should consider operations not only under the Wanger decision, but also under operations consistent with the operational recommendations of the state and federal fishery agencies for protection of species listed as threatened or endangered under the federal or state Endangered Species Acts.

The 2007 DRR assumes that 2027 operations will be subject to the current limitations proscribed by the Wanger Interim Remedy Order and SWRCB water quality requirements. However, the re-consultation on the 2004 OCAP, the continued decline of currently listed species (such as Delta Smelt and Winter-run Chinook Salmon), as well as the potential listing of additional species (such as the Longfin Smelt) are just some of the factors that may require significant changes in operations with effects on delivery reliability well before 2027.

The 2007 DRR notes that assumptions regarding 2027 operations are not a prediction of the future, but rather an assessment of the future with consideration only of hydrological effects of climate change and projections of future land and water use. This caveat must be carried clearly throughout the report, making it clear that modeled reliability is likely to be an *over*estimate based on incomplete knowledge of future operational constraints. Furthermore, the DRR should include a discussion of how water agencies may increase water supply reliability within their own service area in order to reduce the risks associated with uncertainty of future SWP supplies.

7. The DRR must recognize that DWR has not yet issued a final decision and EIR for the Monterey Plus project.

DWR is in the process of responding to comments in the Draft Monterey Plus EIR. In response to those comments and upon further analyses, it is foreseeable that DWR may choose to make changes to the Monterey Plus project. The DRR must acknowledge this fact and recognize that the outcome of DWR's Monterey Amendments decision-making may well cause further impacts to SWP delivery reliability.

PCL appreciates the opportunity to comment on the DRR, and we look forward to working with DWR to improve future drafts of the 2007 report as well as future Delivery Reliability reports.

Sincerely,

Mindy McIntyre
Water Program Manager
Planning and Conservation League

Attachments

Cc:
Lester Snow, Director , Department of Water Resources
Antonio Rossmann, Rossmann & Moore, LLP
Roger Moore, Rossmann & Moore, LLP
Senator Perata
Senator Steinberg
Senator Kuehl,
Senator Machado
Senator Kehoe
Senator Ducheny
Assemblymember Wolk
Assemblymember Eng
Susan Kennedy, Chief of Staff
SWP Contractors

Attachment 1

Delores Brown January 1, 2008
California Department of Water Resources
Chief, Office of Environmental compliance
901 P Street
Sacramento, CA 95814

Re: Draft Environmental Impact Report, Monterey Amendment, SCH#: 200301118

Dear Ms. Brown:

Please accept the attached comments in behalf of the Citizens Planning Association of Santa Barbara County, one of the original plaintiffs in the matter of **PCL et al v. DWR.** The comments have been prepared by Mr. Arve R. Sjovold, our representative to the plaintiffs' committee and a participant in the EIR process. Although Mr. Sjovold participated in many of the EIR committee meetings, he is distressed that virtually none of the comments and suggestions made in the long tenure of this committee were recognized or adopted in the preparation of the document. Accordingly, he regrets that his name is listed as one of the committee responsible for preparing this document. Nonetheless, he will honor his pledge to be of service to the committee and to DWR in this matter.

The comments are divided up into several distinct sections. The first deals with what Mr. Sjovold shows are critical flaws in the CALSIM II model, which was used as the primary analytic tool for the impact analyses. Based on his review of the model CPA finds this Draft EIR is seriously deficient. The CALSIM II review presents several analytic findings that are seminal with regard to this model's flaws; they should be addressed by DWR before this process continues. The CALSIM II review also points to critical failures in the application of the CALSIM II results in the analysis.

The second section addresses other areas of the impact analyses while the third section is an attachment of comments and criticisms of the DWR paper on incorporating climate change in to CALSIM II. Since DWR made this report central to their analyses of climate change impacts in the EIR, it is entirely appropriate to include such comments.

Finally, there are two appendices which support the CALSIM II analysis presented by Mr. Sjovold. They point to constructive changes that should be included in CALSIM II before it is used again.

These comments do not reach all the analyses presented in the Draft; there was not sufficient time to do so. However, because of the central importance of CALSIM II to the Draft's analyses, the flaws that have been shown by Mr. Sjovold are sufficient to render the entire Draft as inadequate.

AN ANALYSIS OF CALSIM II AS USED IN THE DRAFT EIR

By: Arve R. Sjovold

Introduction

The draft EIR uses CALSIM II as its primary methodology in analyzing the impacts of the Monterey Amendments (with Settlement additions) and therefore deserves detailed scrutiny as to its accuracy and appropriateness as a tool for environmental impact analysis. The accuracy problem is paramount given that the Appellate Court found that the original Monterey EIR had not considered the ramifications of the SWP's inability to deliver anywhere near the full entitlement values prescribed in the SWP contracts. A consequence of this finding is the acknowledgement that any entity relying on full entitlements as actual deliveries that cannot be fulfilled is dealing with "paper water". To quantify how much water the project can deliver reliably requires a model with a high degree of absolute accuracy. And the degree to which the project falls short of delivering reliably against expected full entitlements is the measure of "paper water". DWR's analyses of reliability of delivery rely totally on the use of its CALSIM II model; thus the accuracy of CALSIM II is essential.

DWR has not properly calibrated CALSIM II so its accuracy is still in question. The EIR does not reference any calibration exercise of CALSIM II and assumes that it delivers accurate estimates of delivery given the assumptions that are made in its development and use.

CALSIM II is referred to as a "simulation model" though in fact it is an optimization model, which is designed to determine the maximum amount of water that can be exported given the constraints of hydrology and SWRCB rules that govern the project's operations. There are troubling features of CALSIM II, which in all likelihood render the model as unsuitable as an estimator of project deliveries. The troubling features include:

- Its water year indices
- The lack of statistical rigor in characterizing the hydrology
- The inability to use environmental parameters as inputs to study impacts
- The lack of calibrations

Model Suitability for Environmental Impact Analyses

The fact that the model is an optimization model and not a simulation as purported, misleads the analysis of environmental impact. This is particularly true considering that **the optimization objective is maximizing export of water from the Delta and not the maximizing of environmental qualities.** Admittedly, quantifying environmental qualities for a mathematical model is an extremely difficult task. However, the model should at least allow ready testing of various proposals to improve

the environmental health of the Delta. Instead, the model treats the existing set of water rights rules and regulations as hard-coded constraints within the model code such that it is very cumbersome to change them for use in environmental studies**. Furthermore, the constraints coded in the model are only those that the SWRCB has promulgated as regulations on the project that reflect the past history of the project and its observed impacts on the Delta. It is a tenuous proposition to pretend that those constraints are adequate to protect the environment as we move forward with this project.** For example, DWR admits that the model does not include within its code any sense of Endangered Species Act requirements, which given the current state of the Delta should be its primary focus. Furthermore, the last 12 months have seen several court rulings that acknowledge the inadequacy of the current operations and regulations to protect endangered species. As a result of these rulings, Delta exports have been dramatically reduced. As currently configured, CALSIM II is not well suited to help solve these problems.

The SWRCB constraints that are most limiting on exports are the salinity constraints in the Delta and these operate to control salinity mostly in the western Delta. **In fact, it is fair to say that the model assumes that as long as it meets the salinity constraints in the Delta it has met its requirement for environmental protection in the Delta.**

For example, there are no routines in the model to deal with reverse flows in the San Joaquin River and the consequent mortality of Delta Smelt in the project pumps. Yet there is sufficient data to provide a competent predictor based on flow and pumping conditions to predict when reverse flows are likely to occur. It could be used as a constraint on Delta pumping in order to protect the fish. (See Appendix A)

Even in the case of modeling the salinity, the model uses a predictive equation that relies on one position in the western Delta, is dependent only on Delta outflow, and is independent of project pumping. Yet the historical sense on this issue is the knowledge that heavy pumping in the South Delta can affect the position and variability of the salinity gradient in the Delta. With the relationship that presently exists in the model, the prediction of the salinity appears to be unaffected by export operations.

Furthermore, it is a tenuous scientific proposition that a single point for measuring the affects of the project on salinity in the Delta is sufficient given the magnitude and complexity of the Delta. For example, the Delta Smelt is a species that lives entirely within the brackish water of the Delta and its movements to and fro in the Delta are largely dependent on the salinity variations. DWR should use its modeling talents to predict salinity gradients throughout the Delta and how they vary under different hydrologic and pumping scenarios. The EIR is largely silent on this matter and yet it would seem, given the present dire state of the Delta, that analyses of this sort would be a primary focus of the EIR.

The presently used systems of modeling the Delta by DWR rely on CALSIM II in concert with DSM2, a more detailed model that is intended to calculate the flows throughout the myriad Delta channels. It depends on CALSIM II to provide the input and export flows to and from Delta using the CALSIM II calculations for the Sacramento and San Joaquin valleys; in effect CALSIM II provides the boundary conditions for the operation of DSM2. Thus, DSM2 is limited in the scope of its calculations by the CALSIM II constrained inputs. The limitations of CALSIM II as an export optimization

model are visited upon the DSM2 calculations independent of the capability of DSM2 to investigate salinity variations more broadly.

It would be extremely useful to the analysis of the environmental impacts of the project if first model calculations could be obtained for a scenario without regulation of input flows and no exports to establish the conditions in the Delta for which the Delta Smelt are adapted. From this baseline it may be possible to determine the degree to which project operations affect Delta habitat and hence the species that rely on it.

The Problem With Water Year Indices in CALSIM II

CALSIM II uses as a primary input to its calculations a designation called "Water Year Type", which can take on one of five discreet values corresponding to whether the year in question is "wet", "above normal", "below normal", "dry", or "critical". These designations are used as input data to govern project operations in the model (and in practice), particularly in setting environmental constraints and are developed from the historical record spanning 73 years, 1922-1994, the basic hydrologic record used to drive CALSIM II.

Water year type is derived from a "Water Year Index" which is in turn developed from a runoff index. There are two sets of runoff indices, one for the Sacramento Basin runoff and one for the San Joaquin basin runoff. The basin runoff indices are calculated from the measured runoffs from the four major rivers in the Sacramento Basin and the four major rivers in the San Joaquin. These major rivers capture about 80% of the total runoff in the respective basins and are believed to be reliable surrogates for runoff. This runoff data is available on a monthly basis.

For each water year (October through September) a water year index is calculated as the weighted sum of 40% of the current forecast for the upcoming April to July runoff, plus 30% of the current October through March runoff, plus 30% of the previous year's water index. Thus the weighted formulation necessarily spans parts of two water years although it purports to represent the current water year. Depending on the value of the index for a given water year an assignment into one of the water year types is made. For project operations, the index is set by the first of the month forecast beginning in February and continues until the final determination based on the May forecast of runoff.

For use in CALSIM II a water-year type and a water year index are provided as fixed assignments for a given year in a "look-up table" for use in the calculations. **Because of the way in which these two attributes are derived they in effect provide the simulation with "perfect" information as to the upcoming runoff season (December through May) for a given water year, a circumstance that is not possible for making decisions for real time operations.** Also there is the fundamental question posed by the derivation of the water year index in that it combines the runoff from two successive water years. **There is no scientific merit to the notion that the previous year's runoff should affect the subsequent year's runoff, which is precisely what the 40-30-30 weighting does.** A simple serial correlation of the annual runoff record shows that there is no significant correlation, meaning that the current water year's runoff is independent of the previous water year. The water index is without any scientific merit and it should not be used, as is the case for the dependent parameter, water year type.

How the use of these indices biases the CALSIM II calculations and the actual project operations is difficult to deduce, but it is sufficiently clear to state that none of the calculations can be considered useful in the analyses of the EIR.

The additional fact that the indices as they are used are provided to the calculations in a fashion that gives the calculations "perfect information" ahead of the unfolding water year run-off is also sufficient to discredit any claim that this model is a simulation of system hydrology. In a simulation, one tries to replicate the decision structure that faces the system in real time. Knowing how the water year is going to end well before it is experienced allows CALSIM II to begin pumping early in the water year when at times little runoff has materialized. In effect, the early pumping borrows water from the Delta in the knowledge that it will be made up during the spring runoff. However, in real time the system operators do not know that spring runoff will be ample and therefore must restrict early pumping until events on the ground dictate that it is safe to pump.

Environmental Inputs

The object of environmental impact analyses is to evaluate the degree to which project operations and requirements affect what is broadly referred to as the environment. Because environmental attributes are difficult to quantify a good approach is to develop quantitative methods that at least allow ready evaluation of various alternatives intended to both achieve environmental protection and project operations. The present form of CALSIM II focuses only on project operations. It limits its treatment of the environment to what can be hard coded into the model as purported environmental constraints. Even in this regard no attempt has been made to have the model address important environmental questions such as that posed by the dangerous declines in Delta fish species.

A peer review panel of nationally recognized experts was convened to review the CALSIM II model as a tool to support water planning (See Appendix G of the EIR). However, that panel "did not specifically address the manner in which CALSIM II represents the environmental regulations and objectives established for the Central Valley water system", as stated in a study(1) by the National Heritage Foundation. That study builds on the peer review study to examine just how CALSIM II treats environmental constraints and objectives in the model.

The NHI study found that CALSIM II and actual operations are not faithful to the constraints and requirements that have been levied on the projects to protect the environment and the Delta. The study also attempts to examine what would be required in terms of additional changes and requirements that might be necessary to restore Delta health. The EIR does not address the current lack of compliance nor what additional measures might be necessary to begin to restore the Delta. Given the current state of the Delta this deficiency is deplorable and the EIR is again deficient.

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(1) Jeffrey T. Payne et al, "**An Environmental Review of CalSim-II** : Defining "Full Environmental Compliance" and "Environmentally Preferred" Formulations of the CalSim-II Model, Natural Heritage Institute, November 2005

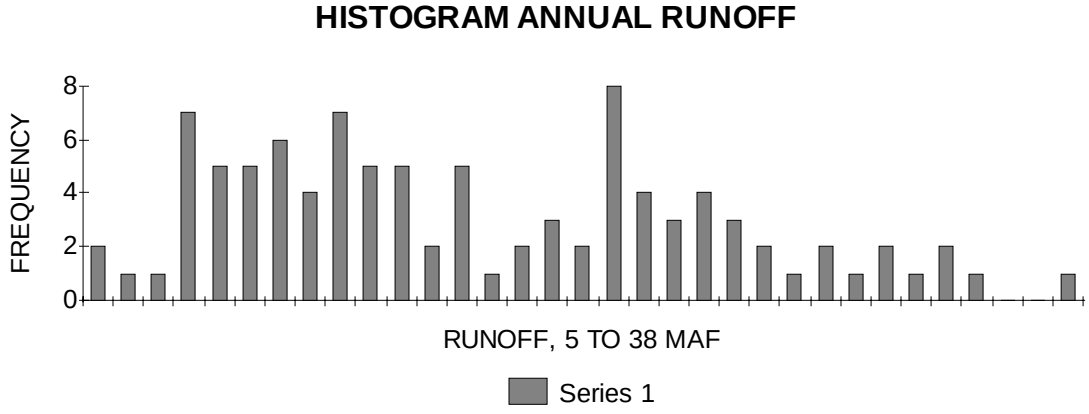
Lack of Statistical Rigor in Characterizing the Hydrology

CALSIM II uses a 73-year historical record of runoff as the primary input to the model. The variation evident in this record is assumed to be an accurate representation of the variation to be expected in the future and this assumption is relied on in characterizing the likelihood of the various output results. For the estimate of reliability of delivery, the model arranges the outputs in ascending order and ranks them in terms of the percentage of outputs exceeding a particular level of delivery. This percentage is used as an indicator of how well the project can meet its delivery requirements. Used in this way the frequency of occurrence takes on the quality of probability. But before any notion of probability can be assigned, the underlying stochastic character of the input variable, runoff, must be ascertained. In fact this information must be available to adequately design the model in the first place. This seems not to have taken place in the development of CALSIM II.

A careful examination of the statistical character of Central Valley runoff (using the 8-river runoff index--the combination of Sacramento and San Joaquin runoff) shows that runoff comprises two distinct groupings, a group that can be described as dry years and the other as wet years. Figure 1 presents a crude histogram of the 98-year runoff record for the 8-river index and it is quite clear that there are two distinct modes (central tendencies). These two tendencies

Figure 1

Runoff Distribution in the Central Valley
8-River Index
(Frequency of occurrence of annual flows-98 year record)



comprise two independent probability distributions and must be treated as such. The overall average runoff for the record (the 8-river index) is 18.04 million acre-feet, which is located in the minimum between the two central tendencies. Accordingly, the average is a relatively unlikely event, certainly not representative of what is normally referred to as “normal.” Thus to characterize individual water years as “normal”, “above normal”, or “below normal” conveys no real meaning. Another characteristic of the dry side

distribution is that the only sense of a threshold that could be described as “critical” are the lowest four years in the distribution, which are all 7 MAF or less.

There are 55 years (56% of the record) that comprise the dry year distribution and 43 years (44%) that are in the wet year distribution. These characterizations are based on total annual runoff. Since project operations cannot know at the beginning of the water year in September what the eventual runoff for the year will be, and the previous year is no indicator for what may happen in the current water year, it is of interest to examine the monthly runoff variations to establish when, in a given water year, a reliable conclusion can be drawn as to the likely amount of total runoff. This is where the look-up table of water year index and water year type bias the calculations by in effect telling CALSIM II what the water year will be before it is fully experienced. (Typically, runoff in the first few months of the water year is not very high and appreciable runoff does not occur until significant rain occurs.) **This is very important to the environmental management of the Delta because it could be extremely detrimental to the fisheries if massive pumping was initiated before a reasonable forecast could be made of the amount of water to be made available.** Since in general significant runoff seldom occurs before December, prudence would dictate reduced pumping rates in the fall until runoff is sufficient to provide exports and assure a healthy Delta habitat. Of necessity the project has to be operated this way because it cannot pump water that is not really available. **However, that level of early year pumping that can both protect the Delta environment and provide for exports has not been ascertained, either for operations or for CALSIM II calculations and the EIR fails to show as much.**

Significant runoff can occur in December and generally runoff increases going into winter and peaks in the spring when snowmelt becomes the major source of runoff. However, the record shows that December and even January and February have widespread variations in runoff. Figures 2, 3, and 4 present the histograms of runoff for those months respectively based on the 98-year runoff record. What is remarkable about these histograms is that they are highly skewed to dry months, so much so that the most likely (mode) runoff is approximately 1/3 of the average runoff for either December or January. More than half the data points in December are in the first three bars of the histogram, which means that for most of the years it is very unlikely that even modest export levels should be entertained. The same is true for January and even February. Again it must be observed that the average values of monthly runoff are not very representative of anything and can be very misleading. The likelihood of an average runoff is about 1/3 that of the most likely runoff. If pumping operational decisions were to be dictated by the average level of runoff, in most years there would be insufficient water for Delta health. This may in fact be the central reason in explaining the current declines in several of the threatened and endangered species in the Delta.

Given the above characteristics for monthly runoff, it is of great interest to establish when at the earliest the overall character of the year can be discerned. To this end some illuminating regression analyses have been performed to see how well earlier monthly runoff can predict total annual runoff (See Appendix B). A fairly good predictor is obtained by taking the sum of December and January runoff as an independent variable and regressing total runoff against that variable. Figure 5 is a scatter-plot of this data and shows distinctly that the Dec-Jan variable divides the data set into wet and dry domains. (There is a gap in the scatter-plot that demarks the two domains.) All the dry year totals

except one are delimited when the Dec-Jan sum is 3.9 MAF or less. That threshold also captures approximately 5 years that belong to the wet year group. The mean of the sum of December and January is 4.46 MAF so a sum of 3.9 or less signifies a dry winter as well. The average annual runoff (8-river index) is 18.04 MAF and the scatter-plot shows few data points surrounding this total, further confirmation that the average does not confer any sense of "normal."

CALSIM II needs to be revised to correctly account for the bi-modal statistical distribution of runoff. The analysis presented in Appendix B shows one possible direction. That direction would lead to a decision framework that would restrict pumping significantly in the fall and early winter until the amount of runoff that has materialized in combination with whatever snow-pack measurements indicate that more pumping can resume. And if that decision framework were put in place it would most likely eliminate the notion that there is any surplus water in January, February, and possibly March, to be used to implement Article 21, Carryover, or Turnback pool provisions in the Monterey Amendments.

Figure 2
Histogram of Dec Flow
Frequency vs. MAF

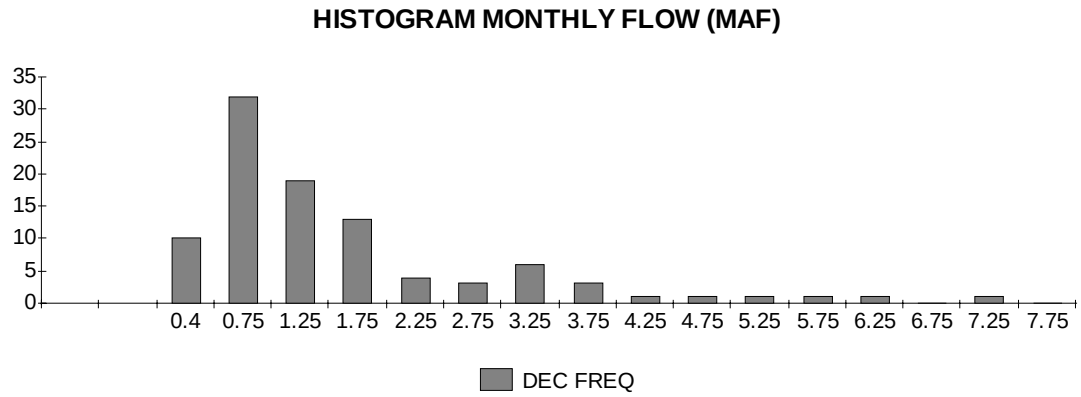


Figure 3
Histogram of Jan Flow
Frequency vs. MAF

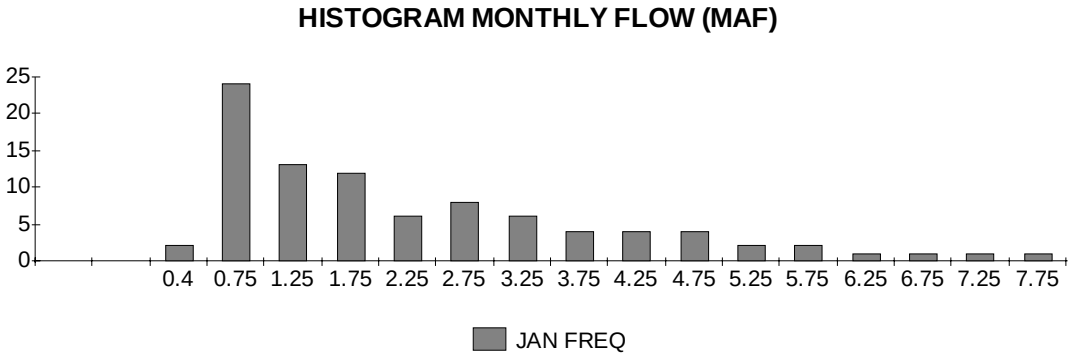


Figure 4
Histogram of Feb Flow
Frequency vs. MAF

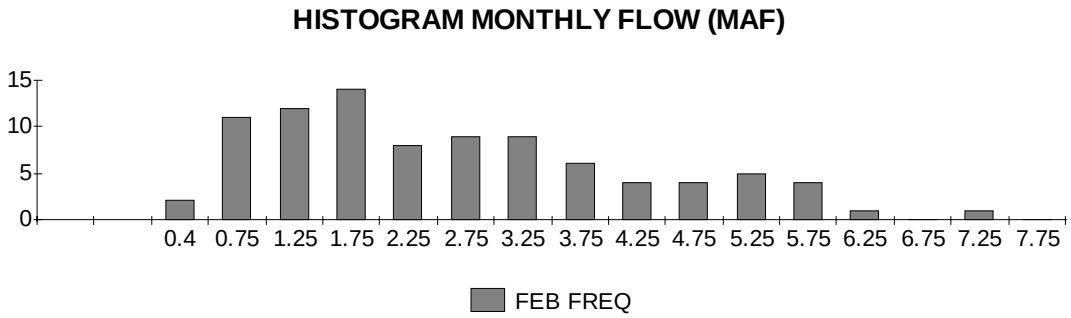
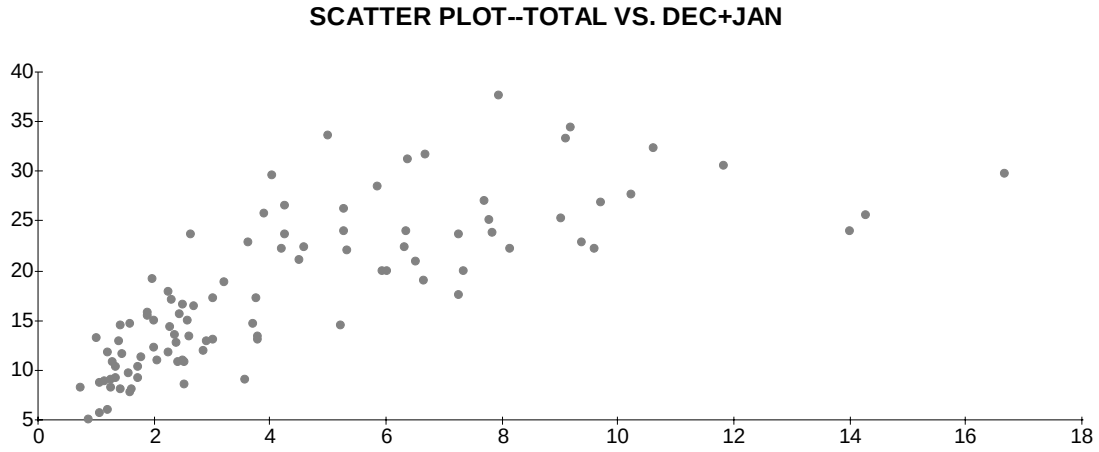


Figure 5

Total 8-River Flow vs. Dec+Jan, (MAF)



The Lack of Calibration of CALSIM II

It was stated above that it is necessary that CALSIM II be calibrated if it is to serve any useful function in environmental assessment or in assessing delivery reliability. DWR claims that its model gives reasonable answers and that it can be relied on for relative accuracy. A peer review of the model strongly recommended that the model be calibrated, especially if it is to be used where absolute accuracy is required and even if it is used for relative accuracy, as in comparisons of cases, given that it is an optimization model. **Calibrating an optimization model is essential in order to establish that whatever optima are calculated are real or possible solutions. This has not been done for CALSIM II and there can be no assurance of how well its calculated values represent reality.**

On the other hand, from the data at hand and with an understanding of how CALSIM II works it is possible to develop some estimates of its accuracy. What is required are CALSIM II estimates for a sequence of years for which there is also actual delivery data and which can be reasonably asserted are for the same conditions assumed for the CALSIM II estimates.

The EIR and the Reliability Report (Final 2005 Report) use CALSIM II estimates for a record that spans 1922-1994 and studies cases for levels of development corresponding to the years 2001, 2003, and 2021. The EIR reports in Table 6-7 the requests and subsequent actual Table A deliveries for the years 1996-2005, a period that spans the assumed level of development for year 2001 but there are no CALSIM II results for those years. The EIR also identifies the water year types associated with the actual deliveries.

Because the CALSIM II runs noted above do not include in its record the years 1996-2005 it is not possible to perform a direct comparison of estimates with deliveries. However, an examination of the CALSIM II results reported in the Reliability Report for the 73-year record shows two sequences of 10 years that are very similar to the 1996-2005 period, as judged by water year type. Those sequences are 1940-1949 and 1978-1987.

Table 1 presents the actual deliveries for the 1996-2005 period, along with the water year type and the contractor requests as reported in the EIR. Also shown are the reported actual deliveries as reported in the DWR reliability report, which show some disagreement from the EIR. Table 2 presents the water year type, assumed level of demand, and the CALSIM II deliveries for the selected 10-year sequences judged equivalent to the 1996-2005 period. The estimated deliveries are from Table B-3 of the reliability report as is the level of assumed demand, year 2001, or roughly the midpoint of the 10-year span. Water year types for these two sequences were taken from the input data file assembled for CALSIM II.

Table 1
SWP Actual Deliveries
Table A as reported (TAF)

		(From EIR)		(2005 Rel Rep)
YEAR	**YR TYPE**	**REQ**	**DEL**	**DEL**
1996	W	2676	2515	2206
1997	W	2976	2326	2308
1998	W	3335	1726	1595
1999	W	3147	2738	2521
2000	AN	3617	3201	2703
2001	D	4124	1547	1374
2002	D	3914	2573	2511
2003	AN	4126	2901	2964
2004	BN	4128	2600	2312
2005	AN	4127	2828	
	AVG	**3617**	**2495.5**	**2277.1**

It is assumed that “Requests” as reported in Table 6-7 of the EIR is a reasonable representation of the “demand” as used in the CALSIM II runs. Table 1 shows quite clearly that deliveries fall far short of requests. There is also the troubling observation that the EIR and Reliability Report do not agree; there is a little more than a 200 TAF difference in the averages. The EIR and the Reliability Report both profess to provide a detailed tabulation of actual deliveries. Since actual deliveries should be a matter of record there should be no discrepancy.

Table 2

Estimated CALSIM II Deliveries
Table A (TAF)
(From 2005 Reliability Report)

YEAR	TYPE	DEMAND	DEL	YEAR	TYPE	DEMAND	DEL
1940	AN	3713	3544	1978	AN	3126	3036
1941	W	3013	3036	1979	BN	3527	3509
1942	W	3583	3599	1980	AN	3197	3208
1943	W	3632	3545	1981	D	3834	3532
1944	D	3563	3449	1982	W	3451	3471
1945	BN	3612	3479	1983	W	3007	3036
1946	BN	3710	3724	1984	W	3692	3706
1947	D	3954	2652	1985	D	3753	3540
1948	BN	3959	2681	1986	W	3345	3023
1949	BN	3864	2568	1987	D	3905	2894
AVG		**3660**	**3227**			**3483.7**	**3295**

For both of the sequences presented in Table 2, looking at just the averages, CALSIM II estimates deliveries that are nearly equal to the assumed level of demand. For either sequence the level of demand is very nearly the same as the level of requests shown in Table 1 above. However, the level of estimated deliveries for each of these sequences is substantially higher than was shown as actual deliveries for the period 1996-2005. The estimated averages are roughly 700 TAF or 950 TAF above the actual average deliveries as reported by the EIR and the Reliability Report respectively for the period 1996-2005.

The two sequences are not perfect reproductions of the hydrologic sequence shown in Table 1 for the period 1996-2005. However, the balance of wetter than normal and drier than normal years is comparable. In fact, there are fewer drier years in the actual delivery sequence than in the two CALSIM II sequences. If there were to be any bias due to this difference it should reduce the estimated delivery level, which is already too high in comparison to the actual.

Based on these comparisons, one must conclude that either the level of demand assumed for the CALSIM II estimates is without foundation or that the model is seriously biased. In fact, until the source of this difference can be discovered and corrected the model is too inaccurate to be used for either absolute or relative accuracy in any study. It should be noted here that the list of contractor requests, which are used to drive

CALSIM II, does include some unrealistic requests. For example, a full Table A request of 25,000 acre-feet is shown for San Luis Obispo County which would be impossible to fulfill since the pipeline to San Luis Obispo County is sized to pass only 4800 acre-feet. What the model does with this excess water is a mystery.

One may conjecture that the bias is due to the difference between the operations implicit in an optimization model and the operations in actual practice. The model is given perfect information concerning the hydrology and only considers constraints that are promulgated by the SWRCB while actual operations must always be governed by the uncertainties of the hydrology ahead and environmental conditions as they materialize, of which the ESA actions are the most important. The optimization model is not really a good simulator of actual operations.

Other Comments on the Utility of CALSIM II in the EIR

Use of Averages in Reporting

Because the EIR relies so strongly on CALSIM II wherever it makes quantitative findings, it is questionable if such findings are of any merit given the deficiencies in the model. Even the methodology for reporting the model's calculations is misleading. First, because the model construction has ignored the underlying stochastic character of the input hydrology, the use of averages everywhere in the report give little insight as to the effects of project operations. For example, many lengthy tables are presented showing average flows throughout the system as calculated by CALSIM II. Table 7.1-2 of chapter 7 of the EIR presents tables that show average monthly flows for a number of stations over a fairly lengthy record. It is not certain what this table is intended to demonstrate since the record spans the period with CVP-only operations up to and including the period when both the SWP and the CVP are operating. What would be more interesting is to show the typical changes in these flows as the projects mature to maximum entitlements. **Furthermore, given the highly skewed character of the monthly flow distributions as shown above, it is more important to show what the flows are for the dry as well as wet domains. We have already shown that the average monthly flow is an uninteresting statistic and lends no meaning to the analysis.**

OTHER COMMENTS ON THE DRAFT MONTEREY + EIR

Use of Partial Hydrologic Records in Some Impact Analyses

In several instances the analysis relies on restricted hydrologic records in quantifying a particular point. The analysis of the effects of "borrowing" from lakes Castaic and Perris is a particular egregious example of distorting the impact by use of a restricted record. The analysis tries to show that the borrowing has little or no impact by comparing operations at these lakes before and after the Monterey amendments. Central to this analysis are the recorded data of operations from 1974 through 1994 for the before and the recorded data of operations from 1995 through 2003. The problem with this comparison is that the before record has an embedded 6-year drought and the after is an acknowledged wet period. Thus borrowing under Monterey occurred during a wet period while the basis for comparison has a mixed hydrologic record. Given the variations in lake parameters over ordinary operations those records are also too short to give confidence to the conclusions drawn.

If CALSIM II did not have so many flaws, this would have been a good example for its use to establish over the variation of a 98-year record the relative changes in lake levels due to borrowing. This would be standard practice for a study of this kind for which a large simulation had been developed. Unfortunately, CALSIM II is not a simulation and is not an appropriate tool. This leaves the analysis of the impact of borrowing resting on comparisons of a very restricted record.

In section 7.1, which characterizes the environmental setting in the major rivers and the Delta, data is presented which comprises significant variations in record lengths. Some data records span the period of SWP start-up but stop before full maturation of project contract entitlements. Only averages over these periods are reported so it is puzzling to discern just what the EIR is attempting to portray. Clearly, what would be much more informative would be to show the trends in stream flows as the project matures. Also, because the data represent several different sources, there are inconsistencies in the data. Inflows do not necessarily add up to Delta outflow (Table 7.1-2), as one would expect from the ensemble of rivers represented. The same can be said of the presentation of pre-project water quality data. If the environmental setting is to serve as a basis for comparison in impact analysis, the presentations leave much to be desired, especially when more informative presentations could have been prepared.

Use of frequency charts

Another reporting method is the use of the "frequency of return" charts that appear throughout the EIR. They purport to give the sense of probability of occurrence. However, because there are really two underlying probability distributions for the hydrology ("dry period" and "wet period" as we show above) the frequency charts are misleading and give an optimistic picture of the project's capabilities. They should not be used in the EIR

Article 21, Carryover, and Turn-back Pool Deliveries

These three categories of contractual water deliveries raise serious questions regarding pumping and Delta health. All are deliveries to be made in January, February, or March when certain conditions prevail. Article 21-water is termed surplus water but the only definition for it comes from the SWP contracts. There is certainly no test of whether it is surplus to the Delta. **DWR must develop a definition of surplus water that is properly constrained by considerations of Delta ecological health. This constraint must supersede the definition of surplus water in the master contract. The EIR must be considered deficient until such a requirement has been met.**

The Monterey Amendments eliminates all the conditions and constraints on delivery of surplus water that were in the original contract and substituted a new Article 21. One of the original provisions was the responsibility to determine that surplus water not be used in any manner that would constitute the development of a permanent-like economy due to its use. The new definition would seem to allow much more latitude to the use of surplus water for M&I uses that might not be allowed under the original contract. The EIR should analyze the impact of this provision in creating still more paper water.

Carryover and Turn-back Pool water are also contractual definitions and, together with Article 21 water, all three definitions have been modified by the Monterey Amendments. Carryover water is strictly a consequence of the difference between the definitions of contract year and water year. "Carryover" as used in the contract does not deal at all with reserving water in one water year to make it available in a subsequent water year, which is the normally intended meaning of the word. Instead, at the end of December when a new contract year starts, whatever Table A amounts that were scheduled but not delivered in the old year may be delivered in the new contract year even though it is in the same water year. The demand for this delivery occurs in the same months as for Article 21 water when, as we have shown, there is great uncertainty as to how the water year will turnout. The same is basically true for Turn-back Pool water. It too is a creation of the difference between contract and water years. Both "Carryover" and "Turn-back Pool" create opportunities for the contractors to "game" the system to get more Table A deliveries, all under the guise of strict adherence to the contracts. Because these categories are basically contractual creations of Monterey, invocation of them to cause deliveries in the first three months of the contract year should be carefully scrutinized in the EIR for impacts on Delta health. In fact, it would be extremely useful to examine project operations without these provisions. Furthermore, an alternative scenario for full EIR examination should be generated which requires the contract year to be coincident with the water year.

EWA operations

The EIR's discussions of the Environmental Water Account (EWA) do not help the reader understand how the EWA is supposed to work. On one hand it sounds like it is intended to reserve water to be made available for fish in the Delta when circumstances indicate that more flow into the Delta is necessary. On the other hand the EIR talks about

storing EWA water in the San Luis Reservoir. If it is in the San Luis Reservoir how is it made available to the fish when needed? The obvious question is could the water be kept above the Delta so that its release for fish is direct and to the point? Why must the water be delivered to San Luis Reservoir if it is anticipated that it will be needed for the EWA? Are those who are selling their water south of the Delta making a profit on it? And if it is a project obligation to adhere to the ESA why doesn't DWR act cautiously to make sure that it keeps enough water above the Delta to assure their ESA obligations? All of these questions should be addressed in the EIR.

Energy Impacts

Since the SWP is a very large net consumer of power, and given the present urgency about energy use and global warming, the analysis of the project's energy impacts is very important. Probably the most important direct energy effect of the Monterey Amendments per se is the transfer of 130 TAF of water from agriculture in the San Joaquin to urban users, most of which are outside the San Joaquin Valley. For those transfers to Southern California the transferred water must be pumped over the Tehachapi Mountains, which constitutes a net increase of pumping energy over and above that which would have been required if the water was used in the Southern San Joaquin as originally called for in the contracts. However, there are many more facets to the impacts of energy requirements associated with this project.

First and foremost, because the project has rarely delivered close to full Table A allotments, there is the question of how the energy required for pumping will be supplied when the project deliveries approach the full allotments. Since the SWP is at present a net energy consumer, any additional deliveries must be presumed to require more pumping energy, which must necessarily come from commercial power from the grid. Given the difficulties that California has in meeting peak demands in the most recent years, it is not at all certain that additional pumping energy can be had without significant impacts on the competing demands of California residents. It may be argued that this particular problem would attend the SWP without Monterey, but we should point out that all of DWR's calculations with CALSIM II predict increased deliveries, so much so that they have made those calculations the basis of their reliability analyses. The same CALSIM II calculations also are used to claim that the amended SWP now has much less "paper water". In any event, to make their calculations consistent they should assess the net increase in pumping energy demands associated with their claim that they can deliver more water than in the past.

A correct reckoning and portrayal of the energy impacts should use the actual record of deliveries as a basis for comparison instead of the CALSIM II generated numbers for year 2020. (There is particular concern in the period 2000 to 2005 when increased Delta pumping during December, January, and February occurred and a tabulation and comparison to prior years would be very informative.) The energy problem is how the additional energy to get to 2020 conditions is to be generated.

Another aspect of the Monterey Amendments that impacts energy demands is the transfer of the Kern Water Bank to the Kern Water Bank Authority (KWBA) combined with the Monterey created delivery categories of Article 21, Carryover, and Turn-back Pool. The combined effect allows the KWBA to request water from these various

accounts to put in the Kern Water Bank for the benefit of the KWBA, which incidentally comprises water entities that are not direct contract recipients of SWP. Thus a demand is placed on the SWP to pump water that would not have necessarily been pumped if KWBA had not been given the Kern Water Bank. The analysis must show how operations of the Kern Water Bank would have been expected to occur if it had remained as an SWP project facility. Also there is the question as to whether non-project participants, such as those comprising the KWBA, should benefit from project contractual provisions regarding the prices they pay for pumping energy. Given that additional energy increments above the previous baseline must come from commercial power, it seems that non-project participants should pay that marginal cost for pumping to fill the Kern water Bank. In other words all other legitimate SWP contractors must pay slightly more for their pumping energy needs because of costs imposed by operations of the KWBA.

In summary, the impact analyses must trace all the different flows that follow from the Monterey Amendments and accurately calculate the pumping energy differences and compare those differences to the previous actual baseline, and not to the year 2020 level of demand.

Land Use and Planning

In California one of the most important elements in land use planning is the availability of a reliable water supply. Because the first Monterey Agreement EIR failed to deal with the well-recognized inability of the SWP to deliver even close to full entitlements the EIR was held to be deficient. The Appellate Court made note that this lack of candid treatment in that EIR placed local planners in a difficult decision as to how much firm water they could count on in approving or rejecting development projects. Because the pre-Monterey contracts had provisions in them to allow DWR to bring entitlements into consonance with real capabilities to deliver and the Monterey Agreement made it a specific objective to eliminate those provisions, the Court stated that a new EIR must be drafted that analyses the consequences of utilizing the eliminated provisions to bring promises of delivery in accord with the project's capability to deliver. The current EIR has attempted to do this, relying on calculations with CALSIM II, but because of the total inadequacy of CALSIM II as presently configured those analyses are flawed. **This brings us to the point in the EIR impact analysis where a fundamental requirement promulgated by the Court of Appeals has not been fulfilled**. The present section of Land Use and Planning is therefore of little use. Nonetheless, there are some observations that can be made that may be useful in correcting the analysis in a future document.

The analysis of impacts on Land Use and Planning avoids the most obvious consequences of the project. Table 7.10-1 attempts to guide the reader to the most important impacts but ignores what must be considered the first order impacts. The table indicates that the only concern with the permanent transfers of water from agriculture to others is with the changes in land uses and agricultural practices of the land from which the water is transferred. However, it should be clear that any transfers to urban uses raises profound issues with changes in developed land use whenever additional water supplies

are make available. A prime example of this is the development now being pursued in the Castaic region solely because the Castaic Lake Water Agency claims to have reliable additional water supplies made available from transfers from Kern County Water Agency, all under the auspices of the Monterey Amendments. How the EIR can be silent on this matter is beyond comprehension.

Furthermore, the amounts of additional, reliable water claimed in the transfers is solely based on DWR's CALSIM II calculations as they are presented in the settlement-mandated provision requiring a reliability report. Because CALSIM II has already been shown to be a grossly inaccurate calculator of reliable water, its use in assessing how much water can be relied upon just continues the problem of "paper water", which the Appellate Court and the Settlement Agreement state must be eliminated from land use planning.

The table also misses the point on the Kern Water Bank transfer. By changing the water bank from a SWP facility to one owned and operated for the benefit of a limited set of water users, the SWP plans for delivery have been necessarily impacted and as a direct consequence the plans regarding the use of whatever water the water bank could have made available for all the SWP contractors are impacted.

Also the Reliability Report fails to account for the presence or absence of local water sources and its guidance to SWP contractors is too simple to be of any practical planning use. For example, many SWP contractors, taking their cue from the Reliability Report, assume a number around 75% reliability, which they apply to their Table A amount in reckoning their reliable supply. In truth, the way that the 75% is calculated depends on the project being able to deliver substantial amounts of Table A to Kern County Water Agency and the Metropolitan Water District because they have large reservoirs and can accept these large amounts in off-demand periods. By contrast, most other SWP contractors do not have such storage means and must take their Table A amounts during seasonal demands and the average amounts that can be relied on under those conditions is much less than 75%. Accordingly, a planner depending on water from one of these other SWP contractors would be misled. It is also an interesting observation that any development which is permitted solely on the basis of a SWP supply can really only depend on approximately 15% of whatever Table A allotment it may have because that is the lowest delivery level in the record. This has proven to be a realistic possibility in Santa Barbara County where transfers of SWP allotments among SWP subcontractors are being made to support developments outside existing water district boundaries. DWR needs to instruct its SWP contractors on how to use the information developed by them respecting each individual contractor's ability to receive SWP water in concert with whatever other water sources it has available.

In summary, the analysis in the EIR of impacts on Land Use and Planning is too superficial and limited to be of any use in prospective project decisions.

APPENDIX A

An Analysis of Reverse Flows at the South Delta Pumps

Recently, additional information on several factors was obtained that could explain the observed Pelagic Organism Decline (POD) in the Delta. It had been posited earlier that unusually high pumping by the SWP in the months of December, January, February, and March could be the cause. The additional information now focuses on the fact that high reverse flows in the Old San Joaquin River brought on by SWP/CVP pumping may explain the loss of the Delta Smelt. The investigations that brought this information to light also were concerned with the same four months (D,J,F,M). This information has been analyzed to relate the Old River flows to export pumping, river flows at Vernalis on the San Joaquin, and the Sacramento at Freeport. To date one quantitative relationship has been developed that explains the reverse flows quite well. The method used was multiple regression analysis and the best relationship so far is given below:

OLDSJ = 243-0.942*EXP+.533*SJVER

Where SJVER = San Joaquin flow at Vernalis, cfs
EXP = export pumping, cfs

Since export pumping is generally much greater than flows at Vernalis, this relationship yields negative flows for Old River in most instances.

The data set covered the years 1981 to 2006. Two data points appear as clear outliers, 1983 and 1997, which were very high run-off years. The standard error for this equation is 430 cfs while the corresponding percentage error of the fit is 18.5%. All coefficients are very significant ("t" values are respectively, 15.11 and 20.23).

What seems clear is that export pumping is a very strong variable; reverse (i.e. negative) Old River flows could be reduced by directly reducing exports. It seems also clear from perusing the input data that San Joaquin flows at Vernalis are not substantial enough to overcome the export reverse draw. This is probably due to the fact that in most years almost all of the San Joaquin is diverted for irrigation.

Another factor not yet analyzed is the magnitude of the exports compared to the volumes of water in the sloughs and Clifton Court forebay. When exports typically average 10,000 cfs for days at a time, the transit time through the sloughs may be quite short. (For example, 10,000 cfs equates to 20,000 acre-feet per day, which could be on the order of the volumetric capacity of Clifton Court forebay.) It seems that the biologists should look at what happens at all the levels of the aquatic food chain when that happens. Perhaps the reduction in smelt numbers and the observation of smaller smelt later in the spring are related to the reduction in biologically available food.

It might also be profitable to take a restricted look at the months of just December and January. Using all four months tends to obscure the fact that quite often river flows in the first two months of the four month period can be quite low, so much so that

exports would be even more devastating. The biologists should be asked to investigate the relationship of POD to just the pumping and flows in the first two months.

The sheer magnitude of the export flows is also interesting. There was a levy failure in one of the Jones tracts during a period when most observers would not have expected any stress on the levies. However, the maps show that the tracts in question are along the channels that lead directly to the pumps. Is it possible that the magnitude of the flows to the pumps was an important factor in the levy failure?

COMMENTS ON DWR'S TECHNICAL MEMORANDUM

"Progress on Incorporating Climate Change into Management of California's Water Resources", July 2006

By Arve R. Sjovold
September 2, 2006

In DWR'S year 2002 report on the "The State Water Project Delivery Reliability Report" it was explicitly acknowledged that climate change would affect the timing and amounts of snowfall and possibly precipitation and that sea level rise was likely. At that time the timing of these impacts was speculative. That report promised that more definitive studies of the impact on climate change would be provided, possibly as soon as the update of the California Water Plan Update 2003. Thus, it was with some anticipation that I looked forward to a comprehensive study of the affects of climate change on the SWP. The subject report fails to provide that comprehensive study. Although DWR did engage in some rather elaborate computerized calculations, the subject of those calculations studiously avoided the impacts, now more widely recognized, but clearly acknowledged in the 2002 Reliability Report. Any keenly interested observer of the debate on climate change would have expected a cogent and objective analysis of the effects of sea level rise and changed Sierra run-off patterns as first order effects.

The report devotes considerable of its quantitative analyses to the calculations of the effects of a very modest sea level rise of 15 inches on the ability of the Delta to deliver water to the pumps without severe violations of salinity thresholds. It does so based on assumptions that upstream reservoir operations are not changed and that sea level rise does not change the hydraulic network in the Delta. Another assumption for this analysis is that the salinity gradient in the western Delta does not change with this sea level rise. No supporting evidence or analysis is given as to why these assumptions are reasonable. In other words, a primary assumption is that the current system of Delta levies remains in tact with a 15 inch sea level rise. I won't argue that that level of sea level rise may indeed leave the levies operationally in tact, but it misses the first order question of what level of sea level rise will compromise the system of levies. There are good maps (produced by DWR, if I am not mistaken) of what the Delta may look like with 1, 2, 4, and 10-foot sea level rises. From these maps it is clear that somewhere between 2 and 4 feet of rise there is little assurance that the Delta can perform as a delivery network of fresh water to the South Delta pumps. Since the subject report acknowledges that 2.9 feet of sea level rise is likely under one of the scenarios studied by the International Panel on Climate Change (IPCC) by the end of the century, clearly the most important question to be addressed by DWR is to calculate at what level the Delta's levies cannot be relied upon. **The subject report does not do this and does not offer a qualitative discussion.**

The other major assumption underlying their quantitative calculations is that reservoir operations (that is, Oroville and Shasta) are not changed by climate change impacts. That this is an untenable assumption is apparent from the report's side study that shows, under 3 different scenarios, that peak discharge from the Feather River may be

substantially altered. In fact, the most severe scenario carefully quantifies that peak discharge for a "15 year event" may be 2 ½ times the current estimate of a 15-year peak discharge. Clearly, any inquiring mind would wonder how reservoir operations might be affected by such a finding. Curiously, the report does not inquire further. But that may be the most intriguing finding of the report. If as a matter of hydrology peak discharges at any return level are 2 ½ times higher, such a finding would call into question the ability of the dams to function as designed. First, 2 1/2 times peak discharge would probably tax the design limits of dam spillways. Second, flood pools in reservoirs would have to be enlarged compromising water conservation objectives. Third, passage of discharges 2 1/2 times as large would undoubtedly cause havoc below the dams. None of this is addressed in the report even though that is where it should logically lead.

In conclusion, the report shows no scientific curiosity concerning the very likely first order impacts of climate change. The detailed quantitative analyses that are performed are totally irrelevant to what are the major questions that are posed by climate change. The report should candidly state that the most reasonable forecasts of what climate change might produce would seriously compromise the project, to the extent that the SWP may be obsolete in its current configuration within the current century. This is certainly a different tone than that conveyed by this report.

Specific Criticisms

1) The report still relies on CALSIM II as a reliable model to study the impacts of climate change. First, as we have so many times stated in the past CALSIM II is a fatally flawed model. It has not been calibrated and is not a true simulation model, as it is commonly referred to. Second, the indices that are use to drive the model in certain of its calculations are without scientific or practical merit. They provide the so-called simulation with perfect information of stream flows in advance of simulated operational decisions and the indices are highly distorted representations of the true stochastic nature of the operational problem, simulating operations in the face of uncertain future stream flows. It is particularly noteworthy that the CALSIM II run labeled "Base" in the report does not resemble the CALSIM II 2021-runs performed for the Reliability Report for ostensibly the very same assumptions. In fact, the variance between these two case studies, the "2021" study in the reliability report and the "Base" in the climate change study, is roughly the same as the differences reported between the "Base" case in the climate change study and the alternative scenarios. (See Table 1 below.) In stark terms, we are using a measuring instrument that is too imprecise to reliably distinguish differences among the scenarios. Scientifically, the model is inappropriate just on that finding and DWR staff should be required to establish why there are such differences between these two reports.

2) Throughout a significant portion of the report detailing previous hydrologic history of the Central Valley, there are many regression analyses results that are portrayed to establish certain trends that may have some significance. The report does not state why they may be relevant. I find it difficult to see any

such relevance except if it is to acknowledge that some climate change may have already occurred. Even then, I fail to see the relevance absent any analysis that shows why it should be. Beyond that observation of relevance, there is the more important issue of deciding when a calculated trend is significant. It appears from the data presented in the report that many of the trends are statistically insignificant at normally accepted thresholds. Why such trends are reported as maybe "real" is puzzling.

3) The preoccupation with the affects of climate change on stream flow temperatures is probably misplaced. Given that current project operations are decimating species in the Delta, the concern seems an attempt to show that the species are doomed anyway and we shouldn't worry about what the projects are doing now. That is a very shortsighted view and seems to be extremely self-serving with respect to current operations. My view would show more emphasis on characterizing future overall stream flow amounts and timing rather than on speculations on stream-flow temperatures as if the basic stream flows are relatively unperturbed.

4) The report does provide a fairly decent summary of the extant scientific theories supporting global warming and the effects on climate. The report depends most strongly on the work reported by the IPCC and the scenarios they cast. However, other more recent work out of the Goddard Space Science Institute (GSSI) strongly suggests that ice sheet breakup of the Greenland and/or Antarctic ice sheets may accelerate sea level rise significantly, an event that is not a major factor in the IPCC scenarios. If the GSSI theory is more correct the integrity of the Delta in the nearer future may be in doubt. Neither the IPCC nor the GSSI can offer precise timelines as to when significant sea level rise may occur. Nonetheless, it is vitally important that DWR include a candid appraisal of the likelihood of sea level impacts on the Delta beyond the mere 15-inch rise assumed in their studies. Calculations can easily show that the generally accepted existing level of climate forcing, .85 watts/m^2, is sufficient to melt sufficient ice to raise sea level by 0.4 feet per year. What is not certain is how future climate forcing will divide between melting ice and warming the biosphere. It is very clear right now that the rate of sea level rise cannot be estimated precisely but the potential for rapid sea level rise is the most important feature of global warming. The report should candidly state so.

5) The report summarizes the past history that has been developed for global warming over the past 650,000 years which shows that within our recorded history the Earth is near a peak warm temperature for this interval. (See; James Hansen, "A Slippery Slope", Climatic Change, 68, 269-279, 2005). If the report had included the corresponding data on the coincidence of greenhouse gas concentrations and sea levels with temperature it would be quite clear that greenhouse gases are the most significant driver of temperature change and consequent sea level rise. The DWR report does

include a table of the existing concentrations of CO_2 and methane, corroborated in the attachment, which are higher than ever measured by the ice cores within the past 650,000 years. This remarkable finding should require the widest possible range of possible changes rather than the restricted ranges chosen by the report. In short, the authors of the report did not delve deeply enough into the current research being performed on climate change and the report cannot claim to have met its objective of "incorporating climate change into the SWP."

6) The analysis to incorporate climate change into CALSIM II involves an intricate attempt to translate IPCC climate change scenarios into specific quantitative changes in major Northern California river run-off as the basis of the computer calculations that form the major effort of the report. It is noted in the analysis that the climate change scenarios are based on global models that incorporate only six grid points to characterize expected rainfall for all of California. The analysis then proceeds to use the information developed for these six grid points to generate estimated changes for 10 of the major rivers. Another model, the Variable Infiltration Capacity (VIC) model, is used to calculate these estimated changes of rainfall into run-off. An important assumption in this exercise is the use of the VIC model to develop perturbation ratios due to climate change that can then be used to modify the characteristic run-off measurements for these rivers. The clear flaw in this methodology is the measured run-off used to characterize the rivers. The analysts chose the year 1976, a readily acknowledged drought year to characterize the average or "normal" run-off. Since 1976 was well below average for any river system in California, this choice necessarily biases the estimated changes low. 1976 run-off was probably less than half the average. Therefore, on translating changed rainfall into estimated run-off for the major rivers feeding the CVP and SWP, the use of 1976 as a basis to scale from as described in the report necessarily underestimates the run-offs under climate change by a significant amount. Accordingly, the entire exercise with the Delta model, DSM, is not even a reasonable estimate. Since this computer exercise seems to comprise the most substantive portion of the report, it calls into question any and all of its findings. DWR should be required to justify the choice of 1976 (although on its face it seems that this can't be done). A standard analysis of this type would have done so as a matter of course.

Table 1
Comparison of "Base" and 2021 CALSIM II Runs

(Million acre-feet per year)

Water Year	Climate Change Report SWP Exports	2002 Reliability Report SWP Exports Fixed Demand	Deviation
76	2.97	2.78	.19
77	1.00	0.83	.17
78	3.61	3.91	.30
79	3.70	3.49	.21
80	4.10	3.46	.64
81	3.33	3.40	.07
82	4.71	4.13	.58
83	3.68	4.13	.45
84	3.42	4.10	.68
85	3.52	3.32	.20
86	4.20	3.01	1.19
87	2.57	2.84	.27
88	1.54	0.99	.55
89	2.72	2.90	.18
90	1.60	1.15	.45
91	1.10	1.00	.10
Average Deviation			**0.39**

APPENDIX B

Development of a Preliminary Algorithm To Guide Pumping from the Delta In the Months of December and January

A look at monthly flows for the runoff record reveals that significant runoff begins in December and increases on through May. The highest runoff measurements generally occur in the spring. However, from time-to-time there are some early winter runoffs that are quite high. When looking at just the dry year portion of the record it is quite clear that the drier years are almost always characterized by runoff in both December and January that are much below average. Thus if the water year is going to produce reasonable runoff it must come from above average spring runoff. But the operators of the projects cannot safely assume that spring will be above average and must then adopt prudent operations when beginning export in the fall and winter. Therefore, an operational procedure must be developed that begins with the assumption that the water year will be dry until conditions show that it is likely to be wet. (We dismiss the notion that the previous water year has any useful information contained in its runoff record as is intimated by the "40-30-30" index.) The question is then, how can we establish with some certainty how much runoff is likely for the year?

To answer this question, we analyzed the relationship between total runoff recorded by the end of the water year to the measurements of monthly runoff as they occur. A perusal of the record shows that trying to rely on December runoff alone does not provide a reliable indicator. Next we examined the potential of the combined runoff of December and January to indicate the character of the impending water year.

We started by defining simple indicator variables. Since we desire to provide indicators that are most useful in the early part of the water year we concentrated on the months of December and January to see how much they could tell us. The indicators that seem to work reasonable well are as follows:

DRYWINTER, which takes on the value of either one or zero. If it is one, then it signifies a combined December-January runoff that is quite dry for that period. We first tried a combined runoff of less than 2.5 million acre-feet (MAF), which is just over half the average for this period. Later we tried a value of less than 2.25 MAF which is just about half.

WETWIN, which takes on the value of either one or zero. If it is one then it signifies a combined December-January runoff of greater than 4.24 MAF, which is the average for this period.

WETSPR, which takes on the value of either one or zero. If it is one then it signifies a combined April-May runoff of greater than 7.4 MAF, which is the average for these two months. Later we tried a threshold value of 6.5 MAF, or slightly less than the average. We felt that more precision in the spring runoff is not necessary since one must wait until spring to measure the runoff. So the role of this indicator variable is to establish explanatory power for the desired relationship for predicted total runoff.

Besides operations can be modified once we have passed beyond the months of December and January and the water year record unfolds.

The best relationship that we could find is given below:

TOTAL= 12.81- 2.99(DRWWINTER) + 7.22(WETWIN) + 5.17(WETSPR)
Where:

TOTAL = total water year runoff in MAF
DRYWINTER = 1,0 where 1 is sum of Dec-Jan when less than 2.25 MAF
WETWIN = 1,0 where 1 is sum of Dec-Jan when more than 4.24 MAF
WETSPR = 1,0 where 1 is sum of April-May runoff when Greater than 6.5 MAF

These variables were then tried in a linear multiple regression relationship to examine their explanatory power. All of the indicator variables were highly significant and the standard deviation of the fit was 3.27 MAF. Nine of the 98 data points in the sample were deleted from the regression calculation as probably too extreme on a probability basis. 7 of those 9 were for extremely high runoff years. Since the problem of export pumping is much less dependent on very high runoff years these deletions are not of prime importance and their inclusion only tends to skew the results. It is also noteworthy that the deletion of these data points appears not to affect the coefficients materially but does improve the precision of the relationship.

Conclusions

With three independent, stratifying variables that take on either of two possible values there are 6 independent outcomes. They are:

DRYWINTER and a dry spring (1,0,0), which produces an estimate of TOTAL of 9.82 MAF.

A winter (December-January runoff) that is greater than 2.25 but less than 4.24 MAF and a dry spring (0,0,0), which produces an estimated total runoff of 12.8 MAF.

DRYWINTER and a WETSPR (1,0,1), which produces an estimated total runoff of 15.0 MAF

A winter that is greater than 2.25 but less than 4.24 MAF and a WETSPR (0,0,1), which produces an estimated total runoff of 18.0 MAF.

WETWIN and a dry spring (0,1,0), which produces an estimated total runoff of 20.5 MAF.

WETWIN and WETSPR (0,1,1), which produces an estimated total runoff of 25.7 MAF.

Of the 98 years of the runoff record, nearly half the points(47) are included in the three categories that have estimated runoff less than the average for the total record. Twenty four (24) of the 47 points are associated with the estimate of 9.82 MAF. 15 are associated with the estimate of 12.8 MAF and 8 are associated with the estimate of 15.0 MAF. All three of these categories are determined by the combined monthly runoff of December and January and make no assumption that the spring will be wet. Accordingly, one may conclude that all December and January operations should assume that the water year is part of the dry period until spring runoff dictates otherwise. It is particularly important to note that for fully one quarter of the record (24 years), only 9.82 MAF can be relied upon. This should be the starting point for developing operations criteria for export pumping that take due care to preserve the Delta environment.

At present it appears that December and January pumping are little modified by the hydrologic indications to that time. Since project demands are low at this time of the year, these months are used to fill south of the Delta reservoirs. Only the constraints on Delta outflow and salinity may limit the pumping; and the restrictions here are highly skewed because of the influence of the erroneous “water year index” discussed in the body of the text. Questions that should be asked include: Should there be much of any export pumping if December and January runoff is below 2.25 MAF? Can the health of the Delta fisheries and its broader ecology be assured under such low flow conditions? Of those 24 years that comprise this condition three are for years that are extremely dry, averaging just under 6 MAF. What would be prudent operations under those conditions? The same questions must be answered for the other two dry year categories. The biologists should be asked to weigh in on what would be desirable under these drier conditions to assure Delta health.

It is possible that integration of snow-pack measurements might improve the ability to forecast more accurately or at least earlier with the same accuracy. However, reliable snow-pack measurements are usually not available until the end of March. Accordingly, early runoff is the most readily available and reliable indicator that can be useful.

Attachment 2

HOW CALSIM II DISTORTS ESTIMATES OF AVAILABLE SWP DELIVERIES

By: Arve R. Sjovold
March 2, 2008

In my comments on the Draft Monterey++ EIR I provided a rather thorough examination of significant flaws in the CALSIM II model. The comments were couched in statistical terms whose significance may not be readily discerned. In this essay I try to provide more commonplace analyses to show what the consequences of the flaws really are.

There are two structural flaws in CALSIM II, the methodology by which the water indices are constructed and the use of these indices in the model. In addition, there is the matter of how CALSIM II results as measures of probability are reported in the Reliability Report and how the results are reported in the EIR. Then there is the matter of the how the hydrology is represented in the model. Here I will attempt to show how each of these factors operate to produce faulty estimates.

Problem 1: Faulty Indices

Indices are sometimes useful in models to categorize certain information to facilitate calculations. In CALSIM II the indices that are used in this fashion are the water year indices. These are constructed from measures of runoff from the major rivers feeding the Central Valley and are used to characterized whether a year is "wet," "above normal," "below normal," "dry," or "critical." One of the problems in using this type of characterization is that there are two definitions of "year." There is the "contract year,' which is identical to the calendar year, and the "water year," which is a characterization developed on the basis of hydrology and is particularly pertinent in a climate that has summer drought. The "water year" is the period from October 1 through the following September 30. This definition follows from the recognition that because of summer drought little runoff is generated in the summer as the streams become increasingly lower until fall and winter rains generate significant runoff, which is later followed by the more important spring snowmelt. Actual project operations must respect both the "contract year" and the "water year."

The water indices that are used in CALSIM II try to span these two definitions by constructing an index that is a weighted average between the runoff from the preceding water year and runoff from the present water year. In so doing the index is made to represent a runoff from two water years that may have nothing to do with each other. It then becomes a flawed guide to operations and calculations.

I performed a correlation analysis on the series of annual measured runoffs (water year) in the Central Valley to find out whether a given water year is more likely to be wet (or dry) if the previous water year was wet (or dry). The result was that there is virtually no correlation, which means that each water year has to stand on its own. Thus the project should not base operational decisions on an index that is a composite of two water years in attempting to characterize the runoff. This is an important finding that has profound consequences on how much and when water can be delivered from the Delta.

First, there are several examples in both operations and in CALSIM II calculations where an erroneous index has led to a serious error in pumping. This circumstance occurs primarily every time a quite dry water year is preceded by a fairly wet water year. When this circumstance occurs, the flawed index indicates that the ensuing water year will be wetter than the actual case. If the quite dry year is followed by another quite dry year (the 1976 and 1977 years are a good example), more water will be pumped in the first of the two dry years with the result that the second dry year will be very short. The record shows that 531 kaf of surplus water was delivered in 1976, a year that delivered only about 30% of Table A entitlements. The following dry year, 1977, 323 kaf of surplus water was delivered while the project could only deliver about 15% of the Table A entitlements. Both of these years were well below average for runoff while the preceding year, 1975 was above normal. Clearly the project could have evened out the deliveries for the two years much better if it hadn't been misled by the erroneous index.

In my comments on the Draft EIR, I also analyzed how the projects should be prudently when each water year is treated independently. There I showed that until there was sufficient fall-winter runoff to indicate that the year would likely be average or better, that pumping should be curtailed. My analysis showed that that point wouldn't be reached until the end of January in most cases and could extend into February in a few cases. Because surplus water is declared available in the first three months of the calendar year, a reduction in pumping for any of these months would impact surplus water deliveries. The water index that is used by the project provides no such restriction.

The reverse case of a wet year following a dry year does not present an equivalent problem simply because project operations always respect the real time unfolding of the water year. Therefore, if the project operations begin in the fall with an index that is biased low, it soon becomes apparent in the actual runoff that conditions will be better than promised by the index. There is little risk that too little pumping will occur.

Problem 2: Perfect information in CALSIM II vs. Operations in the Face of Uncertainty

The next important flaw is with the use of the indices in the CALSIM II calculations. In CALSIM II a look-up table is created to store the water year type for use in the optimization calculations. The entries in this look-up table are single values for an entire year, including the unfolding water year. The indices are not modified in the course of the calculations. CALSIM II is structured to make water routing decisions based on the monthly runoff without knowing how the water year is unfolding except in the case of the indices which are used to set many important parameters in the calculation scheme. But the way the indices are used with respect to the parameters that depend on them is that they provide the advantage of knowing ahead of time the circumstances of the eventual water year. Thus, CALSIM II is armed with information that allows a calculation of the maximum amount of water that can be delivered from the Delta with near perfect knowledge, which must be contrasted with the operational decisions that actually unfold as the water year is experienced and is likely to result in decisions not to pump to avoid the risk that there will be insufficient water in the subsequent months. The difference is the amount that CALSIM II is in error, which can only be determined with a calibration.

Problem 3: Mischaracterization of the Central Valley Hydrology

Perhaps the worst flaw in the Draft EIR and the Reliability Report is the use of averages to describe impacts or outcomes. Most often in ordinary use the term "average" or "normal" connotes what is a most likely value, that which is expected more than any other value. These two terms are used extensively in both documents to depict impacts and outcomes. The problem is that if the "average" or "normal" is an unlikely event, is there any merit in presenting such values. An example will suffice to demonstrate the difficulty.

Say that the series of recorded annual runoff aggregates into two distinct sets, one set of years that we call "dry" which for argumentative purposes range between 5 and 15 MAF per year. The other set we shall call "wet" and they range between 20 and 38 MAF per year. Both sets have about the same number of years but of course they are randomly interspersed except for occasional drought sequences. The average of the entire record is about 18 MAF per year. Now from the way I constructed the two sets 18 MAF per year is an improbable event (actually it is more precisely an impossible event if my record is a precise recording of all the possibilities.) Recognizing this feature of the record we may ask is there any information disseminated by using the term "average," or as often is done "normal." The correct way to address the runoff record is to portray the data as two independent sets, a "dry" one with an average around 10 MAF per year and a "wet" one with an average around, say 25 MAF per year. It is entirely a different picture when one realizes that in any given year the runoff is either going to be 10 MAF +or – 5 MAF per year rather than 18 MAF or 25 MAF +13, -5 MAF.

The constructed runoff record above is fairly idealized but it is not far from the actual data for the Central Valley. According to the 8-river index the runoff indeed aggregates into two distinct sets, one with an average around 12 MAF and the other with an average around 25 MAF. (Please note that the 8-river index only captures about 80% of the total runoff when all the minor streams are accounted.) In the actual record the grand average seldom occurs. In other words, the so-called "normal" is not very normal and is certainly not a most likely event. Why is this important?

Misleading Results

In the reliability report the CALSIM II results over the entire record (93 years) are reported in a frequency diagram, which depicts how often the calculated delivery from the Delta is greater than a prescribed value. Remember delivery is driven by runoff. According to the reliability report the SWP can deliver 75% of Table A entitlement 50% of the time. This is a direct reading from the frequency diagram. However, if one looks at the likelihood of actually getting 75% +or -, it only occurs about 2 or 3 of 93 years. Hardly a likely result and certainly not what we mean when we refer to "normal."

The runoff record indicates that 56% of the time we can expect a runoff less than average and 44% of time it will be greater than average. The dry set (i.e. the 56% of runoff events) has an average runoff of about 12.5 MAF per year; the wet set about 25 MAF per year. The CALSIM II delivery record corresponding to the 93 runoff record used in driving CALSIM II mirrors the runoff record; slightly more than half the years

where delivery is constrained by the “dry” set runoff and slightly less than half the years where delivery is nearer the maximum due to above average runoff.

The problem occurs when the information calculated by CALSIM II is presented in the over simplified frequency diagram and read as probability of delivery. Even though almost half the years are calculated to deliver more than 75%, the actual likelihood of getting near 75% is very poor. When a local planner sees this information he is led to believe that he can rely on 75% most of the time. However, in reality more than half the time he will have to deal with deliveries much less than 75%. If he chooses the 75% level as the reliable delivery and allows new developments to hook up to water supplies on that basis there will be virtually no chance of avoiding a severe shortage in more than half the years. This is the epitome of “paper water.” The Reliability Report does report the calculated results for various drought sequences. For instance, it reports that for a six year drought, like the 1929-1934 and the 1987-1992 periods the average delivery will be somewhere around 37%. With this information the local planner can calculated his ability to compensate during a drought episode. If he has no other sources it will be difficult to promise any development a reliable supply greater than 75%. Even then he has to figure out how to balance the variations in delivery within the drought. For example, in the 1987-1992 drought only 15% was delivered in the worst year. The planner would have to have sufficient other sources to make up another 22% just to make the average for the drought. Because of the way the SWP is set up it is difficult for local planners to decide on a reliable level of delivery from the project. The overly simplified frequency diagram is almost totally useless for the type of analyses that a local planner should be doing.

Attachment 3

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January 14, 2008

Delores Brown, Chief
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(916) 651-9560

RE: Planning and Conservation League comments on the Draft Environmental Impact Report, *Monterey Amendment to the State Water Project Contracts (Including the Kern Water Bank Transfer) and Associated Actions as Part of a Settlement Agreement (Monterey Plus)*, SCH# 2003011118 ("Draft Monterey Plus EIR")

Dear Ms. Brown:

This letter is to provide comments on the Department of Water Resources' Draft Monterey Plus EIR (DEIR), a document whose preparation PCL has actively sought and anticipated for more than a decade. When finalized, this EIR will be used as the decision-making document framing a decision by DWR on the so-called Monterey Amendments. If such amendments to the contracts governing the operations of the State Water Project were adopted and implemented, they would result in a drastic contractual restructuring of the State Water Project, now 47 years old. Our comments here do not speak extensively to the legality (or not) of this proposed decision to modify provisions of the contracts governing operations of the State Water Project, which are based on and carry out directions specifically adopted by the voters of California. This letter focuses on the environmental review document, and its adequacy.

In the litigation that compelled DWR's preparation of this EIR, PCL sought to ensure that DWR—the only entity with the statewide duty to manage and administer the State Water Project[1]—would correct the profound errors of process and substance that fatally infected the

[1] DWR's State Water Project duties, as envisioned by Governor Pat Brown and approved by the voters of California, are codified in the Burns-Porter Act, Wat. Code, §§12930, *et seq.* They also formed the basis for the prototype State Water Project validated by the California Supreme Court in *Metropolitan Water District v. Marquardt* (1963) 59 Cal. 2d 159. No Court has yet addressed the validity of the Monterey Amendments, whose final status necessarily awaits DWR's decision-making.

Central Coast Water Authority's review and approval of the 1995 EIR supporting the Monterey Amendments. In *Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892 ("*PCL v. DWR*"), the Third District Court of Appeal unanimously vindicated PCL and its co-plaintiffs[2] on both grounds. Pointing to "the…contractors and the members of the public who were not invited to the table" in the negotiations that led to the Monterey Agreement, the Court held that "CEQA compels process…a meticulous process designed to ensure that the environment is protected." (83 Cal.App.4th at 905, 911.) Recognizing the "aura of unreality" surrounding discussions of the State Water Project, which has historically been unable to deliver even half the amounts referenced in Table A of the State Water Project contracts[3], the court found that CCWA's EIR "failed to meet the most important purpose of CEQA, to fully inform decision makers and the public of the environmental impacts of the choices before them." (*Id.* at pp. 913, 920.)

PCL entered into a 2003 Settlement Agreeement[4] with the expectation that DWR would counteract these historic errors and find "an effective way to cooperate" with the plaintiffs and other stakeholders in the preparation of an EIR fully complying with CEQA. DEIR, ex. D, and Exh. 3-A. Section III of the Settlement Agreement therefore confirmed, and elaborated on, DWR's EIR duties as previously recognized by the Court of Appeal. *Id.* at pp. 9-15.

The Settlement Agreement also made clear that the final outcome of the Monterey Amendments remains unwritten, so that DWR's new environmental review is not directed, even in part, at a *fait accompli.* While the Monterey Amendments are presently effective, they are effective only under an *interim* court order, made under Public Resources Code section 21168.9. The interim effectiveness of the Monterey Amendments will expire once DWR makes its new decision on all project components, recorded in new Notice of Determination, and files its return to the superior court's writ of mandate.[5] Once DWR completes an adequate environmental review, it is DWR's prerogative, and its duty as State Water Project manager, to render an entirely new final decision, and to choose which path to follow: the "Monterey Plus" project, the "no project" alternative, or one of the project alternatives reviewed in the EIR.

Since the Settlement Agreement went into effect (more than four years ago), PCL has participated in more than two dozen meetings of a Monterey Amendments EIR Committee, seeking to ensure that the EIR would produce a thorough and genuine CEQA analysis of the Monterey Plus actions. The EIR is the "heart and soul"[6] of both CEQA and the Settlement

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[2] The co-plaintiffs were Plumas County Flood Control and Water Conservation District, one of the 29 state water contractors, and the Citizens Planning Association of Santa Barbara County.

[3] See, e.g., DEIR, Appendix C (Long Term Water Supply Contract between DWR and Kern County Water Agency), § 6 and Table A.

[4] DEIR, Appendix D.

[5] DEIR, Appendix D, §§ II, V.F, VII.C; ex. 3-A.

[6] *PCL v. DWR,* 83 Cal. App. 4th at p. 911.

Agreement. Regrettably, DWR's Draft EIR falls far short of what CEQA requires from DWR. In short, the EIR is simply not adequate under CEQA. First, the DEIR does not adequately address specific concerns raised by the court in *PCL v. DWR*, including DWR's clear duty to analyze and disclose the consequences of implementing pre-Monterey article 18(b). That provision of the contract (which the Monterey Amendments would eliminate) requires DWR to reconcile contract amounts with the "humbler, leaner reality"[7] of deliverable supplies—prior to its elimination.

Second, the DEIR threatens a litany of potential new CEQA violations. To mention just several key problems:

- It improperly inserts key components of the Monterey Amendments into the project baseline, distorting the ability of the EIR to compare the project with the "no project" and project alternatives.
- It improperly uses an optimization model, CALSIM II, in a manner that effectively excludes the possibility of operating the project in a manner that would reduce rather than increase exports from the imperiled Bay-Delta Estuary, and fails to disclose project impacts to that estuary.
- It summarily rejects feasible alternatives and mitigation measures that would meaningfully address project objectives without requiring damaging and unlawful levels of new pumping.
- It fails to disclose the institutional and environmental consequences of transferring to local interests the ownership of a key part of the State Water Project—the Kern Water Bank, the world's largest underground storage facility—without any effective statewide accountability, and fails to study alternatives aimed at restoring that accountability.
- It evades, rather than engages, the "common-sense notion that land use decisions are appropriately predicated in some large part on the available water supply,"[8] thereby avoiding an analysis of the project's contributions to sprawl and environmentally destructive new growth.
- It avoids a required discussion of the project's creation of new "paper water" arising from a variety of sources, including the redefinition of article 21 "interruptible" water, administrative changes to the State Water Project, and overstatement of feasible deliveries in DWR's biennial Reliability Reports.[9]
- It fails to address the environmental consequences of the Monterey Amendments' financial restructuring of the State Water Project.

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[7] *Id.* at p. 914, n. 7.

[8] *PCL v. DWR*, 83 Cal. App. 4th at p. 915.

[9] PCL and its co-plaintiffs provided many of these comments to DWR in connection with its work on the Monterey EIR committee. Attachment A to these comments compiles some of these comments, which were not adequately addressed in the DEIR, or were simply ignored. These comment letters are therefore incorporated by reference in these comments, with the request that DWR specifically respond to them. We also incorporate comments made on behalf of PCL at public hearings.

• It recognizes the major problems that climate changes poses for the State Water Project generally, only to evade full assessment of project-related climate changes and defer the task to the very local decision-makers who will need to rely on DWR's programmatic assessment.

Finally, DWR must address these deficiencies at a critical juncture in California's water history, and make its final decision based on conditions as they exist in 2008, not 1995. The depth of the environmental crisis the State Water Project now faces deserves special emphasis. For the first time ever in 2007, the State Water Project's pumps were turned off temporarily to avoid an environmental catastrophe. Separate lawsuits have undercut DWR's ability to operate as in the past, without state permits and without federal biological opinions to justify continued pumping. Climate change, by the current estimations of DWR, could substantially cut project availability by mid-century. Moreover, California now faces the worst drought conditions it has experienced since the early 1990s.

These conditions underscore the crucial importance of delivering a Final EIR that fulfills, rather than avoids, the mandates of *PCL v. DWR* and the Settlement Agreement. In other settings, including Delta Vision, the California Water Plan, and recent reports and actions on climate change, California has commenced the difficult and necessary task of bringing to water policy a new era of realism that transcends the "build it and the water will follow" dictum of a previous generation.[10] Yet the DEIR seems conspicuously disconnected from the state's direction in other settings, to the point that "the plaintiffs" are chided for even suggesting alternatives that are sustainable and would not cause additional injury to the Delta.[11] To meet the hydrological, ecological and legal demands of our time, the Final EIR must rise to the occasion, rather than resorting to evasion.

Specific Comments

I. The DEIR evades key concerns raised by the Court in *PCL v. DWR*.

A. *PCL v. DWR* must serve as the starting point for DWR's EIR responsibilities.

As detailed below, the DEIR in key respects simply attempts to explain away, rather than directly address, the key holdings of the Court of Appeal in *PCL v. DWR.* The EIR must, as a starting point, analyze the substance of the court of appeal's decision in *PCL v. DWR* and ensure that its new project assessment is consistent with the Third District's analysis in that case. The key components of the ruling are as follows

• **Lead agency requirement**

[10] R. Kanouse, "Water Supply Planning and Smart Growth," in C. Davis, *et al.*, Navigating Rough Waters (American Water Works Association, 2001), p. 84. See also E. Rarick, CALIFORNIA RISING (2005), p. 213 (quoting Governor Pat Brown's statement that "I wanted to build a water project, and worry about the philosophy of land use later on").

[11] DEIR, pp. 11-6, 11-7.

Holding that CCWA erroneously acted as lead agency, the court ruled that CEQA required DWR, the only entity with the requisite "statewide perspective and expertise," to assume its proper role as lead agency in preparing a new EIR. (83 Cal. App. 4th at p. 907.) The Court noted the interconnected nature of the statewide project that the Monterey Amendments would transform: "[T]he allocation of water to one part of the state has potential implications for distribution throughout the system. DWR is painfully familiar with the problems plaguing the Delta and the possible impacts of the Delta Accord, an agreement between the federal and state governments on the Kern Fan Element." (*Id.)*[12]

- **"No project" alternative**

The court also held that the CCWA EIR was fatally defective under CEQA for failing to analyze implementation of pre-Monterey state water contract terms, and particularly the permanent shortage provisions of article 18(b), as part of the EIR's no-project alternative. Under the contracts that the Monterey Amendments would change , a permanent shortage occurs when the state is unable to reliably to deliver the full 4.23 million annual acre-feet (MAF) of previously-labeled "entitlements" listed in Table A of the project contracts. In that case, article 18(b) requires the state to make a proportional reduction of each contractor's amount listed in Table A, to match the available supply. The court held that an adequate EIR must analyze the impacts of eliminating these provisions.

- **"Paper water" problem**

The relationship between so-called "entitlements" and land-use planning was central to the court's holding that the EIR failed to address the "no project" alternative. The court connected this error to the risk of statewide land-use decisions made on the basis of "paper" water entitlements not grounded in real, deliverable water. The court openly criticized the false expectation that the State Water Project will deliver on its full "entitlement" level of 4.23 million acre-feet when the project's historic capability, evidenced in DWR's own data, has only been roughly half this level. The ruling therefore noted the "huge gap between what is promised and what can be delivered." (83 Cal.App.4th at 908.)[13]

- **Validation procedure**

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[12] As described in section V below, the Kern Fan Element is an approximately 20,000 acre-foot property on an alluvial fan, and the site of the Kern Water Bank, the world's largest groundwater storage facility. Article 52 of the Monterey Amendments call for DWR to relinquish control of the bank to the Kern Country Water Agency, which held the bank for only one day before retransferring it to a privately controlled joint powers agency, the Kern Water Bank Authority. Whether any statewide accountability will accompany the bank's operation is a key issue for DWR's new project decision.

[13] With respect to the "humbler, leaner reality" of project capability, the Court also noted the implicit assumption in the Monterey Amendments' financial restructuring of the State Water Project (article 51) that key facilities originally envisioned for the SWP will not be built. (*Id.* at 914.)

In addition to ruling for the plaintiffs on these CEQA claims, the court of appeal found that the plaintiffs had properly initiated a proceeding to question the substantive validity of the Monterey Amendments, including DWR's transfer of a 20,000-acre conservation and storage facility—the Kern Water Bank. . The court rejected a procedural challenge based on the theory that nonparty state water contractors were indispensable to the validation challenge. (83 Cal. App. 4th at pp. 920-926.)

- **Scope of the new EIR**

DWR must prepare an entirely new EIR as lead agency addressing the project as a whole. In *PCL v. DWR*, the Court of Appeal opined that it "need not hypothesize on the remaining issues" presented by the plaintiffs—such as the presence of a faulty project definition and the inadequate study of the Kern Water Bank's divestment—"because DWR, with its expertise on the statewide impacts of water transfers, may choose to address those issues in a *completely different and more comprehensive manner."* (83 Cal. App. 4th at p. 920 (emphasis added).)

B. Fundamental flaws in the DEIR undermine DWR's fulfillment of its lead agency duties recognized in *PCL v. DWR.*

As the court-directed lead agency with "principal responsibility " to carry out and approve the project (Pub. Res. Code, § 21067), DWR has an inherent responsibility to render a cohesive EIR that serves as the requisite environmental "alarm bell" in accordance with CEQA. The court recognized this obligation in *PCL v. DWR*, observing:

> The lead agency must independently participate, review, analyze and discuss the alternatives in good faith … Moreover, the agency's opinion on matters within its expertise is of particular value … As the process continues, "the lead agency may determine an environmentally superior alternative is more desirable or mitigation measures must be adopted … In sum, the lead agency plays a pivotal role in defining the scope of environmental review, lending its expertise in areas within its particular domain, and in ultimately recommending the most environmentally sound alternative.

(*PCL v. DWR*, 83 Cal. App. 4th at p. 904 (citing *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal. App. 3d 692, 736-737).)

As elucidated further below, the current DEIR is not written in a way that will allow DWR to fulfill its lead agency obligations as required under CEQA. The DEIR consistently masks impacts and confuses readers. The DEIR obscures project impacts by presenting no project alternatives that include components of the proposed project. It fails, in other words, adequately to distinguish the proposed project from continued current conditions. The DEIR also limits options for decision makers by failing to provide alternatives distinguishable from the proposed action. These flaws prevent a sufficient analysis of the impacts and implications of moving forward with the proposed project. By limiting the outcomes of the alternatives included in the DEIR, and thus constraining the range of potential management decisions, the DEIR

attempts to absolve DWR of its decisional responsibilities as a lead agency. Therefore, the DEIR prevents DWR from fulfilling the lead agency role as defined and anticipated by the court in *PCL v. DWR*.

C. The DEIR fails to analyze the No Project Alternative as directed in *PCL v. DWR* and the Settlement Agreement

1. *PCL v. DWR* and the Settlement Agreement establish clear standards for the assessment and review of the no project alternative.

CEQA requires that the no project alternative address "existing conditions" as well as "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." (14 Cal. Code Regs. §15126(e)(2).) That requirement compels DWR in its new EIR fully to study the consequences of enforcing the terms of pre-Monterey water supply contracts prior to eliminating them.

To overcome the prejudicial error noted in the appellate ruling, DWR must "fulfill its mandate" in the new EIR "to present a complete analysis of the environmental consequences" of enforcing the pre-Monterey permanent shortage provision, article 18(b). (*PCL v. DWR*, 83 Cal.App.4th at 915.) Article 18(b) is the single most controversial aspect of the Monterey Amendments; controversy over its enforcement was the "driving force" behind the Monterey negotiations. (*Id.* at p. 908.) While the original contracts for the State Water Project (SWP) estimated the delivery capacity of the fully constructed SWP to be 4.23 million acre-feet of water, the contracts also anticipated the likelihood that this estimate could be wrong or fail to eventuate. The original contracts prudently included a safety valve in article 18(b), which would allow contracts to be reconciled with the "humbler, leaner reality" of SWP capacity. (*Id.* at p. 914, n.7.) The court of appeal recognized the need for such a safety valve, observing the "huge gap" between SWP entitlements and existing supplies connecting that holding to the risk of planning decisions grounded in "paper" rather than real, deliverable water.[14]

Because the Monterey Amendments, if adopted, would eliminate article 18(b), it is incumbent on DWR to come to terms with its "paper water" problem before finalizing that change to the project contracts. (*Id.*)The EIR must directly evaluate reduced Table A allocations resulting from application of that article. As a useful starting point, DWR should carefully review and perform the analysis requested in public comments referenced in the Third District's opinion. (*Id.* at 908, 915.)[15]

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[14] "Paper water," the court observed, was "always an illusion," steeped in the "unfulfilled dreams" of a water culture that had fostered an inflated expectation of what could be delivered. (*PCL v. DWR* (2000) 83 Cal. App. 4th 892, 914 fn. 7.)

[15] As one comment accurately suggested, the EIR "must include a parametric analysis of alternative levels of a lowered project yield tested by use of DWR's simulation model to establish which level of yield provides for the maximum reliability of deliveries given some tolerable threshold for failure to meet requests (i.e., with what frequency will Article 18(a) be

Section III.C.2 of the Settlement Agreement provides further guidance. It provides that the new EIR shall include "[a]s part of the CEQA-mandated 'no-project' alternative analysis, an analysis of the effect of pre-Monterey Amendment SWP contracts, including implementation of article 18 therein. This analysis shall address, at a minimum, (a) the impacts that might result from application of the provisions of article 18(b) of the SWP Contracts, as such provision existed prior to the Monterey Amendments, and (b) the related water delivery effects that might follow from any other provisions of the SWP Contracts." As PCL informed DWR in its March 28, 2003 scoping comments, two of the "other" contract provisions inevitably related to this assessment are articles 18(a) and 21, which prior to Monterey required, respectively, that agricultural contractors endure the first cutbacks in water allocations in times of temporary shortage and receive the first allocations in times of surplus.

The environmental effects of proportional reductions in Table A amounts, as calculated in the no project assessment, must be directly compared to those of the proposed project. As the court of appeal made clear in *PCL v. DWR*, neither claims of "infeasibility" nor purported legal disagreements can serve as an excuse for avoiding comparison of the environmental consequences of the no project alternative and the project. (*PCL v. DWR*, 83 Cal.App.4th at 918.

2. A dispositive error undermines the integrity of the DEIR's "no project" assessment.

The DEIR recognizes that if pre-Monterey article 18(b) were enforced, Table A amounts would be reduced to less than half their original levels—1.9 million acre-feet— to reflect the firm yield of the SWP. However, the DEIR assumes that this reduction in Table A would not tangibly reduce actual water deliveries, because water not delivered under Table A would be delivered as "surplus" water under article 21 of the pre-Monterey SWP contracts. In numerous passages, the DEIR offers variations on this same basic premise.[16]

This premise, the key to the DEIR's refusal to take article 18(b) reductions seriously, is startlingly close to reasoning in CCWA's decertified 1995 EIR that the Court of Appeal expressly rejected. CCWA's EIR posited that "[i]f Table A entitlements were adjusted, less entitlement water would be delivered and *more surplus water would be delivered pursuant to*

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invoked and with what consequences). All this can be accomplished without modification of the existing contracts." (83 Cal. App. 4th at 908.)

[16] See, e.g., DEIR, p. 2-16 (implementing article 18(b) "would not … have altered the amount of water that the Department delivered to the contractors in the many years when more than the minimum SWP yield was available in the SWP system. Instead, such water would have been delivered to contractors under Article 21"); p. 4-5 (with the elimination of article 18(a)'s agriculture-first shortage provision, "it no longer mattered whether a shortage was a temporary one or a permanent one, since the allocation of available supply would be the same in either situation"); p. 6-54 ("the altered allocation procedures provided for by Articles 18 and 21 result primarily in a shift in deliveries from one contractor to another and do not affect total deliveries").

Article 21. The total amount of water would be *essentially unchanged.*" (*PCL v. DWR*, 83 Cal. App. 4th at p. 929 (emphasis added).) The court specifically addressed this assumption, stating:

> This response does little more than acknowledge the paper commitment to build SWP facilities and the obvious fact that the hopes and dreams upon which the entitlements are based do not create a greater annual supply of water. None of the commenters suggested that implementation of article 18, subdivision (b), altered the contractual and political commitment to complete the SWP. They did, however, suggest that the elimination of paper water would impact land planning decisions that might reduce the need for as many SWP facilities. Under that scenario, article 18, subdivision (d), might not be invoked nor would surplus water under article 21 be tapped and exhausted.

(*PCL v. DWR*, 83 Cal. App. 4 h at p. 919.)

For multiple reasons, this premise in the DEIR is as baseless now as it was when the failure of DWR to address this key issue resulted in the judicial decertification of the 1995 EIR. First, the DEIR simply assumes as a foregone conclusion something that was very much in doubt. In 1994, prior to the initial enactment of the Monterey Amendments, the California Research Bureau (CRB) prepared a paper analyzing twenty options for changing the State Water Project's repayment system, one of which (Option 5) called for the implementation of pre-Monterey article 18(b) (CRB Report).[17] The report found that "[t]here is no guarantee" that implementing article 18(b) "would 'create' any surplus water. If the DWR implemented Article 18(b), they might also change how it operates the SWP reservoirs. They might decide, for example, not to distribute 'surplus' water and instead decide to store the water for distribution as entitlement water in another year."[18]

Second, the analysis incorrectly assumes that demand for SWP water in the Monterey and non-Monterey scenarios would be the same. That assumption is untenable, because The Monterey Amendments, if adopted, would fundamentally change the definition of Article 21 water. In particular, those amendments delete the pre-Monterey proviso in article 21(g)(1) that "the State shall refuse to deliver such surplus water to any contractor" to the extent that "the State determines that such delivery would tend to encourage the development of an economy within the area served by a contractor which would be dependent upon the sustained delivery which would be dependent upon the sustained delivery of water in excess of the contractor's maximum entitlement."[19]

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[17] Dennis O'Connor, FINANCING THE STATE WATER PROJECT: OPTIONS FOR CHANGE (CRB, August 1994). This CRB Report is included as Attachment B to these comments.

[18] Attachment B (CRB Report), p. 21.

[19] See DEIR, p. 2-17; DEIR, Appendix C (Amendment No. 1 to Kern Contract, p. 9). Metropolitan Water District's pre-Monterey contract included this language in Article 21(g)(1). The Monterey Amendments delete this language. DEIR, Appendix C (Amendment No. 23 to Kern contract, p. 13).

Third, other Monterey Amendments-related managerial changes also could profoundly affect the demand for article 21water. These include the removal of limitations on access to storage facilities, and the creation of a "turnback pool," which allows the contractors to sell their unused Table A amounts, acting as though the water resources of the state, which belong to the public, are actually the private property of the contractors. In short, the Monterey Amendments clearly removed constraints that would have limited demand for SWP water and capacity to accept SWP water. Yet the DEIR, recycling reasoning that discredited the 1995 EIR, assumes that these contract provisions are meaningless and have no bearing on demand or capacity to receive water.

Fourth, the DEIR fails to recognize that perceived and explicit disclosure of water reliability can impact demand for SWP water and the use of that water. The shortage provisions (article 18 (a) and 18 (b)) of the pre-Monterey SWP contracts recognized that the reliability of water fluctuates. The contracts also reflected the reality that the level of reliability necessary for certain uses also fluctuates. The pre-Monterey contracts attempted to reconcile water reliability and water allocation with article 18 (a) and 18 (b). The pre-Monterey SWP contracts recognized that water availability would fluctuate according to hydrology, area of origin demand, and environmental needs. Therefore, only a limited amount of water could be reliably delivered during drought and other shortages. The original contract provision of article 18(a) reflected that municipal contractors require a higher reliability of water than agricultural contractors. Thus, article 18(a) provided that level of reliability by providing municipal contractors a preference for water in drought and short term shortage.

In short, the existing (pre-Monterey) contracts recognized that article 21 water, the least reliable category of water under the contract, is unsuitable for use as a prolonged source of supply. Municipal contractors could not depend on sources of unreliable water in the same manner that they depend and use reliable sources, because doing so would put people, businesses and the environment at significant risk. Indeed, the risk that municipal contractors may inappropriately approve permanent development based on unreliable water is the essence of "paper water."[20] Like the invocation of article 18(b), article 21(g)(1)'s prohibition against founding permanent economies on vulnerable "surplus" water provided a powerful "safety valve" against paper water-based development. It provided decision-makers with a clear understanding that deliveries beyond the SWP's minimum yield are unreliable. In such a case, municipal water agencies would be legally and contractually restricted from relying on water in excess of the estimated minimum yield of water for development, as well as for prolonged supplies. By contrast, the Monterey Amendments—provisionally under the present implementation, and permanently under the proposed project—would remove these safeguards.

Yet the DEIR fails to analyze the impacts of these realities. Instead, the DEIR assumes that all water provided by the SWP, either Table A, article 21 or otherwise would be used in the same manner and would procure equal demand regardless of the explicit disclosure of reliability

[20] "Paper water always was an illusion. "Entitlements" is a misnomer, for contractors surely cannot be entitled to water nature refuses to provide or the body politic refuses to harvest, store and deliver." (*PCL v. DWR* (2000) 83 Cal. App. 4th at p. 914, n. 7.)

by the state. The DEIR is thereby assuming that SWP contractors are able to utilize very unreliable water[21] in the same way they demand very reliable water. This assumption is not supported by analysis and is not supported by law. In short, the current DEIR attempts to recycle the same skewed logic that led to the 1995 EIR's specious dismissal of the "paper water" problem.[22]

II. The DEIR fails to provide an accurate, stable and finite definition of the proposed project.

A. CEQA demands an accurate, stable and finite project definition that addresses the "whole of the action" under review.

Leading CEQA decisions have long since recognized that "an accurate, stable and finite project definition is the *sine qua non* of an informative and legally sufficient EIR." (*County of Inyo v. City of Los Angeles (III)* (1977) 71 Cal.App.3d 185, 199.) The CEQA process cannot "freeze the ultimate proposal in the precise mold of the initial project; indeed, new and unforeseen insights might emerge during the investigation, evoking revision of the original proposal." (*Id.*)

Precision and consistency in a lead agency's characterization of the project under review also reinforces related principles of CEQA: that the project must embrace the "whole of the action" (14 Cal. Code Regs., § 15378(a)); and that assessments in an EIR may not be used to justify a decision already made. In sum, CEQA "compels an interactive process of assessment of environmental impacts and responsive modification which must be genuine." (*County of Inyo v. City of Los Angeles* (*VI*) (1984) 160 Cal.App.3d 1178, 1185.)

B. The DEIR substantially understates the scope of the Monterey Amendments' proposed restructuring of the State Water project, and does not explain the source of authority for that proposed restructuring.

The description of the proposed project provides a very abbreviated summary of the changes in the SWP that would accompany the permanent adoption and implementation of the Monterey Amendments – in other words, those changes that would become permanent if the project were approved. Adopting what might be termed a "greatest hits" format, the analysis is limited to five bullet points, a few clarifying paragraphs, and a title line for all the remaining parts of these complex amendments. DEIR, §§ 4.3-4.4, pp. 4-2 to 4.8. Similarly, the background paper on the SWP is limited to a brief description of several articles, divorced from their legal and institutional context. DEIR, Ch. 2, pp. 2-1 to 2-19.

[21] See, e.g., DWR, 2005 RELIABILITY REPORT, p. 15 (article 21 water is "highly unpredictable and unreliable").

[22] *PCL v. DWR*, 83 Cal. App. 4th at p. 914.

These cursory discussions fail to illuminate critical aspects of the SWP that relate to the project's essential mission and statewide environmental accountability, and how this system would be fundamentally changed if the Monterey Amendments become permanent. In the deliberations that framed the SWP, the Governor, DWR, and the Legislature created a water project to enable the state to more evenly to distribute scarce water supplies, which the state controlled as a common good. To develop that resource, DWR and the Governor's office developed--and the Legislature and people approved--a system unique in the country. Unlike the federal Central Valley Water Project, where the federal government paid all project costs, the SWP focused upon water as a public good that belonged to the people.[23]

Authorization of the SWP therefore was premised on an understanding that the voters of California would therefore decide on whether they agreed to the distribution of water in the SWP. If they agreed to that redistribution, the voters would agree to back an issuance of bonds to construct the project with the provisos that (1) agencies contracting for the water would pay back the costs of constructing the project solely for the *right* to have water delivered to them through the project's facilities; and (2) although agencies would repay the costs of constructing the project, the facilities and the water would continue to belong to the State, as a *public* resource.[24]

The project framers also anticipated that the state water project would operate based upon long-term water service contracts that would remain in effect until the retirement of all water resources development bonds no sooner than 2035. These contracts would be unique, in that they were based upon: (1) DWR's inherent responsibility to manage the state's water resources fairly and equitably; (2) the principle that all contractors were to be treated equally; (3) the provision that any agency or district in California could contract with the department for water service; and (4) a trusteeship requiring the project to be constructed and managed for the good of the people of California.[25]

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[23] See P.A. Towner, *Brief History of the Negotiation of Water Supply Contracts for the State Water Project*, presented to the California Water Commission (Dec. 3, 1976).

[24] *Ibid.*

[25] The objective of the state water project to operate for the good of the people of California became part of the Bond Act. Once the Act was passed, it was incorporated into the Water Code (Wat. Code, §12930, *et seq.*) Governor Brown signed the prototype long-term water service contract with Metropolitan Water District just before the 1960 election. (Rarick, *supra*, at p. 221.) To further ensure that the people of California would not be responsible for repaying the bonds used to construct the facilities, DWR required agencies with which it contracted to have taxing authority, so that if the agency could not meet its payments to DWR, it would be required to tax residents to make these payments. (Wat. Code, §12937.) Conversely, if the SWP were "sold" into private ownership, it would potentially threaten the tax-exempt status of the project's general obligation bonds. Attachment B (CRB Report), p. 51.

To develop and secure approval of the state water project, DWR and the Governor first prepared a "statement of principles" for the long-term water service contractors.[26] These principles are derived from the "utility theory," which Governor Brown described to the Legislature as recognizing "our obligation to insure that water will be available to meet the proper demands of every part of the State."[27] These principles were the ones used to promote the project to California voters, and those principles reflected project sponsors' understanding that voters would not vote for project financing to support water facilities they did not own or control. Moreover, those principles specified that DWR would be acting as an agent and trustee of the people to manage water resources for the good of all Californians. After preparing these principles, the framers prepared and secured voter approval of the Burns-Porter Act.[28]

The SWP thus was premised on a fundamental *quid pro quo*: its contractors would benefit from project operation, but the public always would control the project itself, and the project's works truly were to be part of a "state" water project, which would be publicly owned and operated for public benefit. After securing passage of the Bond Act, DWR and the Governor determined the redistribution patterns of water throughout California based on estimated need and secured the water rights for those areas in the amount of estimated need until 2035, the end of the project repayment period. They also negotiated with agencies throughout California for water service contracts. The amount of water these agencies could expect to receive over the life of the project was subject to limitations, including limitations from water rights permits, climatological and environmental conditions. The contracts were to extend until 2035. The Department could not predict all conditions affecting water conditions until 2035. Consequently, state water service contracts were written so that DWR could not be held responsible for water it could not deliver provided that it made reasonable attempts to do so.[29]

On their face, key features of the Monterey Amendments, if made permanent, would differ sharply from the central tenets of the SWP contracts as originally framed, approved, and validated by the voters, shifting a substantial degree of control from SWP to the contractors. To name several examples:

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[26] Cal. State Senate Fact Finding Committee on Water Resources, Partial Report, *Contracts, Financing, Cost Allocations for State Water Development* (March 1960), pp. 51-52.

[27] E.G. Brown, Water Message to Legislature, Cal. Sen. J., Vol. 1 (1959) 222, 224-225. The Governor's principles constituted a "contemporary administrative directive, which was known to the voters at the time of the election," and were also accepted by the Legislature. (*Goodman v. County of Riverside*, (1983) 140 Cal. App. 3d 900, 907-908.)

[28] Wat. Code, § 12930, *et seq.*

[29] Under the state water project, contractors "are obligated to pay for their contractual entitlements of water" from the project, "*whether the water is delivered or not.*" (*PCL v. DWR*, 83 Cal. App. 4th at p. 899.)

- Major changes in article 18 would remove the temporary shortage provision requiring "agriculture first" cutbacks (article 18(a)) and the permanent shortage provision requiring Table A amounts to be reconciled with available supplies.
- Article 51 transforms the financial structure of the SWP, allowing the contractors "a rebate for the costs previously assessed for facilities that have never been built."[30]
- Article 52 facilitates the transfer of the Kern Water Bank property to local control, in exchange for the "retirement" of 45,000 acre-feet of Table A amount that two agricultural contractors-- Kern County Water Agency and Dudley Ridge Water District—had no assurance or reasonable expectation of ever receiving in deliverable water.
- Article 53 authorizes the transfer of 130,000 acre-feet in new agriculture-to-urban transfers, eases requirements for other transfers, and allows the transportation of water in state facilities to other contractors, or entities other than non-contractors.
- Article 54 provides for local control and management of the two terminal reservoirs.
- Article 55 allows contractors to transport non-project water in SWP facilities at the lower costs referenced in the SWP contracts.
- Article 56 allows contractors to sell water outside their service areas.

Collectively, these changes far exceed any other changes in the project's history. At present, the Monterey Amendments are proceeding under the authority of the Sacramento Superior Court's interim order under Public Resources Code section 21168.9.[31] But the DEIR never identifies the source of authority to make the amendments permanent. DWR should address these changes in light of Water Code section 12397(b)(4), the source of DWR's contracting authority, which provides that "[s]uch contracts shall not be impaired by subsequent acts of the Legislature during the time when any of the bonds authorized herein are outstanding and the state may be sued with respect to said contracts." DWR should indicate the source authority, if any, for the project as proposed to become permanent without the approval of the Legislature, or of the voters of California.

This issue of authority cannot be marginalized as a mere "legal" issue divorced from the environmental consequences of the project. Rather, on a host of environmental issues discussed in these comments, a foundational question is for whose benefit the project exists, the people of California or the State Water Contractors. The answer to this question may have profound consequences for the environment, particularly in times of water scarcity. DWR's clarification of its source of authority may therefore help illuminate whether its approach to managing the SWP can proceed consistently consistent with its duties as CEQA lead agency.[32]

C. The DEIR does not adequately clarify the "uses of the EIR."

[30] *PCL v. DWR*, 83 Cal. App. 4th at p. 914, n.7.

[31] Settlement Agreement, Appendix 3-A.

[32] *PCL v. DWR*, 83 cal. App. 4th at 903-907.

When finalized, the EIR will be used primarily by DWR, as lead agency, to decide whether to approve, modify, or disapprove the components of the proposed project: the Monterey Amendments and the further actions described in the Settlement Agreement. The DEIR summarizes the proposed project in Chapter 4, which also briefly describes the Monterey Amendments and the Settlement Agreement. As required by the writ of mandate issued by the Superior Court to implement the decision of the Court of Appeal in *PCL v. DWR*, "upon completion and certification of the new EIR, Respondent DWR shall make written findings and decisions and file a Notice of Determination identifying the components of the project analyzed in the EIR, all in the manner prescribed by sections 15091-15094 of the CEQA guidelines."[33]

Despite some helpful language, the DEIR's section of the "intended uses of this EIR (DEIR, § 1.2) contains one phrase that is ambiguous. It indicates that DWR as lead agency, and the State Water Contractors as responsible agencies, will use the EIR to "decide whether to *continue* operating under the proposed project: the Monterey Amendment and the Settlement Agreement, as described in Chapter 4, or to decide to implement one of the alternatives to the proposed project." (*Id.* at p. 1-1 (emphasis added).

The Monterey Amendments are presently proceeding only under an interim order that will expire following DWR's new Notice of Determination and return to the writ. The use of the word "continue" should not suggest that the default condition will be to make that interim operation permanent, or that DWR's approval decision on the "Monterey" part of the Monterey Plus project can be relegated to the past tense.

Instead, DWR must determine, based on its assessment of project impacts, alternatives, and mitigation measures, whether to (a) approve and execute the Monterey Amendments as initially proposed in 1994 and approved and executed in 1995; (b) approve and execute the Monterey Amendments and the further actions described in the Settlement Agreement; (c) approve and execute the Monterey Amendments as further modified in response in response to the analysis in and public comment on the present EIR; (d) approve and execute an alternative to the Monterey Amendments; or (e) approve no project at all. The EIR will also be used to determine whether or not to authorize the permanent transfer of the Kern Fan Element, and to proceed with the 41,000 acre-foot Kern/ Castaic transfer as part of the final project.

The Superior Court's writ of mandate requires DWR's *de novo* determinations and actions, because at present no project elements have been approved, except for the Superior Court's interim order under Public Resources Code section 21168.9. The exercise of that discretionary power cannot vitiate the fundamental CEQA duties of lead and responsible agencies to precede their final project decisions by the completion and certification of a valid EIR. The EIR will thus be used to DWR to meet these requirements of law and proceed once the section 21168.9 order ceases to be in effect.

PCL requests that the EIR specifically address each of the following questions, which it raised more than a year ago in a letter to the DWR Director:

[33] Settlement Agreement, Appendix 3-A.

1. Once DWR has completed and certified its EIR, will DWR make a new decision on all components of the project, recorded in a new notice of determination?

2. If DWR makes a new project decision, will that decision determine whether or not DWR will approve and execute the Monterey Amendments?

3. If DWR makes a new project decision to approve a project that includes the Monterey Amendments:

    a. Will the decision consider a no project alternative that includes no actions taken under the Monterey Amendments?
    b. Will the decision determine whether or not to adopt alternatives to the Monterey Amendments?
    c. Will the decision determine whether or not to adopt mitigation measures for any significant impacts of the Monterey Amendments?
    d. Will the decision determine whether to authorize the permanent transfer of the Kern Fan Element?
    e. Will the decision determine whether or not DWR approves of water deliveries under the 41,000 acre-foot Kern/Castaic transfer?[34]

III. The DEIR's "aura of unreality"[35] undermines its ability to meaningfully address the distinct environmental consequences of the project.

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[34] The 1999 contracts framing this agriculture-to-urban transfer were not the subject of a validation challenge. However, those transfer contracts were expressly based upon the Monterey Amendments, whose final authorization remains unknown, and DWR has never approved the transfer outside of the Monterey Amendments, which would subject it to the pre-Monterey agricultural deficiency provisions of article 18(a) and undermine its reliability to support urban uses. (See Attachment C (2002 letter of Castaic's counsel).) The Los Angeles Superior Court decertified Castaic's stand-alone 2004 EIR in May 2007 (*Planning and Conservation League v. Department of Water Resources* (LASC No. BS 098724.) While Los Angeles Superior Court Judge James Chalfant characterized the *1999* transfer contracts as "final," he recognized that DWR could still take actions that could "undermine" the ability of the transfer to deliver water. *Id.* at p. 13. He also relied partially on representations of DWR's counsel that DWR had the discretion to take steps that might curtail deliveries under the transfer. *Id.* at p.20 All parties except for DWR have appealed that decision, and it is pending in the Second District Court of Appeal. In addition to fully studying the Monterey-associated impacts of this sprawl-supportive transfer and appropriate mitigation, the EIR should fully consider PCL's proposed alternative that would consider alternative dispositions of its water. In a time of statewide water shortage, the need for DWR's careful evaluation is particularly acute.

[35] *PCL v. DWR*, 83 Cal. App. 4th at p. 912.

A. The DEIR analysis is predicated upon a defective environmental baseline.

Without the development of an adequate baseline condition, "analysis of impacts, mitigation measures and project alternatives becomes impossible." (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal. App. 4th 931, 953.)[36] The baseline for these assessments must be based on an analysis of "real conditions on the ground," rather than mere opinion or narrative. (*Save Our Peninsula Committee v. Monterey County Board of Supervisors* (2001) 87 Cal.App. 4th 99, 121.)

The DEIR accurately notes that that the baseline for assessment here is "complicated" by the implementation of the Monterey Amendments before 2003, when DWR issued its Notice of Preparation.[37] Nonetheless, a series of glaring errors undermine the baseline's integrity to serve as the basis for assessing the project's environmental impacts.

First, the DEIR states that the baseline has been "*adjusted to include events that are expected to occur over time"* that it assumes are "not related to the Monterey Amendment and the Settlement Agreement."[38] That "adjustment" constitutes an error of law under CEQA. It is the "no project" alternative, rather than the baseline, that, in addition to existing conditions, must account for "what would be reasonably expected to occur in the foreseeable future if the project were not approved, based upon current plans and consistent with available infrastructure and community services." CEQA Guidelines, § 15126.6(e)(2). But the "no project" alternative is "not the baseline for determining whether the project's proposed impacts may be significant, unless it is identical to the existing environmental setting analysis which does establish that baseline." *Id.*at 15126.6(e)(1). Here, where the "no project" analysis is much more complex, and by no means "identical" to the environmental setting, there is no basis for making these forecasting adjustments to the baseline, and the resulting mistake fatally infects the comparison between the baseline and impact assessment.

Second, the baseline does not accurately reflect pre-Monterey contract provisions that set limitations for contractors, and thus does not accurately reflect constrained demands or capacity

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[36] See also CEQA Guidelines, § 15125(a) (the environmental setting will "normally constitute baseline physical conditions by which a lead agency determines whether an impact is significant"); DEIR, p. 5-1.

[37] The DEIR inaccurately lists the Monterey Amendments' implementation date as 1995. DEIR, p. 5-2.

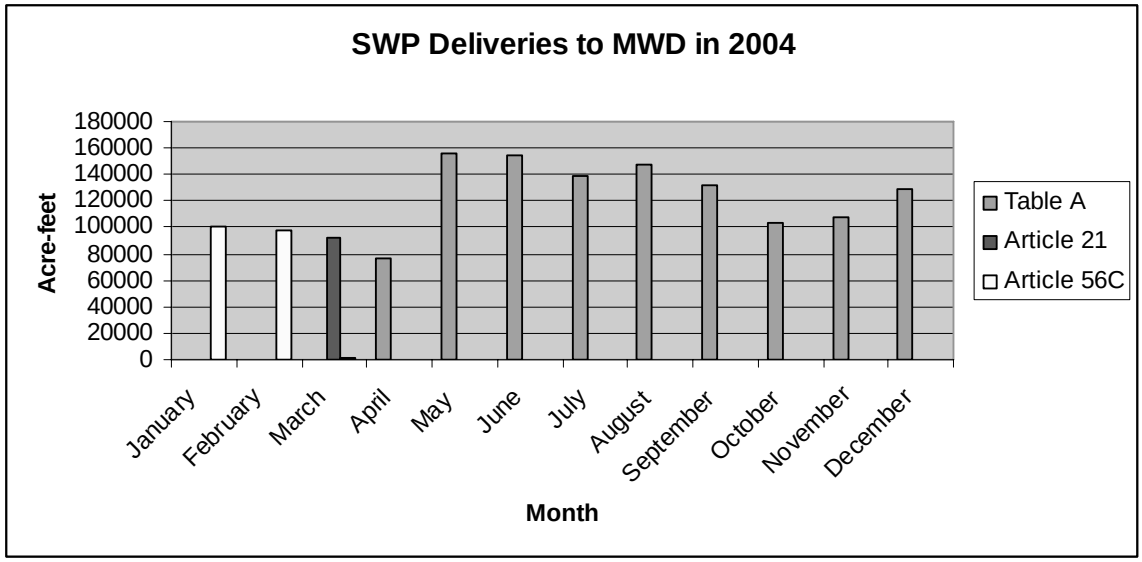
[38] DEIR, p. 5-2 (emphasis added); see also DEIR, p. 3 (postulating that "other changes and transfers" alleged to be "unrelated" to the Monterey Amendment, have occurred or are anticipated to occur by 2020). Although DWR attempts to project baseline and project conditions through 2020, the project involves changes to SWP project contracts that will remain effective until 2035. DWR's impact assessment does not demonstrate why it fails to make reasonable attempts to take account of the additional 15 years of project impacts.

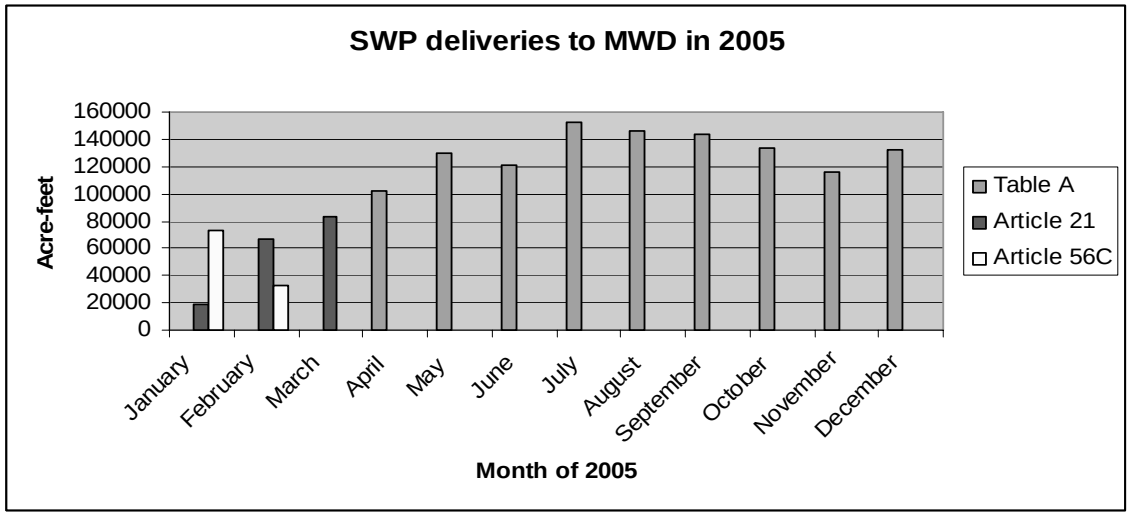
to accept SWP water under pre-Monterey contracts. These provisions, changed under Monterey as noted above, include the following:

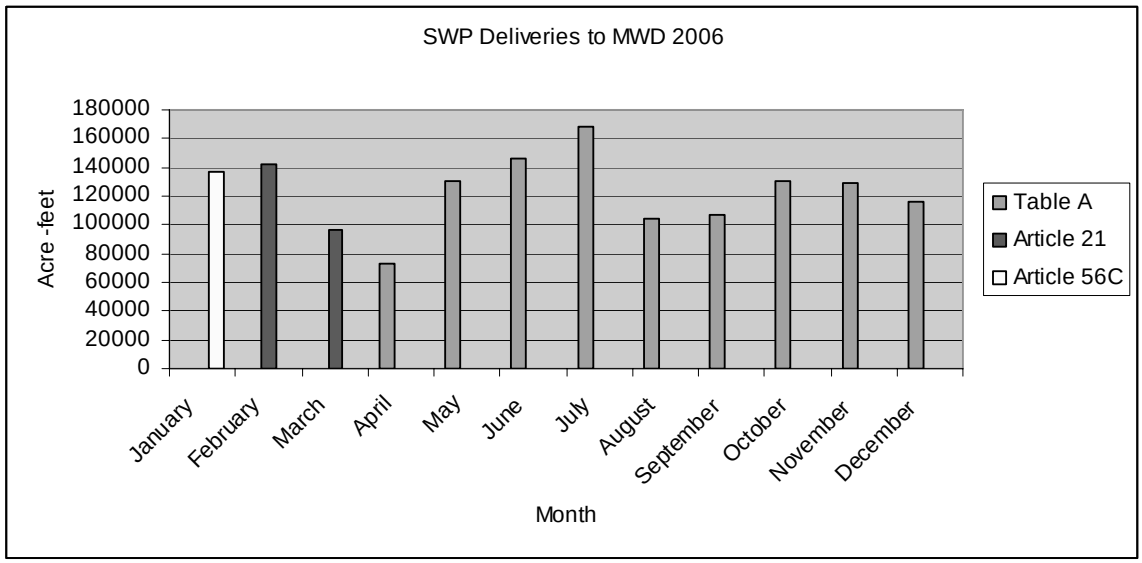
• The pre-Monterey contracts precluded SWP contractors from storing water outside of their own service areas. This provision limited contactors' capacity to accept SWP water to the real-time customer demands plus the amount of water that could be stored in facilities within the contractors' service areas. Eliminating this provision in the Monterey Amendments significantly expanded storage options available to contractors, and thereby enhanced contractors' capacity to take water. Yet the DEIR assumes that the baseline water demand is the same as demands when such limitations are not applied to contractors (as in the proposed project).

• The baseline also does not reflect how Article 21(g) (1) of the pre-Monterey contracts precluded the use and therefore demands for Article 21 water. As noted above, Article 21 (g) (1) prevents the state from delivering "surplus" water where it determines that it would contractor to the extent that the State determines that such delivery would tend to "encourage the development of an economy within the area served by sustained delivery of surplus water." This article established a specific limiting provision for delivery of Article 21 water, and the baseline should assume that DWR would implement it and withhold delivery of water where appropriate. By contrast, the Monterey Amendments have been in effect on an interim basis without that limitation. Several contractors now have economies that are dependent on continued delivery of Article 21 water. According to tables provided by DWR for water years 2004 and 2005, some urban contractors now take Article 21 and carry-over water in the winter months while taking little or no Table A supplies and take Table A supplies later in the year (see tables below). This indicates that some contractors are using Article 21 supplies to sustain the hard demands of their service area in winter months.[39]

[39] In fact, review of the historic deliveries of article 21 water demonstrates that municipal demands for Article 21 water supplies have *increased* since implementation of the Monterey project. Such use would have been prohibited under the pre-Monterey contracts. This increased demand for article 21 water should not be included in the baseline. The EIR should further analyze whether proposed contract amendments have indeed resulted in hardened demand for article 21 water, and corresponding shifts in delivery, demand, and request patterns for Table A supplies.


SWP Deliveries to MWD in 2004
Acre-feet
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
Table A
Article 21
Article 56C


SWP deliveries to MWD in 2005
Acre-feet
160000
140000
120000
100000
80000
60000
40000
20000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month of 2005
Table A
Article 21
Article 56C


SWP Deliveries to MWD 2006
Acre -feet
180000
160000
140000
120000
100000
80000
60000
40000
20000
0
January
February
March
April
May
June
July
August
September
October
November
December
Month
Table A
Article 21
Article 56C

Source data provided electronically to Mindy McIntyre by DWR staff in 2007

Third, the baseline inappropriately excludes an accurate analysis of allowable operations under the current regulatory setting. The baseline does not include operational constraints of the federal Endangered Species Act (FESA) and the California Endangered Species Act (CESA). As detailed further in section III.B, *infra*, recent state and federal court rulings have determined that SWP operations as modeled in the DEIR do not comply with either CESA or FESA, and are therefore illegal.[40]

Fourth, the DEIR fails to recognize climate change in the baseline (and in the analysis of alternatives). The DEIR incorrectly states that too little is known about climate change to warrant incorporation of findings into the baseline and alternative. Rather, the DEIR provides a cursory discussion of climate change in a separate section of the EIR[41]. This assertion is contradicted by numerous studies and findings, including research published by DWR well before the release of the DEIR.

DWR has prepared and released significant information on climate change impacts to the SWP system and to California water resources. The Department's own "Progress on Incorporating Climate Change into Water Management," outlines several feasible scenarios for climate change. CEQA does not require definitive information prior to incorporation into analysis. Indeed, as noted by the Intergovernmental Panel on Climate Change, it is very unlikely that future California hydrology will be the same as past hydrology:

> The IPCC (2001) ranked the confidence limits of major impacts to water resources due to observed and projected climate change as very high (0.95-1.00), high (0.67-0.95), medium (0.33-0.67), low (0.05-0.33), and very low (0.00-0.05). There is high confidence that the timing and amount of runoff is changing, and very high confidence that watersheds with substantial snowpack will experience major changes as temperature continues to rise. The impacts of this trend are a decrease in available water resources in California, primarily during the summer months, and a potential increase in wintertime floods. There is high confidence that California's Sierra Nevada will experience a continued trend of decreased snow accumulation

[40] See, e.g., *Natural Resources Defense Council v. Kempthorne* (E.D. Cal. 2007), 2007 U.S. Dist. LEXIS 42263 (existing and planned future operations in the Central Valley Project and State Water Project may jeopardize the Delta Smelt, creating ESA compliance problems. While the baseline excludes compliance with these state and federal endangered species laws, the DEIR simultaneously relies on the FESA process to mitigate for many of the significant impacts of the proposed project. However, the DEIR provides no analysis to demonstrate that the FESA process is capable of mitigating these impacts.

[41] See DEIR, Ch. 12, addressed in section of these comments, *infra.*

and earlier snowmelt (e.g. Lettenmaier and Gan 1990; Jeton et al. 1996; Miller et al. 1999; Wilby and Dettinger 2000; Knowles and Cayan 2002; Miller et al. 2003).[42]

In fact, and as discussed fiurther below, widely available data demonstrate that climate change is already occurring in California, with trends of declining snowpack and earlier annual peak runoff.[43] Numerous studies, listed in attachment D to these comments, address climate change and its effects on water resources in California are available. Despite this overwhelming body of evidence of current and future climate change, the DEIR ignores climate change in the baseline and in all alternatives. Instead, the baseline and all alternatives are based on past hydrology.

In sum, the DEIR's baseline fails to provide an accurate basis for comparison of environmental impacts associated with the proposed project or other alternatives. The baseline must be adjusted to reflect the pre-Monterey SWP contracts, pre-Monterey SWP operations and the impacts of climate change. Without such adjustments, the baseline is an inadequate reference from which to determine the impacts of the proposed project and project alternatives.

B. The DEIR fails to reflect the current regulatory framework, and in particular the impact of the Delta Smelt/OCAP decision on the delivery reliability of the SWP.

DWR's final decision on the "Monterey Plus" must reflect and address SWP and environmental conditions as they exist now, rather than freezing them in 1995 or 2003. The recent ruling invalidating the biological opinion for the Delta Smelt is one of the most significant current environmental constraints for the SWP. Yet the DEIR fails to incorporate the impact of this decision in alternatives analysis or recognize this significant decision in Section 6.3 (Changes in SWP Operations Since 1995 Unrelated to the Proposed Project). The federal court's

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[42] *California Climate Change, Hydrologic Response, and Flood Forecasting* , Norman L. Miller Earth Sciences Division, Berkeley National Laboratory, Berkeley, California, USA . Presented at the International Expert Meeting on Urban Flood Management 20-21 November 2003, World Trade Center Rotterdam, The Netherlands April 30, 2004. http://www.lbl.gov/Science-Articles/Archive/assets/images/2004/Apr-30/California_Flooding.pdf

[43] *Potential effects of global warming on the Sacramento/San Joaquin watershed and the San Francisco estuary*. Noah Knowles and Daniel R. Cayan, Geophysical Research Letters, VOL. 29, NO. 18, 1891, doi:10.1029/2001GL014339, 2002, http://natypete.andradedowns.googlepages.com/knowles2002.pdf; No. 119. Effects On Water Resources: Monitoring Snowmelt Runoff And Sea Level for Climate Change, Maurice Roos, California Department of Water Resources, presented at the U.S. Climate Change Science Program (CCSP) workshop on November 14-16, 2005, in Arlington, Virginia http://www.climatescience.gov/workshop2005/posters/P-WE2.8_Roos.pdf

summary judgment decision was issued on May 25, 2007, many months before the DEIR and the final ruling has now been issued.[44]

DWR has publicly recognized the impact of the Delta Smelt ruling outside of the DEIR. DWR's Chief of Project Operations Planning Branch, John Leahigh, stated that under the interim remedy actions proposed by the United States Fish and Wildlife Service (USFWS), SWP 2008 deliveries would be reduced anywhere between 8% (91,000 AF) to 27% (305,000 AF) from a baseline delivery of 1.15 MAFY in a dry year; and from between 8% (252,000 AF) and 31% (305,000) from a baseline of 3 MAFY in an average year. (Attachment F, *NRDC v. Kempthorne*, Doc. 398, Declaration of J. Leahigh, dated July 9, 2007, at ¶¶ 6. 36-37.)

While the ruling initially imposed an interim remedy only, it is reasonable to expect that the next biological opinion will impose permanent restrictions that are similar or more stringent to the interim remedy. It is very unlikely that the USFWS will issue a biological opinion significantly similar to the pre-ruling opinion. Given this likelihood, the EIR should reflect the operations imposed by the court in the Delta Smelt ruling. Indeed, the ruling demonstrates that existing operations, as modeled in the DEIR, are not lawful. The Delta Smelt ruling will alter the way the proposed project can be implemented. The interim remedy imposed by the court restricts winter and spring SWP pumping in the Delta. Such restrictions will necessarily impact deliveries of Article 21 water, as well as Turnback Pool transfers. Any conclusions included in the DEIR regarding deliveries of Article 21, Turnback Pool water and other water deliveries in the winter and spring are now inaccurate. The EIR must recognize the Delta Smelt ruling, and fully incorporate it into the environmental analysis for the project.[45]

C. The DEIR improperly uses CALSIM II as the principal tool to analyze baseline condition and environmental impacts.

The DEIR relies on CALSIM II to analyze the impacts of water allocation and deliveries under the baseline, the proposed project and the alternatives. CALSIM II results are relied upon to estimate SWP delivery and export impacts as well as to derive environmental impacts on the Delta and upstream tributaries. While CALSIM II may be a sophisticated and useful modeling tool for certain purposes, it is inappropriate for determining environmental impacts and for estimating impacts in export and deliveries. It has been criticized by a panel of expert reviewers for several weaknesses, including its lack of amenability to proper calibration. (*See* A. Close, *et al., A Strategic Review of CALSIM II and its Use for Water Planning, Management and Operations in Central California* submitted to California Bay Delta Authority Science Program, December 4, 2003.

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[44] Attachment E, *NRDC v. Kempthorne*, 1:05-cv-1207 (EDCA), Doc. 560, Interim Remedial Order Following Summary Judgment and Evidentiary Hearing, dated Dec. 14, 2007, Attachment F, *NRDC v. Kempthorne*, Doc. 323, Order Granting In Part and Denying In part Plaintiffs' Motion for Summary Judgment, dated May 25, 2007.

[45] The EIR also needs to discuss the *time of year* in which cutbacks of pumping will be necessary to achieve the restoration of the Delta Smelt. The timing of these cutbacks may well occur in spring and winter, ordinarily a heavy period for SWP pumping.

In addition, CALSIM II assumes foresight on the part of operators, and thus assumes that operators will not take actions that will result in later violations of environmental standards or other operating constraints. This assumption can lead to great underestimation of environmental impacts, for in the real world operators do not have such foresight and thus may make decisions without realizing the consequences ultimately resulting from those decisions.

Furthermore a recent analysis has revealed additional flaws in the statistical basis for CALSIM II. ("Analysis of CALSIM's Statistical Basis,"by Arve Sjovold, December 28, 2004, previously provided to DWR).

CALSIM II predictions are only as accurate as the data and assumptions that are plugged into the model. Here, those assumptions may be wrong; for example, the DEIR assumption that future water flow patterns will be similar to those that have occurred in the past is inconsistent with the ample literature on the substantial effects of global warming on California water flows. These input data errors and uncertainties further undermine the ability of the DEIR's modeling analysis to make the kind of predictions necessary to support a genuine analysis of impacts.

Because CALSIM II is an optimization model that does not necessarily reflect options available to water operators, it may predict levels of exports. However, federal and state water quality and endangered species laws and regulations probably would prohibit such high export levels for water quality problem. The DEIR assumes that future water exports from the Delta will be nearly twice the historic average. Yet this prediction fails to recognize that DWR has chronically failed to meet water quality standards in the Delta under historic operations, and significant environmental degradation has taken place under such conditions, resulting in new regulatory actions. In light of the recent pelagic organism declines in the Bay Delta Estuary, and resulting rulings invalidating the biological opinion for Delta smelt, it is prudent to ensure the DEIR modeling assumptions predictions are conservative, rather than "optimizing" to ensure assumed deliveries would not violate conditions of the Federal Clean Water Act, the Federal or California Endangered Species Acts, or any other environmental permit condition, regulation, standard, or law.

Finally, the DEIR's presentation of modeling results is flawed. Throughout the DEIR, modeled predictions—for example, statements that salmonid mortality will increase by a certain percentage—are presented as though certain, and discussion of possible error or of ranges of possible outcomes is almost entirely absent. The models used cannot possibly produce such certainty, however; at best, they can predict, given a certain set of data and assumptions, a range of possible outcomes, with some outcomes potentially more probable than others, and with all predictions limited by both known and unknown sources of error. An accurate discussion of the DEIR's modeling results therefore cannot provide certain predictions, and instead should show the range of possible outcomes. By omitting both possible sources of error and potential outcome ranges, the DEIR projects a false certainty that the impacts of the project will be relatively small. Indeed, if the modeling results were properly presented, with ranges of outcomes fully described, the study might show that the models actually predict that significantly larger impacts are entirely capable of occurring.

PCL does not argue that models should never have been used to inform the analysis in the DEIR. But the CALSIM II used cannot possibly provide a near-certain conclusion that significant environmental effects will not occur, or will be fully mitigated especially when both common sense, existing knowledge of the Delta system, and the analyses of other agencies all indicate the extremely high likelihood of such impacts. Indeed, PCL believes that if modeling results were properly reported, they would indicate the reasonable likelihood of significant impacts.

As participants in the EIR Committee process, PCL has previously submitted comments expressing our concerns regarding the adequacy of CALSIM II for analyzing baseline conditions and assessing environmental impacts. The DEIR has not adequately addressed our previous comments, and we resubmit those comments on CALSIM II by reference to the DEIR.

If DWR includes CALSIM II model analyses in future EIR drafts, we request clear explanations and justification of all assumptions made in the CALSIM II model runs. In addition, we request that DWR explicitly state when findings are based on post processing and when findings are based on direct model results. When findings are based on post processing, the rationale behind these post-processing decisions should be clearly articulated.

V. The DEIR fails in its duty to analyze the transfer, development and operation of the Kern Water Bank, and alternatives that would restore its public accountability.

A. DWR must independently study, and exercise its own judgment on, the "transfer, development and operation" of the Kern Water Bank.

As provided in the settlement agreement, "the new EIR shall include an independent study by DWR, as the lead agency, and the exercise of its judgment regarding the impacts related to the transfer, development and operation of the Kern Water Bank" in light of existing environmental permits. (Section III.F.) That study "shall identify SWP and any non-SWP sources of deliveries to the Kern Water Bank." (*Id.*) The EIR must provide this analysis to ensure compliance with the agreement and the requirements of CEQA.

The 2003 Settlement Agreement, which allows the Monterey Amendments to proceed on an interim basis, that "KWBA shall retain title to the KWBA lands. KWBA may continue to operate and administer the KWB lands including the water bank, subject to restrictions herein."[46] The agreement also provides that "[t]he restrictions in this Section V shall become final only upon (1) filing of the Notice of Determination following the completion of New EIR, (2) discharge of the writ of mandate in the underlying litigation as provided below, and (3) conclusion of all litigation in a manner that does not invalidate any Monterey Amendment (or any portion thereof) or the Kern Fan Element Transaction."[47]

[46] Settlement Agreement, § 5.A.

[47] Settlement Agreement, § V.F.

B. **The DEIR's study methods are too narrow to support DWR's independent judgment on the future of the Kern Water Bank.**

DWR's final decision addressing ownership and operation of the world's largest groundwater storage facility, the one million acre-foot capacity Kern Water Bank located west of Bakersfield, raises critical issues involving public trust accountability and environmental responsibility. The various stakes involved in the bank's operation—financial, institutional and environmental—are of immense importance to California's future. Built to capacity, the groundwater bank is capable of delivering 240,000 acre-feet of water per year, enough to supply the needs of roughly 500,000 households.[48]

The facility is also crucial because of its location, providing storage to the southern San Joaquin Valley.[49] When developed, the Kern Fan Element, in combination with the provisions of the proposed project allowing storage outside an SWP service area, significantly increase SWP contractors' capacity to accept water from the Delta.

But the DEIR's draft study on the Kern Water Bank (DEIR, Appendix E) says very little that would alert the reader to momentous environmental significance of DWR's forthcoming decision. The "methods" section of that study (DEIR, Appx. E, p. 5) suggests a possible reason for its benign assessment. Of the three sources of information noted in the study, the only information source that does not come directly from the Kern agencies, KCWA and KWBA, is that DWR contacted personnel from the California Department of Fish and Game and the United States Fish and Wildlife Service. That focus is far too narrow. The substantial environmental issues associated with the loss of statewide environmental accountability over the bank require a more probing analysis that could not be addressed simply by consulting wildlife and fisheries agencies, and it is DWR, as SWP manager, that must provide that analysis. As detailed below, even if the KWBA has been a responsible steward of the Kern Fan Element property that holds the bank, the concerns that arise from the decision for the bank to serve local rather than statewide interests would persist.

DWR's narrow study methods are surprising, because the broader issues surrounding the transfer, development and operation of the Kern Water Bank have been the subject of major public controversy, addressed in the media[50] and in reports that are referenced and discussed nowhere in the DEIR. One of those reports, prepared by Public Citizen, contends that while the

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[48] In August 1996, one day following DWR's transfer of the bank to Kern County Water Agency in its interim implementation of the Monterey Amendments in 1996, KCWA retransferred the bank to the Kern Water Bank Authority (KWBA), which consists of five local public water agencies and a private mutual water company.

[49] Sandino, *California's Groundwater Management Since the Governor's Commission Review: The Consolidation of Local Control* (2005) 36 MCGEORGE L. REV. 471, 489 n. 171.

[50] M. Arax, *Massive Farm Owned by L.A. Man Uses Water Bank Conceived for State Needs,* Los Angeles Times (online), December 19, 2003.

KWBA is formally public entity, it is effectively majority-controlled by one of the world's largest farming companies, Paramount Farming, and largely serves the interests of two corporations with large landholdings in the service area.[51] The Public Citizen report charges that the divestment of the bank from state authority has been environmentally destructive, raising issues that are nowhere addressed in the DEIR.[52] While we believe that DWR is very much aware of this report, and should thus have included a reaction to the report as part of the DEIR environmental analysis of the proposed transfer of the Kern Fan Element, we will attach the Public Citizen Report to these comments, so that DWR will have no excuse not to analyze its findings in connection with producing the final EIR.

Whether or not DWR concurs with them, it would be irresponsible not to address these well-known allegations before taking its final action on the proposed Kern Water Bank transfer.[53] Indeed, broad concerns about the lack of institutional and environmental accountability among Kern County's local water agencies have drawn the attention, not simply of environmental groups, but also some of the most respected scholars of California's water history. For example, Norris Hundley's discussion observes that such local districts "are ordinarily managed by boards of directors made up of a homogeneous, single interest body of people representing the large water users and guided by a rigid set of goals: maximization of water use at minimum cost with little or no regard for the environment or for the welfare of the people of California."[54] In short, the EIR will disserve decision-makers and the public unless DWR is able to step outside the mindset of the local Kern agencies, and address the Kern Water

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[51] J. Gibler, WATER HEIST (Public Citizen, December 2003)("Public Citizen report"), included as Attachment G to these comments. The EIR should specifically address the Public Citizen report as if it were set forth directly in these comments.

[52] See Public Citizen report, p. 2 (arguing that the bank should not "provide a handful of corporations with the keys to a virtual 'switchyard' for controlling water deals between agribusiness and real estate developers").

[53] To assist decision-makers and the public, PCL also requests that DWR include in the EIR a documentary appendix compiling key reference sources on the Kern Water Bank. The public should have an opportunity to directly review such key documents as (1) the 1987 DWR/ KCWA memorandum of understanding; (2) the purchase agreements framing the transfer of the Kern Fan Element from DWR to KCWA, and from KCWA to KWBA; (3) the 1995 KWBA Statement of Principles; (4) the 1995 KWBA Joint Powers Agreement; and (5) the 1995 KWBA Operations and Monitoring Memorandum of Understanding.

[54] N. Hundley, THE GREAT THIRST (2001), p. 536; see also R. Gottlieb and M. Fitzsimmons, THIRST FOR GROWTH (1991), pp. 96-97 ("With new purchases and related expansion of irrigated acreage becoming a speculative spiral, the Kern landowners raced to establish new water districts to contract for State Project water….The tendency toward concentration and overextension, already prevalent in the county from the days of *Lux v. Haggin*, was enormously magnified with the arrival of the aqueduct. A handful of landowners dominated the key water districts affiliated with the [Kern County Water Agency], and these districts, in turn, dominated the agency").

bank issues with the "statewide perspective and expertise" required in its stewardship of the State Water Project.[55]

C. The EIR fails to fully disclose how the transfer of the Kern Fan Element out of DWR's control alters the central purpose of the Kern Water Bank.

Although the DEIR briefly refers to the transfer of the Kern Fan Element out of state ownership, and its subsequent control by the KWBA (DEIR, p. 4-11), it never fully acknowledges how this transformation affected the fundamental purpose of the Kern Water Bank. The DEIR appendix on the transfer briefly references the 1987 Memorandum of Understanding (1987) between DWR and KCWA, which formed the basis for DWR's acquisition of the Kern property from Tenneco West.[56] But it never mentions how two key statewide and public protections referenced in the 1987 MOU were later removed:

- **Shift of bank purpose to serve local rather than statewide interests.**

The 1987 MOU clarified that the "primary purpose" of the Kern Water Bank is to "augment the dependable water supply of the State Water Project"; and that "[i]ncidental" to its primary purpose the bank will produce "local benefits." It defined the bank as a "SWP conservation facility" to be integrated with other SWP operations.

By contrast, the 1995 joint powers agreement for the KWBA reversed the priorities, ensuring that "the Authority will be operated and maintained "*for its benefit and the benefit of the Member Entities*."[57]

- **Failure to acknowledge statewide trust protection**

Although the MOU conferred upon the Agency a ten-year option to purchase the bank, it imposed conditions of that purchase that would have preserved DWR's trust responsibilities under the Water Code. Under the MOU, the Agency's purchase of the bank could only occur "[p]rovided that the *Department's right to use the area for project purposes* will be preserved. Consistent with section 11464 of the Water Code, the Department shall not sell facilities acquired for the Kern Water Bank."[58]

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[55] *PCL v. DWR*, 83 Cal. App. 4th at p. 907.

[56] DEIR, appx. E, p. 10.

[57] 1995 JPA for the KWBA, recitals at ¶ 5.

[58] The non-alienation provision in Water Code section 11464 provides that "no water right, reservoir, conduit, or facility for the generation, production, transmission, or distribution of electric power, acquired by the department shall ever be sold, granted, or conveyed by the department so that the department thereby is divested of the title to and ownership of it."

By contrast, neither article 52 of the Monterey Amendments, nor the conveyance agreements with the Kern agencies for the Kern Fan Element transfer, ever referenced or incorporated DWR's continuing authority, even in the context of local ownership, to use the bank as needed for SWP purposes. Instead, the transfer agreements took the form of unrestricted fee simple transfers, without any discussion of the state's underlying trust duties.

In its EIR, DWR must fully analyze the circumstances surrounding the removal of safeguards for the public and the state, and the environmental consequences of bank operation without these protections. It must also study alternatives that would not eliminate these protections, even in the context of local ownership and administration of the bank.

D. **The EIR must more fully describe DWR's experiences and purposes in attempting to develop the Kern Water Bank.**

The DEIR barely discusses DWR's original plans for the KWB and attempts to develop it. In a 1979 article, then-DWR director Ronald Robie described a variety of environmental advantages to DWR developing an underground storage facility for the SWP. He concluded that "an SWP ground water program will add flexibility to SWP operations and can be a hedge against earthquake or other disablement of the California Aqueduct."[59] Following the release of technical studies, DWR focused on the possibilities of developing SWP groundwater recharge operations in Kern County.

In 1986, DWR prepared an EIR for a state-run water bank, contemplating purchase of approximately 20,000 acres of land from Tenneco West, located on the Kern River's alluvial fan (the area that ultimately became the bank's site is sometimes referred to as the Kern Fan Element).[60] The present DEIR does not disclose that in its own environmental reviews, DWR recognized that operation of the bank might have an impact on the Bay-Delta.[61]

DWR made substantial investments in studies and other activities with the expectation of implementing the state-owned bank. Some estimates have placed the total amount DWR paid to develop the bank, including the initial purchase, over $70 million.[62] The EIR should disclose the full amount of that investment, including any investment in environmental study and mitigation.

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[59] *Id.* at 45.

[60] See also Kletzing, *Imported Groundwater Banking: The Kern Water Bank - A Case Study*, (1988). 19 PAC. L.J. 1225.

[61] DWR, First Stage Kern Fan Element Draft Supplemental Environmental Impact Report (1990). pp. 38-42.

[62] Public Citizen, p. 2.

E. The EIR does not fully disclose the circumstances that caused DWR to relinquish control of the KWB.

The EIR should more fully disclose the circumstances that caused DWR to stop developing the KWB. In this regard, several documents that PCL obtained from DWR, included as attachment H, are illuminating. During the early 1990s, KCWA, joined by other local water districts and the State Water Contractors organization, sought to have DWR cease all "planning, design and land acquisition" activities relating to the water bank, even requesting that it be "mothballed."[63] They also argued that since DWR would not be developing the bank, it should be transferred to local control. In response, DWR director David Kennedy ultimately endorsed divestment of the water bank to the Agency, which then became a key principle in the 1994 Monterey Agreement.[64]

Although DWR had earlier been trying to proceed with the state-run project, two factors--potential ESA impacts, and Kern non-cooperation—thwarted these efforts. The latter reflected both ESA impacts, which KCWA did not want to address, and partly KCWA's reluctance to allow DWR to protect statewide interests in the bank. DWR had reached a HCP addressing on-site impacts, and that HCP was satisfactory to everyone but the Kern interests. However, DWR staff reported that Kern "wanted to recharge and extract at their will and not pay for 'any stinking mitigation costs'. When DWR objected, Kern's Tom Clark responded, "if we think we must, we will buy it."[65]

F. The EIR inadequately addresses the details of DWR's purchase agreement with Kern County Water Agency.

The EIR identifies the agricultural contractors' retirement of 45,000 acre-feet of agricultural entitlement (almost all by KCWA) as the ostensible consideration (the price paid) for DWR's transfer of the Kern Water Bank. But it does not adequately analyze the circumstances surrounding that exchange:

• DWR estimated the bank's worth at just over $33 million. That figure was just two million more than the state had paid in 1988, despite the state's subsequent investment of approximately $40 million in the bank's development. The state apparently valued the element based upon its purchase piece of marginal agricultural land rather than its more important value—a capitalization of the land's highest and best use as a water bank.

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[63] Attachment H (February 18, 1993 draft letter from SWC to DWR).

[64] Attachment H (1992 SWC action report; February 18, 1993 draft letter from SWC to DWR; February 9, 1993 and April 19, 1993 letters from DWR to SWC).

[65] Attachment H (Memorandum of Jack Erickson, DWR to John Pacheco, dated February 13, 1996).

• KCWA's retired agricultural "entitlements" existed only as an accounting tool, and Kern had no realistic expectation of receiving actual wet water under those entitlements. Nevertheless, KCWA was obligated—pursuant to the contracts it signed—to pay the state for that entitlement amount. By retiring those entitlements, KCWA therefore relieved itself of a substantial liability while losing little, if any, chance at wet water. The retired debit would appear to have a substantially higher value than the retired entitlements.

• DWR and KWBA have yet to provide a full accounting of the sources of water going into the Kern Water Bank, an issue that DWR is called upon to address in the Monterey settlement agreement within the Monterey Plus EIR. It seems likely that the other inexpensive sources of water made available to the Kern agencies through the Monterey Amendments—including "interruptible" (formerly surplus) water, carryover storage water, and turnback pool water—might have more than replaced the purported "loss" of KCWA's 45,000 acre-feet of paper entitlements with less expensive sources.

• The state's divestment also included some of its water. DWR conveyed title to half the water stored in the bank, as well as all the water stored during 1995. As the KWBA recognized in its financial statement, "the participants [in the KWBA] received Kern Water Bank land and facilities and 42,380 acre-feet of banked water. The 42,830 acre-feet of water subsequently was transferred to each of the participants in proportion to their ownership. This transaction was reflected as a contribution of capital in the amount of $27,858,500 by the respective participants."[66]

G. The DEIR fails to analyze key environmental consequences of the Kern Water Bank's operation without statewide trust accountability.

The DEIR fails to study the major environmental consequences of the Kern Water Bank, other than some smaller issues that centrally focus on KWBA's administration of the Kern Fan Element lands. Notably, the analysis fails to answer important questions about foreseeable trends in water marketing and groundwater banking due to the project.[67] Instead, the DEIR abruptly concludes that impacts are less than significant because multiple factors increased groundwater banking, and because of a beneficial impact on groundwater levels.[68]

The EIR must carefully study the following issues:

• **Pressures on the Delta**

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[66] KWBA, *Financial Statements* (December 31, 2000 and 1999).

[67] Neither Chapter 8 on growth-inducing impacts, nor Chapter 9 addressing water supply reliability and "paper water," address the transfer and operation of the Kern Water Bank. The effects of available storage and related transfers must be included in those analyses even if the bank is addressed separately in Appendix E.

[68] DEIR, appx. E, p. 49.

The transfer of the Kern Fan Element resulted in a shift in use of the facility. The state had intended to use the facility as a drought mitigation bank. In local control, it has become a new resource to maximize deliveries of SWP water and an economic resource. Local agencies now benefit from aggressively developing the Kern Fan Element. Under the Monterey Amendments, all contractors can use the Kern Water Bank to store SWP water. Therefore, the bank transfer has a significant potential to increase demand for and export of Delta water. The DEIR does not adequately analyze the impact on SWP demand and Delta export resulting from the transfer and development of the Kern Fan Element.

DWR's records, although not yet disclosed in the EIR, suggest a possible close connection between the Kern Water Bank, Delta pumping, and Delta environmental issues. The bank's relationship to Delta pumping and environmental conditions came up repeatedly in DWR's correspondence with other agencies,[69] as well as with the contractor constituencies represented in the Monterey negotiations.[70] In general, those records suggest DWR was well aware that operation of the Kern Bank could lead to increased Delta pumping, and that those increases could affect endangered species.

Additional research by PCL, previously brought to DWR's attention[71], also shows the Kern Bank's role in increased deliveries to southern contractors.[72] These documents highlight how filling the bank can impact the Delta. For example:

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[69] See, Attachment H, including: Letter from Wayne White, Department of Interior to David Kennedy, dated September 30, 1991 ("we are concerned about potential adverse effects of the project in the Sacramento-San Joaquin River Estuary (Delta) area in central California. The reason for this concern is that water storage capacity within the Kern Water Bank would be filled through additional water exports from the Delta averaging approximately 90,000 acre-feet per year"); *id.* (potential adverse effects on Delta smelt and winter-run Chinook salmon); Letter from John Turner, Department of Fish and Game, to Dan Masnada of CCWA, dated July 20, 1995 (development of storage facilities, along with other Monterey operational changes, "combine to create substantial potential for program effects in the Delta and upstream"); *id.* (full study of Kern Water Bank's "potential impacts on the Delta has never been completed").

[70] See Attachment H: MWD letter to Tom Clark dated May 29, 1992 (identifying relevance of Chinook impacts); Memorandum of Jack. A. Erickson, DWR, dated April 20, 1993 (acknowledging Delta issues associated with Kern Fan Element); DWR, Kern Fan Element Re-evaluation Study, February 1996 (acknowledging Kern-Delta link).

[71] See Appendix A.

[72] Several other provisions in the Monterey Amendments also facilitate increased pumping of KWB-bound water. These provisions include liberalized requirements for "interruptible" water, allowance of "carryover" water, and creation of a "turnback pool."

--A KCWA brochure reported that in 2001, the banking program had boosted local supplies by "almost 200,000 acre-feet" and urban Southern California supplies by 81,000 acre-feet.

--Numerous reports from the manager of KCWA member Lost Hills Water District document, among other things, Paramount Farming's use of water banking to obtain inexpensive sources of state water for future water transfers and sales.

--A Georgia State University paper on water sales from 1990-2001 recorded purchases from the Monterey Amendments turnback pool by KCWA, Dudley Ridge and other contractors at prices of $5.90 to $11.79 per acre.[73]

--The Urban Water Management Plan of the McAllister Ranch Irrigation District, a former agricultural area near Bakersfield that is turning to residential development with the assistance of the Kern Water Bank.

--KCWA's 1996 Water Supply report contradicts the assumption that Monterey provisions including the Kern Fan transfer have only had a minor effect on deliveries, reflecting an understanding that it expected the Kern water bank, along with Monterey managerial changes, to help increase its SWP yield.

- **Depleting the Environmental Water Account**

There appears to be significant evidence that effective possession of the Kern Water Bank enabled Paramount Farming subsidiary Westside Mutual and other interests within the KWBA to secure "surplus" water from the state, only to sell it back to the state's Environmental Water Account at a profit.[74] If DWR itself operated the bank, such privately-profitable sales would not have resulted in a transfer of money out of the state system; DWR could pump its own surplus water to the bank (rather than selling it at bargain-basement prices) and then at times of environmental need could pump that water, without paying marked-up prices for it, to users in lieu of Delta deliveries. By paying less for water, DWR thus could slow the depletion of EWA assets, which in turn would allow the EWA to take more protective actions. That change could become crucially important during a drought, for in times of scarcity the KWBA member agencies could charge far higher prices for their water, and the financial difference between a DWR-managed bank and a privately managed bank, and thus the difference in depletion of EWA funds, could be enormous.

- **Increasing the agribusiness footprint**

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[73] M. Czetwertynski, *The Sale and Lease of Water Rights in Western States: An Overview for the Period 1990-2001* (March 2002), pp. 16-17.

[74] The evidence is available at http://www.ewg.org/reports/CAWaterTakings/part4.php; http://www.watertransfers.water.ca.gov/water_trans/water_trans_index.cfm. Despite its prominent role in securing the divestment of the Kern Water Bank and benefiting from it, Paramount Farming—whose wholly owned subsidiary Westside Mutual Water Company owns more than 48 percent of the bank--is only cryptically referred to in the DEIR analysis of the Kern bank, and not by name. See DEIR, Appx. E, p. 17 (noting that Westside was formed by "a landowner").

The profit stream to Paramount Farming and other Roll International affiliates deserves further attention. The bank, which was intended to help balance out the state's water supply to cities, farms and fish, has instead allowed Paramount Farming to double its acreage of nuts and fruits since 1994."[75] If the Kern Bank has indeed allowed a private company to put substantial additional acreage to agricultural use, that change could have multiple environmental consequences, including local habitat loss, increased pollutant loading, and, perhaps more importantly, increasing and hardening overall south-of-Delta water demand, which in turn could increase Delta impacts in the next drought.

- **Constrained public uses**

Private operation of the bank outside DWR control would hamper the state's ability to manage water resources for a variety of public purposes, including drought storage for emergency preparedness, urban uses, environmental protection, river restoration, and water quality.[76] The specialty crops and urban uses supported by the bank, due to their inflexibility in times of drought, may increase pressure for water exports from the overburdened Bay Delta during times of critical shortage.

- **Supporting growth and development**

In KCWA's March 1995 newsletter, its general manager describes "our local groundwater basin" as "a multi-billion dollar resource."[77] The Public Citizen report alleged that the privately controlled water bank serves as "switchyard" for transactions between agribusiness and real estate interests in Southern California.[78] The DEIR must investigate these allegations, as well as suggestions that the bank may promote sprawl development.[79]

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[75] Arax, *supra*.

[76] "Water banking could be used as drought protection to statewide benefit and to help improve water quality in the heavily depleted San Joaquin Valley groundwater basin. Operating banks for water marketing will have the opposite effect, fueling increased dependence upon distant water supplies for new growth…." Public Citizen, *Water for People and Place* (Nov. 2005), p. 28.

[77] KCWA General *Manager* Jim Beck, quoted in *Water Age*, March 2005, p. 3.

[78] Public Citizen report, p. 2.

[79] See, e.g., V. Pollard, *Los Angeles Eyeing Kern Water Source*, Bakersfield Californian, March 24, 2002 (online) ("DWP officials have had early talks with representatives of Paramount Farming Co. and other participants in the about possible purchase of an as-yet-unspecified amount of water…The chairman of the Kern Water Bank Authority Board, Bill Phillimore, said sales from the water bank were contemplated from the time the bank was acquired by Kern County water agencies…."). The Public Citizen report asserts that Roll International affiliate WV Acquisitions has contracted with Lennar / LNR subsidiary Newhall Land and farming for

H. The DEIR fails to analyze alternatives that would restore state trust accountability to the Kern Water Bank's operation.

In light of the history and risks described above, it is essential that DWR develop and analyze a meaningful project alternative that would restore some measure of statewide accountability over the manner in which the KWB is operated. That alternative may even be compelled by the need to comply with Water Code section 11464 and other applicable laws.

Throughout its participation in this EIR review, PCL proposed two alternatives that would have addressed the Kern issues. The first was a "Kern Fan retention" alternative, which assumes state ownership and operation to enhance dry-year reliability. The second was a "Kern Fan Transfer with trust conditions" alternative that would allow the Kern Water Bank to remain in local control, subject to operational and financial criteria designed to maximize environmental benefits. It would require the bank to store environmental water in time of surplus and make it available at no cost to the state in time of drought, in exchange for allowing the asset to operate the rest of the time for local purposes. In sum, a variety of operating and financial arrangements must be explored to maximize the bank's contributions to the State's environment. CEQA requires a full analysis of these feasible alternatives, as part of the DEIR prepared on the proposed action.

Unfortunately, the DEIR summarily rejected the "Kern transfer with trust conditions" alternative with a cursory, untenable explanation. DEIR,§ 11.2.6, p. 11-16. The DEIR asserts that this alternative would fail to "meet the objectives" of the Monterey Amendment, but does not explain why. On the contrary, allowing local control of the bank to continue subject to the imposition of a state trust—which closely resembles the approach to local control of the bank already set forth in the 1987 DWR/ KCWA MOU—would be a balanced way to "[r]esolve legal and institutional issues related to storage of SWP water" in the county that would harmonize local and statewide interests.[80] In light of Water Code section 11464 and legal constraints

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sales of water entitlement. See http://www.hoovers.com/the-newhall-land-and-farming-company/--ID__11074--/free-co-factsheet.xhtml (describing Newhall as the "landing strip fot urban flight"). PCL has no independent knowledge of these accounts, but believes they deserve analysis.

[80] DEIR, p. 4-1 (listing project objectives). The "local control subject to DWR trust" approach does not appear incompatible with any of the other fundamental project objectives either. Moreover, the prospect that stakeholders might challenge the approach would provide no reason to summarily reject it as a project alternative. *PCL v. DWR*, 83 Cal. App. 4th at p. 915. Nor would the need for local agreement and funding be grounds to summarily dismiss this alternative from consideration (cf. DEIR, p. 11-6), particularly if DWR finds that it is the only lawful manner to proceed with local ownership of the bank.

related to conditions in the Delta, this alternative may well constitute the only lawful manner in which DWR can make a final decision that allows the bank to remain in local ownership.[81]

I. The EIR must answer additional questions about the Kern Water Bank's transfer, development and operation.

PCL requests that the EIR answer the following additional questions, each of which relates to potentially significant environmental impacts, as outlined in this comment letter, and each of which CEQA requires be addressed:

1. Does the KWBA actually acquire and sell water, or does it merely provide a facility that allows its member agencies to store and recover water that they acquire and sell?[82]

2. If the KWBA does actually acquire and sell water, how much water does it acquire and sell on a yearly basis?

3. How much water have each of the KWBA members, including Westside, bought and sold during each year of the Kern Bank's operations, using the Kern Bank in connection with such purchases and sales?

4. To whom has water stored in the Kern Bank been sold?

5. At what price has Kern Bank water been sold? Does that represent a markup beyond costs?

6. How much has the KWBA charged for storage in the Kern Bank ?

7. Has DWR purchased Kern Bank water? For what purpose and place of use? How much has come from the KWBA, and how much from particular agencies? At what price?

8. What are the sources of water that go to the Kern Bank? Each year, how much has come from: (a) SWP Table A allocations; (b) SWP Article 21 water; (c) CVP water; (d) surface runoff; (e) Kern River water?

9. Is there any evidence that DWR delivered water to the Kern Bank knowing it would later need to repurchase that water? Or is there evidence that DWR

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[81] The DEIR's premise that alternatives cannot be used here simply to improve "the health of the environment" (DEIR, 11-6) could not be more at odds with the elementary requirements of CEQA, which may be used to *mandate* feasible alternatives or mitigation measures. Pub. Res. Code, § 21002.

[82] Under the joint powers agreement, the KWBA is empowered to acquire and sell water, but it is less clear where it would get such water, or how it would access recharge or withdrawal facilities; the JPA appears to assign shares of facility use exclusively to the member agencies.

delivered water to the Kern Bank while simultaneously repurchasing earlier-delivered supplies?

10. Does the KWBA pay taxes on the land it owns?

11. Does the KWBA pay taxes on profits from water sales (if sales are above-cost)?

12. Does Westside profit from water sales, and if so does it pay taxes on those profits?

13. Have the KWBA member agencies obtained SWRCB approval for changing (either temporarily or long-term) the place or purpose of use of water stored in the Kern Bank and transferred to different users?

14. What are the KWBA member agencies doing with the profits from their sales, and what are the environmental consequences?

VI. The DEIR's assessment of alternatives is defective.

A. The DEIR presents multiple muddled versions of the No Project Alternative, blurring the distinction between "no project" and project alternatives.

CEQA defines the purpose of a No Project Alternative as, "to allow decision makers to compare the impacts of approving the proposed project with the impacts of not approving the proposed project" (CEQA Guidelines, § 15125).[83] Making up in quantity for what they lack in accuracy, the DEIR identifies multiple iterations of the No Project Alternative. As demonstrated here, each of these attempts is incoherent, and in some instances, they muddle the distinction between the No Project Alternative and project alternatives.

A brief synopsis of these attempts highlights their flaws:

• The No Project Alternative 1 (NPA1) assumes at the state would have developed the Kern Fan Element to a capacity of 350,000 acre-feet by 2003 and to 500,000 acre feet by 2020. The capacities used appear to be entirely arbitrary, and may well serve simply to narrow the distance between the no-project and the project without factual foundation. Moreover, the EIR appears to be internally inconsistent as the subject of how much state bank development was foreseeable.[84]

[83] PCL has already explained above why the no project assessment has not met the requirements of *PCL v. DWR*. This section describes, in addition, how the DEIR develops no project alternatives that are muddled with project alternatives.

[84] Inclusion in the No Project Alternative suggests a belief that state development could be "reasonably expected to occur in the foreseeable future," CEQA Guidelines, § 15126.6(c)(2); but

• The No Project Alternative 2 (NPA2) includes a number of the Table A transfers facilitated under the Monterey Agreements, conveyance of non-project water, and storage of contractor water outside of the contractors' service area-all key components and other provisions of the proposed project that were implemented as of 2003. The DEIR argues that these projects and policies would have been approved by the Department regardless of the Monterey project. However, that argument is entirely speculative, and in no way excuses the CEQA-mandated no project analysis. Each of these components was initiated as a direct result of the Monterey Amendments. As such, they are components of the very action under review and cannot be included in a no project alternative. [85]

• Court-Ordered No Project Alternative 3 (CNPA3) and Court-Ordered No Project Alternative 4 both contain significant flaws. As discussed above, neither of these alternatives provided the rigorous review anticipated by the court in *PCL v. DWR* and by plaintiffs in the settlement agreement.

• CNPA3 is also based on water allocation methods that were not in place at prior to the Monterey agreement. CPNA3 does not reflect the agricultural and groundwater replenishment priority for article 21 that was a specific requirement of the pre-Monterey contracts. Without the Monterey Amendment, this contract provision would remain in place. Therefore the only appropriate no project alternative is one which includes all pre-Monterey contract provisions, including the "agriculture first" and groundwater replenishment provisions of Article 21.

• The no project alternative must reflect the actual 'no project' condition. Rather than speculate that DWR might alter contract provisions, approve water transfers and overcome significant challenges to aggressively develop the Kern Fan Element, the no project alternative should assume that DWR would have implemented the pre-Monterey SWP contracts as written, including enforcement of all limitations and conditions.

B. The DEIR summarily rejected feasible alternatives to the project.

The DEIR must examine a range of reasonable alternatives that would feasibly obtain most of the project objectives, but avoid or substantially lessen any significant adverse effects of the project. (14 Cal. Code Regs. §15126.6.) In its screening and review of alternatives, the EIR must provide more than "cursory" analysis. (*PCL v. DWR*, 83 Cal. App. 4th at 919.) It should not construe project objectives so tautologically that only the proposed project could conceivably be capable of achieving them. Nor should the EIR allow the mere "threat of litigation" under a proposed alternative to prevent its environmental review. *Id.* at 914.

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in DWR's Kern study, it asserts that uncertainties made state bank development "infeasible." DEIR, Appendix E, p. 10

[85] Rather than include these components in the NPA2, subsequent drafts of the EIR must include this analysis of a limited set of policies (as opposed to the entire suite of Monterey Amendments) in the alternatives section of the EIR.

DEIR summarily eliminated *nine alternatives* that were suggested by PCL and the two other plaintiffs within the EIR committee process, each without any satisfactory explanation.[86] These alternatives were offered in order to provide a reasonable range of alternatives within the EIR analysis consistent with the requirements of CEQA. But the DEIR provides unjustified conclusions for each alternative that derailed any further review of them. Although increasing exports south of the Delta is notably (and properly) absent from the list of project objectives (DEIR, p. 4-1), the DEIR's alternatives analysis implicitly appears to assume that unless the contractors' pumping objectives are met, an alternative is infeasible.

The DEIR also gratuitously, and incoherently, chides "the plaintiffs" for seeking in proposed alternatives to improve the *environment.* (DEIR, pp. 11-5 to 11-7.) That reasoning would have been faulty if DWR's EIR had been done in 1995, but it particularly suspect in 2008, in light of the pelagic organism decline in the Delta and recent court rulings, discussed above, that will require constraints on pumping south of the Delta. Moreover, the summary exclusion of alternatives that attempt to balance contractors' and environmental objectives is entirely inconsistent with efforts the state is engaged in elsewhere, including Delta Vision and updates to the California Water Plan. Indeed, the state has long been aware of a variety of approaches that would serve the SWP's financial, management and operational goals while *also* considering environmental protection.[87] This context underscores the practicality of PCL's proposed alternatives.

A review of the grounds for dismissing the **"Improved Reliability through Environmental Enhancement" (IREE)**[88] alternative illustrates how the DEIR avoided analyzing a reasonable range of alternatives. Similar grounds were also used to reject other alternatives. The EIR's reasoning suggests that DWR views the project objectives so tautologically that seemingly only the Monterey Amendments (or a negligible variation on them) could feasibly accomplish them:

- The DEIR claims that the IREE "alternative was not considered in detail in the EIR because it would not meet any of the objectives of the Monterey Amendments. Furthermore, it would be in conflict with the basic terms of the long-term water supply contracts." DEIR, p. 11-6. But in summarily dismissing this alternative, the DEIR provides no substantiating evidence or analysis to demonstrate that the alternative would not meet any of the project objectives.

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[86] These alternatives, listed in PCL's December 18, 2006 comments on the last administrative draft EIR (Attachment A) pp. 12-15, are incorporated by reference. PCL proposes again that they be considered for full-fledged review rather than summary rejection.

[87] CRB report, attachment B to these comments.

[88] This alternative "would involve the Department reducing stress on fishery resources in the Delta by directly implementing water use efficiency measures, water recycling, storm water capture, and other local water system enhancements that stabilize water demand and improve SWP reliability." DEIR, p. 11-5.

• The assertion that IREE would not meet any of the project objectives is false. A key objective of the project provided in the DEIR is to increase the flexibility of the SWP. DEIR, p. 4-1. DWR specifically identifies environmental regulations as a primary limitation, in addition to hydrologic conditions, to delivery of water through the SWP. [Cite] [89] It is reasonable to expect that enhancements in the environment of the Delta would reduce the need for regulatory agencies to set new regulations or mandate actions to enforce existing regulations. Reduced regulatory actions would result in increased flexibility of the SWP. The DEIR does not provide any analysis which would indicate that such an assumption is unfounded or inaccurate.

• The DEIR's further claim that the IREE alternative is in conflict with the basic terms of the water supply contracts is also without merit. The proposed project is a set of contract amendments. It follows that alternatives to the proposed project would appropriately incorporate contract amendments. In fact, many of the provisions of the proposed project are in direct conflict with the basic terms of the pre-Monterey long-term water supply contracts. [90]

• The DEIR's rejection of IREE rests heavily on the notion that DWR already operates in compliance with Delta water quality and flow objectives "as constrained by the need to protect threatened and endangered fish species listed pursuant to federal and state Endangered Species Acts." DEIR, p. 11-6. As discussed above, the pelagic species crash and the *Kempthorne* decisions on the Delta Smelt shatter the foundations of this assertion, which must now be revisited. There is now a compelling legal, as well as environmental, reason not to summarily reject an alternative that could feasibly accomplish most of the project objectives, while also reducing injury to the Delta.

• The DEIR also rejects IREE on the preposterous theory that "the Monterey Amendment is not an appropriate tool for mandating that |SWP water be used to benefit the Delta environment. DEIR, p. 11-6. That is a remarkable assertion, considering that, as discussed elsewhere, the proposed project could result in increased pumping and thereby injure the Delta.

• Finally, the DEIR rejects IREE, as well as some other alternatives, based upon the legally erroneous theory that it would require action by local agencies; according to DWR, such agencies would have to propose water efficiency measures, which DWR recognizes it could

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[89] In fact, environmental problems in the Delta were contributing factors which led to the reductions in SWP deliveries in the early 1990's, and the contractor disputes that precipitated the Monterey Amendments. *PCL v. DWR*, 83 Cal. App. 4th at p. 908.

[90] For instance, eliminating the "agriculture first" reduction in article 18(a) of the contract, as is proposed in the proposed project, is in direct conflict with the pre-Monterey contracts. If such conditions were applied to all alternatives, then the proposed project would also have to be eliminated. Alternatives should not be held to a standard that is not imposed on the proposed project.

fund. DEIR, 11-5,11- 6. That misstates CEQA, which does not foreclose an alternatives assessment simply because other agency action may be required.[91]

C. The DEIR fails to analyze a reasonable range of alternatives to the project.

While unreasonably rejecting all of the alternatives proposed by plaintiffs, the DEIR remarkably provides *only one* project alternative to the DEIR. Alternative 5 "would be the same as the proposed project except that the Monterey water management practices would not be implemented." DEIR, p. 11-3. The DEIR's very limited range of alternatives is misleading and incomplete. In order to provide for reasonable comparison, alternatives to the proposed project must be distinguishable from the proposed project. However, alternative 5 (and NPA2) inappropriately includes significant portions of the proposed project. As a result the DEIR inappropriately concludes that all available courses of action have roughly similar impacts and outcomes.

The DEIR rationalizes this approach by suggesting that many of the actions taken under Monterey could have occurred under the original contracts. Prior to Monterey, however, these policies were not widely adopted by the SWP and they were not commonly practiced under the previous contract. Had DWR decided to implement these actions under a different hypothetical approach, DWR would still have had to complete CEQA review prior to taking those actions. Therefore, it is not appropriate to include these actions in Alternative 5 or NPA2. Since DWR has proposed to take these actions as part of the Monterey Amendments, these actions must be properly treated as potential decisions rather than assumed components of the no project alternative.

In sum, the EIR should include alternatives that are clearly distinguishable from the "no project" and proposed project. These alternatives should not include polices or actions that are being proposed for implementation as part of the proposed project.

VII. The DEIR contains faulty and legally unsupportable assessments of project impacts.

A. The DEIR uses inconsistent time periods for its analyses.

In the historical analysis provided in Chapter 6 the DEIR uses different time periods for analyses in various sections of the EIR. For instance, carryover in Dan Luis is analyzed from 1996 through 2004, while the flexible starage provisions are analyzed from 1996 through 2003 (see DEIR at 6-57 through 6-58).These variations make it impossible to determine the full impact of any of the proposed project and alternatives included in the DEIR. No explanation is provided as to why certain sections are analyzed under differing time periods. Subsequent draft EIR analyses must use a consistent time period throughout the EIR.

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[91] See, e.g., *Friends of the Eel River v. Sonoma County Water Agency* (2003) 108 Cal. App. 4th 859. 864-867. Similar grounds are improperly used to summarily reject other of PCL's proposed alternatives, such as the "urban preference and dry year reliability" and "no urban preference and dry year reliability" alternatives. DEIR, pp. 11-4, 11-5.

B. The DEIR inadequately analyzes impacts resulting from eliminating and changing contract provisions.

- **Altered Article 21 rules for "surplus"**

As extensively discussed in connection with the baseline, the DEIR failed to analyze the impact of eliminating article 21(g)(1), the prohibition on using "surplus water" (or post-Monterey, "interruptible" water) to build permanent local economies. The EIR must fully analyze how eliminating this provision and simultaneous transfer of the Kern Water Bank and allowance of water storage outside of the SWP service area has altered or will alter SWP contractor demand and ability to receive article 21 water.

The EIR must analyze the degree to which eliminating use provisions for article 21 and providing urban users with increased access to article 21 water resulted in new uses of that water, including serving new growth-fostering water transfers. Analyses should also identify the degree to which altered article 21 previsions have shifted scheduling and delivery of Table A water and whether such shifts have resulted in changes to SWP operations (including changes in the timing or amount of water released from Lake Oroville and San Luis Reservoir).

The proposed project would eliminate pre-Monterey allocation rules for article 21. The priority for agricultural use and groundwater replenishment would be removed, and a new allocation method allowing access to article 21 based on Table A amount percentages would be adopted. Eliminating pre-Monterey contract allocations allows more contractors, including municipal contractors that had not historically received significant deliveries of article 21, to access this water and put it to use for purposes that are much different than per-Monterey uses of Article 21.

The DEIR fails to disclose the implications of this potential change in allocation. In particular, the DEIR fails to clearly account for the impact resulting from allocating Article 21 to municipal contractors that may use the water for hardened demand and development. Subsequent versions of the EIR must include analysis and clear disclosure of the implications of altering Article 21 allocations.

- **Turnback Pool**

With the Monterey Amendments in place, all SWP contractors have an incentive to request their full contract amounts. In addition, the Turnback Pool provisions of the Monterey Amendments provide a new incentive for SWP contractors to maximize their annual demand for their full contract amounts. The DEIR recognizes that pre-Monterey some contractors could not use their full Table A amounts, and in some cases that resulted in reduced water deliveries through the SWP. That water which was not captured or delivered by the SWP would have thus been left instream for environmental benefit.

However, the Turnback Pools allow the contractors to benefit financially by requesting their full Table A amounts, even if that contractor does not require such water within its own service area. Other contractors who can make use of the water are encouraged under the

Monterey Amendments to purchase Turnback Pool water. It follows that under the proposed project, all contractors would request full contract allocations, regardless of need for that water. As PCL has long since noted, that tendency is likely to harden, and increase, the demand for Delta pumping.[92]

- **Storage Outside of Service Area**

In allowing SWP contractors to store SWP water outside of their service area, the proposed project significantly expands SWP contractors' ability to accept water, and increases the demand for water from the Delta. The DEIR obscures this fact by assuming that much of the water stored outside contractors' service areas under the provisional implementation of the Monterey Amendments *could* have been stored within the contractors' service area. This assumption is very speculative. It assumes that infrastructure including transport facilities was available; cost of delivery, water quality, access to the right to store water, and other factors impacting the availability of storage capacity within the service area would not have prevented storage of that water within the service area. None of these factors were analyzed when the lead agency determined that water delivered out of the service areas could have been received within the service areas. Rather, the DEIR explains that the assumption is based on, "a telephone survey of contractors conducted by DWR."[93]

The DEIR further seeks to reduce the perceived impact of water delivered to out of service area storage by assuming that such water would have instead been stored in San Luis Reservoir and delivered to other contractors via article 21 or increased Table A. Again, this assumption is purely speculative. It assumes that other contractors could have received the water and placed it within service area storage. These assumptions clearly seek to minimize the appearance of impacts. Indeed, through this methodology, the DEIR determines that of the 1,092,647 acre-feet of water delivered to out of service area storage between 1996 and 2003, only 44,000 acre feet are actually attributable to the proposed project. This is due to the multiple assumptions inappropriately incorporated into the baseline. However, as explained above, these assumptions do not belong in the baseline, and must be removed from the EIR.

- **Altered allocation under Articles 18 (a) and 21**

The DEIR fails to disclose the impacts of altered allocations under article 18(a). Specifically, the DEIR fails to how altered allocations that expose municipal contractors to reduced reliability could tend to encourage municipal contractors to increase demand for water in normal and wet years in order to restore dry year and shortage reliability.

The pre-Monterey article 18(a) provision requiring an agriculture-first reduction in the event of water shortages provided municipal contractors with a higher degree of drought reliability. Under the proposed project's alteration of article 18(a) this protection is eliminated. The proposed project thus exposes municipal contractors to reduced water reliability during

[92] See Attachment A (PCL comments on Draft Chapter 9, p. 6.)

[93] DEIR, p. 6-60 (No details of that survey are presented).

periods of shortage. Moreover, because the Monterey Amendments would, if finalized, permanently delete article 18(a)'s agriculture-first cutbacks, they would remove a major obstacle to agriculture-to-urban transfers that facilitate growth.[94]

It is reasonable and foreseeable to expect that municipal contractors will seek to mitigate the impact on their water reliability. In fact, the proposed project provides water management tools that would assist contractors in such an effort. The proposed project allows these contractors to greatly expand storage options, it provides these contractors with greater access to article 21 water and eliminates restrictions on use of that water, and it establishes the Turnback Pool giving these contractors greater access to water that would not be used by other contractors.

It is reasonable to assume that given the changes proposed, municipal contractors would have a greater incentive to maximize use of the tools provided in the proposed contract (maximizing Table A requests, utilizing article 21, Turnback Pool and carryover provisions to maximize water in newly available storage) in order restore their dry year and shortage reliability.

It is important to note that both Turnback Pool and article 21 water are usually available in the winter and the spring. SWP exports during these periods have been identified as a primary contributor to the Pelagic Organism Decline in the Delta Any action that would tend to encourage increased demand and increased export for these categories of water would therefore have a significant impact on the Delta.

The EIR must explicitly disclose the impact of eliminating the protections for municipal contractors under Article 18 (a), and the resulting impacts on the Delta. As elaborated below, the DEIR omits analysis of impacts or provides inadequate analysis of significant impacts associated with the proposed project.

- **Environmental consequences of financial restructuring under Article 51**

The DEIR briefly describes, but never analyzes the environmental consequences of article 51, one of the most important structural revisions in the SWP system that would be initiated by the Monterey Amendments, should they be adopted. DEIR, p. 4-8. Among other revisions, article 51 changes the way that DWR addresses revenues exceeding the cost of operating the SWP system.[95] As Environmental Defense documented years ago in legislative

[94] The record of such transfers during the interim enforcement of the Monterey Amendments deserves careful study. There is no evidence to support the speculative assertion that these Table A transfers would have occurred anyway in the absence of the Monterey Amendments. Rather, as the EIR correctly points out (DEIR 6-10), only one occurred previously (Devil's Den), and it was expressly subject to agriculture-first cutbacks even after transfer to urban use.

[95] In *PCL v. DWR*, the court of appeal recognized the interrelationship between revised articles 18 and 51 in the Monterey Amendments. The court "agree[d] with plaintiffs that inclusion of article 51 in the amended contracts implies that DWR and the contractors have forsaken their expectation that the SWP facilities will be built as planned and will deliver 4.23 MAF of water annually. Article 51 allows contractors a rebate for the costs previously assessed for facilities

testimony on the Monterey Amendments, appended as attachment I, the revenue stream returned to the contractors under article 51 is enormous over the life of the project contracts.

The new EIR must carefully analyze the environmental consequences of article 51 as an integral part of the Monterey Amendments, rather than summarily assuming that because this provision is "economic" in nature it would not contribute to such impacts. Although CEQA does not require analysis of purely economic or social changes, it requires analysis of environmental impacts that can be traced to such changes. (See, e.g., 14 Cal. Code Regs, § 15131; *San Franciscans Upholding the Downtown Plan v. City and County of San Francisco* (2002) 102 Cal.App.4th 656, 695-98.) Here, the EIR must analyze the relationship between articles 18 and 51, and must compare the project to the no-project scenario in which table A amounts are reduced *without* article 51 rebates. The EIR must also evaluate the environmental consequences of article 51's effect on water rates, and consider the financial adjustments made in article 51 when making its assessment of project alternatives and mitigation.

- **Reduction of state oversight of water transfers under Article 53**

Prior to the Monterey Amendments, DWR had contractual responsibility to oversee and approve transfers of water through the SWP. Under the proposed project, DWR largely excuses itself from this responsibility for certain transfers. Contractors are now permitted to transfer project and no project water at their convenience. DWR has essentially given up effective ability to control where and how water is used within the SWP.

This provision is particularly important for its implications on growth in California. As stated above, the pre-Monterey contracts recognized the difference between municipal reliability and agricultural reliability. Agricultural Table A amounts were explicitly conditioned by their reliability. Thus, it would be inappropriate to use agricultural water transfers for certain purposes, including development. However, provisions of the proposed project including elimination of article 18(b) and changes in 18(a) now imply that all water in the SWP has equal reliability. This new dynamic risks creating, rather than eliminating, a paper water problem. Under the proposed project, DWR would abandon its role in clearly articulating the difference in reliability of water and hand that responsibility to local agencies.

The proposed project implies that all water under the SWP has equal reliability, yet very little water has been removed from the total Table A amount. Given that the original contracts explicitly stated that Table A amounts for agriculture were not as reliable as municipal contracts, it is illogical to assume that suddenly, the SWP can reliably deliver water to all contractors. Yet under the proposed project, agricultural to municipal transfers will be more common and there will be no requirement to address the issue of reliability. This scenario risks inducing growth based on unrealistic assumptions of water reliability.

- **The DEIR fails to disclose impacts to the Bay Delta Estuary.**

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that have never been built. Indeed, fiscal and environmental pressures militate against completion of the project." (83 Cal.App.4th at p. 914, n. 7.)

As discussed above, the Bay Delta Estuary is in critical decline. Fisheries populations have declined dramatically since 2000. Several fish species, including the Delta Smelt, are now at historic low population indices. State and Federal scientist have determined that increased Delta exports, and in particular, exports occurring in the winter and spring are a significant contributor to these declines.

Yet many of the provisions of the proposed project would *increase* the amount of water exported by the SWP during times of "excess" in the Delta. Excess conditions usually occur in the winter and spring, the very time that delta smelt have become vulnerable to project operations. For instance, the DEIR admits that the Turnback Pool and Article 21 are both provisions that seek to capture water earlier in the year. Yet the DEIR fails to incorporate that timing factor into the analysis of impacts in the DEIR.

C. The DEIR fails to adequately growth-inducing impacts, and impermissibly defers the responsibility to analyze them.

The DEIR attempts to absolve DWR of fully analyzing and mitigating the growth inducing impacts of the proposed project. That evasion has profound environmental consequences, due to the stakes involved: as the DEIR concedes, the combination of new table A and article 21 deliveries in the project could support new populations ranging from 405,103 in the "more resource-intensive" scenario, and 561,684 in a "less resource-intensive" scenario. DEIR, p. 8-9. Yet the DEIR asserts in that DWR is *not* required to extensively analyze the growth inducing impacts of water delivered by DWR because DWR is not responsible for land-use decision. *Id.* at pp. 8-13, 14. The DEIR further holds that DWR is not responsible for differentiating between the impacts of water deliveries that stimulate new growth and the impacts of water deliveries used to enhance dry year reliability. *Id.*, p. 13.

This indifference to a major environmental consequence of the project, if finalized, would constitute a major evasion of CEQA responsibility. CEQA requires a lead agency, such as DWR, to analyze the full environmental consequences of its decisions. That responsibility creates a duty to analyze the consequences of removing an obstacle to growth, or accommodating growth. In this context, the DEIR's principal strategy—to defer the real analysis to post-decision *local* determination, is completely untenable.[96] None of these local decision-makers will have the opportunity to analyze the cumulative consequences of accommodating half a million Californians before the suite of growth-inducing changes in the Monterey Amendments become a *fait accompli.* Moreover, particularly given the decade-plus history with interim enforcement of the Monterey Amendments, there is no basis to support the EIR's premise that the consequences are speculative. Remarkably, the EIR does not even attempt to address the growth-inducing or growth-accommodating impacts of known projects that have relied, in whole or in part, on the Monterey Amendments.[97] The EIR must disclose the impacts associated with

[96] See DEIR, p. 8-14.

[97] The EIR should start by analyzing the documentary history of such projects as Dougherty Valley in Contra Costa County, as well as numerous projects in Los Angeles County: among

the decision to remove the state oversight of SWP water that was embodied in the original pre-Monterey contracts.[98]

While the DEIR argues that DWR does not have responsibility for how water is put to use, it is indisputable that DWR has specific and fundamental responsibilities for overseeing the use of SWP water. Under the Monterey Amendments, DWR has given local agencies increased flexibility, and therefore increased ability to use the water in a way that would potentially impact the environment. While DWR cannot be expected to predict with absolute certainty how contractors and land-use agencies will use the water in the future, DWR has a responsibility to disclose all *potential* significant impacts resulting from this decision and the proposed project. DWR simply cannot be excused from disclosing the impacts of eliminating previously held responsibilities.

The EIR must include adequate analysis of growth inducing impacts, including analysis of how, where and for what purpose water made available under the Monterey Amendments has been put to use, and will likely be used should DWR adopt the proposed project. This analysis must disclose the growth inducing implications of eliminating article 18(b) and article 21(g)(1) of the original contracts, facilitating transfers between agricultural and urban contractors, conveying non-project water, providing municipal contractors increased access to Article 21, permitting unlimited storage outside of the service area, and implementing the Turnback Pool. In addition, the EIR must fully disclose how these provisions may tend to increase the demand for such water and the resulting impacts on the Delta and upstream operations of delivery of such water.

The EIR must specifically state the percentage of water which contractors now have access to under the Monterey Amendments that is likely to be stored for dry year reliability and the percentage which will be used for new growth. Also, the EIR must disclose the degree to which water made available under the Monterey Amendments will be used for resource-intensive growth and urban sprawl. Impacts analysis should include a study of the impacts of the growth likely to be induced by the proposed project water deliveries (i.e. resource intensive sprawl or infill development). For instance, water made available to Castaic Lake Water Agency is likely to result in development of open space and agricultural lands (and require new annexations), whereas water made available to Los Angeles Department of Water and Power is likely to result in development in already developed areas.

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them, West Creek, Gate-King, Riverpark, Northlake, Mission Village, Soledad, River Valley, and Newhall Ranch.

[98] Prior to the Monterey amendment, DWR had explicit oversight of storage of SWP water, water transfers through the SWP, Table A transfers, use of article 21 water, and allocation of water in times of shortage. article 18(b) also required DWR to provide explicit information on the reliability of SWP water through determining the minimum yield of the Delta. Furthermore, under article 18(b), DWR has the authority to reconcile Table A amounts with that minimum yield. Such authority provided the State will direct discretion over the amount of water that could be determined to be reliable.

In addition, as discussed extensively in section V above, the EIR must analyze how the transfer of the Kern Water Bank to local control has facilitated growth-inducing uses of the facility, as compared to operations that would prioritize dry year reliability.

D. The DEIR's assessment of the reliability of water supplies and growth evades, rather than analyzes, the problem of "paper water."

Regrettably, the DEIR's chapter on the reliability of water supplies (Chapter 9) and growth virtually ignores everything that PCL submitted to DWR on the subject during years of EIR planning that preceded the public draft. PCL therefore references its previous submissions on this issue[99] and once again requests specific responses. In a case of "fighting the hypothetical," the DEIR does not seriously engage the "common sense" connection between water availability and growth identified in *PCL v. DWR*, and instead, undertakes to dispute the premise. Essentially, DWR argues that growth based upon paper water never existed, that its extent has been exaggerated, and that new measures (biennial reliability reports, Urban Water Management Plans, and SB 221/ 610) will prevent it from happening in the future. DEIR, pp. 9-2 to 9-11.

This analysis is fatally flawed. First, it asks the wrong question about the historical role of paper water, focusing on whether inflated water reliability estimates have subjectively motivated land-use decision-makers to approve projects. The DEIR answers the question in the negative, not because paper water isn't real, but because ignoring water reliability has been so pervasive that Table A amounts can't be considered uniquely responsible. DEIR, p, 9-10. But a "but for" causation test is not what CEQA requires. What matters is the following:

- Historically and recently, land use decision-makers in California have frequently approved projects with little regard for the availability of adequate water supplies to support the development. Many of these projects have involved State Water Project water resources.[100] Moreover, a consistent body of CEQA case law, from *Kings County* through *Vineyard*, underscores the depth of the problem of decision-makers ignoring the reliability of water supplies,

- The pre-Monterey Amendments SWP contracts had mechanisms that could have been used to take "paper water" out of the calculus regardless of decision-makers' subjective motivations where SWP water was involved: enforcement of article 18(b)'s permanent shortage provision, and article 21(g)(1)'s proscription on using "surplus" water to build permanent economies.

- If the Monterey Amendments become permanent, these safeguards will disappear from the SWP contracts, regardless of what local decision-makers may later do in review of specific projects.

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[99] See Attachment A, particularly the comments addressing the chapter on paper water and growth.

[100] See Attachment J (Kanouse/ EBMUD study).

The problem of "paper water"—stated in its simplest terms, of development decisions grounded in expectations of water supplies exceeding what can actually be delivered—emerged as one of the central themes in the Third District's ruling, and is perhaps the issue with which *PCL v. DWR* is most closely associated in both case law and in public discussion. [101] Rather than providing the thorough and candid assessment of "paper water" and development anticipated in the appellate ruling, the DEIR provides little more than a cursory historical summary, a description of planning laws and practices, and a superficial discussion of Urban Water Management Plans. Indeed, the analysis presented here bears more resemblance to arguments about "paper water" unsuccessfully presented to the court of appeal than the probing and comprehensive assessment anticipated in the appellate ruling and settlement.

A puzzling duality pervades the DEIR's discussion. The historical overview is dismissive of the notion that inflated expectations of SWP deliveries affected development decisions. But rather than debunking the notion that such inflated expectations were present in projects relying on SWP water, the chapter argues, if anything, that they were all too real; that decision-makers so pervasively failed to consider potential constraints on SWP water deliveries that they would have paid little attention to the amounts of "entitlement" referenced in the project contracts.

The core of this analysis posits that planners assume that *local water agencies* will obtain the supply necessary to meet the long-term water demand that results from planned growth. But far from "disproving" reliance on SWP paper water, this analysis points to planners and decision-makers trusting the water agencies; in other words, they are presumed to have relied upon the same pervasive "water culture" in which the court grounded its historical analysis of the "huge gap" between entitlements and available supplies. Instead of analyzing the historical paper water problem, the DEIR repackages it.

A similar circularity pervades the chapter's extremely cursory analysis of SWP water supply and urban planning in the future. From the historical position that planners and decision-makers rarely even considered water supply, the draft swings to a somewhat exaggerated faith that they now "get it," due in part to changes produced by the *PCL v. DWR* decision and settlement, and in part due to parallel legislative changes (notably, SB 610 and SB 221). But the DEIR does not even begin to show that the "modern" mechanisms, such as SB 610/ 221 and Urban Water Management Plans, have now made paper water disappear. [102] Notably, the DEIR does not even analyze two new sources of paper water that are specifically associated with this project. The first, extensively discussed above, is the growing reliance on article 21 water to support permanent developments. The second is that DWR's over-reliance on CALSIM in its reliability reports, which have induced local decision-makers to rely on estimates of SWP yield

[101] See, e.g., *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal. App. 4th 715, 721; Kibel and Epstein, *Sprawl and 'Paper Water': A Reality Check for the California Courts* 20 CALIFORNIA REAL PROPERTY JOURNAL 22, 23 (Winter/ Spring 2002).

[102] Indeed, the DEIR has not yet addressed PCL's earlier criticisms of its analysis of Urban Water Management Plans, included in Attachment A,

that are vastly beyond historical deliveries. DWR still has yet to come to terms with this "cyber water" problem, which PCL identified in its scoping comments more than four years ago.[103]

D. The DEIR avoids, and impermissibly delegates to subsequent local review, project-related climate change impacts.

Climate change has been extensively addressed above in connection with baseline issues. The separate chapter on climate change in the DEIR (Chapter 12) creates additional CEQA problems, by systematically avoiding full and responsible discussion of project-related climate impacts. First, the analysis relies heavily on the dubious premise that, because DWR had concluded that the project would not affect *statewide* population growth, it would not affect growth-related greenhouse gas emissions "within the SWP service area as a whole." DEIR, p. 12-14. But DWR provides no support for the speculative premise that the location of development is inconsequential to greenhouse emissions. In fact, sprawling patterns of development cause considerably more greenhouse gas emissions than more compact forms of development that occur within existing urban areas. Turning "surplus" water into water that facilitates permanent new development in areas that are currently rural or agricultural will have a very significant impact on greenhouse gas emissions, and the DEIR needs to analyze how the proposed Monterey Amendments will affect that possibility.

Second, the DEIR does not study whether the elimination of pre-Monterey safeguards—including the permanent shortage provision in article 18(b) and the proscription on using "surplus" water to build permanent economies in article 21(g)(i)—may impact climate change by removing useful tools to reconcile supplies and deliveries in a climate-constrained project. The DEIR should study from a climate change perspective whether there is a difference between those pre-Monterey approaches and the post-Monterey approach (reliability reports and liberalized use of article 21).

Finally, the DEIR does not analyze whether would be a project-related difference in emissions due to the difference between serving urban and agricultural contractors. The elimination of the pre-Monterey "agriculture first" preference may make that distinction tangible.

E. The DEIR inadequately addresses cumulative impacts.

[103] As PCL observed in its March 2003 scoping comments (p. 8), a detailed analysis by Dennis O'Connor, then of the California Research Bureau, concluded that DWR's reliability report had no credible explanation for exceeding historic deliveries by around 50 percent. He concluded that the results were inconsistent with previous estimates and models, and recent deliveries were lower than the modeled conditions. His assessment also observes that CALSIM II is not calibrated or otherwise verified, and that the reliability report did not use the CALSIM II model as designed. O'Connor's analysis warns that DWR's assessments of reliability should not replace the "paper water" problem with a new, simulation-based "cyber water" problem. While O'Connor was addressing the draft 2002 report, the problems have never been corrected.

Although the cumulative impacts discussion (Chapter 10) mentions the Central Valley Project, it does not analyze the important question of how the project will affect the environment via CVP use of Delta export capacity. The DEIR analyzes the impact on the availability of water (DEIR, pp. 7-55 to 7-57), but the environmental impacts due to increased pumping from the Delta were not.

VII. Recommended mitigation of impacts

PCL expects that with the additional analysis suggested above, the Final EIR will determine that the proposed project has significant impacts on the environment. Therefore, we provide the following recommendations that could be utilized to mitigate for some, although not all, of the significant impacts identified in these comments.

- To partially prevent growth inducing impacts, the EIR can require DWR to provide a clear statement that Article 21, transfers of Article 21 and reliance on Turnback Pool water are not reliable sources of water and that such sources are not suitable for support of permanent economy, including development. To avoid any confusion, the EIR should commit DWR to excluding these sources of water from the Report on the Delivery Reliability of the State Water Project.

- To partially mitigate impacts associated with eliminating Article 18(b), the EIR should commit DWR to provide explicit guidance on how to interpret reliability curves included in the SWP Delivery Reliability Report.

- To partially mitigate potential impacts to the Delta from increased pumping of Article 21 water, the EIR can prohibit declaration of Article 21 when fish agencies determine that there would be threat to fish species from export of such water.

- To partially mitigate for the loss of statewide oversight of the use of SWP water, the EIR should commit DWR to providing full disclosure of accounting, pumping and delivery of SWP water to the public in a timely (weekly) basis.

- To partially mitigate for the loss of the Kern Fan Element as a public trust resource, the EIR should impose conditions requiring that public trust agencies will have priority for the capacity of the Kern Fan Element for the storage of water to protect public trust resources including the health of the Delta.

These measures would not fully mitigate the impacts of proposed project. Impacts such as increased demand for SWP water to offset dry year by municipal contractors would not be addressed by the proposed mitigation measures above. However, the final EIR would need to address all impacts of the proposed project.

As an original plaintiff in the Monterey Amendments litigation, PCL has an interest in ensuring that the final EIR provide the public and decision-makers with an accurate and thorough

analysis of the proposed Monterey Plus actions and a thorough comparison of viable and feasible alternatives, consistent with the original *PCL v. DWR* court decision.

We are distressed that despite the direction provided by the Court of Appeal, and despite our participation in the EIR process, and despite the significant events that have occurred since 1995, including the collapse of the Delta, the Monterey Plus DEIR is largely based on the same unfounded assumptions included in the CCWA EIR, and EIR rejected by the Court of Appeal.

The current DEIR manifestly fails to provide the full review demanded by the Court – and by the California Environmental Quality Act – and that was anticipated by plaintiffs in the settlement agreement.

We urge DWR to remedy the significant flaws in the current DEIR by fully analyzing, disclosing and mitigating the impacts of the proposed project in future versions of the EIR, as CEQA most emphatically requires.

Thank you for taking our strongly felt comments into consideration.

Sincerely yours,

Gary A. Patton, Executive Director

Roger B. Moore
Rossmann and Moore, LLP

CC:
Lester Snow
Arve Sjovold
Naomi Kovacs
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Senator Machado
Senator Steinberg
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SWP contractors

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August 25, 2008

Ms. Mindy McIntyre, Water Program Manager
Planning and Conservation League
1107 9th Street, Suite 360
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Dear Ms. McIntyre:

This letter responds to your letter dated March 16, 2008 providing comments of the Planning and Conservation League (PCL) on the draft of the State Water Project Delivery Reliability Report—2007 (DRR(2007)). Your letter criticizes the timing of the release of the report, expresses concern about using CalSim II for determining absolute values of exports and deliveries, and makes several recommendations for improvement. Responses to your specific comments are included in the attachment.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department of Water Resources (DWR) responses.

Attached is a summary of your comments and DWR's responses that will appear in final of the 2007 Delivery Reliability Report.

Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

Attachment

cc: See attached list

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Attachment

Comment:
DWR should commit to releasing the Draft 2009 Delivery Reliability Report in June 2008 and the final report by February 2009 in order for local water agencies to have sufficient time to incorporate the information in the report into the 2010 Urban Water Management Plans (UWMPs).

Response:

DWR agrees with the goal of producing the 2009 Delivery Reliability Report according to a timeline which will allow for the information in the report to be incorporated into the 2010 UWMPs. The objectives of DWR for the report are to encourage public discussion and understanding of the estimation of the SWP delivery capability, meet the conditions of the settlement agreement, and provide the best available quantification of SWP deliveries. It is unfortunate that the DRR (2007) could not be finalized in 2007. Given the 2007 federal court order on new SWP operation criteria to protect delta smelt, DWR chose to delay the completion of the report until the impacts of this court order on SWP delivery reliability could be assessed. Re-consultation under the Endangered Species Act is underway for the SWP and CVP. The resulting biological opinions will define the operation rules for the water projects. The biological opinion from the U.S. Fish and Wildlife Service is expected to be completed this calendar year (2008). However, the biological opinion from the National Marine Fisheries Service will be completed in Spring 2009. The information contained in the next Delivery Reliability Report will incorporate these new rules and, therefore, the draft report is expected to be issued in mid-2009.

Comment:

The draft DRR (2007) fails to articulate how reliability should be factored into water planning.

Response:

Chapter 7 of the draft DRR (2007) presents two examples of how to use the information in the report to estimate SWP deliveries at 5-year increments between 2007 and 2027. Example 1 illustrates this process for calculating average annual supplies, a single dry year, and average deliveries over multiple dry years. Example 2 illustrates how to develop similar information for years or sequences selected by the individual SWP contractor.

By providing examples of a hypothetical contractor with Table A amounts of 100,000 af and using the delivery data in terms of percent of maximum Table A amount, the report makes the examples easy to apply by any contractor. Each SWP contractor has a

unique mix of local and imported water supplies, relies on SWP supplies for a different proportion of its needs, and has an individual conservation flexibility to accommodate supply variations. DWR believes that individual contractors can best determine under which conditions to rely upon current and future SWP deliveries, given a contractor's other supply sources or given the locally acceptable risk level for water delivery shortages.

Comment:

The draft DRR (2007) fails to disclose the implications of reliance on water that cannot be reliably delivered, in particular Article 21 water. Article 21 water should not be included in the list of water supply sources in any table.

Response:

The draft DRR (2007) clearly communicates the conditional availability of Article 21 deliveries. The first mention of Article 21 water in Chapter 4 includes a footnote which lists the limitations for the availability of this water. Chapter 5 includes a discussion of Article 21 of SWP contracts allowing contractors to receive additional water deliveries only under four specific conditions:

1. The water is available only when it does not interfere with Table A allocations and SWP operations;

2. The water is available only when excess water is available in the Delta;

3. The water is available only when conveyance capacity is not being used for SWP purposes or scheduled SWP deliveries; and

4. The water cannot be stored within the SWP system. In other words, the contractors must be able to use the Article 21 water directly or be able to store it in non-SWP facilities.

Chapter 5 of the report also points out that in the absence of storage, Article 21 water is not likely to contribute significantly to local water supply reliability. In addition, Tables 6-8, 6-9, 6-17 and 6-18 compare the results of the annual amounts of Article 21 available during prolonged dry periods and wet periods for the DRR (2005) and the DRR (2007). The variability of the annual amounts and the reduction in the amounts estimated in the DRR (2007) clearly illustrate the uncertainty associated with Article 21 supplies.

DWR believes that the issue of incorporating supplies received under Article 21 into the assessment of water supply reliability is a local decision based on specific local circumstances, facts, and level of water supply reliability required. Article 21 water is

presented separately in the report so local agencies can determine whether it is appropriate to incorporate this supply into their analyses. In many cases, water supplies available under Article 21 of the water supply contract are an important yet ephemeral source of water from SWP facilities that needs to be included in the DRR.

Comment:
The draft DRR (2007) fails to inform the reader that CalSim II model runs very likely overestimate the reliability of the SWP because the studies in the DRR do not account for Delta risk factors and the need to respond to environmental, water quality, and area of origin legal requirements.

Response:

"Delta risk factors" is an all inclusive term that has numerous components. It is not accurate to claim that CalSim-II simulations do not account for them. The simulations in the DRR (2007) account for restrictions due to potential protective measures for endangered fish, water quality requirements, and climate change. These potential impacts are extensively addressed in Chapter 4 of the DRR (2007). Implementation of potential limitations to exports from the Delta to protect delta smelt are represented in the current level study in the DRR (2007) by incorporating the interim decision of the federal Court. The future level studies incorporate climate change and these fish protection measures. CalSim II simulations do not account for a catastrophic levee failure but the potential interruptions to water supply are discussed in the report (ref. DRR 2007, P.8, PP.18-19). It is also inaccurate to claim that CalSim-II does not account for the "area of origin legal requirements." The estimates of water available from the source areas have been developed with assumptions on future population growth in upstream areas and the resulting consumptive demand, as well as projections of crop acreages in the valley floor and the resulting evapotranspiration demand.

Comment:

The draft DRR (2007) fails to provide guidance to SWP contractors on how local and overall water supply reliability could be improved.

Response:

Providing guidance to SWP contractors on how local and overall water supply reliability could be improved is beyond the intended scope of the DRR (2007). The purpose of the report is to present DWR's current information regarding the annual water delivery reliability of the State Water Project for existing and future conditions. A key objective of the California Water Plan is to provide guidance to local agencies and governments and regional partnerships on ways to increase regional self sufficiency in meeting their future water demands. The Water Plan includes a diverse set of resource management strategies that can be implemented in different combinations to provide water supply reliability and to meet other water related resource management needs in different regions of the state.

Comment:

The DRR (2007) should include a discussion regarding the reliability of all types of water delivered from the SWP.

Response:

The report provides information on the water supply categories most important to SWP water contractors, Table A and Article 21. The conditions associated with the supply under Article 21 are fully discussed in the report. More detail on the characterization of Article 21 supply is provided in the third response contained in this attachment.

Comment:

The DRR (2007) should include water supply source tables for each SWP contractor. DWR should include a clear and understandable forecast of how much water (both Table A and Article 21) the SWP can deliver under current and future conditions for each SWP contractor.

Response:

The DRR (2007) provides estimates of Table A supply for the entire range of delivery probabilities, zero to 100 percent. Calculating a Table A delivery amount for an individual contractor is a direct calculation based upon the maximum Table A amount in the contractor's water supply contract. The maximum Table A amounts for each contractor are contained in Appendix C, *State Water Project Table A Amounts*. Determining the acceptable level of risk associated with the estimated Table A delivery amount is a local decision based on specific local circumstances, facts, and level of water supply reliability required. Article 21 water is presented separately in the report so local agencies can determine whether it is appropriate to incorporate this supply into their analyses. Some SWP contractors will have no ability to receive Article 21 supplies. Estimating the amount of Article 21 deliveries for each SWP contractor is beyond the scope of the DRR (2007), as is developing an inventory of each SWP contractor's water supply sources.

Comment:

The DRR should provide estimates of SWP delivery reliability for the period required by the following UWMP (which would be 2030).

Response:

The DRR for 2009 will include estimates for 2009 and 2029 which can be used for the updated Urban Water Management Plans.

Comment:

The DRR should clearly disclose the limitations of modeling, the implications of modeling assumptions, and provide recommendations to water agencies for appropriate use of modeling results.

Response:

The points PCL includes in this comment are ones which were included in your letters commenting on the draft DRR (2002) and draft DRR (2005). The responses to these comments are included in the appendices of the corresponding final reports and referenced here. Disclosing the limitations of modeling is accomplished through clearly disclosing significant assumptions that are made in the modeling process, and that disclosure has been done fully and extensively in the DRR (2007). Chapter 7 of the report illustrates how to interpret and apply the results should local planning agencies choose to use these estimates as one of the components of their resource management decisions.

Comment:

The DRR should include a more comprehensive analysis of climate change impacts on water delivery reliability, including issues of Delta water quality and sea level rise, consumptive use of water in areas of origin, availability of hydropower, and flood safety. DRR should provide guidance to water agencies on how these omitted impacts are likely to affect deliveries.

Response:

DWR is a leader in applying climate change factors to projections for water supply and we will continue to take a leadership role in this endeavor. The DRR (2007) uses four climate change scenarios for rainfall and runoff to develop the range of delivery estimates for the future. The Department is investigating methods to estimate the effects of sea level rise on Delta water quality. The DRR is published every two years and we will use the best information and analytical methods available to develop the latest projections for delivery capability under potential climate change scenarios. Flood safety and hydropower effects are beyond the scope of the report.

Comment:

The DRR fails to evaluate variable levels of demands, including the goal of a 20% reduction in per capita consumption. The DRR should use the three demand scenarios presented in DWR's 2005 State Water Plan.

Response:

The DRR is intended to provide information on the amount of Table A and Article 21 water that can be delivered considering a variety of hydrologic conditions, climate change factors, regulatory constraints, and other factors. It also illustrates how that water would be allocated among contractors based on their Table A amounts. The DRR is not intended to evaluate how a comprehensive demand reduction might affect the demand for SWP supplies of individual municipal and agricultural contractors.

A reduction in per capita consumption may not affect SWP demands. If individual contractors can reduce their demand for SWP supplies as part of their total water supply portfolio, they could either offer any unneeded water to other contractors or request delivery of less water from the SWP than would otherwise be available to them. In the latter case, DWR could allocate the unclaimed amount to other contractors by increasing the percentage allocation of Table A supplies available to them. In other words, the same amount of water would continue to be allocated, but in different proportions to the contractors. In addition, factors such as water quality of the source supply and the costs associated with treating the supply for municipal use are significant considerations for SWP contractors. For some SWP contractors, the quality of the SWP supply is better than other sources and it is used to reduce treatment costs for municipal supply. In this situation, demand on another source of supply may be reduced due to conservation measures and the demand for SWP supplies would be unchanged.

SWP contractors should consider their current water demands and future demand scenarios to help determine the mix and amounts of water supply sources, including SWP supplies, they will need to meet their water demands and other water resource objectives. It would be advisable for local water agencies to consider a future demand scenario that assumes a reduction in per capita water use because it could change how much they decide to invest in different water supply sources. These evaluations, and their implications to the demand for imported water from the SWP and other sources, is a responsibility of the SWP contractors and can be a part of their 2010 Urban Water Management Plans.

Comment:

The DRR should consider operations beyond the Wanger decision to include those that are consistent with State and federal fishery agencies for protection of threatened or endangered species.

Response:

The estimates for delivery capability will be updated when the rules of operation to protect endangered fish are defined in the revised federal biological opinions for the operation of the SWP and Central Valley Project.

Comment:

The DRR must recognize that DWR has not yet issued a final decision and EIR for the Monterey Plus Project.

Response:

The DRR will be updated in 2009, and will include the most current information available regarding the status of the Monterey Plus Project and any relevant decisions of DWR regarding the project. It is not possible to predict at this time what those decisions might be and whether they would affect the reliability of SWP deliveries.

Comment:

As participants in the Monterey Plus EIR Committee process, PCL has previously submitted comments to DWR expressing our concerns regarding the adequacy of CALSIM II for use in water management planning and deliveries assessment. Rather than resubmit those comments, we incorporate them by reference here, and highlight some particular issues below.

Response:

Most of the comments PCL incorporates from comments submitted on the Monterey Agreement DEIR are ones that are addressed above or have been previously responded to as comments to the DRR (2002) or DRR (2005). We refer to those responses. Our response to the comment regarding bimodal distribution of water years follows.

Comment:

Exceedence charts in the DRR hide the bimodal distribution of water years in California. CalSim II is ill-suited to address bimodal distribution of water years because the model produces an exceedence chart that hides this reality.

Response:

Currently CalSim-II uses 82 years (water years 1922-2003) of historical flow records to reflect the hydrologic variations in Central California. The historical flow records are adjusted for the influence of land-use change and upstream flow regulation in order to represent the possible range of water supply conditions at a given level of development. The model assumes that facilities, land use, water supply contracts, and regulatory requirements are constant over the 82 years of study period. Using a monthly time step, CalSim II model simulates operation of CVP and SWP system storage and conveyance under specified operations rules. Model output provides project operations under a given level of development for the entire study period. One of the key model outputs is simulated SWP annual deliveries, which are ranked from low to high and plotted in an

exceedence chart. There is no intention to hide any inherent statistical properties of historically observed flow data.

Comment:

DRR fails to recognize that DWR has chronically failed to meet water quality standards in the Delta under historical operations and it fails to recognize the significant environmental degradation under the historical operations.

Response:

DWR operates the SWP to meet water quality objectives established by the State Water Resources Control Board (Board) and incorporated into DWR's water rights permits for the SWP. The water quality and fish flow requirements are contained in the Board's Decision 1641. In addition, the SWP is operated to meet requirements contained in the federal ESA biological opinions. Operation of the SWP has consistently met all water quality requirements except for those established for the south Delta, for which the salinity source is the San Joaquin River and not ocean-derived salts. The SWP does not contribute in any way to salt loads in the San Joaquin River and the southern Delta. The SWP is operated to help in achieving the south Delta salinity standards however, SWP operation cannot control south Delta water quality. This is because of the effects of the local flow and water quality conditions attributable to areas of stagnation, agricultural diversion and return flows, local wastewater discharges and lower quality water from the San Joaquin River. DWR is pursuing the installation of operable gates in the south Delta to improve circulation and, hence, water quality in the area.

Comment:

DRR should list potential sources of errors and show the range of possible outcomes due to these errors and provide recommendations to water agencies for addressing modeling faults-for example reduce the amount of deliveries predicted by CalSim II by some percent. By omitting both possible sources of errors and potential outcome ranges, the DRR projects a false certainty that reported deliveries are likely.

Response:

Quantifying the amount by which DRR estimates should be reduced or increased in order to achieve more accurate estimates of reliability requires a scientifically sound analysis of the uncertainties for numerous variables, each with their own error band, and developing a method to combine these uncertainties to get an estimate of the resultant uncertainty and its effect on the delivery reliability of the system. This is the approach that DWR is pursuing in conjunction with identifying and quantifying uncertainties associated with the system reliability in the face of the climate change phenomenon. However, until we can make reasonable and scientifically sound statements on uncertainties, we must rely on identifying a handful of variables that we know by experience could significantly affect SWP system reliability and provide the

users with a sense of how much over-estimation or under-estimation might be involved. An example would be reducing the input data on rim flows to major storage facilities of the system by a certain percentage and reporting the difference in simulation results. Such a study was done in the CalSim-II sensitivity analysis conducted in 2005 and presented in the 2005 Delivery Reliability Report.

From: Stuart Robertson [stuart@robertson-bryan.com]
Sent: Thursday, January 31, 2008 3:11 PM
To: 2007DRRComments
Subject: Comments

You are way off base to focus on climate change – this is more speculation than science as to timing and magnitude.

Delta conveyance is a far bigger, real and eminent threat. The weakness of the Delta levees is a known risk. One major failure due to a rodent, earthquake (quantifiable) or yes, global warming would catastrophically impair the SWP.

Get off the climate change and address something we can deal with within 20 years

Stuart Robertson, President
ROBERTSON-BRYAN, INC.
voice: (916) 687 - 7799
stuart@robertson-bryan.com

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
SACRAMENTO, CA 94236-0001
(916) 653-5791

August 11, 2008

Mr. Stuart Robertson, President
Robertson-Bryan, Inc.
9888 Kent Street
Elk Grove, CA 95624

Dear Mr. Robertson:

This letter responds to your email of January 31, 2008 providing comments on the draft of the State Water Project Delivery Reliability Report—2007 (DRR(2007)).

In your email, you state that the draft DRR (2007) places too much focus on climate change and should instead focus on less speculative risks which can be addressed in the next 20 years, in particular the threat posed by weak Delta levees.

The relative uncertainty of the effects of climate change on SWP delivery reliability are appreciated. However, Governor Schwarzenegger's Executive Order S-3-05, signed on June 1, 2005, directs the Secretary of the California Environmental Protection Agency to coordinate with State agencies to report every two years on the impacts to California of global warming, including impacts to water supply. The Department of Water Resources identifies climate change in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management. This is because analysis has shown that climate change may in the future seriously affect the State's water resources, particularly SWP's ability to deliver water. The DRR (2007) recognizes the uncertainty of climate change projections by evaluating future State Water Project deliveries under four scenarios of climate change: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0. Simulated deliveries under these scenarios of climate change were then interpolated to estimate deliveries in the year 2027.

The draft DRR (2007) acknowledges the real threat of levee failure to State Water Project delivery reliability, citing key findings in the Draft Delta Risk Management Study (DRMS) Phase 1 Report. The draft DRMS Phase 1 report also points out that the impact of a levee failure on SWP deliveries would depend upon when and where the levee failure occurred. The draft DRR (2007) includes a discussion of DWR's development of an Emergency Operations Plan that will establish procedures for emergency preparedness and incident management activities to enhance the State's ability to prepare for, respond to, and recover from a Delta levee failure disaster and will provide DWR with a plan focused specifically on a catastrophic levee failure disaster.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

March 13, 2008

Department of Water Resources
SWP Delivery Reliability Report – Attn: Cynthia Pierson
P.O. Box 942836
Sacramento, CA 94236-0001

Re: Comments on Draft State Water Project Delivery Reliability Report, 2007

Dear Ms. Pierson:

On behalf of the State Water Contractors (SWC), I am writing to provide comments on the Department of Water Resources' (DWR) Draft State Water Project Delivery Reliability Report, 2007 (2007 Report). The SWC is a non-profit association of 27 public agencies from Northern, Central, and Southern California that purchase water under contract from the California State Water Project (SWP).[1] The SWP is the state's largest water delivery system, and collectively, members of the SWC deliver SWP water to more than 25 million residents throughout the state and more than 750,000 acres of highly productive agricultural land.

The SWC have reviewed the 2007 Report and found that it provides a reasonable assessment of current and future SWP delivery reliability, given the limitations and future uncertainty discussed in the report. We believe that the following comments will help improve the final 2007 Report and provide additional information that will be useful to the SWP Contractors in applying the delivery reliability results from the report into their own planning efforts.

STATE WATER CONTRACTORS
SWC
Served by the State Water Project
FOUNDED IN 1982

DIRECTORS

Dan Masnada
President
Castaic Lake Water Agency

Thomas Hurlbutt
Vice President
Tulare Lake Basin Water Storage District

Steven Robbins
Secretary-Treasurer
Coachella Valley Water District

Stephen Arakawa
Metropolitan Water District of Southern California

Thomas Clark
Kern County Water Agency

Russell Fuller
Antelope Valley-East Kern Water Agency

Joan Maher
Santa Clara Valley Water District

David Okita
Solano County Water Agency

Ray Stokes
Central Coast Water Authority

General Manager
Terry Erlewine

[1] The members of the SWC are: Alameda County Flood Control and Water Conservation District Zone 7, Alameda County Water District, Antelope Valley-East Kern Water Agency, Casitas Municipal Water District, Castaic Lake Water Agency, Central Coast Water Authority, City of Yuba City, Coachella Valley Water District, County of Kings, Crestline-Lake Arrowhead Water Agency, Desert Water Agency, Dudley Ridge Water District, Empire-West Side Irrigation District, Kern County Water Agency, Littlerock Creek Irrigation District, Metropolitan Water District of Southern California, Mojave Water Agency, Napa County Flood Control and Water Conservation District, Oak Flat Water District, Palmdale Water District, San Bernardino Valley Municipal Water District, San Gabriel Valley Municipal Water District, San Gorgonio Pass Water Agency, San Luis Obispo County Flood Control and Water Conservation District, Santa Clara Valley Water District, Solano County Water Agency, Tulare Lake Basin Water Storage District.

1. **Studies in 2007 Report are based on interim operations and will need updating with new OCAP operations.** The updated studies included in the 2007 Report all include the interim SWP and CVP operations rules imposed by the December 2007 Federal Court order. These interim operations rules are temporary and will be imposed only until a new Operations Criteria and Plan (OCAP) and biological opinion are issued, which is anticipated to occur in September 2008. In spite of the temporary nature of these interim operations rules, these rules are included as operational constraints in the 2007 Report's updated studies, not only for 2007 but for 2027 as well. This may provide the mistaken impression that the constraints are long-term, which is not the case.

   The new OCAP and biological opinions will most likely include operations rules that differ from those in the interim Court order. As a consequence, the results in the 2007 Report will be outdated as soon as the new OCAP is available in about six months. If DWR proceeds with finalizing this 2007 Report based on the interim operations rules, the final report should more clearly stress the interim operations upon which the 2007 Report studies are based and the limitations of the results presented, and DWR should commit to updating the report's studies based on new OCAP operations when it is available. Or alternatively, since there seems to be little value in finalizing a report that will almost immediately be outdated, DWR could delay finalization of this report until the new OCAP is finalized and studies can be updated (and in the interim, data from this draft 2007 Report would be available for use by anyone needing reliability data). This updated reliability information will be particularly important given that many agencies will begin preparation of their Urban Water Management Plan (UWMP) updates during 2009 (updates are due by December 31, 2010), and the final version of this 2007 Report will serve as guidance for their SWP supply analyses.

2. **Changes included in 2007 Report studies should be disaggregated.** A number of new factors are included in the 2007 report studies (i.e., modeling improvements, current interim operations, and climate change), each with a different degree of uncertainty. The CALSIM II modeling improvements should provide more accurate results, and presumably a corresponding improvement in certainty of results. However, the interim operations, which are in part based on real-time conditions that can produce a range of operational restrictions, introduce a new degree of uncertainty on delivery reliability. Further, the inclusion in the 2027 studies of a range of potential climate change impacts introduces an additional dimension of uncertainty. To provide readers with better information on which to make more informed judgments regarding the impacts on reliability of each of these factors and the varying levels of uncertainty associated with them, the final 2007 Report should present additional studies that separate out the effects of the new factors included, as discussed further below.

   a. **Effects of CALSIM II improvements since 2005 Report should be shown separately.** In the 2007 Report, results from studies in the 2005 Report are shown for comparative purposes along with results from the 2007 studies. The model studies in the 2007 Report were based on a version of CALSIM II that was modified from the CALSIM II version used in the 2005 Report to include several modeling improvements (i.e., improved San Joaquin River module, improved Artificial Neural Network to estimate Delta salinity, and

an extended hydrologic period used to simulate operations). The effects of these modeling improvements should be shown separately so that the changes in estimated delivery reliability resulting from this change alone can be ascertained. The SWC suggest including an additional study, under both 2007 and 2027 conditions, using the 2007 version of the model with its modeling improvements, but using the same SWP/CVP operational criteria as in the 2005 Report (i.e., based on 2004 OCAP operations). This comparison could be included as part of Appendix A, or possibly in Chapter 2 as part of the discussion of CALSIM II.

In the remainder of the 2007 Report, it is these added studies based on the 2007 version of the model and 2004 OCAP that should be used for comparative purposes to the 2007 Report studies presented, rather than the 2005 Report study results which are based on an earlier version of the model and a different hydrologic period. This would then provide an apples-to-apples study comparison, rather than the apples-to-oranges study comparison now included in the 2007 Report.

b. **Effects of changed operations (either interim or new OCAP operations) should be shown separately.** The SWC suggest that the effects on delivery reliability of the change in SWP/CVP operations rules since 2005, isolated from the modeling improvements, be presented. For the current conditions (2007) analysis in the 2007 Report, this could be shown by comparing the updated studies currently included in the 2007 Report, to the added study with the 2007 CALSIM II model version based on 2004 OCAP (described in Comment 2.a above). For the future conditions (2027) analysis, this could be shown by comparing studies that include just the change in SWP/CVP operations without the potential effects of climate change, to the added study with the 2007 CALSIM II model version based on 2004 OCAP (described in Comment 2.a above). Existing studies of future conditions that do not include the effects of climate change are currently included in Appendix B, but they are only used for interpolation purposes. The results of these studies should also be presented in the body of the report in Chapter 6, for comparative purposes alongside the other study results.

c. **Potential effects of climate change should be shown separately.** For the future conditions (2027) analysis, a comparison of the studies with climate change included in the 2007 Report to the existing studies without climate change (described in Comment 2.b above) would show a range of potential effects of climate change on SWP deliveries, isolated from the modeling improvements and change in SWP/CVP operations since 2005. Since there is a great degree of uncertainty associated with the broad-brush estimates of potential climate change included in the 2007 Report, it is appropriate to show these impacts separately from the better known and more certain effects of assumed future operations. This will also enable any refined estimates of potential climate change effects to more readily be compared to the range of delivery impacts included in the 2007 Report. In addition, separation of the potential climate change effects will be useful for UWMP preparation, as it will enable agencies to incorporate that information into their plans as a stand-alone analysis.

3. **Full range of future conditions scenarios should be shown.** In the 2007 Report, interim operations, which are based in part on real-time conditions that can produce a range of operational restrictions, are evaluated in two separate studies, one study with the high end of those restrictions the other with the low end. The results of these two studies are then averaged for each year and it is those average results that are presented. We agree that this average is a reasonable estimate of likely operations in a given year. For the future conditions, however, it would be informative to show the more complete range of potential deliveries by presenting the full range of non-averaged results.

We appreciate the opportunity to review and provide comments on the 2007 Report. If you have any questions about these comments, please contact me at (916) 447-7357.

Sincerely,

Terry L. Erlewine
General Manager

cc: SWC Member Agencies

STATE OF CALIFORNIA -- THE RESOURCES AGENCY **ARNOLD SCHWARZENEGGER,** *Governor*

DEPARTMENT OF WATER RESOURCES
1416 NINTH STREET, P.O. BOX 942836
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(916) 653-5791

August 11, 2008

Mr. Terry L. Erlewine, General Manager
State Water Contractors
1121 L Street, Suite 1050
Sacramento, CA 95814

Dear Mr. Erlewine:

This letter responds to your letter dated March 13, 2008 providing comments of the State Water Contractors on the draft of the State Water Project Delivery Reliability Report—2007 (DRR(2007)). Your letter expresses concern that the SWP delivery reliability analysis in the DRR (2007) is based upon interim operation rules to protect delta smelt which may change in 2008 and requests that study results in the report be disaggregated and not averaged to provide readers better and more complete information. Responses to your detailed comments are provided below.

Comment: Studies in the 2007 Report are based on interim operations and will need updating with new Operations Criteria and Plan (OCAP) operations. DWR should either delay finalizing the report until the new OCAP is finalized and studies can be updated or DWR should more clearly stress the limitation of using interim operations in the report's studies and commit to updating the report's studies based on new OCAP operations when they are available.

Response: Your point about concern for the use of interim operation rules in estimating current and future SWP delivery reliability is well taken. The estimates of SWP delivery reliability in the DRR (2007) necessarily reflect the best information available at a point in time. It is recognized that operation rules under the new OCAP may differ from the interim rules assumed in the DRR (2007) and that estimated SWP delivery reliability could subsequently change. When the new OCAP and biological opinion are issued, DWR will update and make available the studies and analyses presented in the DRR (2007).

Comment: The final 2007 report should include studies in which the version of CalSim II used in the DDR (2007) evaluates SWP deliveries under the 2004 OCAP operation rules used in the 2005 report. Results of these studies should be compared to the results from the 2005 report and also be used for comparative purposes to the 2007 report studies presented.

Response: The updated estimates of SWP delivery reliability in each report reflect the use of the best available tools and information at the time of the report. The focus of the presentation of delivery reliability in each report are the updated estimates of current and future SWP deliveries not the effect of changes of the tools upon the estimates. The DDR (2007) includes a discussion of how the updated estimates compare to those in the previous report.

As you note in your comments, the version of CalSim II used in the 2007 draft report is different from the version used in the 2005 report because it uses an improved San Joaquin River water quality module, an improved Artificial Neural Network model to estimate Delta salinity, and an extended hydrologic period under which operations are simulated. DWR documented the improved Artificial Neural

Network model in CalSim II in Chapter 3 of the 2007 edition of its annual report, *Methodology for Flow and Salinity Estimates in the Sacramento-San Joaquin Delta and Suisun Marsh*. This report is accessible at http://baydeltaoffice.water.ca.gov/modeling/deltamodeling/annualreports.cfm and selecting "Entire Report" under 2007. The San Joaquin River module in CalSim II was documented in U.S. Bureau of Reclamation's 2005 report, *CALSIM II San Joaquin River Module (DRAFT),* available at http://science.calwater.ca.gov/pdf/calsim/CALSIMSJR_DRAFT_072205.pdf. This module was subsequently reviewed by an expert panel in a 2006 report for CALFED titled, *Review Panel Report: San Joaquin River Valley CalSim II Model Review*. This report is available at http://science.calwater.ca.gov/pdf/calsim/calsim_II_final_report_011206.pdf

Comment: Since the estimates of effects of climate change have a great degree of uncertainty, potential effects to SWP delivery reliability due to climate change should be shown separately from the better know certain effects of assumed future operations.

Response: The relative uncertainty of the effects of climate change is appreciated. However, Governor Schwarzenegger's Executive Order S-3-05, signed on June 1, 2005, directs the Secretary of the California Environmental Protection Agency to coordinate with State agencies to biannually report on the impacts to California of global warming, including impacts to water supply. The Department of Water Resources identifies climate change in the 2005 update of the California Water Plan (Bulletin 160-05) as a key consideration in planning for the State's future water management. This is because analysis has shown that climate change may in the future seriously affect the State's water resources, particularly SWP's ability to deliver water. In DRR (2007), the Department recognizes the uncertainty of climate change projections by evaluating future State Water Project deliveries under four scenarios of climate change: weak temperature warming and weak precipitation increase in California under model PCM; modest warming and modest drying under model PCM; modest warming and modest drying under model GFDL v. 2.0; and weak temperature warming and weak precipitation increase in California under model GFDL v. 2.0. Simulated deliveries under these scenarios of climate change were then interpolated to estimate deliveries in the year 2027. The annual SWP deliveries under future conditions with and without climate change are contained in Tables B-4 through B-11 in the Appendix B of DRR (2007).

Comment: For future conditions, it would be helpful if the full range of potential deliveries were presented that weren't averaged by simulations using higher and lower operational restrictions in accordance with the 2007 interim operations.

Response: Since the real-time conditions that would determine the extent of operation restrictions are unknown, we believe that averaging the deliveries under assumed higher and lower operation restrictions is reasonable. The annual Table A and Article 21 deliveries under both the higher and lower restrictions to operations are presented in Appendix B and have been made available electronically at the SWP Delivery Reliability Report website.

The final report will be issued soon and will include an appendix containing the comment letters on the draft report and the Department's responses. Thank you for your comments. If you wish to discuss this report further, please contact me at (916) 653-1099 or kkelly@water.ca.gov.

Sincerely,

Original Signed By

Katherine F. Kelly, Chief
Bay-Delta Office

References

Resources Agency. 2007. *Pelagic Fish Action Plan*. 39 p.

The Intergovernmental Panel on Climate Change. 2007. *Climate Change 2007: Synthesis Report*. p 52.

Potential Capture of Perchlorate Contamination Valencia Water Company's Wells E14 – E17

PREPARED FOR: Valencia Water Company

PREPARED BY: Joseph C. Scalmanini
William L. Halligan

DATE: April 26, 2006

PROJECT NUMBER: 06-2-008

Introduction

As part of its water supply planning in accordance with the overall groundwater operating plan in the Santa Clarita Valley Groundwater Basin, East Subbasin, Valencia Water Company is in the process of installing four new municipal water supply wells in the western part of its overall service area, generally near the mouth of Castaic Creek Canyon. Those four wells are intended to augment Valencia's groundwater source capacity and, in general, provide municipal pumping capacity in that part of the overall basin that will replace a number of agricultural supply wells in the same area as the latter are abandoned in concert with general land development in the area.

In light of general concerns about perchlorate contamination in the groundwater basin, despite the fact that the focus of that concern is several miles to the east of the new Valencia wells, Valencia commissioned the work reported herein to investigate the risk of perchlorate contamination on its new wells. As a result, the analysis described below was undertaken to examine the potential capture of perchlorate-impacted groundwater by the new Valencia wells, and the results have been interpreted to conclude regarding risk of perchlorate capture at the new wells.

In summary, the approach to investigating potential capture of perchlorate-impacted groundwater by the new wells involved three sequential steps: identification of local and regional groundwater flow patterns in the Alluvium, the aquifer in which all four wells are completed; application of a single layer groundwater flow model to examine the capture zone of the four-well "well field" under planned operating conditions; and interpretation of potential capture of perchlorate via examination of the wells' theoretical independent capture zone relative to known occurrence of perchlorate and its mobility in the Alluvium. The latter step was subsequently augmented by considering other factors, such as the locations and magnitude of pumping between the new wells and the known occurrence of perchlorate, that affect the potential capture of perchlorate by the new wells. Ultimately, conclusion regarding the risk of perchlorate contamination at the new wells was drawn from a combination of the theoretical independent

capture zone analysis and the other factors that affect the potential capture of known perchlorate in the basin.

Valencia Wells E14 – E17

Valencia's four new Alluvial wells are numbered E14 through E17. The locations of the new Valencia municipal wells are illustrated in Figure 1, which also shows other nearby wells.

As specified in Valencia's Water Supply Permit issued by the State Department of Health Services (DHS), Valencia's new municipal E wells are replacement wells for some of the nearby Newhall Land and Farming Company's agricultural E wells, e.g. Wells E, E2, E4 and E5, which are in the process of being permanently sealed and abandoned in accordance with the DHS Permit. As land development occurs in the general area of those wells, the need for irrigation water supply will progressively decrease and municipal water demands will correspondingly increase. Thus, in general, the new Valencia wells will generally produce water comparable to the historical production from the NLF wells, resulting in no substantial change in basin operation. Pumping from the basin will thus remain within the operating yield concept incorporated in the 2005 Urban Water Management Plan and analyzed in the 2005 Basin Yield Report.

The four new Valencia E wells are all generally similar in terms of aquifer completion and construction details. All four are completed solely in the Alluvium. All four well sites were explored via pilot hole drilling and logging to about 200 feet, and the four completed wells range in depth from 133 feet (Well E-15) to 170 feet (Well E-16). All four wells are similarly constructed with 18 inch nominal production casing from the ground surface to the top of a single perforated (louvered well screen) intake section. The depths of blank production casing range from 76 feet (Well E-14) to 92 feet (Well E-15). Louvered well screens range in length from 38 feet (Well E-14) to 63 feet (Well E-16). The bottom of the well intake sections ranges between depths of 114 feet (Well E-14) and 145 feet (Well E-16). All four wells have gravel envelopes extending from total depth to just above the top of the intake section, and are sealed above that depth, to the surface, with cement grout. Key well construction details for all four Valencia E wells are summarized in Table 1.

The four new Valencia E wells are intended to be equipped to pump between 1,000 and 1,400 gallons per minute (gpm). Three of the four wells (E-14 through 16) have comparable, high yields as indicated by their respective specific capacities (gpm per foot of drawdown) generally between about 62 and 66 gpm/ft. Well E-17, while still capable of its design capacity of 1,000 gpm, has a notably lower yield, about 34 gpm/ft. Well yield and design capacity details for all four wells are also summarized in Table 1.

At present, Valencia Well E-15 has been equipped with a permanent pump and appurtenant facilities to render it operational at its design capacity of 1,400 gpm. The other three wells have been approved by DHS for addition to Valencia's Water Supply Permit, but have not been equipped pending further development and associated increase in water demands.

Table 1
Design and Construction Features
Valencia Water Company Wells E14-E17

	Well			
	E14	**E15**	**E16**	**E17**
Test Hole/Pilot Hole Depth (ft.)	191	200	200	194
Production Borehole Depth (ft.)	150	180	184	160
Well Depth (ft.)	135	160	170	150
Well Diameter (ft.)	18	18	18	18
Well Casing Depth (ft.)	0-76 114-135	0-92 133-160	0-82 145-170	0-81 121-150
Well Screen Depth (ft.)	76-114	92-133	82-145	81-121
Design Capacity (gpm)	1,200	1,400	1,200	1,000
Specific Capacity (gpm/ft.)	65.9	62	61.8	34.1

Groundwater Flow

There is no known occurrence of perchlorate contamination in the Alluvium anywhere near the new Valencia E wells. Consequently, it is illogical to think that the E wells, regardless of design capacity or future operation, would induce the movement, or capture, of perchlorate-contaminated groundwater as a result of their pumping. However, to examine what might theoretically be captured by the new Valencia E wells, consideration was given to the limited detection of perchlorate in the Alluvium, about five miles east of those wells, and the general movement of groundwater in the Alluvium, both regionally and locally near the E wells.

In the Alluvium, groundwater flow is generally recognized to be aligned with the Santa Clara River and its tributaries. For the most part, groundwater levels west of Bouquet Canyon remain relatively constant over time, suggesting that both the direction and rate of groundwater flow do not vary widely in that part of the aquifer system. East of Bouquet Canyon, the Alluvium has experienced groundwater level fluctuations of varying magnitudes, generally increasing to the east, through wet and dry periods. Examination of the fluctuations suggests that the overall flow direction has remained westerly and southwesterly beneath the Santa Clara River and its main

tributaries respectively, although the rate of groundwater flow has fluctuated as groundwater levels have changed.

More specifically for purposes of this analysis, groundwater flow in the vicinity of the Valencia E wells, and upgradient from the vicinity of the E wells to the area where perchlorate has been detected in the Alluvium, was examined by preparing contour maps of equal groundwater elevation for both wet and dry climatic conditions, i.e. high and low groundwater levels. The resultant contour maps are illustrated in Figures 2 and 3. Unaffected by local groundwater level drawdown directly attributable to pumping operations, groundwater flow directions in the Alluvium, in both wet and dry periods, are generally westerly beneath the Santa Clara River from the vicinity of Bouquet Canyon where the only two Alluvial production wells ever impacted by perchlorate are located. Near the E wells themselves, there is a confluence of groundwater flow, with some southerly inflow beneath Castaic Creek joining the predominant westerly to southwesterly groundwater flow at the mouth of the Castaic Creek Canyon and its confluence with the main Santa Clara River Valley. The hydraulic gradient in both wet and dry periods is approximately 30 feet per mile. The lack of significant differences in groundwater flow directions and hydraulic gradients between the wet and dry periods is consistent with the generally stable groundwater level conditions in the westerly portion of the overall groundwater basin, west of the mouth of Bouquet Canyon.

Considering the locations of the E wells relative to the surrounding groundwater flow directions, a component of flow into the E wells can be expected to be from the upgradient easterly direction. Further considering the confluence of groundwater flow from the north (Castaic Canyon) with the regional flow from the east, it is also likely that a component of flow into the E wells will be from the upgradient northerly direction. Of course, pumping operations at the wells themselves will locally alter the gradient and associated flow directions, potentially resulting in inflow to the wells from cross-gradient and downgradient directions.

Capture Zone Simulation

The nature of drawdown around one or more pumped wells, and the resultant impact on local groundwater flow, i.e. "capture" of groundwater by the well(s), is directly affected by several factors related to the well(s) and the aquifer in which they are completed. Well parameters include pumping capacity and duration of pumping cycles (time). Aquifer parameters include hydraulic conductivity, transmissivity, and storage coefficient of the aquifer materials. Design capacities for all four E wells are listed in Table 1; in summary, they are 1,000 to 1,400 gpm. Pumping cycles for all the Valencia wells are variable as water requirements fluctuate through the year. During peak demand periods, some wells can operate as much as all day, or slightly longer. However, for all Valencia wells as a group, long-term average pumping cycles are about 8 hours per day. For the conservative analytical purposes described herein, drawdown due to pumping of the new Valencia E wells and the associated capture zone formation were based on hypothetical continuous pumping equivalent to intermittent pumping for an average of 8 hours per day. The duration of such hypothetical continuous pumping can be widely varied as a function of other water supply considerations. In light of other perchlorate-related activities in the Valley, with recognition of the plans to start construction later in 2006 for perchlorate control

and extraction from the Saugus Formation, the theoretical capture associated with assumed continuous pumping of the E wells was analyzed for a two year period.

In selecting the two year period for theoretical independent capture zone analysis, it should be recognized that there is no absolute nexus between the planned construction of perchlorate containment facilities in the Saugus Formation and any significant change in the Alluvial aquifer that would further protect the E wells. While previous analyses of Saugus containment have included a small component of containment-type capture of Alluvial groundwater, that ultimate effect will be a small incremental addition to the nature of "containment" that results from the regular operation of numerous high capacity Alluvial wells between the E wells and the limited detection of perchlorate in the Alluvium. The capture zone analysis described herein is theoretical and independent in the sense that it purposely ignores the containment and capture effects of all intervening pumping between the E wells and the area of perchlorate detection in the Alluvium. The two year capture zone time period was simply utilized to conservatively examine the potential capture of perchlorate in spite of the actual operation of intervening wells, through a time period until some additional control of migration would be added to the rest of ongoing Alluvial pumping.

A final comment on the two year time period selection is to recognize that, again ignoring the effects of all other Alluvial pumping, in particular the "containment" effects of intervening pumping between the E wells and the historical detection of perchlorate in the Alluvium, the capture zone of the new E wells could theoretically be extended incrementally farther upgradient by simply extending the simulated time period. Ultimately, a scenario could be crafted to show theoretical "capture" of groundwater from an area where perchlorate has been detected. However, such an interpretation would be unrealistic in light of a combination of actual pumping practices and natural processes in the aquifer system as discussed below. In summary, the two-year theoretical independent capture zone is presented for theoretical, conservative illustration purposes; however, it should not be interpreted as the probable real capture zone of the E wells for the collection of reasons discussed below.

Based on interpretation of aquifer tests, and consistent with hydraulic aquifer characteristics used in the recently completed numerical groundwater flow model of the basin, a theoretical, independent capture zone analysis was conducted using a steady-state, single-layer numerical flow model of the Alluvium. The model incorporated specific yield (storage coefficient) and hydraulic conductivity values consistent with the recently completed basin-wide groundwater flow model developed by CH2M Hill. The steady-state model incorporated a specific yield value of 0.1, hydraulic conductivity values that ranged from 105 to 550 feet per day, and transmissivity values that ranged from 200,000 to 600,000 gpd/ft. The model was calibrated to the contours of equal groundwater elevations in the Alluvium presented in the 2004 CH2M Hill regional flow model report. Assumptions incorporated into the model included no change in aquifer storage, which is supported by a review of Alluvium groundwater elevations and the minimal amount of storage change over the past several decades.

As discussed above, the theoretical, independent capture zone analysis simulated the extent of the E Wells capture of groundwater flow over a two-year period. In addition to the conservative nature of the capture zone analysis that ignored all other pumping and related capture or

"containment", the E well analysis was further conservative in that it assumed actual operation of all those wells, at their design capacities of 1,000 to 1,400 gpm, when in reality only one of the wells is currently equipped and operational, and the other three wells are not scheduled to become operational until water requirements increase.

Based on a combination of the aquifer characteristics and equivalent full time pumping for two years as described above, assuming all four Valencia E wells are operational, the theoretical independent capture zone for the new Valencia E wells would primarily extend upgradient in two directions: up to about 13,000 feet, or about 2.5 miles, northerly and easterly. The extent and shape of the integrated capture zones of all four E wells is illustrated in Figure 4. The outer bounds of the integrated individual capture zones of the individual wells are illustrated; each individual well's capture zone is a narrower, elongated zone, parallel to the overall integrated capture zone as illustrated in Figure 4.

Perchlorate Contamination in the Alluvium

The overall issue of perchlorate contamination of groundwater in the Santa Clarita Valley has primarily impacted the Saugus Formation, where four municipal wells have been out of service due to perchlorate since 1997. The Alluvium, on the other hand, has been impacted to a notably lesser extent. From the perspective of impacted municipal water supply wells, Santa Clarita Water Division's Stadium well was the first and, for a long time, the only Alluvial well impacted by perchlorate. The Stadium well is located on the south side of the Santa Clara River, upstream of its confluences with Bouquet Canyon and the South Fork of the Santa Clara River. The Stadium well is also located adjacent to the Northern Alluvium area on and immediately adjacent to the northern-most part of the Whittaker-Bermite site. The initial detection of perchlorate in that well was 5.9 g/l in 2002. The Stadium well has been removed from municipal service since the initial detection of perchlorate.

The only other detection of perchlorate in an Alluvial water supply well was in March and April 2005 when Valencia's Well Q2 was found to have low concentrations of perchlorate. Well Q2 is located on the north side of the Santa Clara River, on the west side of its confluence with Bouquet Creek. Initial detection and confirmation sampling of Well Q2 ranged between 9.8 and 11 g/l. After confirmation of perchlorate in April, Valencia temporarily removed the well from service and proceeded with a fast-track permitting and construction program to install wellhead treatment and return the well to service. That work was completed in September and Well Q2 has been in service, with wellhead treatment, since October 2005. Since then, however, the only indications of perchlorate at Well Q2 have been below the analytical detection limit of 4 g/l.

In addition to the limited detection of perchlorate in two municipal supply wells as described above, off-site investigation of perchlorate associated with the Whittaker-Bermite site has identified low concentrations (less than 10 g/l) in shallow Alluvium near Valencia's Pardee well field (Wells N, N7 and N8). Those detections have all been from sampling of shallow groundwater, above 50 feet and also above the intake (screened) sections of those wells. Despite those detections, however, there has been no detection of perchlorate in the nearby, deeper completed production wells.

Whittaker-Bermite has recently initiated actions to pump a production well, and to also extract from several small monitoring wells, as part of perchlorate containment efforts in the Northern Alluvium. The extracted water will be treated for perchlorate removal and then discharged to the Santa Clara River system. These pump and treat activities are intended to subsequently expand as necessary the remediation of perchlorate contamination in the Alluvium, immediately upgradient of the Stadium well, and also upgradient of the other municipal production wells in the vicinity of the Whittaker-Bermite site.

Potential Capture of Perchlorate by Valencia's E Wells

As illustrated in Figure 4, the theoretical independent capture zone of Valencia's new E wells, after an equivalent two year period of continuous pumping of all four wells, would extend toward the area where perchlorate has been detected in two Alluvial water supply wells (Stadium and Q2). However, the capture zone would not extend as far as any historical detection of perchlorate in the Alluvium, whether in production wells or as part of the off-site investigation of the Whittaker-Bermite site. Literal interpretation of the extent of the capture zone and the known detection of perchlorate would be that the E wells can be expected to not capture perchlorate-contaminated groundwater over the time period of analysis, which includes the period of construction and initial operation of facilities to contain and extract perchlorate from the Saugus Formation. However, as discussed above, such an expectation can be interpreted two ways: that the E wells are thus not a risk or, conversely, that the E wells could be at risk if the capture zone analysis were simply extended for sufficient time to encounter areas of perchlorate detection. As also discussed above, the planned containment and extraction of perchlorate in the Saugus Formation is expected to have a small effect on the Alluvium, but not to the extent that it will sufficiently contain perchlorate that downgradient wells can be considered to be protected. Thus, it could be reasoned that the capture zone should be analyzed for a longer pumping period, i.e. beyond the two years related to construction of the Saugus containment facilities. In simple summary, given the nature of groundwater flow direction and the hydraulic properties of the Alluvial aquifer, it is possible to model sets of conditions that would result in theoretical "capture" of groundwater from the area where perchlorate has been detected in the Alluvium. However, recognizing that such a result could be simulated, it should also be recognized that, for the reasons discussed below, such a result should not be interpreted to conclude that the E wells are at risk. In fact, it is logical to conclude, again for the reasons discussed below, that the E wells are likely not at risk.

Upgradient of the E wells in the direction of perchlorate detection in the Alluvium are several high capacity production wells, all of which are artificially removed from the simulated capture zone analysis, but all of which represent actual pumping locations that provide a combination of containment in the aquifer and potential capture of perchlorate if it were to mobilize that far from where it has been detected. For reference with regard to mobility, as discussed above, sampling of shallow portions of the Alluvium near the Pardee well field has detected low concentrations of perchlorate, but the nearby production wells have not detected any perchlorate. Ongoing pumping for water supply since the initial detections of perchlorate (in the Saugus Formation in 1997 and in the Alluvium in 2002) have resulted in only one additional Alluvial production well impact: Valencia's Well Q2 which was briefly impacted but has not detected perchlorate since it was equipped with wellhead treatment and returned to service in October 2005. All other

Alluvial wells between the Whittaker-Bermite site and the E wells have not been impacted despite closer proximity to detected perchlorate and regular water supply pumping for at least four years since perchlorate was first encountered.

The Alluvial production wells between the E wells and the area of detected perchlorate can be considered in three groups, progressively farther from the E wells: the S well field (Wells S6, S7, and S8); the Pardee well field (Wells N, N7 and N8); and Well Q2. Collectively, all those wells have a total pumping capacity of nearly 13,500 gpm, or nearly three times the total design capacity of the E well field. The S well field has existing pumping capacity of 6,000 gpm; the Pardee well field has existing pumping capacity of 6,250 gpm; and Well Q2 is equipped to pump and treat 1,200 gpm. Collectively and as individual wells or groups of wells, those various wells represent significant local pumping locations that provide a form of "containment", if perchlorate were to migrate to any of those areas, against further downgradient movement; and they represent significant extraction rates that would also extract perchlorate, again if it were to migrate to any of those areas. As described above, Well Q2 is already equipped to treat any perchlorate if it were to re-impact that well. The other intervening wells are not equipped with wellhead treatment; however, as is also the case at the E wells, all are designed with wellhead space and provisions for installation of treatment facilities, as was rapidly done at Well Q2 when perchlorate was detected, to enable their continued operation for perchlorate containment and extraction if they are impacted. Thus, the collective intervening wells represent a real pumping scenario that, in effect, produces pumping interruptions of the independent, theoretical capture zone of the E wells described and illustrated above.

In light of all the preceding, it can be concluded that, while a theoretical capture zone can be simulated to show that, with sufficient extended pumping, the new Valencia E wells might "capture" groundwater from areas where perchlorate has been detected in the Alluvium, such a capture zone analysis would necessarily be overly theoretical and conservative because it ignored the intervening effects of numerous other high capacity pumping. It also ignored the actual observations that have shown no detection of perchlorate in all but one of those intervening wells after at least four years of regular pumping operations since initial detection of perchlorate in the Alluvium. The presence of those wells, combined with the existing wellhead treatment at one of them and the provisions for installation of treatment at all the others if ever necessary, represents significant containment of potential perchlorate migration toward the E wells, again assuming perchlorate first migrates as far as the intervening wells. Thus, it can be concluded that the E wells are not at risk of capturing perchlorate from areas in the overall Alluvial aquifer system where it has previously been detected.

References

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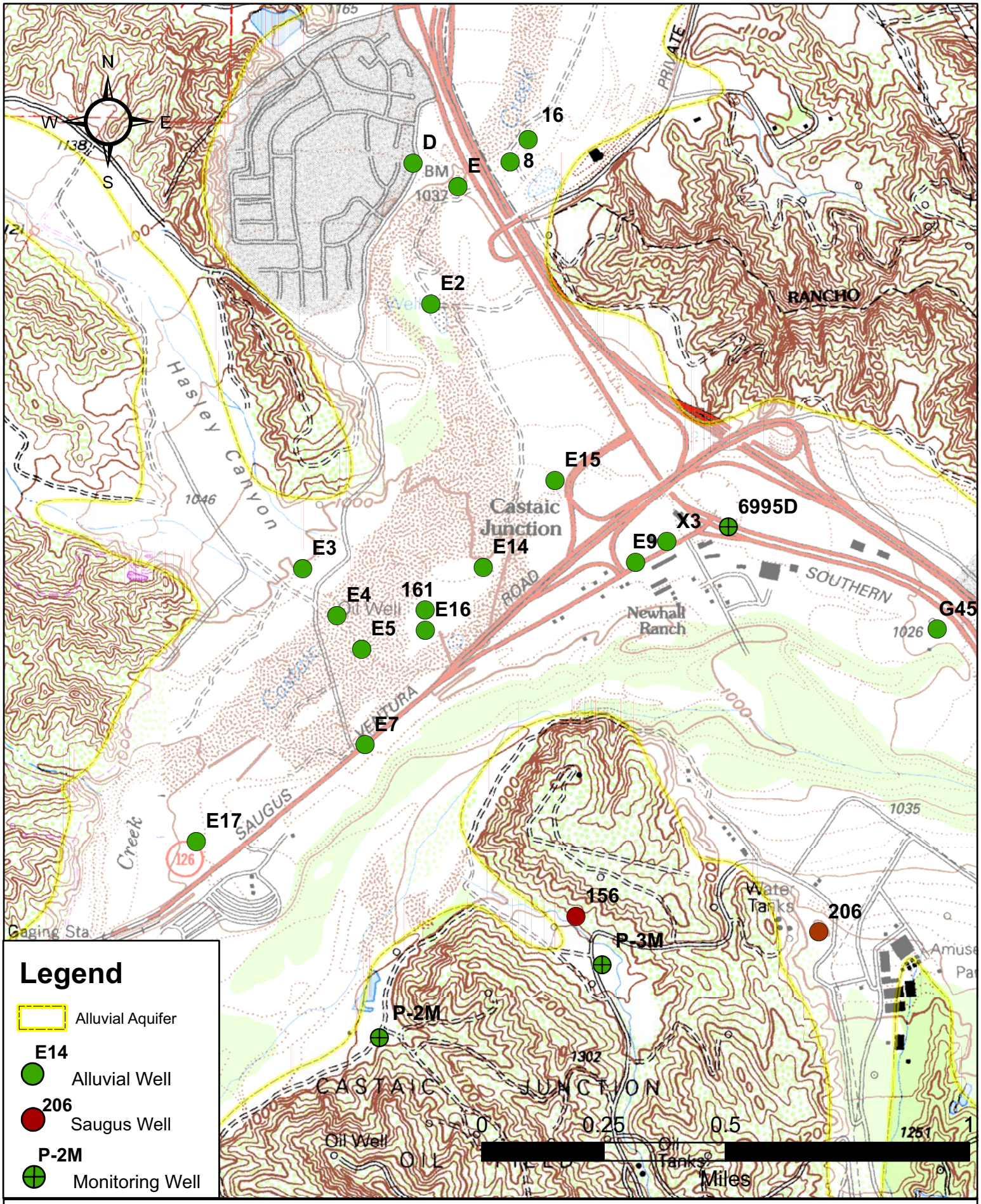
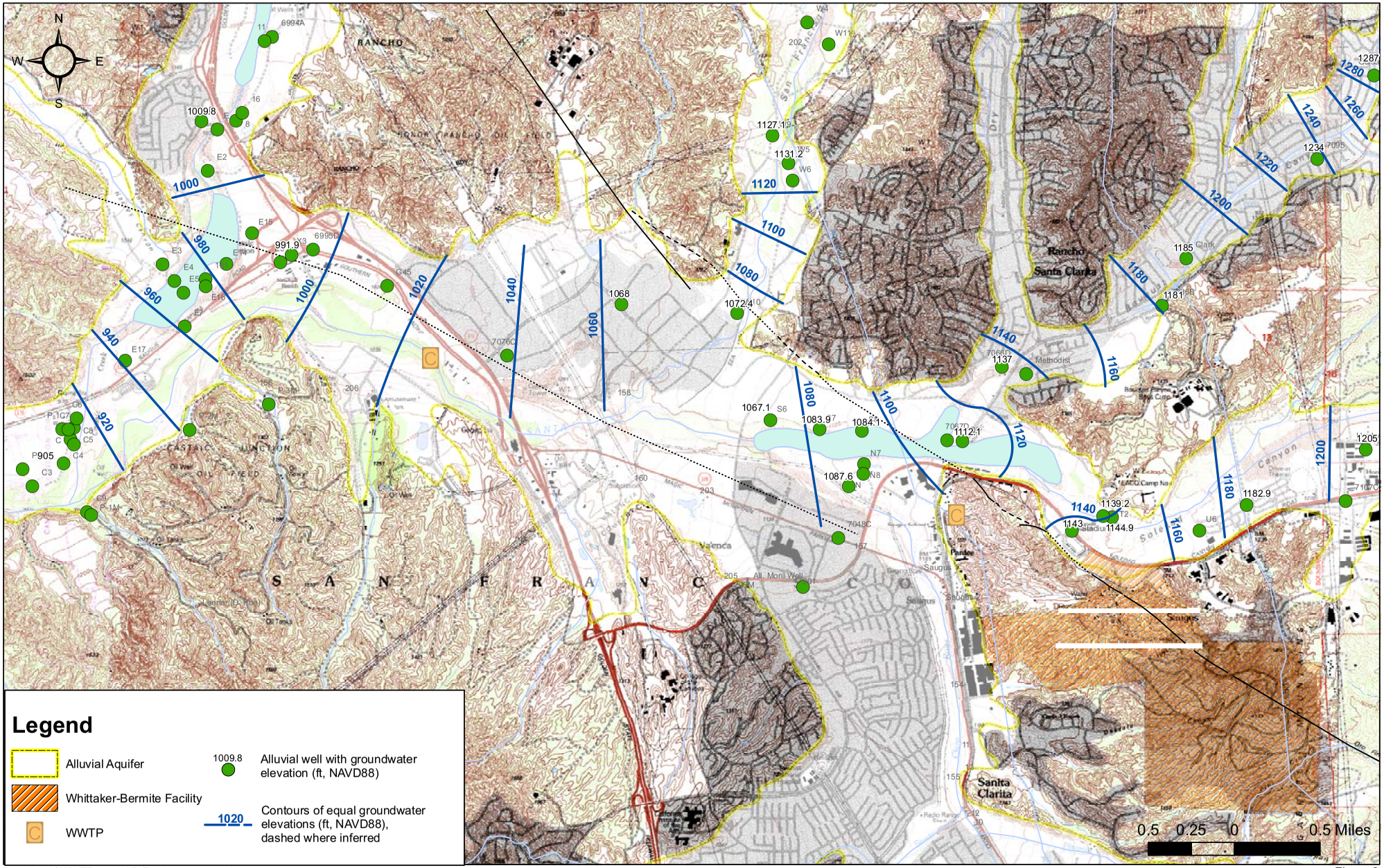


LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure 1
Well Location Map



Location of WWTP and W-B Facility are approximate.

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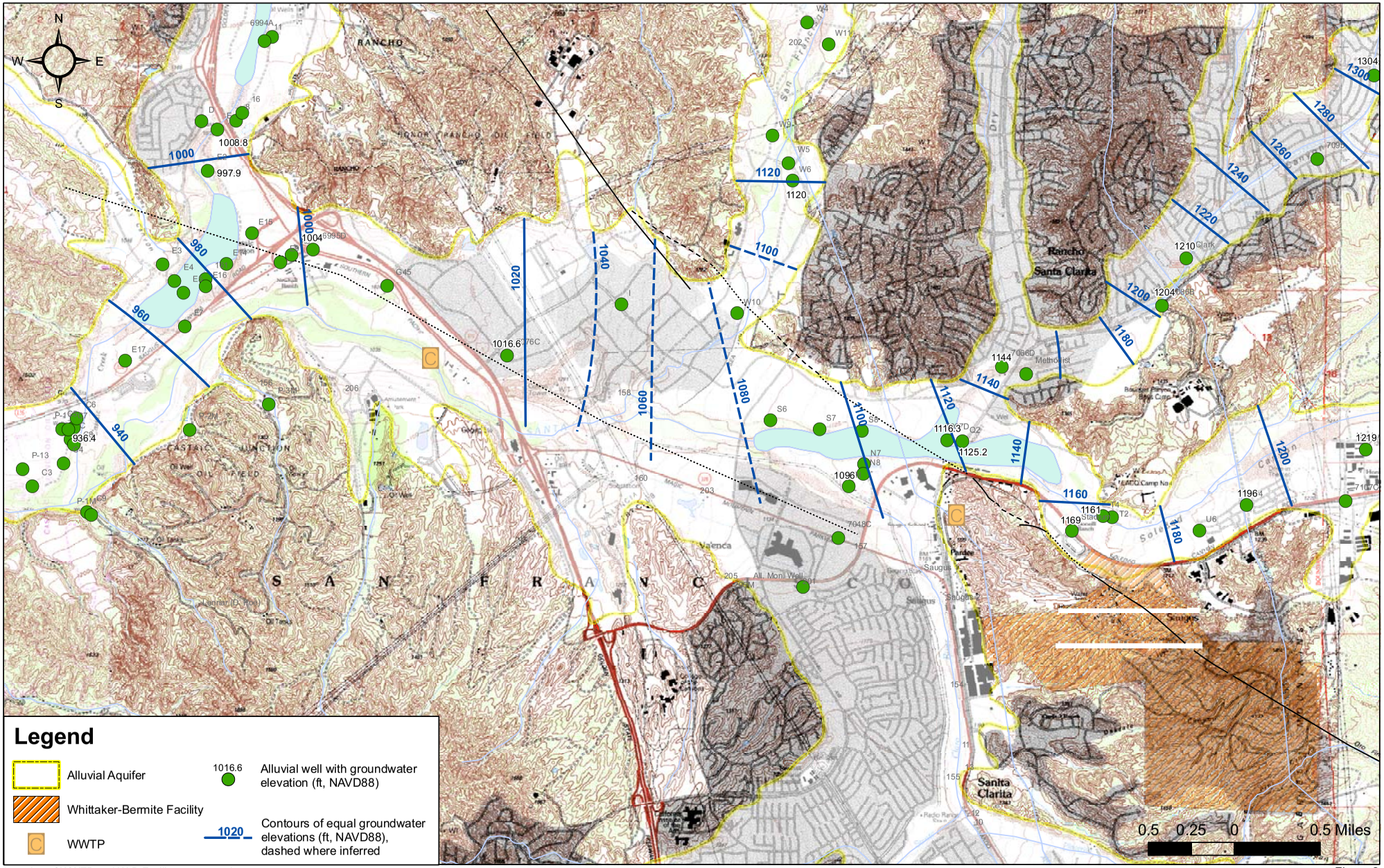
Figure 3
Contours of Equal Groundwater Elevation in Alluvium
Wet Period, Spring 2004



Location of WWTP and W-B Facility are approximate.

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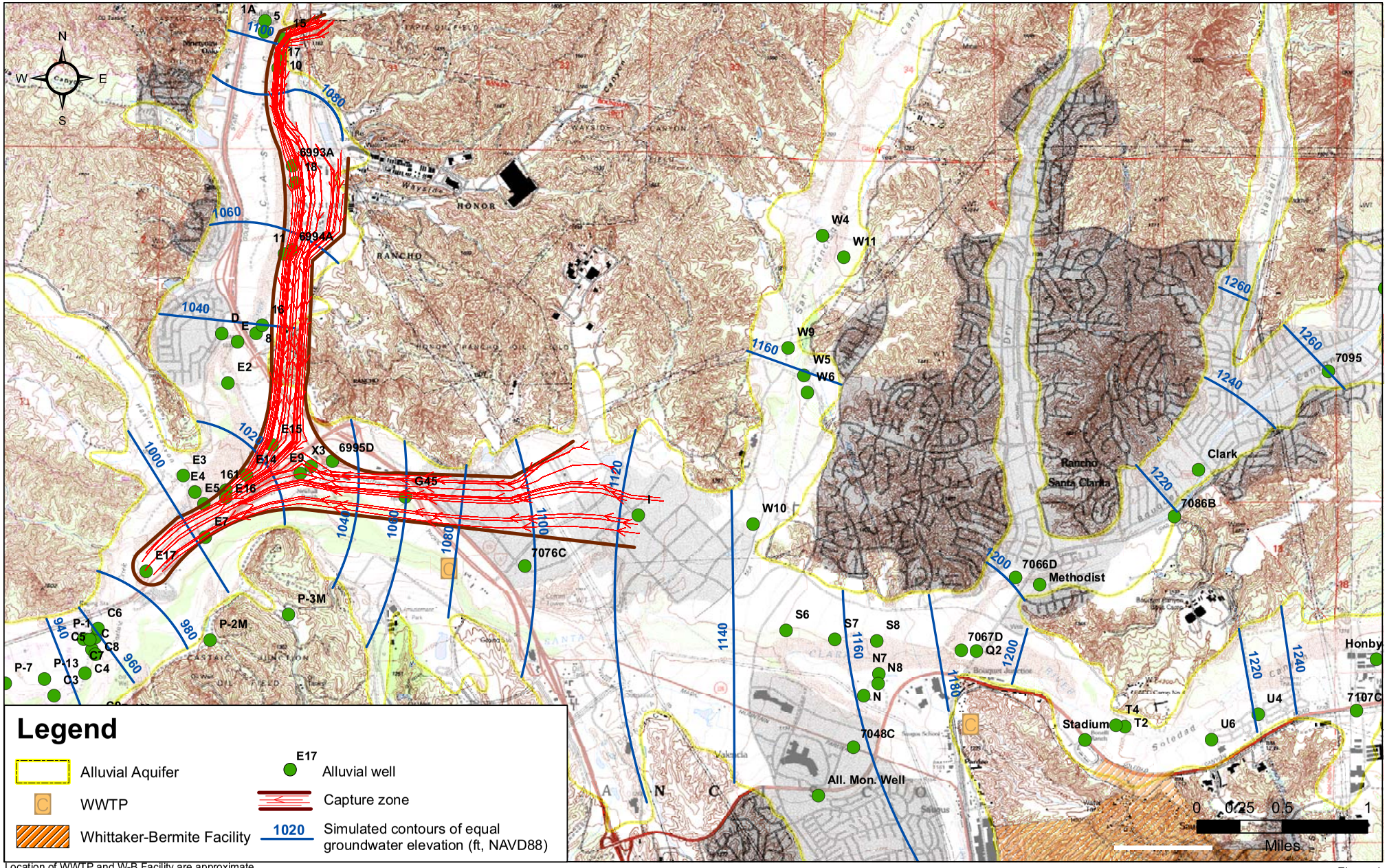
Figure 2
Contours of Equal Groundwater Elevation in Alluvium
Dry Period, Spring 1992



Location of WWTP and W-B Facility are approximate.

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Figure 4
Valencia E Well Capture Zone
Two-Year Groundwater Travel Time Simulation

Water Supply Contracts Between the State of California Department of Water Resources and CLWA including Amendment No. 18 (41,000 Acre-Feet Water Transfer)

UPPER SANTA CLARA VALLEY WATER AGENCY

Location and Size

The Agency is located in Los Angeles County about 40 miles northwest of the city of Los Angeles. The Agency, as of July 1, 1964, encompassed an area of 86,100 acres and had an estimated population of 26,000.

Water Supply and Utilization

The entire water supply utilized within the Agency is obtained from underlying ground water basins. There are no streams within the Agency on which a dependable surface water supply could be developed. Water requirements in excess of the safe yield of the local ground water supply will be met with water from the State Water Project. Primary use of water in 1960 was for irrigated agriculture but by 1970 and thereafter the primary use is expected to be for municipal and industrial purposes.

Items of Contract Information Unique to Agency

Date of Contract - Preamble

April 30, 1963

Agency's Principal Place of Business - Preamble

Newhall

Estimated Year of Initial Water Delivery - Article 6(a)

1972

Date of Request as to Delivery Structures - Article 10(b)

June 30, 1963

Limit on Instantaneous Rate of Delivery - Article 12(c)

42 cfs (Increased by Amendment No. 2 to 48 cfs.)

E. SPECIAL PROVISIONS AND TABLES

45. SPECIAL PROVISIONS

(a) On or before June 30, 1963, the Agency shall furnish to the State its written request specifying the year in which the first delivery of project water from the West Branch Aqueduct as defined in Table H of this contract shall be made to the Agency. The timing of first deliveries of project water from said Branch Aqueduct shall be as so requested by the Agency: *Provided*, That in the event said request is, in the judgment of the State, incompatible with similar requests received from other contractors to be served from or through said Branch Aqueduct, which contractors have executed contracts with the State on or before June 30, 1963, the timing of first deliveries of project water to the Agency and such other contractors from said Branch Aqueduct shall be as established by mutual agreement among the State, the Agency, and said contractors: *Provided further*, That if such agreement has not been reached on or before December 31, 1963, the State may then construct said Branch Aqueduct in accordance with such construction schedules as, in the judgment of the State, will best serve the interests of all those contractors whose service areas are located south of the South Portal of the Tehachapi Tunnels and which have executed contracts with the State on or before June 30, 1963.

(b) The State shall provide sufficient capacity in the transportation facilities, subject to the provisions of Article 17(b), to deliver 11 percent of the Agency's annual entitlement in each of four months in each year. Subject to the foregoing limitation, in scheduling deliveries under Article 12(a) the State will provide for up to 1/9 of the Agency's annual entitlement to be delivered in excess of a rate of 8 1/3 percent of the annual entitlement per month.

(c) The annexations to the Agency, authorized by Ordinance No. 3 of the Agency dated March 13, 1963, are deemed to be approved by the department within the meaning of Article 15(b) and are generally described as the Val Verde--Hasley Canyon Area annexation, comprising approximately 7,280 acres, situated westerly of the Agency.

TABLE H

PROJECT TRANSPORTATION FACILITIES
UPPER SANTA CLARA VALLEY WATER AGENCY

A San Joaquin Valley–Southern California Aqueduct extending to Castaic Reservoir on the West Branch Aqueduct defined below, to the extent such aqueduct is determined by the State to be required for water transportation.

"West Branch Aqueduct" shall mean that portion of the San Joaquin Valley–Southern California Aqueduct specified in Section 12934(d) (2) of the Water Code extending from the junction of East and West Branches to a terminus in the vicinity of Newhall, Los Angeles County.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

P. G. Torres

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By Wm. E. Warne
Director

Attest:

Helen L. Thompson
Secretary
P.O. Box 328
Newhall, California

UPPER SANTA CLARA VALLEY WATER AGENCY

By M. E. Bonelli Jr.
President

Approved as to form and execution:

Stanley C. Logsdon
Counsel

By Everett W. Nichols
Director

By Earl Schmidt
Director

By [illegible]
Director

By Robert L. Essick
Director

By Roger C. Morey
Director

By E. Ray Fisher
Director

WHEREAS, the State and the Agency are desirous of making certain changes and additions to the above-mentioned contract, while otherwise continuing the contract in full force and effect;

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

Article 46 is added to the contract to read as follows:

46. Amendatory Provisions

a. Surplus Water

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available in any year, in an amount which bears the same ratio to the total amount of surplus water available in that year as the sum of the annual entitlements delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the total amount of the annual entitlements delivered for agricultural and ground water replenishment use during the preceding three years of all contractors requesting surplus water: Provided, That if its proportion of such surplus water is not required by or cannot be delivered to any contractor, such amount of additional surplus water shall be offered to other contractors for agricultural and

under the provisions of Article 21.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

b. Surcharge Credit

Notwithstanding other provisions of this contract, the State may include provisions in water supply contracts allowing a credit to a contractor not to exceed the surcharge to be paid by such contractor: Provided, That such credit shall be utilized to reduce the cost of water for agricultural use on other than excess land at a uniform rate per acre-foot not to exceed two dollars ($2) per acre-foot. Any contract including provisions pursuant to this subdivision shall assure that the reductions in the contractors' obligations authorized by this subdivision are made available exclusively for the benefit of agricultural use on land other than excess land and are not directly or indirectly made available for the benefit of agricultural use on excess land.

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 2 TO WATER SUPPLY
CONTRACT BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
UPPER SANTA CLARA VALLEY WATER AGENCY

THIS CONTRACT, made this 22nd day of December 1964, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Upper Santa Clara Valley Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Newhall, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated April 30, 1963, as amended November 15, 1963, providing that the State shall supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

1. Subdivision (k) of Article 1 is amended to read as follows:

(k) Minimum Project Yield

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,230,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(1) The estimated relative proportion of deliveries for agricultural use to deliveries for municipal use for the year 1990, and the characteristic distributions of demands for these two uses throughout the year.

(2) An allowable reduction in the agricultural use portion of the minimum project yield, due to drought, of not to exceed fifty percent (50%) in any one year, nor a total of one hundred percent (100%) of one year's supply in any series of seven consecutive years.

(3) Agreements now in effect or as hereafter amended or supplemented between the State and the United States and others regarding the diversion or utilization of waters of the Delta or streams tributary thereto.

2. Table A of the contract entitled "Annual Entitlements Upper Santa Clara Valley Water Agency" is amended to read as follows:

4. Subdivision (a) of Article 16 is amended to read as follows:

(a) Limit on Total of All Maximum Annual Entitlements

The Agency's maximum annual entitlement hereunder, together with the maximum annual entitlements of all other contractors, shall aggregate no more than the minimum project yield as defined herein and in no event more than 4,230,000 acre-feet of project water.

5. Subdivision (b) of Article 45 is amended to read as follows:

(b) The State shall provide sufficient capacity in the transportation facilities, subject to the provisions of Article 17(b), to deliver 11 percent of the Agency's annual entitlement in each of eight and one half months in each year. Subject to the foregoing limitation, in scheduling deliveries under Article 12(a) the State will provide for up to 22 2/3 percent of the Agency's annual entitlement to be delivered in excess of a rate of 8 1/3 percent of the annual entitlement per month.

6. Article 46 is amended to read as follows:

46. Amendatory Provisions

(a) Surplus Water

Notwithstanding other provisions of this contract, surplus water for agricultural and ground water replenishment use shall be offered to contractors on the following basis. Before surplus water is sold for other than agricultural and ground water replenishment use, each contractor shall have the right, subject to the ability of the State to deliver such water and to the

contractor shall furnish certified copies of such records and data concerning the use of water within its boundaries as the State may request.

The provisions of this paragraph shall be applicable only to contractors in the San Joaquin Valley Service Area, contractors in the Southern California Service Area, and contractors in the Central Coastal Service Area. Before surplus water is sold for other than agricultural and ground water replenishment use, each such contractor shall have the right, subject to the ability of the State to deliver such water, to contract for agricultural and ground water replenishment use in accordance with the following formula: contractors in the San Joaquin Valley Service Area shall have a right to contract for sixty-nine percent (69%) of the surplus water available at the Mile 18 Pumping Plant; contractors in the Southern California Service Area shall have a right to contract for twenty-nine percent (29%) of such water; and contractors in the Central Coastal Service Area shall have a right to contract for two percent (2%) of such water: Provided, That within each of these service areas, each contractor shall have the right to contract for agricultural and ground water replenishment use for a portion of the total amount of surplus water available to that service area in any year, in an amount which bears the same ratio to the total amount of surplus water available to the service area in that year as the sum of the annual entitlements, set forth in Table A of this contract, delivered to the contractor for agricultural and ground water replenishment use during the preceding three years bears to the

and Ventura County Flood Control District; "contractors in the Central Coastal Service Area" shall mean: San Luis Obispo County Flood Control and Water Conservation District and Santa Barbara County Flood Control and Water Conservation District.

The provision of this paragraph shall be applicable only to a contractor to which the delivery of project water for municipal use as of 1990 is estimated by the State to be in excess of fifty percent (50%) of such contractor's maximum annual entitlement. For the purpose of fixing such contractor's right to delivery of surplus water, water from a watershed not tributary to the contractor's area which is delivered within the contractor's boundaries for agricultural or ground water replenishment use shall be deemed to be part of the contractor's annual entitlement delivered for such use in computing the quantity of surplus water to which the contractor is entitled under this subdivision: Provided, That the contractor shall not be deemed to have used more than its annual entitlement, as set forth in Table A, for such use. Surplus water shall be deemed to be used by the contractor for agricultural or ground water replenishment use if an equal quantity of water imported from a watershed not tributary to the contractor's area is delivered within the contractor's boundaries for such use.

In providing for the delivery of surplus water to contractors pursuant to this subdivision, the State shall refuse to deliver such surplus water to any contractor to the extent that the State determines that such delivery would tend to encourage the development of an economy within the area served by such contractor which would be dependent upon the sustained delivery of

under the provisions of Article 21. Nothing in this subdivision shall limit the right of the Agency to increase its annual entitlements as otherwise provided in this contract.

As used in this subdivision "ground water replenishment use" shall mean the use of project water exclusively by direct application to spreading basins, streambeds, or through other means of direct artificial recharge for the purpose of replenishing overdrawn ground water basins.

(b) Surcharge Credit

Notwithstanding other provisions of this contract, the State may allow a credit to each contractor not to exceed the surcharge paid by such contractor.

For the purpose of this contract, the surcharge credit shall be determined and applied in the following manner:

(1) The State shall, in each year after the year of initial water delivery, allow a credit to the Agency in the amount of the surcharge forwarded by the Agency to the State in the preceding year.

(2) The Agency shall not establish water rates, or tax or assessment rates, so as to cause the surcharge credit to be passed on to water users in a manner which will bring about a greater reduction in the cost per acre-foot of project water put to use on excess land than such cost of project water put to use on other than excess land.

This subdivision 46(b) shall be separable from all other provisions in this contract, and in the event that any or all of the provisions of this subdivision are in any manner or to any extent

STATE OF CALIFORNIA

DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 3 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND UPPER SANTA CLARA VALLEY WATER AGENCY

THIS CONTRACT, made this 24th day of January 1966, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Upper Santa Clara Valley Water Agency, a public agency in the State of California, duly organized, existing, and acting pursuant to the laws thereof with its principal place of business in Newhall, California, herein referred to as the "Agency",

WITNESSETH, That:

WHEREAS, the State is authorized to construct and operate facilities for the storage and conveyance of water, certain of which facilities will make water available to the Agency; and

WHEREAS, the State and the Agency have entered into a water supply contract, dated April 30, 1963, as amended

TABLE A
Annual Entitlements
Upper Santa Clara Valley Water Agency

Year	Total Annual Amount In Acre-Feet
1	1,600
2	3,700
3	5,700
4	7,500
5	9,500
6	11,400
7	13,400
8	15,300
9	17,700
10	20,100
11	22,100
12	24,600
13	26,900
14	29,100
15	30,900
16	32,900
17	35,300
18	37,400
19	39,300
20	41,500
And each succeeding year thereafter, for the term of this contract:	41,500

3. Subdivision (c) of Article 12 is amended to read as follows:

(c) Limit on Rate of Delivery to Agency

In no event shall the State be obligated to deliver water to the Agency through all delivery structures at a total combined instantaneous rate of flow exceeding seventy-six (76) cubic feet per second, except as this rate of flow may be revised by amendments of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 4 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
UPPER SANTA CLARA VALLEY WATER AGENCY

THIS CONTRACT, made this 31st day of December, 1969, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Upper Santa Clara Valley Water Agency,

herein referred to as the "Agency";

WITNESSETH, That

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year and that beginning in the year 1970, the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and

Thermalito power facilities through Central Valley Project Revenue Bonds and may finance other portions of the project facilities through additional revenue bond issues, bonds issued under other authority granted by the Legislature or the voters, bonds issued by other state agencies, advances from contractors, and other methods under which the financing costs relate to interest rates that may exceed the interest rate of the bonds issued under the Bond Act; and

WHEREAS, either the State or contractors making advances to the State may be subject to interest rates, or other financing costs that relate to interest rates, which will be greater than the "project interest rate" as presently defined in the contracts; and

WHEREAS, the parties desire that (1) the interest costs hereafter incurred by or on behalf of the State in financing the construction of project facilities by means other than the use of moneys provided under the Bond Act will be reflected in appropriate adjustments of the "project interest rate" (excepting the interest costs incurred for the Central Valley Project Revenue Bonds issued prior to the date of this amendment); (2) appropriate credit will be given to any contractor having made an advance of funds to the State corresponding to the bond service obligation payable by such contractor by reason of such advance or if bonds were not used to obtain funds for such advance, then to the net interest cost which would have resulted if the contractor had sold bonds for the purpose of funding the advance; and (3) if any sources of funds other than those provided under the Bond Act are employed to finance the construction of specific project facilities and the interest or other costs of such financing are greater than the cost would have been if bonds issued under the Bond Act had been used, appropriate

"Project interest rate" shall mean the weighted average interest rate of (1) through (6) below computed by dividing (i) the total interest cost required to be paid or credited by the State during the life of the indebtedness or advance by (ii) the total of the products of the various principal amounts and the respective terms in years of all such amounts:

(1) general obligation bonds issued by the State under the Bond Act,

(2) revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) bonds issued by any agency, district, political subdivision, public corporation, or non-profit corporation of this State,

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing

construction of specific project facilities, any additional costs incurred because of such financing will not be charged to the contractors, except for adjustments to the "project interest rate".

Approved as to legal form and sufficiency:

C. Tanner

Chief Counsel
Department of Water Resources
P. O. Box 388
Sacramento, California

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

By W. E. Gianelli
Director

Approved as to form and execution:

Counsel

UPPER SANTA CLARA VALLEY
WATER AGENCY

By
Pres.

1971 the Delta Water Charge shall be the sum of the capital cost component, minimum operation, maintenance, power and replacement component, and variable operation, maintenance, power and replacement component computed in accordance with Articles 22(c) and (d) of the water supply contract; and

WHEREAS, Articles 22(e) and (g) of such water supply contract provide that the Delta Water Charge as computed in accordance with Articles 22(c) and (d) shall include all projected costs of additional project and supplemental conservation facilities commencing in the years in which the State first incurs capital costs for such facilities after the facilities are authorized; and

WHEREAS, the parties desire that all water supply contracts be amended to postpone inclusion of the projected costs of any authorized additional project and supplemental conservation facilities in the computation of the Delta Water Charge until after the year 1971 and to fix the rate for computing the Delta Water Charge for the year 1971 at $7.24;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Subdivision (b) of Article 22 is amended to read as follows:

For each contractor receiving project water in any year through December 31, 1969, the Delta Water Charge shall be the product of $3.50 and the contractor's annual entitlement to project water for the respective year. For each contractor receiving project water in the year 1970, the Delta Water Charge shall be the

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 6 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
CASTAIC LAKE WATER AGENCY

THIS CONTRACT, made this 27th day of December, 1971, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, Article 22(b) of such water supply contract, as amended, provides that for each year through the year 1969 the Delta Water Charge shall be the product of $3.50 and the Agency's annual entitlement for the respective year, that for the year 1970 the Delta Water Charge shall be the product of $6.65 and the

the Delta Water Charge shall be determined on the basis of an allocation to project purposes, by the separable cost-remaining benefits method, of all actual and projected costs of all those initial project conservation facilities located in and above the Delta, and upon an allocation to the purposes of water conservation and water transportation, by the proportionate use of facilities method, of all actual and projected costs of the following project facilities located below the Delta: The aqueduct intake facilities at the Delta, Pumping Plant I (Delta Pumping Plant), the aqueduct from the Delta to San Luis Forebay (O'Neill Forebay), San Luis Forebay (O'Neill Forebay), and San Luis Reservoir: Provided, That all of the actual and projected costs properly chargeable to the generation and transmission of electrical energy in connection with operation of project conservation facilities shall be allocated to the purpose of water conservation in, above, and below the Delta: Provided further, That allocations to purposes the cost of which are to be paid by the United States shall be as determined by the United States.

Commencing in the year in which the State first awards a major construction contract for construction of a major feature of additional project conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of additional project conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the

which are allocated to the purpose of water conservation, in, above, and below the Delta pursuant hereto. Commencing in the year in which the State first awards a major construction contract for construction of a major feature of any supplemental conservation facilities, or first commences payments under a contract with a federal agency in the event a major feature of supplemental conservation facilities is constructed by such federal agency under an agreement requiring the State to pay all or part of the costs of such construction, the Delta Water Charge shall be determined on the basis of the allocations made pursuant to subdivision (e) of this article, and upon an allocation to project purposes, by the separable costs-remaining benefits method and subject to provisos corresponding to those contained in said subdivision (e), of all projected costs of such feature of the supplemental conservation facilities. Commencing in the same year, the computation of the rates to be used in determining the components of the Delta Water Charge shall include the annual entitlements to water under all contracts for supplemental water. If the repayment period of any bonds sold to construct supplemental conservation facilities or the repayment period under any agreement with a federal agency for repayment of the costs of supplemental conservation facilities constructed by such federal agency extends beyond the repayment period of the contract, the Delta Water Charge shall be determined and redetermined on the basis of such extended repayment period as the State determines to be appropriate: Provided, That if the agreement with such federal agency allows repayment of costs

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 7 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
CASTAIC LAKE WATER AGENCY

THIS CONTRACT, made as of the 15th day of October, 1972, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract, dated April 30, 1963 (herein referred to as the "Amended Contract") providing that the State shall supply certain quantities of water to the Agency, and that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the Amended Contract provides for a surcharge equivalent to the power credit per acre-foot of water to be charged to water users, other than the United States or the State of California, for each acre-foot of project water determined to have been put to agricultural or manufacturing uses on excess land, for collection by the Agency either itself or through a

1. Article 30 entitled "Surcharge for Project Water Used on Excess Land".

2. The next-to-the-last sentence of the fifth paragraph of subdivision (a) of Article 46, entitled "Surplus Water", which sentence reads as follows:

> "A surcharge shall be added to the rate for surplus water furnished to excess land in an amount and under the conditions specified in Article 30 of this contract".

3. Subdivision (b) of Article 46 entitled "Surcharge Credit".

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment on the date first above written.

Approved as to legal form and sufficiency:

By P. G. Turner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By W. H. Gianella
Director

Attest:

By _____
(Title)

CASTAIC LAKE WATER AGENCY

By Earl Schmidt
(Title) President

Approved as to form and execution:

By _____
(Title)

interest rate, and all other factors which are determinative of such charges; and

WHEREAS, Article 28 also provides that each such redetermination shall include an adjustment of the components of the Transportation Charge to be paid by the Agency for succeeding years which shall account for differences, if any, between projections used by the State in determining the amounts of such components for all preceding years and actual costs incurred by the State during such years, but does not specify the computational details or the method of payment of such adjustments; and

WHEREAS, the State has been including such adjustments as "one-shot" credits or additional charges to be subtracted from or added to the Transportation Charge to be paid by the Agency in the year following the redetermination; and

WHEREAS, the magnitude of such adjustments together with changes in other determinants of charges may be significantly different in comparison with the amounts projected by the State under previous determinations and could impair the planned fiscal operations of the Agency, depending on the method of payment, and the parties desire to amend the contract to provide a method of amortizing the payment of the amounts of such differences over two or more years, depending on the magnitude of the differences; and

WHEREAS, bookkeeping will be simplified if the amortization of the payments of the amounts of such differences is

the State. Such adjustment shall be computed by the State and paid by the Agency or credited to the Agency's account in the manner described in (b) and (c) below.

(b) Adjustment: Transportation Charge-Capital Cost Component

Adjustments for prior underpayments or overpayments of the capital cost component of the Transportation Charge to the Agency, together with accrued interest charges or credits thereon computed at the then current project interest rate on the amount of the underpayment or overpayment and compounded annually for the number of years from the year the underpayment or overpayment occurred to and including the year following the redetermination, shall be paid in the year following the redetermination: Provided, That the Agency may elect to exercise the option whereby when the redetermined Transportation Charge for the following year, with adjustments, including adjustments of the operation, maintenance, power, and replacement components provided for in subdivision (c) of this article, is more or less than the last estimate of the Charge provided pursuant to Article 27 for the corresponding year, without adjustments, an amount equal to the total of such difference shall be deducted from or added to the adjusted capital cost component for that year and paid or credited in accordance with the following schedule:

Percent that Transportation Charge differs from last estimate (+ or -)	Period, in years, for amortizing the difference in indicated charge
for 10% or less	no amortization
more than 10%, but not more than 20%	2
more than 20%, but not more than 30%	3
more than 30%, but not more than 40%	4
more than 40%.	5

the Transportation Charge for the year in which the option is to become effective.

Such option, once having been exercised, shall be applicable for all of the remaining years of the project repayment period.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

By R. C. Turner
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By [illegible]
Director

Attest:

By Betty L. Castleberry
(Title) Secretary

CASTAIC LAKE WATER AGENCY

By [illegible]
(Title) President

Approved as to form and execution:

By [illegible]
(Title) Counsel

delivery of all of its annual entitlement for 1972 on a reasonable schedule; and

WHEREAS, the State has developed a proposed adjustment of the Agency's 1972 entitlement taking into consideration the monthly distribution of 1972 project water deliveries as requested in its five-year delivery schedule submitted to the State in 1967; and

WHEREAS, the Agency has requested that its annual entitlement for the first year of water deliveries be decreased accordingly; and

WHEREAS, the State has determined that a decrease from 1,600 acre-feet to 1,236 acre-feet is justified and that allowing such a decrease in the Agency's 1972 annual entitlement will not impair the financial feasibility of the project facilities;

NOW THEREFORE, it is mutually agreed as follows:

Table A entitled "Annual Entitlements Castaic Lake Water Agency" is amended to read as follows:

TABLE A

ANNUAL ENTITLEMENTS
CASTAIC LAKE WATER AGENCY

Year	Total Annual Amount in acre-feet
1	1,236
2	3,700
3	5,700
4	7,500
5	9,500
6	11,400
7	13,400
8	15,300
9	17,700
10	20,100
11	22,100
12	24,600
13	26,900

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 10 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
CASTAIC LAKE WATER AGENCY

THIS CONTRACT, made as of the 28th day of August, 1974, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency";

WITNESSETH, That:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State; and

WHEREAS, the State and the Agency included in such contract a subarticle, hereinafter referred to as the agricultural and ground water replenishment provision, which entitles the Agency to obtain from the State a supply of surplus water for agricultural and ground water replenishment use when available; and

WHEREAS, Article 21 of such contract also provides for the sale by the State of a supply of surplus water when available; and

(iii) Operational requirements regarding recreation and fish and wildlife uses;

(iv) Generation of power by the System or furnishing of project water required by power contracts;

(v) The exchange of water and the filling, retention, and release of storage in System reservoirs necessary for operational flexibility and to meet the requirements of paragraphs (i) through (iv) of this subdivision.

(vi) Losses of water due to evaporation, leakage, seepage, or other causes to meet the requirements of paragraphs (i) through (v) of this subdivision.

(3) "Ground water replenishment use" shall mean the use of project water exclusively for recharge of ground water basins by direct application to spreading basins, streambeds, or through other means of direct artificial recharge.

(4) "Contractors in the San Joaquin Service Area" shall mean those contractors which are furnished water through delivery structures from the California Aqueduct between Dos Amigos Pumping Plant and the South Portal of the Carley V. Porter Tunnel and from the Coastal Branch, California Aqueduct, from its junction with the California Aqueduct to the site for Devil's Den Pumping Plant.

(5) "Contractors in the Southern California Service Area" shall mean contractors for which water is delivered from the California Aqueduct downstream from the South Portal of the Carley V. Porter Tunnel.

(1) First, the quantity of surplus water to be delivered to noncontractors shall be limited to the quantity available in excess of the requests under the first priority and the second priority.

(2) Second, if there is not sufficient surplus water in excess of the requests under the first priority to meet the requests of contractors under the second priority, the quantity of water to be delivered under the second priority shall be limited to the quantity available in excess of the requests under the first priority and that quantity shall be apportioned in proportion to the amounts of the contractors' current annual entitlements that are to be used for purposes other than agricultural and ground water replenishment uses as determined by the State. If any contractor decides not to use the surplus water available to it under this provision, such surplus water shall be offered on a similar basis to other contractors for such uses.

(3) If there is not sufficient surplus water to meet the requests of contractors under the first priority, the quantity of water to be delivered under that priority shall be limited to the quantity available, and such quantity shall be apportioned to areas upstream and downstream from Dos Amigos Pumping Plant in proportion to the contractors' current annual entitlements that are to be used in such areas for agricultural and ground water replenishment purposes as determined by the State. The quantity of such water available upstream from Dos Amigos Pumping Plant shall be apportioned to contractors upstream from Dos Amigos Pumping Plant in proportion to the amounts of the contractors' current annual entitlements that are to be used for agricultural and ground water

in the judgment of the State to furnish surplus water to it, the contractor shall have a prior right to have such power utilized for furnishing surplus water otherwise available to it pursuant to this article at a cost no higher than that which the State is obligated to pay at the time it orders such power, but it shall have no greater right or priority to receive surplus water. A contractor's commitment may be for any part of the six-year period of its schedule, and the contractor will become bound by such commitment and become entitled to the prior right provided for in the preceding sentence only when the State, after consultation with the contractor, notifies the contractor in writing that it has ordered power based on the contractor's commitment.

(e) Rates.

(1) Surplus water (except further surplus water as described in subdivision (e)(4) of this article) shall be furnished to a contractor for agricultural use and for ground water replenishment use at rates which will return to the State all power costs as defined in subdivision (f) of this article and all incremental operation, maintenance, and replacement costs, and any other incremental costs, incurred in the conservation and transportation of such surplus water as determined by the State, which rates shall include an administrative charge to be determined by the State for each acre-foot of surplus water scheduled for delivery during the year. The amount of such administrative charge shall be credited to general operating costs of the System prior to the allocation of such costs. Incremental costs shall mean those costs which would not be incurred if surplus water were not scheduled for or delivered to the contractor.

article to any contractor which, under Table A of its contract, is scheduled to receive its maximum annual entitlement prior to 1978 and every year thereafter.

(5) Any revenues in excess of operation, maintenance, power and replacement costs and the administrative charge derived from sales of surplus water shall be credited as follows: The Delta water rate or portion thereof paid in accordance with subdivisions (e)(2), (e)(3), or (e)(4) of this article shall be credited to the cost of project conservation facilities, and the balance of such excess revenues, if any, shall be apportioned and credited, as appropriate, to the capital and to the minimum operation, maintenance, power and replacement costs of reaches of the transportation facilities of the System utilized for conveying such water to the purchasers.

(6) The rates and charges for surplus water shall be subject to redetermination by the State to reflect actual costs incurred and the difference shall be promptly credited or debited to the contractor that purchased such surplus water.

(f) Power Costs. Power costs for pumping surplus water shall consist of the cost of capacity, energy and additional transmission service required for the delivery of surplus water, including but not limited to the following:

(1) To the extent utilized for pumping surplus water:

(i) The cost of power purchased for pumping entitlement water,

(ii) The value of project recovery plant generation scheduled for pumping entitlement water, and

contract (disregarding any amendments reducing such Table A executed after July 1, 1974) is first scheduled and unless all of its deferred entitlements are first scheduled: Provided, That at the request of the contractor surplus water may be scheduled in lieu of deferred entitlements and the right to receive such deferred entitlements shall be reduced accordingly. If at the end of any year delivery of scheduled surplus water has prevented any annual entitlement or deferred entitlement from being delivered during that year, then for the purpose of charging for water delivered, deliveries during the year shall be considered first as annual entitlement water to the extent of the annual entitlement, and the balance as deferred entitlement or surplus water in accordance with the option of the contractor previously exercised pursuant to the first sentence of this subdivision.

(3) Before a contractor can receive surplus water under its contract in an amount greater than its annual entitlement for the year as shown in its Table A, it shall first increase its annual entitlement for such year to an amount equivalent to the surplus water scheduled, but it shall not be required to increase its annual entitlement to an amount in excess of 75 percent of its maximum annual entitlement.

(4) The State shall not sell surplus water to a contractor or noncontractor for use directly or indirectly within the boundaries of any other contractor without the written consent of such other contractor, nor shall the State authorize any contractor to supply surplus water for use outside such contractor's boundaries and within the boundaries of any other contractor without the written consent of such other contractor: Provided, That where

and data concerning the use of water within its boundaries as the State may request.

(j) Contracts.

(1) To obtain a supply of surplus water, any contractor or noncontractor shall execute a fuether contract with the State which shall be in conformity with this article and will include at least the following: Further provisions concerning the scheduling of surplus water and provisions as to times and methods of payment.

(2) The State shall not contract to sell surplus water to noncontractors for periods in excess of five years.

IN WITNESS WHEREOF, the parties hereto have executed this contract amendment as of the date first above written.

Approved as to legal form and sufficiency:

By _____
Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

CASTAIC LAKE WATER AGENCY

By _____
(Title) PRESIDENT

(t) Project Repayment Period

"Project repayment period" shall mean that period of years commencing on January 1, 1961, and extending until December 31, 2035; Provided, that whenever construction of any project facilities is financed by a bond issue with maturity dates later than December 31, 2035, whether the bonds are issued pursuant to the Bond Act or other authority, repayment of the costs of such facilities shall be extended to end on the date of the latest maturities of the bonds with which construction of such facilities is financed.

2. Article 2 of the Agency's Water Supply Contract with the State is amended to read as follows:

(2) Term of Contract

This contract shall become effective on the date first above written and shall remain in effect for the longest of the following:

1. The project repayment period

2. 75 years

3. The period ending with the latest maturity date of any bond issue used to finance the construction costs of project facilities.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 12 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND THE
CASTAIC LAKE WATER AGENCY

THIS CONTRACT, made this 12th day of January, 1983, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency";

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment; and

WHEREAS, the State and the Agency desire to make certain changes and additions to such contract, while otherwise continuing the contract in full force and effect;

NOW, THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. Article 1(e) is amended to read:

construction at the same time of alternative new water supply sources which are either reservoirs located north of the Delta or off-Aqueduct storage reservoirs located south or west of the Delta designed to supply water to the California Aqueduct. The following facilities and programs shall hereinafter be referred to as "Local Projects":

(A) On-stream and off-stream surface storage reservoirs not provided for in Section 12938 of the Water Code, that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(B) Ground water storage facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(C) Waste water reclamation facilities that will produce project water for the System for a period of time agreed to by the sponsoring contractor;

(D) Water and facilities for delivering water purchased by the State for the System for a period of time agreed to by the sponsoring contractor; provided that the economic test specified herein shall be applied to the cost of these facilities together with the cost of the purchased water; and

(E) Future water conservation programs and facilities that will reduce demands by the sponsoring contractor for project water from the System for a period of time agreed to by the sponsoring contractor and will thereby have the effect of increasing project water available in the Delta for distribution.

(B) All contractors within whose boundaries any portion of such Local Project is located, and who are not sponsoring contractors for such Local Project give their written approval of such Local Project.

(5) "Sponsoring contractor" as used in this Article 1(h) shall mean the contractor or contractors who either will receive the yield from facilities described in 2(A), (B), (C), or (D) above, or agree to reduce demands for project water from the System pursuant to 2(E) above.

(6) In the event of a shortage in water supply within the meaning of Article 18(a), the determination of whether to count, in whole or in part, the yield from facilities described in 2(A), (B), (C), or (D) above, or the reduced demand from future conservation programs described in 2(E) above in the allocation of deficiencies among contractors will be based on a project-by-project evaluation taking into consideration such factors as any limitation on the use of the water from such facilities and whether the sponsoring contractor has access to project water from the Delta as an alternate to such facilities.

3. Article 1(i)(2) is amended to read:

(2) Facilities for the generation and transmission of electrical energy of the following types:

(A) Hydroelectric generating and transmission facilities, whose operation is dependent on the transportation of project water, or on releases to channels downstream of project facilities defined under (1) above. Such facilities shall be called "project aqueduct power recovery plants."

(5) funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State, and

(6) funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Pooled Money Investment Account of such Treasury invested in securities,

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

5. Subdivision (h) is added to Article 22 to read:

(h) The determination of the rate for water under the Delta Water Charge shall be made by including the appropriate costs and quantities of water, calculated in accordance with subdivisions (c), (d) and (e) above, for all additional project conservation facilities as defined in Article 1(h) hereinabove. In the event a Local Project as defined in Article 1(h)(2) will,

(d) Notwithstanding the provisions of subdivisions (a) and (b) of this article, or of Article 1(s), the costs of off-aqueduct power facilities shall be determined and allocated as follows:

(1) The off-aqueduct power costs shall include all annual costs the State incurs for any off-aqueduct power facility, which shall include, but not be limited to, power purchases, any annual principal and interest payments on funds borrowed by or advanced to the State, annual principal and interest on bonds issued by the State or other agency, or under revenue bond financing contracts, any requirements for coverage, deposits to reserves, and associated operation and maintenance costs of such facility, less any credits, interest earnings, or other monies received by the State in connection with such facility. In the event the State finances all or any part of an off-aqueduct power facility directly from funds other than bonds or borrowed funds, in lieu of such annual principal and interest payments, the repayment of capital costs as to that part financed by such other funds shall be determined on the basis of the schedule that would have been required under Article 24.

(2) The annual costs of off-aqueduct power facilities as computed in (1) above shall initially be allocated among contractors in amounts which bear the same proportions to the total amount of such power costs that the total estimated electrical energy (kilowatt hours) required to pump through project transportation facilities the desired delivery amounts of annual entitlements for that year, as submitted pursuant to

reallocation shall include appropriate interest at the project interest rate.

9. Subdivision (e) is added to Article 25 to read:

(e) The total minimum operation, maintenance, power and replacement component due that year from each contractor shall be the sum of the allocations made under the proportionate use of facilities method provided in subdivision (b) of this article and the allocations made pursuant to subdivision (d) of this article for each contractor.

10. Subdivision (b) of Article 32 is amended to read:

(b) Interest on Overdue Payments

Upon every amount of money required to be paid by the Agency to the State pursuant to this contract which remains unpaid after it becomes due and payable, interest shall accrue at an annual rate equal to that earned by the Pooled Money Investment Fund, as provided in Government Code Sections 16480, et seq. calculated monthly on the amount of such delinquent payment from and after the due date until it is paid, and the Agency hereby agrees to pay such interest: provided, that no interest shall be charged to or be paid by the Agency unless such delinquency continues for more than thirty (30) days.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 13 TO WATER SUPPLY CONTRACT
BETWEEN THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES AND
CASTAIC LAKE WATER AGENCY

THIS CONTRACT is made this 6th day of June, 1987, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency".

WHEREAS, the State and the Agency have entered into and subsequently amended a water supply contract providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the State and the Agency wish to provide financing for project facilities with water system revenue bonds and provide for repayment of water system revenue bonds;

WHEREAS, the State and the Agency wish to clarify the definition of the project interest rate without changing the interpretation of Article 1(r), except for the addition of item (7), and to specify that financing costs of water system facilities and East Branch Enlargement facilities shall not be included in calculating the project interest rate; and

(2) Revenue bonds issued by the State under the Central Valley Project Act after May 1, 1969,

(3) Bonds issued by the State under any other authority granted by the Legislature or the voters,

(4) Bonds issued by any agency, district, political subdivision, public corporation, or nonprofit corporation of this State,

(5) Funds advanced by any contractor without the actual incurring of bonded debt therefor, for which the net interest cost and terms shall be those which would have resulted if the contractor had sold bonds for the purpose of funding the advance, as determined by the State,

(6) Funds borrowed from the General Fund or other funds in the Treasury of the State of California, for which the total interest cost shall be computed at the interest rate earned over the period of such borrowing by moneys in the Surplus Money Investment Fund of such Treasury invested in securities, and

(7) Any other financing capability available in the Treasury of the State of California at whatever interest rate and other financing costs are provided in the law authorizing such borrowing. However, the use of other financing from the State Treasury is intended to involve only short term borrowing at interest rates and other financing costs no greater than those charged to other State agencies during the same period until such time as the Department can sell bonds and reimburse the source of the short term borrowing from the proceeds of the bond sale.

between the State and The Metropolitan Water District of Southern California, dated July 2, 1984, and May 15, 1985, which increased the East Branch Aqueduct capacity beyond that set forth in Table B-2 as shown in State Bulletin 132-70;

(5) That portion of Reach 24 (Silverwood Lake) to be determined by reallocation of Reach 24 to reflect the additional use to be made of that reach as a result of the East Branch Enlargement operation; and

(6) That portion of Reach 25 (San Bernardino Tunnel) to be determined by an allocation of total delivery capacity of Reach 25 between the basic East Branch facilities and the East Branch Enlargement as a result of East Branch Enlargement operation.

4. Article 1 (hh) is added to read:

(hh) "Water System Facilities" shall mean the following facilities to the extent that they are financed with water system revenue bonds or to the extent that other financing of such facilities is reimbursed with proceeds from water system revenue bonds:

(1) The North Bay Aqueduct,

(2) The Coastal Branch Aqueduct,

(3) Delta Facilities, including Suisun Marsh facilities, to serve the purposes of water conservation in the Delta, water supply in the Delta, transfer of water across the Delta, and mitigation of the environmental effects of project facilities, and to the extent presently authorized as project purposes, recreation and fish and wildlife enhancement,

(4) Local projects as defined in Article 1(h)(2) designed to develop no more than 25,000 acre-feet of project yield from each project,

shall be calculated in accordance with provisions in Article 5. of this contract.

6.5. Article 28(e) of the Agency's water supply contract with the State is added to read:

28(e) Notwithstanding the provisions of Article 28(b), adjustments for prior overpayments and underpayments shall be repaid beginning in the year following the redetermination by application of a unit rate per acre-foot which, when paid for the projected portion of the Agency's annual entitlement will return to the State, during the project repayment period, together with interest thereon computed at the project interest rate and compounded annually, the full amount of the adjustments resulting from financing after January 1, 1987, from all bonds, advances, or loans listed in Article 1(r) except for Article 1(r)(3) and except for bonds issued by the State under the Central Valley Project Act after January 1, 1987 for facilities not listed among the water system facilities in Article 1(hh). Notwithstanding the immediately preceding exception, such amortization shall also apply to any adjustments in this component charge resulting from a change in the project interest rate due to any refunding after January 1, 1986 of bonds issued under the Central Valley Project Act. However, amortization of adjustments resulting from items 1(r)(4) through (7) shall be limited to a period which would allow the Department to repay the debt service on a current basis until such time as bonds are issued to reimburse the source of such funding. In no event shall this amortization period be greater than the project repayment period.

credits are determined by the State to be available, such credits shall be promptly provided to the contractors and shall be in proportion to the payments under this article from each contractor. Reserves, bond debt service coverage, interest, and other earnings may be used in the last year to retire the bonds.

(b) Annual charges to recover water system revenue bond financing costs shall consist of two elements.

(1) The first element shall be an annual charge to the Agency for repayment of capital costs of water system facilities as determined under Articles 22 and 24 of this contract with interest at the project interest rate. For conservation facilities, the charge shall be a part of the capital cost component of the Delta Water Charge in accordance with Article 22. For transportation facilities, the charge shall be a part of the capital cost component of the Transportation Charge in accordance with Article 24.

(2) The second element shall be the Agency's share of a Water System Revenue Bond Surcharge to be paid in lieu of a project interest rate adjustment. The total annual amount to be paid by all contractors under this element shall be the difference between the total annual charges under the first element and the annual financing costs of the water system revenue bonds. The amount to be paid by each contractor shall be calculated annually as if the project interest rate were increased to the extent necessary to produce revenues from all contractors sufficient to pay such difference for that year. In making that calculation, adjustments in the Agency's Transportation capital cost component charges for prior overpayments and underpayments shall be determined as if amortized over the remaining years of the project repayment period.

of any water system revenue bond issuances and the form of any necessary resolutions or supplements.

(h) Defaults. (1) If a contractor defaults partially or entirely on its payment obligations calculated under this article and sufficient insurance or other security protecting the non-defaulting contractors is not provided under Article 50(f), the State shall allocate a portion of the default to each non-defaulting contractor. The Agency's share of the default shall be equal to an amount determined by multiplying the total default amount to be charged to all non-defaulting contractors by the ratio that the Agency's maximum Table A entitlement bears to the maximum Table A entitlements of all non-defaulting contractors. However, such amount shall not exceed in any year 25 percent of the Water System Revenue Bond financing costs that are otherwise payable by the Agency in that year. The amount of default to be charged to non-defaulting contractors shall be reduced by any receipts from insurance protecting non-defaulting contractors and bond debt service coverage from a prior year and available for such purpose.

(2) If a contractor defaults partially or entirely on its payment obligations under this article, the State shall also pursuant to Article 20, upon six months' notice to the defaulting contractor, suspend water deliveries under Article 20 to the defaulting contractor so long as the default continues. The suspension of water deliveries shall be proportional to the ratio of the default to the total water system revenue bond payments due from the defaulting contractor. However, the State may reduce, eliminate, or not commence suspension of deliveries pursuant to this subparagraph if it determines suspension in the amounts otherwise required is likely to impair the

coverage, such increase shall be handled in the same manner as provided in Article 50(a).

(7) Action taken pursuant to this subarticle shall not deprive the State of or limit any remedy provided by this contract or by law for the recovery of money due or which may become due under this contract.

(i) Power of Termination.

(1) The Department and the Agency agree to negotiate in good faith the development of a means to provide adequate protection for the Department's cash flow into priorities one and two for revenues under Water Code Section 12937(b) with the goal of obtaining agreement by April 1, 1987. The Department and the Agency agree to continue negotiations beyond April 1, 1987 if necessary to meet their common goal of arriving at agreement.

(2) If such an agreement has not been reached by April 1, 1987, and if the Director of Water Resources determines that adequate progress has not been made toward such an agreement, the Director may give notice to the Agency and other contractors that he intends to exercise the power to terminate provided in this subarticle 50(i). The Director's authority to give such a notice shall terminate on July 1, 1988.

(3) After six months from the date of issuing the notice of intent to terminate, but in no event later than January 1, 1989, the Director may terminate the authority of the Department to issue additional series of water system revenue bonds using the repayment provisions of Article 50. The Department shall promptly notify the Agency and other contractors that the Director has exercised the power of termination.

IN WITNESS WHEREOF, the parties have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

By _____
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

By _____
Director

Attest:

By _____
(Title)
Secretary

CASTAIC LAKE WATER AGENCY

By _____
General Manager

to the extent the proceeds of any such bonds, advances or loans are for construction of the State Water Facilities defined in Section 12934(d) of the Water Code, the additional project conservation facilities, and the supplemental conservation facilities, (except off-aqueduct power facilities and advances for delivery structures, measuring devices and excess capacity) and without regard to any premiums received on the sale of bonds under item (1) above. The "project interest rate" shall be computed as a decimal fraction to five places.

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the delivery and scheduling of entitlement water to allow, under certain conditions, the carry-over of a portion of the Agency's entitlement deliveries from a respective year into the first three months of the next calendar year.

WHEREAS, the carry-over of entitlement by the Agency is not intended to adversely impact current or future project operations.

WHEREAS, the State Water Project contractors and the Department are aware that the carry-over of entitlement water from one year into the next may increase or decrease the costs to other SWP contractors in either year. The tracking of those costs may be too complex and expensive and does not warrant special accounting procedures to be established; however, any significant identifiable cost shall be charged to those contractors causing such cost, as determined by the Department;

WHEREAS, the carry-over of entitlement water is not to affect the payment provisions of the contract.

NOW THEREFORE, it is mutually agreed that the following changes and additions are hereby made to the Agency's Water Supply Contract with the State:

1. Article 1(ii) is added to read:

"Carry-over Entitlement Water" shall mean water from a contractor's annual entitlement for a respective year which is made available for delivery by the State in the next year pursuant to Article 12(e).

conditions consistent with this Article 12(e) that would govern the delivery of the Carry-over Entitlement Water.

The Agency agrees to pay all significant identifiable costs associated with its Carry-over Entitlement Water, as determined by the State.

All scheduling and delivery of Carry-over Entitlement Water shall be carried out pursuant to the provisions of this contract.

The Agency agrees to forego the delivery of any Carry-over Entitlement Water that is lost because of project operations or is not delivered by March 31 of the next year.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 15 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND CASTAIC LAKE WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 11th day of APRIL, 1991, pursuant to the provisions of the California Water Resources Development Bond Act, the State Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency".

RECITALS:

WHEREAS, the State and the Agency entered into a contract whereby the State will deliver and the Agency will purchase a supply of water to be made available from project facilities constructed by the State;

WHEREAS, the State and the Agency included in such contract an article which entitles the Agency to obtain from the State deliveries of surplus water when available;

WHEREAS, the State and the Agency desire to amend the provisions of such contract related to the deliveries of surplus water; and

3. Article 21(f) of the Agency's water supply contract with the State is amended to read:

(f) Power Costs.

(1) Beginning January 1, 1991, the Agency shall pay power charges for pumping surplus water as follows:

(A) If during a calendar month it is either not necessary to purchase power for pumping surplus water, or it is necessary to purchase power for pumping surplus water and the purchased power rate is less than or equal to the Melded Power Rate (defined as the average unit charge for pumping entitlement water during the calendar year for all power resources, including on-aqueduct power resources, off-aqueduct power resources, and any other power resources), then the monthly charges to the Agency for the Net Power (gross power used to pump the surplus water less power generated by the surplus water) used to pump surplus water to the Agency shall be determined using the Melded Power Rate.

(2) By receiving surplus or unscheduled water under this Article 21(f), the Agency accepts the responsibility to indemnify, defend, and hold harmless the State, its officers, employees and agents from all liability, expenses, defense costs, attorney fees, claims, actions, liens, and lawsuits of whatever kind, arising out of or related to this article.

(3) Effective January 1, 1991, power charges for delivery of unscheduled water to the Agency shall be calculated in the same manner as provided in this Article 21(f).

4. This Amendment shall take effect on January 1, 1991, only if, by January 31, 1991 an Amendment substantially the same as this one is executed by contractors that together have maximum annual entitlements totaling at least 3,796,007 acre-feet. By February 15, 1991, the State will inform the Agency of whether sufficient contractors had executed the Amendment to cause the Amendment to take effect.

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AGREEMENT RELATING TO CONSOLIDATION AND TERMINATION OF THE WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA AND DEVIL'S DEN WATER DISTRICT BEING AMENDMENT NO. 16 TO WATER SUPPLY CONTRACT BETWEEN THE STATE OF CALIFORNIA DEPARTMENT OF WATER RESOURCES AND CASTAIC LAKE WATER AGENCY

THIS CONTRACT is made this 3rd day of January, 1991, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State", and Castaic Lake Water Agency, herein referred to as the "Agency", and Devil's Den Water District, herein referred to as "Devil's Den".

RECITALS:

WHEREAS, the State and the Agency (formerly Upper Santa Clara Water Agency) have entered into and subsequently amended a water supply contract dated April 30, 1963, providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment;

WHEREAS, the State and the Agency desire to make certain changes to the Agency's mentioned contract, while otherwise continuing the Agency's contract in full force and effect.

AGREEMENT:

NOW, THEREFORE, the parties agree that the following changes are made to the Agency's water supply contract with the State, effective January 1, 1992.

1. Table A is amended to read as follows:

TABLE A
ANNUAL ENTITLEMENTS
CASTAIC LAKE WATER AGENCY

Calendar Year		Total Annual Amount in Acre-Feet
1968		3,700
1969		5,000
1970		5,700
1971		6,700
1972	1	8,936
1973	2	12,400
1974	3	15,400
1975	4	18,200
1976	5	21,200
1977	6	24,100
1978	7	24,762
1979	8	28,000
1980	9	30,400
1981	10	32,800
1982	11	34,800
1983	12	37,300
1984	13	39,600
1985	14	41,800
1986	15	43,600
1987	16	45,600
1988	17	48,000
1989	18	50,100
1990	19	52,000
1991	20	54,200
1992	21	54,200
And each succeeding year thereafter, for the term of this contract		54,200

4. Article 12(c) of the Agency's contract with the State is amended to read:

(c) **Limit on Rate of Delivery to Agency**

(1) In no event shall the State be obligated to deliver water to the Agency from Castaic Lake at a total combined instantaneous rate of flow exceeding ninety-nine (99) cubic feet per second, except as this rate of flow may be revised by amendment of this article after submission to the State of the Agency's requests with respect to maximum flow capacities to be provided in said delivery structures, pursuant to Article 10.

(2) In no event shall the State be obligated to deliver water to the Agency through the delivery structure at Devil's Den from Reach 31A at a total combined instantaneous rate of flow exceeding thirty-eight (38) cubic feet per second.

5. The proportionate use of facilities factors in the Agency's Table B will be revised to include:

(a) Additional capacity in the California Aqueduct from the Sacramento-San Joaquin Delta through Reach 31A of the Coastal Aqueduct for transporting 12,700 acre-feet with no more than a total amount in any one month of any year of project water greater than eighteen (18) percent of that portion of the Agency's annual entitlement for that year,

8. Pursuant to Article 15(a), the State consents to the Agency annually taking delivery of up to 12,700 acre-feet of the Agency's Table A annual entitlement water at the turnout to Devil's Den in Reach 31A consistent with Article 5(a) above. In any year when the Department determines that sufficient water is available, Article 12(d), surplus, and unscheduled water may also be delivered to the Agency in Reach 31A based upon the amount of the Agency's Table A annual entitlement requested for delivery in that reach.

9. The Agency agrees to indemnify, defend, and hold harmless the State from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising out of or related to the actions implementing this amendment.

10. Covenants Between the State and Devil's Den:

The State and Devil's Den agree, in consideration of the assumption hereunder by the Agency and the State of new duties under the Castaic Lake Water Agency contract, that the Devil's Den Contract is terminated effective January 1, 1992, and the State and Devil's Den are discharged, effective January 1, 1992, from their respective duties under the Devil's Den Contract.

IN WITNESS WHEREOF, the parties hereto have executed this contract on the date first above written.

Approved as to legal form and sufficiency:

Acting Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

for Director

CASTAIC LAKE WATER AGENCY

President E. B. "Jerry" Gladbach

Secretary Betty L. Castleberry

DEVIL'S DEN WATER DISTRICT

President Robert L. Larson

Secretary Laurie Foster

WHEREAS, the contractors and the State have negotiated an amendment to the water supply contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment"); and

WHEREAS, the State and the Agency desire to implement such provisions by incorporating this Monterey Amendment into the water supply contract;

NOW, THEREFORE, IT IS MUTUALLY AGREED that the following changes and additions are hereby made to the Agency's water supply contract with the State:

1. **Article 1(d) is amended to read:**

(d) **Contractor**

"Contractor" shall mean any entity that has executed, or is an assignee of, a contract of the type published in Department of Water Resources Bulletin No. 141 dated November 1965, with the State for a dependable supply of water made available by the System, except such water as is made available by the facilities specified in Section 12934(d)(6) of the Water Code.

2. **Article 1(k) is amended to read:**

(k) **Minimum Project Yield**

"Minimum project yield" shall mean the dependable annual supply of project water to be made available, estimated to be 4,185,000 acre-feet per year, said amount to be determined by the State on the basis of coordinated operation studies of initial project conservation facilities and additional project conservation facilities, which studies shall be based upon:

(5) Land acquisition prior to December 31, 1995, for the Kern Fan Element of the Kern Water Bank,

(6) Additional pumps at the Banks Delta Pumping Plant,

(7) The transmission line from Midway to Wheeler Ridge Pumping Plant,

(8) Repairs, additions, and betterments to conservation or transportation facilities existing as of January 1, 1987, and to all other facilities described in this subarticle (hh) except for item (5),

(9) A project facilities corporation yard, and

(10) A project facilities operation center.

4. Article 1(jj) is added to read:

(jj) **Interruptible water**

"Interruptible water" shall mean project water available as determined by the State that is not needed for fulfilling contractors' annual entitlement deliveries as set forth in their water delivery schedules furnished pursuant to Article 12 or for meeting project operational requirements, including storage goals for the current or following years.

5. Article 1(kk) is added to read:

(kk) **Nonproject water**

"Nonproject water" shall mean water made available for delivery to contractors that is not project water as defined in Article 1(j).

Other terms and conditions of the continued service shall be reasonable and equitable and shall be mutually agreed upon. In the event that said terms and conditions provide for continued service for a limited number of years only, the Agency shall have the same option to receive continued service here provided for upon the expiration of that and each succeeding period of continued service.

8. Article 7(a) is amended to read:

(a) **Changes in Annual Entitlements**

The Agency may, at any time or times during the term of this contract, by timely written notice furnished to the State, request that project water be made available to it thereafter in annual amounts greater or less than the annual entitlements designated in Table A of this contract. Subject to approval by the State of any such request, the State's construction schedule shall be adjusted to the extent necessary to satisfy the request, and the requested increases or decreases in said annual entitlements shall be incorporated in said Table A by amendment thereof. Requests for changes in annual entitlements for more than one year shall be approved by the State: *Provided*, That no change shall be approved if in the judgment of the State it would impair the financial feasibility of project facilities.

9. The title of Article 12 is amended to read "Priorities, Amounts, Times and Rates of Deliveries".

Fourth, project water previously stored pursuant to Articles 12(e) and 56.

Fifth, nonproject water to fulfill contractors' annual entitlements for that year not met by the first two priorities.

Sixth, additional interruptible water delivered to contractors in excess of their annual entitlements for that year.

Seventh, additional nonproject water delivered to contractors in excess of their annual entitlements for that year.

13. Article 14 is amended to read:

Curtailment of Delivery

(a) **State May Curtail Deliveries**

The State may temporarily discontinue or reduce the delivery of project water to the Agency hereunder for the purposes of necessary investigation, inspection, maintenance, repair, or replacement of any of the project facilities necessary for the delivery of project water to the Agency, as well as due to outages in, or reductions in capability of, such facilities beyond the State's control or unuseability of project water due to an emergency affecting project facilities. The State shall notify the Agency as far in advance as possible of any such discontinuance or reduction, except in cases of emergency, in which case notice need not be given.

(b) **Agency May Receive Later Delivery of Water Not Delivered**

In the event of any discontinuance or reduction of delivery of project water pursuant to subdivision (a) of this article, the Agency may elect to receive the amount of annual entitlement which otherwise would have been delivered to it during such period under

contractors for domestic supply, fire protection, or sanitation during the year. If a contractor is allocated more water than it requested, the excess water shall be reallocated among the other contractors in proportion to their annual entitlements as provided for above. The foregoing provisions of this subdivision shall be inoperative to the extent necessary to comply with subdivision (c) of this article and to the extent that a contractor's annual entitlement for the respective year reflects established rights under the area of origin statutes precluding a reduction in deliveries to such contractor.

(b) - Deleted

(c) **Permanent Shortage; Contracts for Areas-of-Origin**

In the event that the State, because of the establishment by a party of a prior right to water under the provisions of Sections 11460 through 11463 of the Water Code, enters into a contract with such party for a dependable supply of project water, which contract will cause a permanent shortage in the supply of project water to be made available to the Agency hereunder:

(1) The State shall: (i) equitably redistribute the costs of all transportation facilities included in the System among all contractors for project water, taking into account the diminution of the supply to the Agency and other prior contractors in accordance with the terms of their contracts, and (ii) revise the Agency's annual entitlements and maximum annual entitlement, by amendment of Table A of this contract to correspond to the reduced supply of project water to be made available to the Agency: *Provided*, That such redistribution of costs of transportation facilities shall not be made until there has been reasonable

(d) **Reinstatement of Entitlements**

If after any revision of annual entitlements and maximum annual entitlements pursuant to subdivision (c) of this article, circumstances arise which, in the judgment of the State, justify a revision upward of the same, the State shall, with the consent of the affected contractor, reinstate proportionately the previously reduced entitlements of such contractor to the extent deemed justified, and shall equitably redistribute the costs of the project transportation facilities if inequities would otherwise occur as a result of such reinstatement of entitlements.

(e) **Advance Notice of Delivery Reductions**

The State shall give the Agency written notice as far in advance as possible of any reduction in deliveries to it which is to be made under subdivision (a) of this article and, to the extent possible, shall give the Agency written notice five (5) years in advance of any reduction in its annual entitlements and maximum annual entitlement under subdivision (c) of this article. Reports submitted to the Agency pursuant to Article 16(c) may constitute such notices.

(f) **No Liability for Shortages**

Neither the State nor any of its officers, agents, or employees shall be liable for any damage, direct or indirect, arising from shortages in the amount of water to be made available for delivery to the Agency under this contract caused by drought, operation of area of origin statutes, or any other cause beyond its control.

off-aqueduct, and any other power) incurred in the transportation of such water as if such interruptible water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State. The State shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if interruptible water were not scheduled for or delivered to the contractor. Only those contractors not participating in the repayment of the capital costs of a reach shall be required to pay any use of facilities charge for the delivery of interruptible water through that reach.

(c) **Contracts**

To obtain a supply of interruptible water, a contractor shall execute a further contract with the State which shall be in conformity with this article and shall include at least provisions concerning the scheduling of deliveries of interruptible water and times and methods of payment.

17. Article 22(j) is amended to read:

(j) Notwithstanding provisions of Article 22(a) through (i), the capital cost component and the minimum OMP&R component of the Delta Water Charge shall include an annual charge to recover the Agency's share of the conservation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with provisions in Article 50 of this contract. Charges for the conservation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

subdivision shall be controlling as to allocations of capital costs to the Agency. Proportionate use of facilities factors for prior years shall not be adjusted by the State in response to changes or transfers of entitlement among contractors unless otherwise agreed by the State and the parties to the transfer and unless there is no impact on past charges or credits of other contractors.

19. Article 24(g) is amended to read:

(g) Notwithstanding provisions of Article 24(a) through (d), the capital cost component of the Transportation Charge shall include an annual charge to recover the Agency's share of the transportation portion of the water system revenue bond financing costs. Charges to the Agency for these costs shall be calculated in accordance with the provisions of Article 50 of this contract. Charges for the transportation portion of the water system revenue bond financing costs shall not be affected by any reductions in payments pursuant to Article 51.

20. Article 25(d)(3) is amended to read:

(3) An interim adjustment in the allocation of the power costs calculated in accordance with (2) above, may be made in May of each year based on April revisions in approved schedules of deliveries of project and nonproject water for contractors for such year. A further adjustment shall be made in the following year based on actual deliveries of project and nonproject water for contractors provided, however, in the event no deliveries are made through a pumping plant, the adjustments shall not be made for that year at that plant.

the charges for the year before that for obligations under subdivisions (c)(2)(ii) and (iii) of this article.

(b) **State Water Facilities Capital Account**

(1) The State shall establish a State Water Facilities Capital Account to be funded from revenues available under Water Code section 12937(b)(4). Through procedures described in this article and as limited by this article, the State may consider as a revenue need under subdivision (c)(2)(v) of this article and may deposit in the State Water Facilities Capital Account the amounts necessary to pay capital costs of the State Water Facilities for which neither general obligation bond nor revenue bond proceeds are available, including but not limited to planning, reconnaissance and feasibility studies, the San Joaquin Valley Drainage Program and, through the year 2000, the CALFED Bay-Delta Program.

(2) The Director of the Department of Water Resources shall fully consult with the contractors and consider any advice given prior to depositing funds into this account for any purposes. Deposits into this account shall not exceed the amounts specified in subdivision (c)(2)(v) of this article plus any amounts determined pursuant to subdivision (e)(1)(iii) of this article.

(3) The State shall use revenue bonds or other sources of moneys rather than this account to finance the costs of construction of any major capital projects.

(c) **Calculation of Financial Needs**

(1) Each year the State shall calculate in accordance with the timing provisions of Articles 29 and 31 the amounts that would have been charged (but for this article) to each contractor as provided in other provisions of this contract.

(3) Subject to the provisions of subdivision (e) of this article, the State shall reduce the annual charges in the aggregate for all contractors by the amounts by which the hypothetical charges calculated pursuant to subdivision (c)(1) above exceed the revenue needs determined pursuant to subdivision (c)(2) above. The reductions under this article shall be apportioned among the contractors as provided in subdivisions (d), (e), (f) and (g) of this article. Reductions to contractors shall be used to reduce the payments due from the contractors on each January 1 and July 1; *Provided*, however, that to the extent required pursuant to subdivision (h) of this article, each Agricultural Contractor shall pay to the Agricultural Rate Management Trust Fund an amount equal to the reduction allocated to such Agricultural Contractor. Any default in payment to the trust fund shall be subject to the same remedies as any default in payment to the State under this contract.

(4) The State may submit a supplemental billing to the Agency for the year in an amount not to exceed the amount of the prior reductions for such year under this article if necessary to meet unanticipated costs for purposes identified in Water Code section 12937(b)(1) and (2) for which the State can issue billings under other provisions of this contract. Any supplemental billing made to the Agency for these purposes shall be in the same proportion to the total supplemental billings to all contractors for these purposes as the prior reduction in charges to the Agency in that year bears to the total reductions in charges to all contractors in that year and shall be treated as reducing the amount of the reduction made available for that year to the Agency by the amount of the supplemental bill to the Agency.

Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iii) In 1999 reductions in the amount of $32 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(iv) In 2000 reductions in the amount of $33 million are projected to be available and shall be applied as follows: the first $10 million of reductions shall be apportioned among the Agricultural Contractors, and the remaining reductions shall be apportioned among the Urban Contractors.

(3)(i) In the event that the aggregate amount of reductions in any of the years 1997 through 2000 is less than the respective amount projected for such year in subdivision (d)(2) above, the shortfall shall be taken first from reductions that would have been provided to Urban Contractors. Only after all reductions to Urban Contractors have been eliminated in a given year shall the remaining shortfall be taken from reductions scheduled for Agricultural Contractors. Any projected reductions not made available due to such shortfalls in the years 1997 through 2000 shall be deferred with interest at the project interest rate to the earliest subsequent years when reductions in excess of those projected for those years are available. Such deferred reductions with interest at the project interest rate shall be applied to the charges of the contractors whose reductions have been deferred.

(ii) In the event that the aggregate amount of reductions available in any of the years 1997 through 2000 is

(5) Annual charges to a contractor shall only be reduced prospectively from and after the date it executes the Monterey Amendment to this contract. Apportionments of reductions shall be calculated on the assumption that all contractors have executed such amendment.

(e) **Review of Financial Requirements**

(1) In 2001 and every fifth year thereafter the Director of the Department of Water Resources, in full consultation with the contractors, will review the financial requirements of the State Water Resources Development System and determine the following:

(i) The amount of revenues that are needed for State Water Resources Development System purposes in addition to those needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii), and (iv) of this article;

(ii) If the aggregate amount that would have been charged to all contractors in any year but for this article exceeds the sum of (A) the amount of revenues needed for the purposes specified in subdivisions (c)(2)(i), (ii), (iii) and (iv), plus (B) $40.5 million, plus (C) the amount determined pursuant to subdivision (c)(2)(v) of this article, the amount of such excess.

(iii) The amount of the excess determined in subdivision (e)(1)(ii) above that should be collected by the State for additional State Water Resources Development System purposes and the amount of such excess that should be used for further annual charge reductions.

(2) After making the determinations required above, the State may collect the revenues for additional State Water Resources

account in excess of this requirement shall be returned to general project revenues.

(vi) Sixth, remaining amounts if any shall be used for reductions divided on a 24.7% - 75.3% basis between the Agricultural Contractors and the Urban Contractors respectively.

(f) **Apportionment of Reductions among Urban Contractors.** Reductions in annual charges apportioned to Urban Contractors under subdivisions (d) and (e) of this article shall be further allocated among Urban Contractors pursuant to this subdivision. The amount of reduction of annual charges for each Urban Contractor shall be based on each Urban Contractor's proportionate share of total allocated capital costs as calculated below, for both project conservation and project transportation facilities, repaid by all Urban Contractors over the project repayment period.

(1) The conservation capital cost component of the reduction allocation shall be apportioned on the basis of maximum annual entitlement. Each Urban Contractor's proportionate share shall be the same as the percentage of that contractor's maximum annual entitlement to the total of all Urban Contractors' maximum annual entitlements.

(2) The transportation capital cost component of the reduction allocation shall be apportioned on the basis of transportation capital cost component repayment obligations, including interest over the project repayment period. Each Urban Contractor's proportionate share shall be the same as the percentage that the contractor's total transportation capital cost component repayment obligation is of the total of all Urban Contractors' transportation capital cost component repayment obligations.

calculated in subdivision (f)(2) of this article by seventy percent (70%).

(iii) A total, weighted capital cost percentage shall be calculated for each Urban Contractor by adding the weighted conservation capital cost component percentage to their weighted transportation capital cost component percentage.

(4) The total amount of the annual charges to be reduced to Urban Contractors in each year shall be allocated among them by multiplying the total amount of annual charges to be reduced to the Urban Contractors by the total, weighted capital cost percentages for each such contractor. If the amount of the reduction to an Urban Contractor is in excess of that contractor's payment obligation to the Department for that year, such excess shall be reallocated among the other Urban Contractors.

(5) In the case of a permanent transfer of urban entitlement, the proportionate share of annual charge reductions associated with that entitlement shall be transferred with the entitlement to the buying contractor. In the case of an entitlement transfer by either Santa Barbara County Flood Control and Water Conservation District or San Luis Obispo County Flood Control and Water Conservation District, the reductions in annual charges to that agency shall be allocated (a) on the basis of that entitlement being retained by that agency which bears Coastal Branch Phase II transportation costs, (b) on the basis of that entitlement being retained by that agency which does not bear Coastal Branch Phase II transportation costs, and (c) on the basis of the balance of that agency's entitlement which also does not bear Coastal Branch Phase II transportation costs.

Transportation Charge (excluding off-aqueduct power charges) and Water Revenue Bond Surcharge shall be totaled for the years 1997 through 2035.

(iii) Kern County Water Agency and Dudley Ridge Water District totaled costs shall be reduced for the 45,000 acre-feet of annual entitlement being relinquished by them.

(iv) Any reductions in an Agricultural Contractor's totaled costs resulting from the transfer of any of the 130,000 acre-feet of annual entitlement shall be re-added to that contractor's costs.

(v) Each Agricultural Contractor's proportionate share shall be computed by dividing that contractor's total costs by the total costs for all Agricultural Contractors determined pursuant to subparagraphs (ii), (iii) and (iv) above.

(2) The reductions in annual charges, for 1997 through 2001, shall be calculated using the method described in subdivision (g)(1) of this article.

(3) The allocation shall be recalculated using the same method described in subdivision (g)(1) of this article every five years beginning in 2002, if any Agricultural Contractor requests such a recalculation. Any recalculation shall be based on project cost data beginning with the year that the recalculation is to become effective through 2035.

(h) **Agricultural Rate Management Trust Fund**

(1) **Establishment.** Through a trust agreement executed contemporaneously with this amendment, the State and the Agricultural Contractors that sign the Monterey Amendments shall

the percentage of the total of that contractor's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of that contractor's annual entitlement for that year that was not allocated to it by the State by April 15th of that year.

(ii) In addition to the provisions of subdivision (h)(4)(i) of this article, if on April 15 of any year any of the irrigable land within the Tulare Lake Basin Water Storage District (Tulare) is flooded, and Tulare in writing requests the trustee to do so, the trustee shall, to the extent there are funds in Tulare's account, distribute to the State from such account for the benefit of Tulare an amount equal to the percentage of the total of Tulare's statement of charges for that year, as redetermined by the State on or about May 15th of that year, for (a) the Delta Water Charge; (b) the capital cost and minimum components of the Transportation Charge (including off-aqueduct power charges); and (c) the water system revenue bond surcharge, that is equal to the percentage of the irrigable land within Tulare that is flooded on April 15.

(iii) Each Agricultural Contractor shall remain obligated to make payments to the State as required by other articles in this contract. Any amount to be disbursed pursuant to subdivisions (h)(4)(i) and (h)(4)(ii) shall be paid by the trustee to the State on July 1 of the year involved and shall be credited by the State toward any amounts owed by such respective Agricultural

subdivision (d) of this article so long as the amount in that contractor's account is less than its share of the Cap.

(7) **Distribution of Funds in Excess of the Cap.** Whenever accumulated funds (including interest) in an Agricultural Contractor's account in the trust fund exceed that contractor's share of the Cap, or the estimated remaining payments the contractor is required to make to the State prior to the end of the project repayment period, that contractor may direct the trustee to pay such excess to the contractor.

(8) **Termination of Trust Fund.** At the end of the project repayment period, the Agricultural Rate Management Trust Fund shall be terminated and any balances remaining in the accounts for each of the Agricultural Contractors shall be disbursed to the respective Agricultural Contractors.

(i) **Definitions.** For the purposes of this article, the following definitions will apply:

(1) "Agricultural Contractor" shall mean the following agencies as they now exist or in any reorganized form:

(i) County of Kings,

(ii) Dudley Ridge Water District,

(iii) Empire West Side Irrigation District,

(iv) Kern County Water Agency for 993,300 acre-feet of its entitlement,

(v) Oak Flat Water District,

(vi) Tulare Lake Basin Water Storage District.

(2) "Urban Contractor" shall mean every other agency having a long term water supply contract with the State as they exist as of the date of this amendment or in any reorganized form as well as

24. Article 53 is added to read:

53. PERMANENT TRANSFERS AND REDUCTIONS OF ENTITLEMENT

(a) Article 41 provides that no assignment or transfer of a contract or any part thereof, rights thereunder or interest therein by a contractor shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose. In accordance with State policy to assist water transfers, the State and the County of Kings, Dudley Ridge Water District (DRWD), Empire West Side Irrigation District, Kern County Water Agency (KCWA), Oak Flat Water District and Tulare Lake Basin Water Storage District (for the purposes of this article the "Agricultural Contractors") shall, subject to the conditions set forth in this article, expeditiously execute any necessary documents and approve all contracts between willing buyers and willing sellers until permanent transfers totaling 130,000 acre-feet of annual entitlements of the Agricultural Contractors and, to the extent provided in such contracts, rights in project transportation facilities related to such annual entitlement have been made to other contractors (the "Urban Contractors") or noncontractors in accordance with the provisions of this article. Such approval requirement shall apply to all contracts executed prior to January 1, 2011. KCWA shall be responsible for approval of such transfers for any portion of the 130,000 acre-feet not previously made available under this article by the other Agricultural Contractors. A contract between a willing buyer and a willing seller shall mean a contract between (1) a buyer which is an Urban Contractor or, to the extent provided in subdivision (e) of this article, a noncontractor and (2) a seller which is an Agricultural Contractor

entitlements as well as transportation rights in accordance with the following terms and procedure:

(1) The Agricultural Contractor shall provide the State a copy of a bona fide contract or Proposed Contract (the "Proposed Contract") and the State shall, within five working days of receipt, provide copies of such Proposed Contract to all Urban Contractors together with a Notice of Proposed Contract stating the date on or before which a Notice of Intent to Exercise a Right of First Refusal (NOI) must be delivered to both the State and the seller, which date shall be 90 days from the date the State mails the Notice of Proposed Contract.

(2) The Proposed Contract shall provide for the transfer of rights in project transportation facilities sufficient to deliver to the seller's service area in any one month eleven percent (11%) of the annual entitlement being transferred or such greater amount as the seller determines to sell; *Provided*, however, that sellers shall not be obligated to sell any transportation rights in the Coastal Aqueduct.

(3) To exercise the right of first refusal, an Urban Contractor shall deliver to the State and the seller its NOI within the time period stated in the Notice of Proposed Contract and shall proceed in good faith to try to complete the transfer to the Urban Contractor. If two or more Urban Contractors deliver NOI's to the State, the amount of annual entitlement and transportation rights being sold shall be allocated among those Urban Contractors that are prepared to perform the purchase by the Performance Date provided for herein in proportion to their maximum annual entitlements, or in another manner acceptable to the Urban Contractors delivering the

(5) If an Urban Contractor issuing a NOI fails to complete its exercise of the Right of First Refusal by the Performance Date, the seller shall be free to sell its entitlement in substantial conformance with the terms and conditions set forth in the Proposed Contract . An Urban Contractor issuing a NOI may assign its rights to exercise a right of first refusal to another Urban Contractor and the assignee shall have the same rights as the assignor to complete the purchase by the Performance Date.

(6) In exercising the Right of First Refusal, an Urban Contractor, at its option, may either agree to perform the Proposed Contract in its entirety, including all of its terms and conditions, or agree to pay the price offered under the Proposed Contract for the annual entitlement and transportation rights without condition and without being entitled to enforce or being subject to any other provisions of the Proposed Contract.

(e) As used in this article, "price" shall mean the dollar amount of consideration provided for in the Proposed Contract.

(f) Upon the effective date of any such transfer, the seller shall be relieved of and the buyer shall become liable to the State for all prospective Delta Water Charges, the related Transportation Charges and any other charges for the annual entitlements and associated transportation rights transferred unless the seller and buyer provide otherwise in the contract for the transfer and the State approves such other provisions. However, the contractor making the sale shall remain obligated to the State to make the payments if the buyer defaults on its payments to the State related to the water transferred and is not a party to a long term water supply contract of the type contained in Department of Water

impaired. The capital cost and minimum operation, maintenance, power and replacement components of the Transportation Charges shall then be reallocated among the other entities participating in repayment of costs of that reach. For the purposes of this determination, all payments received by the State from the seller relating to the annual entitlement sold shall be deemed to have been received from the buying contractor. Any increased Transportation minimum operation, maintenance, power and replacement component charges allocated to the buying contractor pursuant to this subdivision (g) shall begin January 1 of the year following the effective date of the transfer.

(h) Individual contractors may transfer entitlements among themselves in amounts in addition to those otherwise provided for in this article. The State shall expeditiously execute any necessary documents and approve all contracts involving permanent sales of entitlements among contractors, including permanent sales among Urban Contractors. Such sales shall be subject to the provisions of subdivisions (b), (f) and (g) of this article; *Provided*, however, that for a buying contractor needing transportation capacity in excess of the capacity factors on which its charges are based in any reach, reallocation of the Transportation capital cost component charges for transfers other than (i) the 130,000 acre-feet provided for in this article and (ii) the approximate 33,000 acre-feet of transfers proposed from contractors located in Santa Barbara or San Luis Obispo counties, shall be determined both prospectively and retroactively.

(i) On January 1 following the year in which such Monterey Amendments take effect and continuing every year thereafter until

25. Article 54 is added to read:

54. Usage of Lakes Castaic and Perris

(a) The State shall permit the contractors participating in repayment of the capital costs of Castaic Lake (Reach 30) and Lake Perris (Reach 28J) to withdraw water from their respective service connections in amounts in excess of deliveries approved pursuant to other provisions of the state water contracts. Each such contractor shall be permitted to withdraw up to a Maximum Allocation from the reach in which it is participating. The contractors participating in repayment of Castaic Lake may withdraw a collective Maximum Allocation up to 160,000 acre-feet pursuant to this article, which shall be apportioned among them pursuant to the respective proportionate use factors from the Department of Water Resources' Bulletin 132-94, Table B-1 upon which capital cost repayment obligations are based, as follows:

Castaic Lake

Participating Contractor	Proportionate Use Factor	Maximum Allocation (Acre Feet)
The Metropolitan Water District of Southern California	0.96212388	153,940
Ventura County Flood Control and Water Conservation District	0.00860328	1,376
Castaic Lake Water Agency	0.02927284	4,684
Total	**1.00000000**	**160,000**

delivery schedule at any time, and the modified schedule shall be subject to review in the same manner. If necessary, the State may modify the schedule after consultation with the contractor and other contractors participating in repayment of that reach but may not change the total quantity of water to be withdrawn. As part of the consultation, the State shall advise a contractor if it determines a withdrawal will adversely impact the rate of delivery provided for the contractor in this contract. The State shall not be responsible for any such impacts.

(c) A contractor may withdraw all or a portion of its Maximum Allocation. It shall restore any withdrawn portion of such allocation by furnishing an equivalent amount of replacement water to the reservoir from which the water was withdrawn within five years from the year in which the withdrawal takes place. The unused portion of the allocation, in addition to any replacement water furnished to the reservoir, shall remain available for subsequent withdrawal. The State shall keep an accounting of the contractor's storage withdrawals and replacements. In any year, the State shall permit a contractor to withdraw an amount equivalent to the contractor's Maximum Allocation minus remaining replacement water requirements due to previous withdrawals. If the contractor fails to schedule and replace the withdrawn water within the five-year return period, the State shall provide the replacement water from water scheduled for delivery to the contractor in the sixth year or as soon as possible thereafter. The total amount of scheduled annual entitlement which a contractor can use in any one year for restoring its Maximum Allocation and storing water in surface storage facilities

A contractor may use any of this total amount for replacement water but cannot use any more than that provided for in Article 56 to add to storage in project surface conservation facilities and in nonproject surface storage facilities. There shall be no limit under this article on the amount of scheduled annual entitlement a contractor can use to restore its Maximum Allocation in a year when its percentage of annual water supply allocation is one-hundred percent (100%), nor shall there be any limit under this article on the amount of interruptible water, nonproject water or water obtained through an exchange which a contractor can use to restore its Maximum Allocation.

(d) For any replacement water furnished to reservoir storage pursuant to this article, the responsible contractor shall pay the State charges for the conservation, if any, and transportation of such replacement water as are associated with the type of replacement water that is furnished, as if such water were delivered to the turnout at the reservoir to which the replacement water is furnished. Adjustments from estimated to actual costs shall be subject to provisions applicable to the type of replacement water. The State shall not charge contractors for water withdrawn pursuant to this article.

(e) The State shall operate capacity in Castaic and Perris Reservoirs, not required for purposes of Maximum Allocation deliveries, in compliance with the requirement of Article 17(b) of The Metropolitan Water District of Southern California's water supply contract with the State to maintain an amount of water reasonably sufficient to meet emergency requirements of the contractors participating in repayment of that reach. A

26. Article 55 is added to read:

55. Transportation of Nonproject Water

(a) Subject to the delivery priorities in Article 12(f), contractors shall have the right to receive services from any of the project transportation facilities to transport water procured by them from nonproject sources for delivery to their service areas and to interim storage outside their service areas for later transport and delivery to their service areas: *Provided,* that except to the extent such limitation in Section 12931 of the Water Code be changed, a contractor shall not use the project transportation facilities under this option to transport water the right to which was secured by the contractor through eminent domain unless such use be approved by the Legislature by concurrent resolution with the majority of the members elected to each house voting in favor thereof.

(b) For any nonproject water delivered pursuant to this article, contractors shall pay the State the same (including adjustments) for power resources (including on-aqueduct, off-aqueduct, and any other power) incurred in the conservation and transportation of such water as if such nonproject water were entitlement water, as well as all incremental operation, maintenance, and replacement costs, and any other incremental costs, which may include an administrative or contract preparation charge, all as determined by the State. Incremental costs shall mean those nonpower costs which would not be incurred if nonproject water were not scheduled for or delivered to contractors. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities

limits and in accordance with the provisions provided for in this subdivision (c) and any applicable water right laws, by setting forth on the preliminary water delivery schedule submitted to the State on or before October 1 of each year pursuant to Article 12(a) the quantity of project water it wishes to store in the next succeeding year. There shall be no limit on the amount of project water a contractor can store outside its service area during any year in a then existing and operational groundwater storage program. The amount of project water a contractor can add to storage in project surface conservation facilities and in nonproject surface storage facilities located outside the contractor's service area each year shall be limited to the lesser of the percent of the contractor's Table A annual entitlement shown in column 2 or the acre-feet shown in column 3 of the following table, depending on the State's final water supply allocation percentage as shown in column 1. However, there shall be no limit to storage in nonproject facilities in a year in which the State's final water supply allocation percentage is one hundred percent. These limits shall not apply to water stored pursuant to Article 12(e).

(2) Storage capacity in project surface conservation facilities at any time in excess of that needed for project operations shall be made available to requesting contractors for storage of project and nonproject water. If such storage requests exceed the available storage capacity, the available capacity shall be allocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. A contractor may store water in excess of its allocated share of capacity as long as capacity is available for such storage.

(3) If the State determines that a reallocation of excess storage capacity is needed as a result of project operations or because of the exercise of a contractor's storage right, the available capacity shall be reallocated among contractors requesting storage in proportion to their annual entitlements designated in their Table A's for that year. If such reallocation results in the need to displace water from the storage balance for any contractor or noncontractor, the water to be displaced shall be displaced in the following order of priority:

First, water, if any, stored for noncontractors.

Second, water stored for a contractor that previously was in excess of that contractor's allocation of storage capacity.

Third, water stored for a contractor that previously was within that contractor's allocated storage capacity.

The State shall give as much notice as feasible of a potential displacement.

point of return to the aqueduct to the turn-out in the contractor's service area. In addition, the contractor shall pay all incremental operation, maintenance, and replacement costs, and any other incremental costs, as determined by the State, which shall not include any administrative or contract preparation charge. Incremental costs shall mean those nonpower costs which would not be incurred if such water were scheduled for or delivered to the contractor's service area instead of to interim storage outside the service area. Only those contractors not participating in the repayment of a reach shall be required to pay a use of facilities charge for use of a reach for the delivery of water to, or return of water from, interim storage.

(7) A contractor electing to store project water in a nonproject facility within the service area of another contractor shall execute a contract with that other contractor prior to storing such water which shall be in conformity with this article and will include at least provisions concerning the point of delivery and the time and method for transporting such water.

(d) **Sale of Project Water For Use Outside Service Area**

(1) If in any year a contractor has been allocated annual entitlement that it will not use within its service area, the contractor has not elected to store project water in accordance with the provisions of subdivision (c) of this article during that year, and the contractor has not elected to carry over entitlement water from the prior year pursuant to the provisions of Article 12(e), the contractor may sell such annual entitlement for use outside its service area in accordance with the following provisions.

(4) Each year the price per acre-foot to be paid by the State to contractors selling water remaining in the Pool or placed in the Pool after February 15, but on or before March 15 that is purchased by a contractor requesting such purchase by April 1 or by the State on April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of that date. The price per acre-foot to be paid to the State for the purchase of water from the Pool by a contractor placing a request for such purchase between March 2 and April 1 shall be equal to twenty-five percent (25%) of the Delta water rate as of the later date. Any water placed in the Pool on or before March 15 that is not purchased by a contractor or the State by April 1 may be withdrawn from the Pool by the selling contractor.

(5) If there are more requests from contractors to purchase water from the Pool than the amount in the Pool, the water in the Pool shall be allocated among those contractors requesting such water in proportion to their annual entitlements for that year up to the amount of their requests. If requests to purchase water from the Pool total less than the amount of water in the Pool, the sale of Pool water shall be allocated among the contractors selling such water in proportion to their respective amounts of water in the Pool.

(6) Any water remaining in the Pool after April 1 that is not withdrawn by the selling contractor shall be offered by the State to contractors and noncontractors and sold to the highest bidder: *Provided*, that if the highest bidder is a noncontractor, all contractors shall be allowed fifteen days to exercise a right of first refusal to purchase such water at the price offered by

Article 12(e) for carrying over water from the last three months of that year into the first three months of the succeeding year.

(f) **Bona Fide Exchanges Permitted**

Nothing in this article shall be deemed to prevent the Agency from entering into bona fide exchanges of project water for use outside the Agency's service area with other parties for project water or nonproject water if the State consents to the use of the project water outside the Agency's service area. Also, nothing in this article shall be deemed to prevent the Agency from continuing those exchange or sale arrangements entered into prior to September 1, 1995, which had previously received any required State approvals. A "bona fide exchange" shall mean an exchange of water involving a contractor and another party where the primary consideration for one party furnishing water to another is the return of a substantially similar amount of water, after giving due consideration to the timing or other nonfinancial conditions of the return. Reasonable payment for costs incurred in effectuating the exchange and reasonable deductions from water delivered, based on expected storage or transportation losses may be made. A "bona fide exchange" shall not include a transfer of water from one contractor to another party involving a significant payment unrelated to costs incurred in effectuating the exchange. The State, in consultation with the contractors, shall have authority to determine whether transfers of water constitute "bona fide exchanges" within the meaning of this paragraph and not disguised sales.

October 1, 1996 date and the January 1, 2000 date may be extended by unanimous agreement of the State, Kern County Water Agency and The Metropolitan Water District of Southern California.

(b) The State shall administer the water supply contracts of any contractors that do not execute the Monterey Amendment so that such contractors are not affected adversely or to the extent feasible beneficially by the Monterey Amendments of other contractors' water supply contracts.

(c) If a court of competent jurisdiction issues a final judgment or order determining that any part of a contractor's Monterey Amendment is invalid or unenforceable, all provisions of that amendment shall be of no force or effect as to such contractor, except as provided in subdivisions (e) and (f) of this paragraph.

(d) If any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contracts or if the conveyance of the Kern Fan Element of the Kern Water Bank to the Kern County Water Agency provided for in Article 52 is determined by a court of competent jurisdiction in a final judgment or order to be invalid or unenforceable, the Monterey Amendments of all contractors and the Kern Water Bank Contract shall be of no force and effect except as provided in subdivisions (e) and (f) of this paragraph.

(e) Notwithstanding subdivisions (c), (d) and (f) of this paragraph, if any part of the Monterey Amendment of the Kern County Water Agency's or The Metropolitan Water District of Southern California's contract is determined by a court of competent jurisdiction in a final judgment or order to be invalid

District of Southern California. In cases arising under subdivision (c) or (d), the affected contractor whose Monterey Amendment has been determined to be partially invalid or unenforceable must first request the waiver.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form and sufficiency

Susan N. Weber
Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

Director

CASTAIC LAKE WATER AGENCY

ATTEST:

Robert H. Clark
ASSISTANT SECRETARY

GENERAL MANAGER

STATE OF CALIFORNIA
THE RESOURCES AGENCY
DEPARTMENT OF WATER RESOURCES

AMENDMENT NO. 18 TO THE WATER SUPPLY CONTRACT
BETWEEN
THE STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES
AND
CASTAIC LAKE WATER AGENCY

THIS AMENDMENT to the Water Supply Contract is made this 31st day of March, 1999, pursuant to the provisions of the California Water Resources Development Bond Act, the Central Valley Project Act, and other applicable laws of the State of California, between the State of California, acting by and through its Department of Water Resources, herein referred to as the "State," and Castaic Lake Water Agency, herein referred to as the "Agency."

RECITALS:

A. The State and the Agency have entered into and subsequently amended a Water Supply Contract (the "Water Supply Contract") providing that the State will supply certain quantities of water to the Agency, and providing that the Agency shall make certain payments to the State, and setting forth the terms and conditions of such supply and such payment.

B. The contractors and the State have amended the Water Supply Contracts to implement provisions of the Monterey Agreement (the "Monterey Amendment").

C. Among other things, Article 53 of the Water Supply Contract provides for the permanent transfer of up to 130,000 acre-feet of agricultural entitlement water to urban agencies.

D. The Agency and the Wheeler Ridge-Maricopa Water Storage District have entered into an Agreement to Purchase Wheeler Ridge-Maricopa Water Storage District State Water Project Entitlement to Water executed as of this date to provide for the sale by Kern County Water Agency, herein referred to as "KCWA", on behalf of Wheeler Ridge-Maricopa to the Agency of 41,000 acre-feet per year of KCWA's annual entitlement that has been allocated to Wheeler Ridge-Maricopa by KCWA under the contract between Wheeler Ridge-Maricopa and KCWA dated January 8, 1970 and all amendments thereto.

E. The State and Agency wish to set forth their agreement as to such matters as (i) the 41,000 acre-feet per year increase in the Agency's annual entitlement, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors set forth in the Water Supply Contract.

F. The State and KCWA are simultaneously with the execution and delivery of this Amendment, entering into Amendment No. 28 to KCWA's Water Supply Contract between KCWA and the State in order to reflect (i) the transfer of Table A Entitlement described herein, (ii) the transfer of related transportation repayment obligations, and (iii) the revision of proportionate use of facilities factors.

G. This Amendment is permitted by the terms of the Water Supply Contract, and except as amended herein, the provisions of the Water Supply Contract will remain in full force and effect.

NOW, THEREFORE, it is mutually agreed that the following changes are hereby made to the Agency's Water Supply Contract:

1. Article 53(j) is added to read:

(j) In accordance with Article 53(a) the Agency is increasing its Table A annual entitlements by 41,000 acre-feet beginning in year 2000 and each succeeding year thereafter for the term of the contract through a sale from Kern County Water Agency of 41,000 acre-feet of the 130,000 acre-feet made available to Urban Contractors. As a result of this sale, Table A as designated in Article 6(b) is amended as follows:

TABLE A

ANNUAL ENTITLEMENTS
CASTAIC LAKE WATER AGENCY
(Acre-feet)

Year		
1	(1968)	3,700
2	(1969)	5,000
3	(1970)	5,700
4	(1971)	6,700
5	(1972)	8,936
6	(1973)	12,400
7	(1974)	15,400
8	(1975)	18,200
9	(1976)	21,200
10	(1977)	24,100
11	(1978)	24,762
12	(1979)	28,000
13	(1980)	30,400
14	(1981)	32,800
15	(1982)	34,800
16	(1983)	37,300
17	(1984)	39,600
18	(1985)	41,800
19	(1986)	43,600
20	(1987)	45,600
21	(1988)	48,000
22	(1989)	50,100
23	(1990)	52,000
24	(1991)	54,200
25	(1992)	54,200
26	(1993)	54,200
27	(1994)	54,200
28	(1995)	54,200
29	(1996)	54,200
30	(1997)	54,200
31	(1998)	54,200
32	(1999)	54,200
~~33~~	~~(2000)~~	~~54,200~~
33	(2000)	**95,200**
And each succeeding year thereafter, for the term of this contract as an annual entitlement:		~~54,200~~ **95,200**

The following apply to this sale:

(1) Increases in the Agency's Delta Water and Transportation Charges and Water System Revenue Bond Surcharge resulting from the increase in the Agency's annual entitlements for 2000 and each year thereafter shall commence January 1, 2000, and be identified by the State and included in its annual Statement of Charges to the Agency.

(2) All future adjustments in charges and credits of past costs associated with the 41,000 acre-feet of annual entitlement (or applicable portion thereof) and the related transportation capacity in Reaches 1 through 16A of the California Aqueduct shall be attributable to the Agency as if the Agency's annual entitlement and the related transportation capacity had been increased by the 41,000 acre-feet of annual entitlement purchased from the KCWA in years prior to January 1, 2000.

(3) For cost allocation and repayment purposes, Exhibit A attached hereto shows entitlement and capacity amounts for each aqueduct reach in which the Agency participates. These redetermined values shall be used to derive the proportionate use of facilities factors as set forth in Table B as designated in Article 24(b). The capacity amounts shown in Exhibit A are estimated values. Actual values will be used by the State in implementing the terms of this Amendment and in redetermination of Table B of this Water Supply Contract under Article 28.

2. Article 12(c)(1) which defines the limits on the instantaneous rate of flow to the Agency from Castaic Lake based on peaking factors, is modified to delete "ninety-nine (99)" and replace it with "one hundred fifty (150)."

3. This Amendment is contingent upon the effectiveness of Water Supply Contract Amendment No. 28, between the State and the KCWA. If either amendment ceases to be effective, the State may identify the date on which the contract amendments shall be deemed inoperative, for the purpose of assuring timely repayment of contract obligations and orderly administration of the long-term water supply contracts.

4. The Agency agrees to indemnify, defend, and hold harmless the State and any of its officers, agents, or employees from any liability, expenses, defense costs, attorney fees, claims, actions, liens and lawsuits of any kind arising from or related to any and all actions implementing this Amendment and associated agreements.

IN WITNESS WHEREOF, the parties hereto have executed this Amendment on the date first above written.

Approved as to legal form and sufficiency:

for Chief Counsel
Department of Water Resources

STATE OF CALIFORNIA
DEPARTMENT OF WATER RESOURCES

for Director

CASTAIC LAKE WATER AGENCY

ATTEST:

Robert H. Clark
Signature

Asst Secretary
Title

Signature

President, Board of Directors
Title

CASTAIC LAKE WATER AGENCY
ANNUAL ENTITLEMENT AND CAPACITY VALUES FOR EACH REACH FOR COST ALLOCATION AND REPAYMENT ONLY

The values related to this transfer are estimated to be as follows:

California Aqueduct [1]	Before Transfer		Entitlement Transferred from KCWA (AF) (3)	Capacity Transferred from KCWA (cfs) (4)	Additional Capacity Required (cfs) (5)	After Transfer	
	Annual Entitlement (AF) (1)	Capacity (cfs) (2)				Total Annual Entitlement (AF) (6)	Total Capacity (2)+(4)+(5) (cfs) (7)
Reach 1	54,200	95	41,000	122	0	95,200	217
Reach 2A	54,200	95	41,000	122	0	95,200	217
Reach 2B	54,200	95	41,000	122	0	95,200	217
Reach 3	54,200	95	41,000	122	0	95,200	217
Reach 4	54,200	95	41,000	122	0	95,200	217
Reach 5	54,200	95	41,000	122	0	95,200	217
Reach 6	54,200	95	41,000	122	0	95,200	217
Reach 7	54,200	95	41,000	122	0	95,200	217
Reach 8C	54,200	95	41,000	122	0	95,200	217
Reach 8D	54,200	95	41,000	122	0	95,200	217
Reach 9	54,200	75	41,000	122	0	95,200	197
Reach 10A	54,200	75	41,000	122	0	95,200	197
Reach 11B	54,200	75	41,000	122	0	95,200	197
Reach 12D	54,200	75	41,000	122	0	95,200	197
Reach 12E	54,200	75	41,000	122	0	95,200	197
Reach 13B	54,200	75	41,000	122	0	95,200	197
Reach 14A	54,200	75	41,000	120	0	95,200	195
Reach 14B	54,200	75	41,000	77	0	95,200	152
Reach 14C	54,200	75	41,000	46	11	95,200	132
Reach 15A	54,200	75	41,000	39	18	95,200	132
Reach 16A	54,200	75	41,000	25	32	95,200	132
Reach 17E	54,200	75	41,000	0	57	95,200	132
Reach 17F	54,200	75	41,000	0	57	95,200	132
West Branch							
Reach 29A	54,200	75	41,000	0	57	95,200	132
Reach 29F	54,200	75	41,000	0	57	95,200	132
Reach 29G	54,200	75	41,000	0	57	95,200	132
Reach 29H /2/	54,200	--	41,000	0	--	95,200	--
Reach 29J	54,200	75	41,000	0	57	95,200	132
Reach 30 /2/	54,200	--	41,000	0	--	95,200	--

[1] These numbers apply to the reaches as set forth in Bulletin 132, Figure B-4, "Repayment Reaches and Descriptions."

[2] Aqueduct capacity in cfs is not applicable to Pyramid Lake (Reach 29H) and Castaic Lake (Reach 30). The maximum instantaneous flow rate for deliveries to the Agency from Castaic Lake is 150 cfs.

H

FRIENDS OF THE SANTA CLARA RIVER, Plaintiff and Appellant, v. CASTAIC LAKE WATER AGENCY, Defendant and Respondent.
Cal.App.2.Dist.

FRIENDS OF THE SANTA CLARA RIVER,
Plaintiff and Appellant,
v.
CASTAIC LAKE WATER AGENCY, Defendant and Respondent.
No. B145283.

Court of Appeal, Second District, Division 4, California.
Jan. 10, 2002.

SUMMARY

A nonprofit environmental group filed a petition for a writ of mandate challenging a water agency's certification of an environmental impact report (EIR) as inadequate under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The project analyzed in defendant's EIR was its purchase of entitlement to 41,000 acre-feet per year of state water from a water storage district. Defendant's EIR was tiered on an earlier EIR, which had been prepared in conjunction with a statewide agreement that equalized allocations of entitlements to water from the state water project between agricultural and urban contractors. The trial court entered judgment denying plaintiff's petition. (Superior Court of Los Angeles County, No. BS05694, David P. Yaffe, Judge.)

The Court of Appeal reversed, directing the trial court to issue a writ of mandate vacating the certification of defendant's EIR, and ordering the trial court to retain jurisdiction until defendant certified an EIR complying with CEQA. The court held that decertification of defendant's EIR was required, since another appellate court had found that the previous EIR, on which defendant's EIR was tiered, was inadequate and had decertified it. Pub. Resources Code, § 21094, subd. (a), authorizes tiering when the previous EIR has been certified. Defendant's EIR had a defect, since the previous EIR had been decertified. The court further held that defendant's tiering on the decertified EIR was prejudicial error, since defendant had not in its EIR addressed the environmental effects of its project absent the protections for agricultural contractors provided for in the statewide agreement that had been the subject of the decertified EIR. (Opinion by Vogel (C. S.), P. J., with Hastings and Curry, JJ., concurring.)

HEADNOTES

Classified to California Digest of Official Reports

(1a, 1b) Pollution and Conservation Laws § 2.3--California Environmental Quality Act--Environmental Impact Reports--Tiering--***1374** Effect of Decertification of Previous EIR.
The trial court erred in denying a nonprofit environmental group's mandamus challenge to a water agency's environmental impact report (EIR) on the ground it was inadequate under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). The project analyzed in defendant's EIR was its purchase of entitlement to 41,000 acre-feet per year of state water from a water storage district. Defendant's EIR was tiered on an earlier EIR, which had been prepared in conjunction with a statewide agreement that equalized allocations of entitlements to water from the state water project between agricultural and urban contractors. Decertification of defendant's EIR was required, since an appellate court had found that the previous EIR, on which defendant's EIR was tiered, was inadequate and had decertified it. Pub. Resources Code, § 21094, subd. (a), authorizes tiering when the previous EIR has been certified. Hence, defendant's EIR had a defect, since the previous EIR had been decertified. In addition, defendant's tiering on the decertified EIR was prejudicial error, since defendant had not in its EIR addressed the environmental effects of its project absent the protections for agricultural contractors provided for in the statewide agreement that had been the subject of the decertified EIR.
[See 4 Witkin, Summary of Cal. Law (9th ed. 1987) Real Property, § 59 et seq.; West's Key Digest System, Health and Environment k. 25.10(6.5).]
(2) Pollution and Conservation Laws § 2.3--California Environmental Quality Act--Environmental Impact Reports--Tiering.
The tiering provisions (Pub. Resources Code, § §

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21068.5, 21093, 21094) of the California Environmental Quality Act (Pub. Resources Code, § 21000 et seq.) enable a public agency to incorporate by reference and utilize a prior environmental impact report. Tiering is favored by the Legislature to streamline the regulatory process and avoid wasteful duplication of effort. Under CEQA Guidelines, the later EIR should state that the lead agency is using the tiering concept and that it is being tiered with the earlier EIR.

COUNSEL

Brandt-Hawley & Zoia and Susan Brandt-Hawley for Plaintiff and Appellant.

Robert H. Clark; Kane, Ballmer & Berkman and R. Bruce Tepper, Jr., for Defendant and Respondent.

***1375 VOGEL (C. S.), P. J.**

Introduction

In 1995, the California State Department of Water Resources (DWR) and water contractors of the State Water Project (SWP) reached a historic agreement, known as the Monterey Agreement, changing the allocations between agricultural and urban contractors of entitlements to SWP water. A major component of the Monterey Agreement was the transfer of entitlements up to 130,000 acre-feet per year from agricultural contractors to urban contractors, on a willing buyer-willing seller basis. Pursuant to the Monterey Agreement, respondent Castaic Lake Water Agency (respondent) purchased from the Kern County Water Agency (KCWA) and its member district the Wheeler Ridge-Maricopa Water Storage District (WRMWSD) entitlement to 41,000 acre-feet per year of SWP water.

Respondent approved this transfer after certifying a project environmental impact report (EIR) pursuant to the California Environmental Quality Act (CEQA), Public Resources Code section 21000 et seq. [FN1] In the present case appellant Friends of the Santa Clara River (appellant), a nonprofit California corporation, challenges the sufficiency of respondent's EIR.

> FN1 All further statutory references are to the Public Resources Code unless otherwise indicated. All references to "Guidelines" are to the CEQA regulations in title 14, California Code of Regulations.

Previously, the Central Coast Water Authority (CCWA) as lead agency prepared an EIR on the environmental effects statewide of implementing the Monterey Agreement (the Monterey Agreement EIR). Then the Belridge Water Storage District, one of the member districts of KCWA, as lead agency prepared an EIR on the environmental effects in Kern County of selling up to 130,000 acre-feet of SWP entitlements to then unidentified purchasers (the Belridge EIR). Then respondent's EIR "tiered" on the Monterey Agreement EIR and the Belridge EIR.

Appellant unsuccessfully petitioned the trial court in the present case for a writ of mandate compelling respondent to set aside the certification of respondent's EIR and approval of this project, on various grounds of alleged failure to comply with CEQA. Appellant appealed the judgment denying its petition for a writ of mandate.

While the present appeal was pending, the Court of Appeal for the Third Appellate District found the Monterey Agreement EIR inadequate and ordered it decertified. (***1376***Planning & Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892 [100 Cal.Rptr.2d 173], review den. Dec. 13, 2000, hereafter cited as *PCL*.) We conclude this requires decertifying respondent's tiered EIR.

Factual and Procedural Background

The Monterey Agreement

The SWP was constructed in the 1960's. It is a complex system of reservoirs, dams, power plants, pumping plants, canals, and aqueducts for storage and delivery of water. DWR manages the SWP. DWR has contracts with water contractors to deliver water to the contractors. Each such contract sets forth a maximum annual entitlement. DWR has historically delivered less water than the entitlements. The reliability of delivery is approximately 50 percent of entitlements.

Before the Monterey Agreement, shortfalls in deliveries due to prolonged droughts and other factors led to friction among the contractors over obtaining the available SWP water. Urban and agricultural contractors each believed the other was receiving preferential treatment. This friction was exacerbated by a provision in the SWP contracts that in years when shortfalls occurred, required agricultural contractors to incur the first delivery cutbacks. [FN2] Because contractors pay certain fixed costs to finance the SWP regardless of actual

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deliveries, agricultural contractors suffered severe delivery reductions with little relief from their financial obligations. Litigation was threatened. DWR, agricultural and urban water contractors met and negotiated the Monterey Agreement to avoid litigation and to increase the reliability of supply to all contractors. (*PCL, supra*, 83 Cal.App.4th at pp. 901-902.)

> FN2 Under article 18(a) of then existing contracts, deliveries to agricultural contractors were reduced by 50 percent in any one year or a total of 100 percent in seven consecutive years, before deliveries were reduced to other contractors. (*PCL, supra*, 83 Cal.App.4th at p. 899.)

Under the Monterey Agreement, all future allocations of SWP water are based on entitlements; when supply is insufficient to meet requests, deliveries to all contractors will be reduced in proportion to their entitlements; no longer will agricultural contractors be required to absorb the first reductions. This increases the reliability of supply to agricultural contractors.

Inferably in return, under the Monterey Agreement, agricultural contractors "will make available for permanent transfer to Urban Contractors on a willing buyer-willing seller basis 130,000 acre-feet of annual entitlements, ***1377** with [KCWA] being responsible for any portion of this amount not made available by other Ag Contractors." This will allow urban contractors to obtain additional entitlements, thereby slightly increasing their overall deliveries even in times of shortage.

In addition, the Kern Fan Element, a property acquired by DWR for water banking, will be transferred to agricultural contractors, 45,000 acre-feet of agricultural contractors' entitlements will be retired, and various operational changes will be made to improve efficiency and flexibility of the system.

The Monterey Agreement EIR

The parties to the Monterey Agreement determined that its implementation could have potential environmental consequences and therefore an EIR was required. They designated CCWA, one of the SWP contractors, as lead agency to prepare the Monterey Agreement EIR. CCWA prepared the draft and final EIR's on implementation of the Monterey Agreement in May and October 1995.

The introduction to the draft Monterey Agreement EIR stated it is a "program" EIR. Reiterating the criteria for a program EIR found in Guideline section 15168, it stated: "The purpose of a Program EIR is to document a series of actions so related that they can be characterized as one project. The actions may be related in one or more of the following ways: by geographical proximity; as logical parts in a chain of contemplated actions; in connection with the issuance of rules, regulations, plans, or other general criteria to govern the conduct of a continuing program; or as individual activities carried out under the same authorizing statutory or regulatory authority and having generally similar environmental effects that can be mitigated in similar ways. The proposal to implement the Monterey Agreement fulfills both the second and third criteria above, i.e., logical parts in a chain of contemplated actions, and a series of actions related to the issuance of rules, regulations, plans, and other general criteria to govern the conduct of a continuing program." Again reiterating matter in Guideline 15168, it stated the advantages of a program EIR are that it may: "provide an occasion for a more exhaustive consideration of effects and alternatives than would be practical in an EIR on an individual action; ensure consideration of cumulative actions that might be slighted in a case-by-case analysis; avoid duplicative reconsideration of basic policy considerations; allow the Lead Agency to consider broad policy alternatives and program-wide mitigation measures at an early time when the agency has greater flexibility to deal with basic problems or cumulative impacts; and allow reduction in paperwork." ***1378**

The Monterey Agreement EIR identified five major components of the Monterey Agreement with potential environmental effects: (1) revision of the methodology used to allocate water among contractors, (2) retirement of 45,000 acre-feet of agricultural entitlement, (3) transfer by sale between willing sellers and willing buyers of 130,000 acre-feet of entitlements from agricultural to urban contractors, (4) changes in the Kern Fan Element of the Kern Water Bank, and (5) changes in the manner Castaic Lake and Lake Perris terminal reservoirs may be operated. In general, the Monterey Agreement EIR determined the environmental effects that were capable of quantification at that time were negligible.

With regard to the change in the method of allocating entitlements, it summarized, "Changes in the method of allocating water become relevant only in years

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when demand exceeds available supply. During such years, following enactment of the principles contained in the Monterey Agreement, shortages will be shared proportionately by all contractors rather than be borne primarily by Agricultural Contractors as is the current practice. Thus, during future deficit years Agricultural Contractors can anticipate larger deliveries of water and Urban Contractors can expect smaller quantities of water than would have been the case in the past. These changes bring about a decrease in the variability of supplies delivered to Agricultural Contractors while increasing slightly that for the Urban Contractors. [¶] Added reliability of deliveries to Agricultural Contractors could increase the continuity of agricultural activities in these service areas. Added variability of water deliveries to Urban Contractors can, however, be offset by their acquisition of additional entitlement offered for sale by Agricultural Contractors as outlined below, and through other measures included in the program for increased water management flexibility."

With regard to the transfers of entitlements, it summarized: "The transfer of 130,000 AF of water entitlement from Agricultural Contractors to Urban Contractors and non-SWP Contractors has the potential to affect activities and land use patterns in those jurisdictions both relinquishing and acquiring the entitlement. Effects in those areas relinquishing water entitlement are likely to be centered on agricultural practices while those in areas acquiring water entitlement may relate to growth accommodation. The location of the eventual sellers and buyers of water entitlements is not known at this time." "SWP operations would not be adversely affected by the shift in deliveries among Contractors."

Belridge EIR

In contemplation of the transfer of up to 130,000 acre-feet of SWP entitlements from KCWA pursuant to the Monterey Agreement, the Belridge ***1379** Water Storage District as lead agency prepared a draft and final EIR in April and June of 1998 evaluating the effects in Kern County of such transfers. It evaluated the effects on the Belridge Water Storage District, the Lost Hills Water District, and the WRMWSD (all member districts of KCWA) of their transfer of SWP entitlements to yet undetermined purchasers.

The Belridge EIR repeatedly described the project being studied as a transfer of up to 130,000 acre-feet of entitlements *under the Monterey Agreement.* It stated: "The entitlement transfer would occur under the Monterey Agreement.... The benefits and impacts of the Monterey Agreement were evaluated in a separate environmental impact report [the Monterey Agreement EIR] which is discussed below and incorporated into this report by reference. However, to understand the potential benefits and impacts of the entitlement transfer, conditions that existed prior to the Monterey Agreement and after the Monterey Agreement are discussed."

The Belridge EIR then summarized how deliveries of SWP water differ before and after the Monterey Agreement. It also summarized in detail the Monterey Agreement EIR, which it incorporated by reference.

The Belridge EIR repeatedly stressed that under the changes made by the Monterey Agreement in allocating water during periods of shortage, agricultural contractors would not disproportionately suffer reduced deliveries, and therefore would enjoy increased reliability of deliveries even in times of shortage.

These assumptions enabled the Belridge EIR to conclude that the transfer of up to 130,000 acre-feet of entitlements from the member districts would not adversely affect at all the irrigated agricultural lands therein, because relinquishment of the entitlements would be compensated, on an average annual basis, by the increased reliability of SWP deliveries pursuant to the Monterey Agreement.

Respondent's EIR

The EIR in dispute in the present case is the EIR prepared by respondent in February 1999 on the proposed transfer to respondent of 41,000 acre-feet per year of SWP entitlement from KCWA and its member district WRMWSD.

The introduction section of respondent's EIR expressly stated, "*This EIR is a Project EIR that tiers from*" (1) a prior 1988 EIR by respondent, "Capital Program and Water Plan Including Acquisition of Supplemental Water and ***1380** of a Proposed Second Plant Site", (2) the Monterey Agreement EIR, and (3) the Belridge EIR. It stated the proposed transfer "is an example of the individual projects envisioned in the Monterey Agreement and evaluated on a programmatic basis in the Monterey Agreement

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EIR."

This introduction stated that "As a result of the recently adopted Monterey Agreement, [respondent] has the opportunity to purchase additional SWP entitlement beyond its current entitlement. The opportunity to acquire additional entitlement under the terms of the Monterey Agreement disappears when the subject entitlement (130,000 AFY) is transferred to [respondent] or other entities. A summary of the Monterey Agreement is presented below, and a more complete discussion of the SWP is included in the Monterey Agreement FEIR." A separate section of the introduction described "the Monterey Agreement/Amendment and its anticipated effect on historic water deliveries." After summarizing the major provisions of the Monterey Agreement, it concluded, "The Monterey Agreement has three primary objectives: (1) to increase the reliability of all SWP Contractors' water supplies; (2) to stabilize the rate structure to improve the financial viability of the SWP; and (3) to increase water management flexibility for all SWP Contractors. A permanent transfer of agricultural entitlement to an area with urban development potential such as that analyzed in this document is one of the ways that these objectives are intended to be met."

Respondent's EIR also discussed the Belridge EIR. It stated, "An independent EIR evaluating the environmental impacts of the sale of SWP entitlement within Kern County was completed by Belridge Water Storage District in June 1998. Issues identified in that EIR are not evaluated further in this EIR. Appropriate sections of the Belridge EIR ... are incorporated herein." It added that the proposed transfer would not significantly decrease water deliveries or irrigated acreage within KCWA or WRMWSD because, with implementation of the Monterey Agreement, "SWP deliveries to agricultural users will not be subject to absorbing the initial deficiencies during droughts and other unreliable delivery scenarios." The project description section acknowledged that this proposed transfer, "assuming it proceeds under the Monterey Agreement, will fulfill part of [KCWA's] commitment [under the Monterey Agreement to transfer up to 130,000 acre feet of entitlements to urban contractors]."

A commenter on respondent's draft EIR, Santa Clarita Organization for Planning the Environment, commented that the draft EIR was deficient in failing to analyze impacts on land in Kern County or on Castaic Lake as a terminal reservoir of the SWP. Respondent responded that those impacts had ***1381** already been evaluated in the Belridge EIR and the Monterey Agreement EIR and therefore were not required to be addressed in respondent's EIR.

Despite these numerous references relying on the Monterey Agreement and the Monterey Agreement EIR, respondent's EIR also asserted the proposed transfer of SWP entitlements could take place without the Monterey Agreement, under pre-Monterey Agreement contract law, with the consent of all parties and DWR. It acknowledged that the Monterey Agreement EIR was challenged in the *PCL* case, had been upheld by the Sacramento Superior Court, but was still challenged in the appeal then pending.

A comment from the Environmental Defense Center on the proposed final EIR complained that the EIR expressly tiers on the Monterey Agreement EIR, the status of which was questionable because it was in litigation in the Court of Appeal for the Third Appellate District; it also asserted the Belridge EIR was inappropriate for tiering. Respondent's consultant replied, "The proposed FEIR identifies that the proposed project may proceed either under the provisions of the Monterey Agreement or under the terms of the Kern County Water Agency Contract before it was modified by the Monterey Amendment .... The proposed final EIR identified the referenced litigation and Superior Court ruling .... [¶] The EIR does not tier from the Belridge ... EIR but incorporates appropriate sections by reference.... The inclusion of the reference to the Belridge 1998 EIR [as having been tiered on, as distinguished from having been incorporated by reference] is an error."

On the present appeal respondent admits that its EIR tiers on the Monterey Agreement EIR. Respondent states its EIR incorporates by reference the Belridge EIR.

Trial Proceedings in the Present Case

Appellant Friends of Santa Clara River filed a petition for a writ of mandate compelling respondent to set aside respondent's certification of its EIR and approval of the project, primarily on the ground respondent failed to comply with CEQA. Appellant alleged various defects in the EIR and respondent's findings. The alleged defects did not involve the Monterey Agreement EIR or the then pending *PCL* appeal. The trial court denied appellant's petition, finding that the EIR was adequate and that appellant's

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other contentions lacked merit. Appellant appealed from the judgment denying the petition. ***1382**

The PCL Case

In September 2000, after the trial court's judgment in the present case, the Court of Appeal for the Third Appellate District held the Monterey Agreement EIR prepared by CCWA was inadequate. (*PCL, supra*, 83 Cal.App.4th 892.) The Court of Appeal found two major defects. (1) The DWR, not CCWA, should have prepared the report as the lead agency; DWR has a statewide perspective and expertise on how allocation of water to another part of the state has implications for distribution throughout the system. (83 Cal.App.4th at pp. 903-907.) (2) The EIR did not adequately address the alternative of "no project"; it should have addressed the environmental implications of invoking article 18(b) of existing contracts, under which entitlements would be permanently reduced to reflect actual delivery patterns. (83 Cal.App.4th at pp. 908-920.) The court commented, "Perhaps the deficiencies in the EIR relate to the provincial experience of the lead agency, a topic we addressed earlier. We conclude the EIR failed to meet the most important purpose of CEQA, to fully inform the decision makers and the public of the environmental impacts of the choices before them. A new EIR must, therefore, be drafted. [¶] In view of our earlier conclusion that DWR must serve as lead agency under CEQA, we need not, as we ordinarily would, address the other alleged deficiencies in this EIR. (Pub. Resources Code, § 21005, subd. (c).) We need not hypothesize on the remaining issues because DWR, with its expertise on the statewide impacts of water transfers, may choose to address those issues in a completely different and more comprehensive manner." (83 Cal.App.4th at p. 920.)

The Court of Appeal reversed the judgment of the Sacramento Superior Court and remanded with directions to "issue a writ of mandate vacating the certification of the EIR," to "consider such orders it deems appropriate under Public Resources Code section 21168.9, subdivision (a)" and to "retain jurisdiction over this action until DWR certifies an EIR in accordance with CEQA standards and procedures that meets the substantive requirements of CEQA." (*PCL, supra*, 83 Cal.App.4th at p. 926.) It noted, "We earlier declined to stay implementation of the Monterey amendments and transfer of the Kern Fan Element. Consequently, the project was permitted to proceed pending disposition of this appeal. The record does not reflect the current status of the project and, in the absence of such information, we shall issue no orders concerning further implementation of the project. The trial court, acting under the authority provided by Public Resources Code section 21168.9, is the more appropriate forum to consider and rule upon requests to enjoin all or portions of the project pending completion of administrative and judicial proceedings necessitated by our opinion." (*Id.* at p. 926, fn. 16.) ***1383**

Expanded Issue on This Appeal

(1a) In its appellant's opening brief on the present appeal, appellant reasserted various arguments that appellant had unsuccessfully raised below concerning respondent's EIR and findings. Appellant's opening brief added, cursorily, that the decision in the *PCL* appeal, during pendency of this appeal, "completely shattered" respondent's EIR that was tiered on the EIR decertified in the *PCL* decision. Appellant more fully developed this argument in its appellant's reply brief. We requested and received supplemental briefs from the parties on this issue.

Legal Background: Tiering of EIR's

(2) Tiering "means the coverage of general matters and environmental effects in an environmental impact report prepared for a policy, plan, program or ordinance followed by narrower or site-specific environmental impact reports which incorporate by reference the discussion in any prior environmental impact report and which concentrate on the environmental effects which (a) are capable of being mitigated, or (b) were not analyzed as significant effects on the environment in the prior environmental impact report." (§ 21068.5; Guidelines, § § 15152, 15385.)

Tiering is favored by the Legislature to streamline the regulatory process and avoid wasteful duplication of effort. (*Stanislaus Natural Heritage Project v. County of Stanislaus* (1996) 48 Cal.App.4th 182, 197-198 [55 Cal.Rptr.2d 625]; § § 21093, 21094; Guideline, § 15152, subd. (b).) "To achieve this purpose, environmental impact reports shall be tiered whenever feasible, as determined by the lead agency." (§ 21093, subd. (b).) "Where a prior environmental impact report has been prepared *and certified* for a program, plan, policy, or ordinance, the lead agency for a later project that meets the requirements of this section shall examine significant

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effects of the later project upon the environment by using a tiered environmental impact report ....” (§ 21094, subd. (a), italics added.) “All public agencies which propose to carry out or approve the later project may utilize the prior environmental impact report and the environmental impact report on the later project to fulfill the requirements of Section 21081 [which concerns findings necessary in order to approve a project if significant environmental effects have been identified]. [¶] When tiering is used pursuant to this section, an environmental impact report prepared for a later project shall refer to the prior environmental impact report and state where a copy of the prior environmental impact report may be examined.” (§ 21094, subds. (d), (e).) “The later EIR ... should state that the lead agency is using the tiering ***1384** concept and that it is being tiered with the earlier EIR.” (Guideline, § 15152, subd. (g).)

Discussion

(1b) Respondent's EIR expressly tiered on the Monterey Agreement EIR. Section 21094, subdivision (a) authorizes tiering where the previous EIR was certified. As a result of the *PCL* decision, the Monterey Agreement EIR is no longer certified. Respondent's EIR therefore has a defect. The question presented for us is whether that error was prejudicial. (§ 21005, subd. (b).)

Respondent contends that although its EIR tiered on the Monterey Agreement EIR, it did not expressly or specifically incorporate any substantive analysis from specific portions of the Monterey Agreement EIR. But respondent's reliance on the Monterey Agreement EIR is implicit in the concept of tiering, even without express reference to portions of the prior EIR's analysis. The express statement that respondent's EIR tiers on the prior EIR may be treated as an admission that respondent relied upon and needed to rely upon the Monterey Agreement EIR. (Guideline, § 15152, subd. (g).)

Aside from a few cursory statements that the present transfer could legally be accomplished under pre-Monterey Agreement contracts, a point we discuss later, respondent's EIR repeatedly referenced this project's part of the overall scheme envisioned by the Monterey Agreement. It stated this EIR was a project EIR tiered on the Monterey Agreement EIR, and that the project may be viewed as one of the projects “evaluated on a programmatic basis in the Monterey Agreement EIR.”

Respondent's EIR also expressly tiered on, or at least expressly incorporated and relied upon, the analysis in the Belridge EIR. Respondent's EIR acknowledged that the transfer would not affect irrigated lands in Kern County because of the increased reliability of deliveries to agricultural contractors under the Monterey Agreement, and that the present transfer would fulfill part of KCWA's commitment in the Monterey Agreement. The Belridge EIR, on which respondent relied, repeatedly stated that the potential transfers of up to 130,000 acre-feet would be made pursuant to the Monterey Agreement and would have no significant effect on the irrigated lands, due to the increased reliability of deliveries under the Monterey Agreement. Respondent's reliance on the Belridge EIR illustrates respondent's implied acknowledgement that the transfer in this case is part of an overall larger scheme, analyzed on a programmatic basis in the Monterey Agreement EIR. The *PCL* decision also emphasizes the importance of the statewide perspective in analyzing the implications of water entitlement transfers for the state ***1385** and SWP as a whole. We therefore find unpersuasive respondent's present argument that respondent did not rely on the Monterey Agreement EIR.

At oral argument respondent offered a variant of this contention. According to respondent: “the project” being analyzed in respondent's EIR was only the transfer of 41,000 acre-feet of entitlements from WRMWSD to respondent; respondent was only required, therefore, to analyze the environmental effects of that narrow project; respondent adequately evaluated the local environmental effects of the subject transfer; respondent was not *required* to analyze the effects of the transfer on irrigated lands in Kern County or on the SWP upstream from Kern County, and to any extent respondent relied on the Belridge EIR and Monterey Agreement EIR to do so, this was surplusage; therefore the tiering on the Monterey Agreement EIR was harmless and does not require setting aside respondent's EIR that was otherwise adequate, viewed as a stand-alone document evaluating the local environmental impacts of this specific project. Appellant answers that respondent was required to review “the whole of the project.” (Guideline, § 15378, subd. (a) [“ 'Project' means the whole of an action.”].)

Respondent's argument is not persuasive. The purpose of an EIR is to inform the public and the decision makers of the environmental effects of a project. Implicit in respondent's argument is an innuendo the public and decision makers in

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respondent's service area do not care about the upstream effects of this project. But in any event, this case does not squarely present that issue. This is not a case where (1) respondent neglectfully failed or deliberately refused to evaluate "upstream" environmental effects and (2) appellant challenged such an EIR as inadequate based on its failure to review upstream effects. Rather, respondent's EIR assumed the public and decision makers would want to know (1) that this project implements the Monterey Agreement, the environmental effects of which were analyzed in the Monterey Agreement EIR and found to be negligible, and (2) that the environmental effects in Kern County were studied in the Belridge EIR and found to be insignificant because of the increased reliability of water deliveries to agricultural contractors under the Monterey Agreement. The *PCL* decision undermined those premises by decertifying the Monterey Agreement EIR.

Respondent next contends the tiering on the Monterey Agreement EIR was not crucial because respondent and KCWA could legally have accomplished the transfer of entitlements under SWP contract law existing prior to the Monterey Agreement. Respondent cites the following portions of its EIR: section 1.3 of the introduction stated, "The SWP entitlement transfer analyzed in this document may proceed either under the provisions of the ***1386** Monterey Amendment [FN3] to KCWA water supply agreement with the DWR (Contract), or under the provisions of KCWA's Contract before it was modified by the Monterey Amendment," and again, "The entitlement transfer that is the subject of this EIR is of the type that falls within the provisions of the Monterey Amendment. However, this water transfer could occur without the Monterey Amendment with the consent of all affected parties." The project description section included, "This water transfer is expected to be subject to the conditions of the Monterey Amendment, but is not necessarily dependent upon the Monterey Amendment. With the cooperation of the participating agencies and the California Department of Water Resources (DWR), the transfer could occur in the absence of the Monterey Amendment." Finally, in response to comments from the Environmental Defense Center that tiering on the Monterey Agreement EIR was questionable in light of the *PCL* litigation, respondent's consultant stated, "The proposed FEIR identifies that the proposed project may proceed either under the provisions of the Monterey Agreement or under the terms of the Kern County Water Agency Contract before it was modified by the Monterey Amendment."

> FN3 By the Monterey "Amendment" respondent's EIR meant amendment of the SWP contracts between DWR and the approving contractors, to implement the principles of the Monterey Agreement.

These assertions are based on article 41, a standard provision of state water contracts, stating that "No assignment or transfer of this contract or any part hereof, rights hereunder, or interest herein by the Agency shall be valid unless and until it is approved by the State and made subject to such reasonable terms and conditions as the State may impose."

Respondent's argument is based on a straw man. The issue in this case is not the legal authority of KCWA to sell and of respondent to buy SWP water entitlements, but rather the adequacy of the evaluation of the environmental effects of doing so. The Belridge EIR evaluated those effects in Kern County pursuant to the Monterey Agreement, concluding that selling the entitlements would not have an effect on irrigated lands because, on average, it would be compensated by the increased reliability of deliveries to agricultural contractors under the Monterey Agreement. Neither the Monterey Agreement EIR, nor the Belridge EIR, nor respondent's EIR evaluated the environmental effects on the seller's irrigated lands of selling the entitlements under pre-Monterey-Agreement conditions, with agricultural contractors subject to the first and severest reductions in times of shortage.

Respondent contends this shortcoming is alleviated by the inclusion of discussions in the Belridge EIR and respondent's EIR of a "no project ***1387** alternative." This is incorrect. The no project alternative in the Belridge EIR was: not selling the entitlements. The no project alternative in respondent's EIR was: not buying the entitlements. Neither addressed the environmental effects of transferring the entitlements without the protections for agricultural contractors in the Monterey Agreement.

We conclude respondent's tiering on the now decertified Monterey Agreement EIR was prejudicial error. The judgment must be reversed because the certification of respondent's EIR must be vacated, based on the *PCL*/tiering problem. The question arises whether we should address the *other* alleged defects that were litigated below and raised in

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appellant's opening brief. We asked the parties to address whether these issues were moot if the judgment were reversed based on the *PCL*/tiering problem. Both parties remind us of section 21005, subdivision (c), which provides, "It is further the intent of the Legislature that any court, which finds, or, in the process of reviewing a previous court finding, finds, that a public agency has taken an action without compliance with this division, shall specifically address each of the alleged grounds for noncompliance." A treatise states, "This language, which courts may not treat as mandatory, is apparently intended to avoid situations in which a court, presented with numerous theories as to why a respondent agency purportedly violated CEQA, chooses to issue a writ based solely on one or a handful of theories, leaving the parties to wonder whether or not the unaddressed theories had merit. In such situations, where the respondent agency must conduct a second CEQA process to cure the problems identified by the court, the agency often does not know whether to modify its environmental document (or findings) to address concerns raised by the petitioners but ignored by the court." (Remy et al., Guide to the California Environmental Quality Act (10th ed. 1999) Judicial Review, pp. 646-647.)

Section 21005, subdivision (c) thus requires only that *if we find* other respects in which the EIR was defective we should describe them for the guidance of the parties. We have examined all of appellant's other contentions and find them to be *without merit.* If the *PCL*/tiering problem had not arisen, we would have affirmed the judgment. Section 21005, subdivision (c) does not require us to lengthen this opinion by addressing in detail why we *reject* appellant's other contentions. Appellant's supplemental reply brief so concedes: "The court's discussion of all aspects of CEQA noncompliance is respectfully requested, while areas of compliance are not required to be addressed."

This suggests that respondent may be able to cure the *PCL* problem by awaiting action by the DWR complying with the *PCL* decision, then issuing ***1388** a subsequent EIR, supplement to EIR, or addendum to EIR (Guidelines, § § 15162, 15163, 15164) tiering upon a newly certified Monterey Agreement EIR. Appellant itself so suggests.

Like the court in *PCL, supra,* 83 Cal.App.4th at page 926 and footnote 16, we leave to the trial court's discretion whether to enjoin all or portions of respondent's project pending completion of an adequate EIR. The trial court is in a better position than this court to determine factually the current status of the *PCL* litigation or of a new Monterey Agreement EIR.

Disposition

The judgment is reversed. The trial court shall issue a writ of mandate vacating the certification of the EIR, shall retain jurisdiction until respondent certifies an EIR complying with CEQA consistent with the views expressed in this opinion, and shall consider such orders it deems appropriate under section 21168.9. The parties shall bear their own costs on appeal.

Hastings, J., and Curry, J., concurred.
Respondent's petition for review by the Supreme Court was denied April 17, 2002. Baxter, J., was of the opinion that the petition should be granted. ***1389**

Cal.App.2.Dist.
Friends of Santa Clara River v. Castaic Lake Water Agency
95 Cal.App.4th 1373, 116 Cal.Rptr.2d 54, 02 Cal. Daily Op. Serv. 1246, 2002 Daily Journal D.A.R. 1477

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Los Angeles County Superior Court, "Judgment Granting Peremptory Writ of Mandate, *Friends of the Santa Clara River v. Castaic Lake Water Agency*, Case No. BS056954" (October 25, 2002)

OCT 2 2 2002
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SUPERIOR COURT OF THE STATE OF CALIFORNIA
IN AND FOR THE COUNTY OF LOS ANGELES

FRIENDS OF THE SANTA CLARA RIVER,

Petitioner,

v.

CASTAIC LAKE WATER AGENCY,

Respondent.

Case No. BS 056954

JUDGMENT GRANTING PEREMPTORY WRIT OF MANDATE

On Remand from the Court of Appeal

The hearing on the merits of the petition for writ of mandate was held on June 12, 2000, before the Honorable David P. Yaffe. Petitioner Friends of the Santa Clara River (Friends) was represented by attorney Susan Brandt-Hawley and respondent Castaic Lake Water Agency (CLWA) was represented by attorneys Robert H. Clark and R. Bruce Tepper. The court considered the briefs filed by the parties, the arguments of counsel, and the administrative record of proceedings, and took the case under submission.

On August 16, 2000, judgment was entered denying the petition in its entirety. An appeal was timely filed on October 16, 2000. The Fourth Division of the Second District Court of Appeal issued a slip opinion in Civil Case Number 145283 on January 10, 2002, and at the request of the National Audubon Society and the American Planning Association certified the opinion for publication on February 6, 2002. (*Friends of the Santa Clara River v. Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373.) The Court of Appeal reversed the judgment and ordered that "the trial court shall issue a writ of mandate vacating the certification of the EIR, shall retain jurisdiction until respondent certifies an EIR complying with CEQA consistent with the views expressed in this opinion, and shall consider such orders it deems appropriate under [Public Resources Code] section 21168.9."

CLWA filed a petition for review with the California Supreme Court on February 19, 2002, in Case Number S 104550, which was summarily denied on April 17, 2002. The remittitur issued from the Court of Appeal on May 3, 2002.

On September 24, 2002, at 9:30 a.m., the parties' proposed forms of judgment and writ on remand were considered by the Honorable David P. Yaffe. Friends was represented by attorney Susan Brandt-Hawley and CLWA was represented by attorneys Robert H. Clark and R. Bruce Tepper. The court considered the briefs filed by the parties and the arguments of counsel, and,

WHEREFORE, GOOD CAUSE APPEARING,

Susan Brandt-Hawley 707-576-0175 Oct 14 02 02:32p p.3

IT IS ORDERED THAT THE TENTATIVE RULING IS ADOPTED:

1. The judgment of this court denying the petition for writ of mandate, signed and filed on August 16, 2000, is vacated.

2. A peremptory writ of mandate shall issue ordering respondent Castaic Lake Water Agency to set aside its certification, made on March 29, 1999, of the Final Environmental Impact Report published in February 1999.

3. The Court retains jurisdiction until respondent Castaic Lake Water Agency certifies an Environmental Impact Report that complies with the California Environmental Quality Act and is consistent with the views expressed by the Court of Appeal Opinion filed January 10, 2002, Case No. B145283.

4. The Court finds that petitioner is the prevailing party in this proceeding.

5. The Court is informed that petitioner and respondent have fully and finally settled the outstanding issue of petitioner's claim for attorney fees and costs incurred in this action to date both in this Court and in the Court of Appeal, pursuant to CCP § 1021.5 and on all other bases whatsoever, for the compromise sum of $215,000.00, and the Court accepts said settlement.

6. Petitioner requests that the Court also prohibit respondent from using any of the 41,000 acre feet of additional water allotted to it from the subject State Water Project. Petitioner contends that the said water will be used to approve new development that will not be able to be reversed if a Final Environmental Impact Report is not certified. Respondent contends that such a prohibition would prevent it from meeting the existing water needs in the area it services. Both contentions appear to be speculative at this time. Respondent will not be prohibited from using the water to which it is entitled, but petitioner may renew its application for such prohibition based upon evidence of the actual use of such additional water for purposes it considers improper.

Approved as to form:

Date: October 7, 2002

Susan Brandt-Hawley
Attorney for Petitioner

Approved as to form:

Date: October 8, 2002

Robert H. Clark
Attorney for Respondent

IT IS SO ORDERED.

Date: OCT 25 2002

David P. Yaffe
Honorable David P. Yaffe
Judge of the Superior Court

Nov 14 02 02:33p Susan Brandt-Hawley 707-576-0175 p.5

Memorandum of Understanding Between the Santa Clara River Valley Upper Basin Water Purveyors and United Water Conservation District, August 2001

MEMORANDUM OF UNDERSTANDING
BETWEEN THE
SANTA CLARA RIVER VALLEY
UPPER BASIN WATER PURVEYORS
AND
UNITED WATER CONSERVATION DISTRICT

AUGUST 2001

COPY

Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation**. The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights**. Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

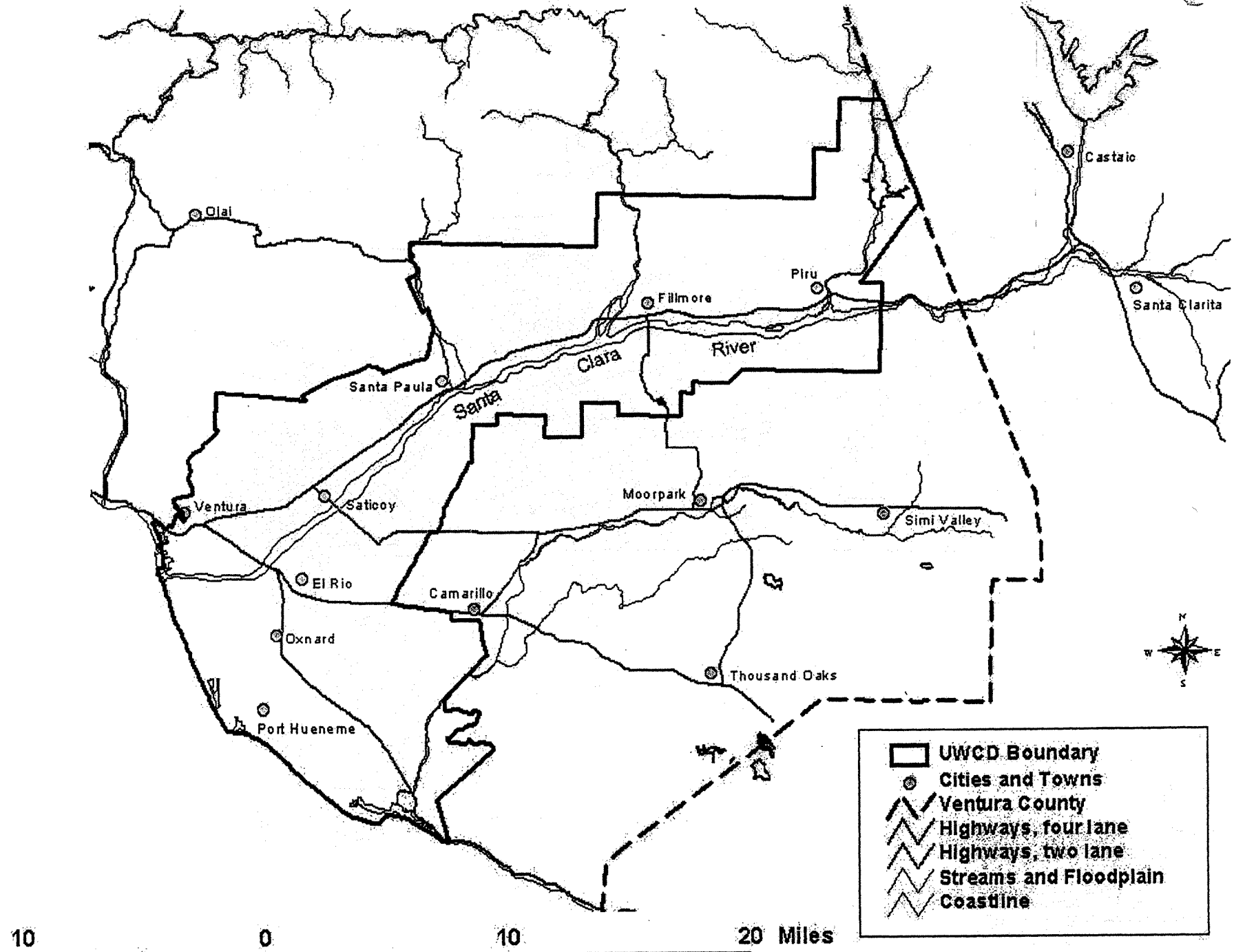
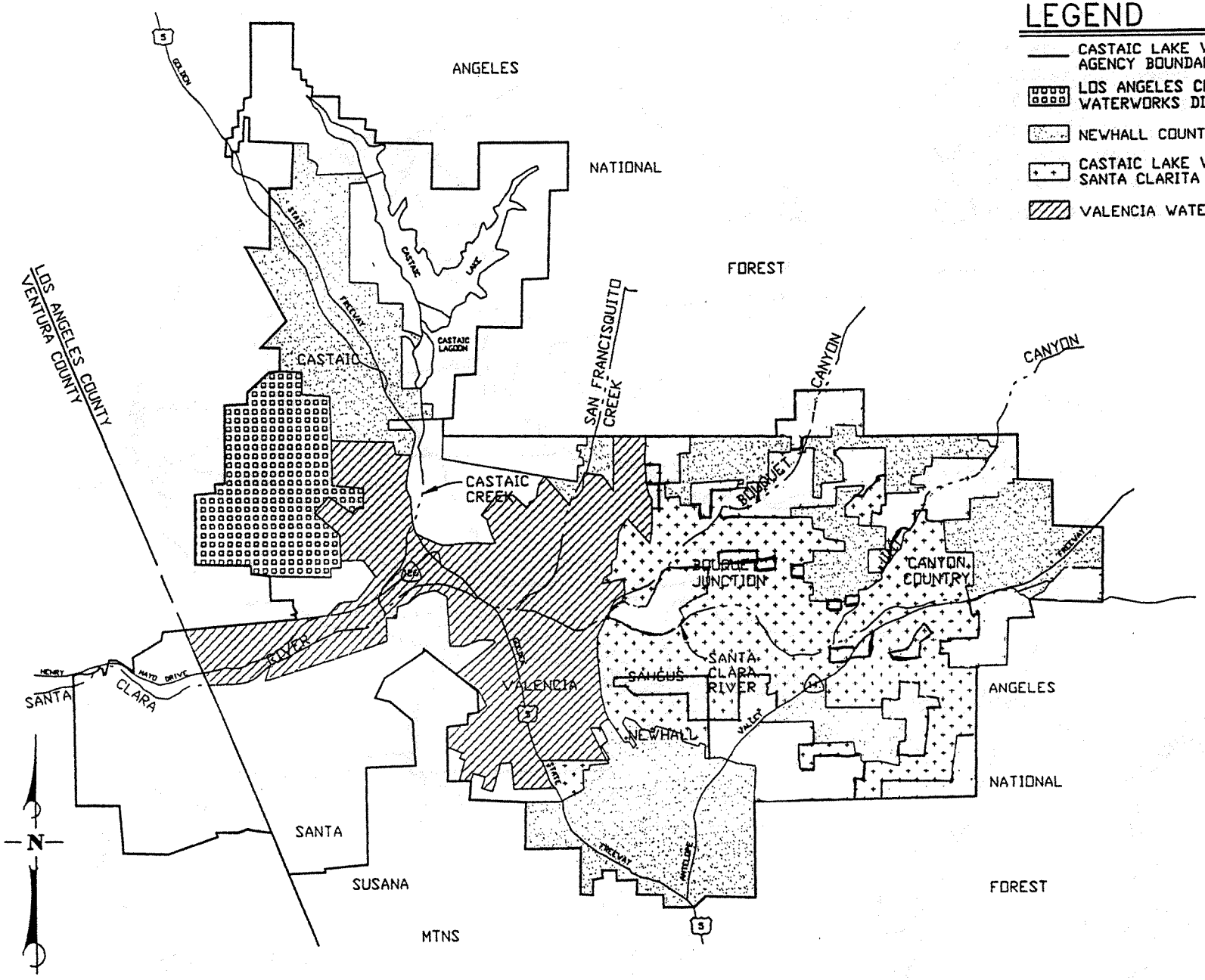


Figure 1-1



FIGUI 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

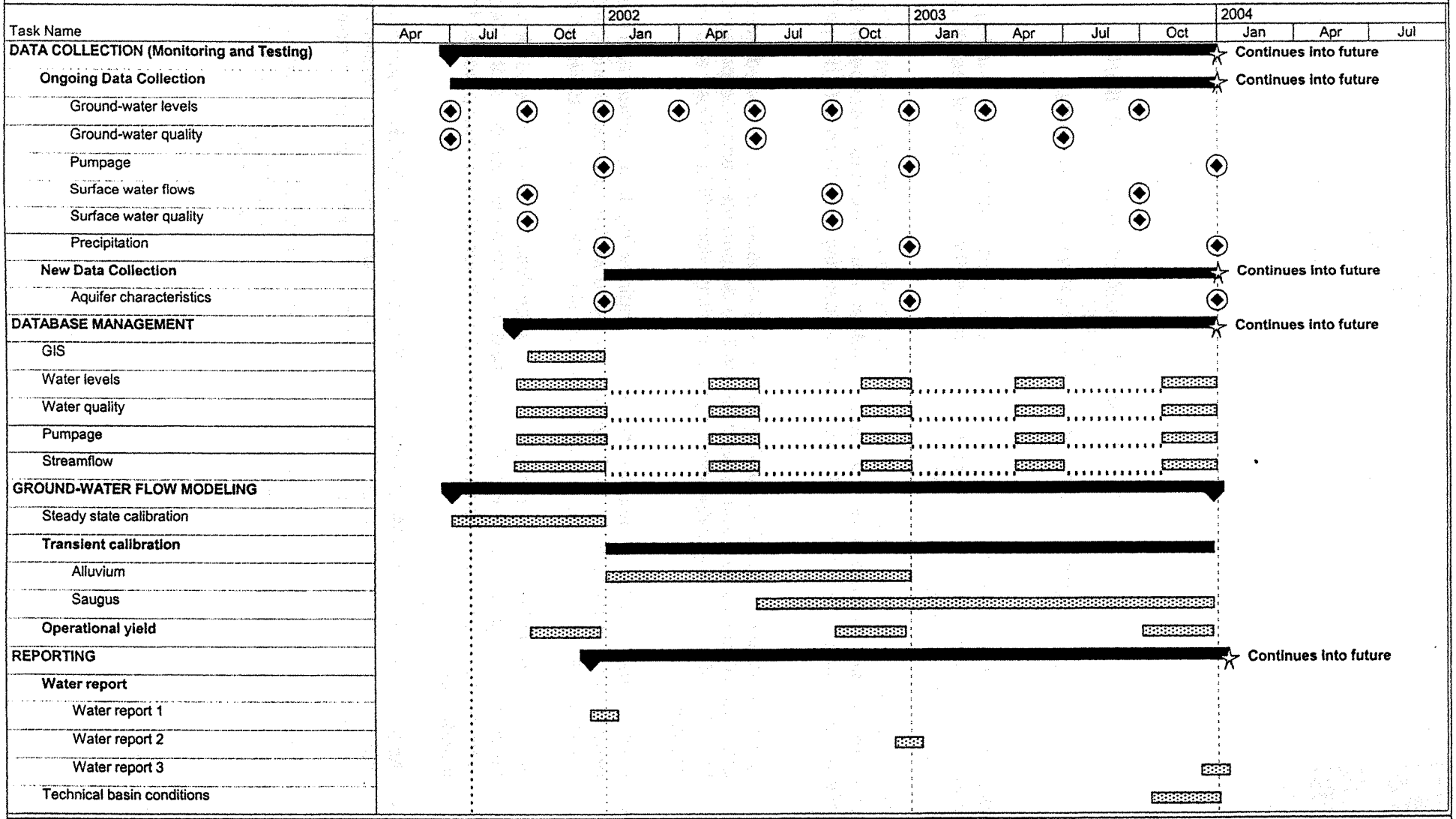
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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NCWD

NEWHALL COUNTY WATER DISTRICT
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(661) 259-3610 Phone • (661) 259-9673 Fax • email: mail@ncwd.org

Directors: RANDALL D. PFIESTER, *President* VALERIE THOMAS, *Vice President* BARBARA DORE LYNNE A. PLAMBECK DICK A. UNGER

ATTACHMENT TO MEMORANDUM OF UNDERSTANDING BETWEEN UPPER BASIN WATER PURVEYORS AND UWCD

NEWHALL COUNTY WATER DISTRICT strongly supports a cooperative working relationship and establishment of a joint monitoring program among the signatories of the attached Memorandum of Understanding (MOU).

This attachment shall not be construed to alter either the terms of agreement or the proposed activities that are the substance of the MOU. Rather, the intent is to describe the District's interpretation of the document and to convey their resulting expectations to the parties to the MOU.

- Subcommittee membership, meeting times, and locations will be finalized within six months. Subcommittee structure and organization will be documented and incorporated into the MOU by reference. Opportunities for public participation will be defined and included in the process.

- Cost estimates, activity plans and schedules, engineering data, models and modeling results, actual expenditures, and reports generated will be considered public information and made available under the terms and conditions of current law and established policies.

- Neutral technical expertise to ensure objective analyses and recommendations will be provided through inclusion of a USGS "expert" as a working member of the Technical Committee. Conclusions, proposals, and extrapolation of data must proceed from a credible foundation.

- As the provisions of the MOU are fulfilled, the parties will undertake regional water planning efforts to protect and enhance the water resources within the region. Water Code Sections 10750 through 10795 describe activities that may be included, where feasible.

- The Upper Basin Water Purveyors recognize the importance of the alluvial aquifer as a source of water supply for the residents of the Santa Clarita Valley, and will cooperatively encourage replenishment projects, particularly in the eastern reaches of the Santa Clara River.

August 16, 2001

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

California Rules of Court, rule 977(a), prohibits courts and parties from citing or relying on opinions not certified for publication or ordered published, except as specified by rule 977(b). This opinion has not been certified for publication or ordered published for purposes of rule 977.

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

SECOND APPELLATE DISTRICT

DIVISION FOUR

FRIENDS OF THE SANTA CLARA RIVER, Plaintiff and Appellant, v. CASTAIC LAKE WATER AGENCY, Defendant and Respondent.	B164027 (Los Angeles County Super. Ct. No. BS056954)

COURT OF APPEAL - SECOND DIST.
FILED
DEC 01 2003
JOSEPH A. LANE Clerk
Deputy Clerk

APPEAL from a judgment of the Superior Court of Los Angeles County, David P. Yaffe, Judge. Affirmed.

Law Office of Alyse M. Lazar and Alyse M. Lazar for Plaintiff and Appellant.

Rossmann and Moore, Antonio Rossmann and Roger B. Moore for Amici Curiae Planning and Conservation League and Citizens Planning Association of Santa Barbara County, Inc., in support of Plaintiff and Appellant.

Horvitz & Levy, Barry R. Levy, William N. Hancock; R. Bruce Tepper; and McCormick, Kidman & Behrens, Russell G. Behrens, H.L. (Mike) McCormick and David D. Boyer for Defendant and Respondent.

INTRODUCTION

This is the second time this case has been before us. On the first appeal we directed the trial court to issue a writ of mandate to set aside certification of respondent Castaic Lake Water Agency's Environmental Impact Report (EIR) because the EIR had been tiered upon a prior EIR that had been found to be infirm by an intervening appellate decision. Upon remand, respondent and appellant Friends of the Santa Clara River agreed a writ of mandate should issue to decertify the EIR but disagreed about whether the trial court should also enjoin the project pending certification of a new EIR. After consideration of documentary evidence and the presentation of written and oral arguments, the trial court rejected appellant's request for an injunction without prejudice to entertaining a renewed request founded on an adequate showing of entitlement to relief. This appeal follows entry of judgment in October 2002.

Appellant attacks the trial court's denial of its request for an injunction on two separate grounds. Appellant first contends the trial court's denial was in derogation of the directions contained in our earlier decision. The contention lacks merit. The clear and unambiguous dispositional language in our opinion granted the trial court the authority to deny in toto the request for an injunction. Appellant next contends the trial court erred on the merits in denying its request. Based upon the record, we find the trial court did not abuse its discretion in implicitly finding

appellant had failed to carry its burden of establishing the predicates for injunctive relief. We therefore affirm the judgment.

FACTUAL AND PROCEDURAL BACKGROUND

Respondent purchased from the Kern County Water Agency entitlement to 41,000 acre-feet per year of water. The purchase followed consummation of the Monterey Agreement which changed the allocation between agricultural and urban contractors of entitlements to State Water Project (SWP) water. Respondent approved this purchase after first certifying an EIR. This EIR was "tiered" upon an earlier EIR approving the Monterey Agreement.[1] The Legislature favors tiering to streamline the regulatory process and to avoid unnecessary duplication of effort.

Appellant filed a petition for a writ of mandate in the superior court to compel respondent to set aside its certification of the EIR for the purchase of 41,000 acre-feet per year of SWP water. Appellant advanced various grounds in support of its petition. The superior court denied the petition. Appellant appealed the adverse judgment to this court.

While that appeal was pending, our colleagues in the Third Appellate District concluded the EIR prepared for the Monterey Agreement was inadequate and therefore ordered it decertified. (*Planning & Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, review den. (*PCL*).)

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1 Tiering "means the coverage of general matters and environmental effects in an environmental impact report prepared for a policy, plan, program or ordinance followed by narrower or site-specific environmental impact reports which incorporate by reference the discussion in any prior environmental impact report and which concentrate on the environmental effects which (a) are capable of being mitigated, or (b) were not analyzed as significant effects on the environment in the prior environmental impact report." (Pub. Res. Code, § 21068.5.)

We therefore concluded that in the appeal presented to us *PCL* required decertification of respondent's EIR because it had been tiered on the now-decertified EIR for the Monterey Agreement. (*Friends of the Santa Clara River v. Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373, 1383-1388, review den. (*Friends I.*) We, however, rejected all of appellant's other challenges to respondent's EIR, finding "them to be *without merit.*" (*Id.* at p. 1387.) We noted: "[R]espondent may be able to cure the *PCL* problem by awaiting action by the [Department of Water Resources] complying with the *PCL* decision, then issuing a subsequent EIR, supplement to EIR, or addendum to EIR [citations] tiering upon a newly certified Monterey Agreement EIR." (*Id.* at pp. 1387-1388.)

In regard to further action in the trial court we wrote: "[W]e leave to the trial court's discretion whether to enjoin all or portions of respondent's project pending completion of an adequate EIR. The trial court is in a better position than this court to determine factually the current status of the *PCL* litigation or of a new Monterey Agreement EIR." (*Id.* at p. 1388.)

The dispositional paragraph of our decision read, in relevant part: "The judgment is reversed. The trial court shall issue a writ of mandate vacating the certification of the EIR, shall retain jurisdiction until respondent certifies an EIR complying with CEQA consistent with the views expressed in this opinion, and shall consider such orders it deems appropriate under [Public Resources Code] section 21168.9." (*Id.* at p. 1388.)

Upon remand, the parties agreed the trial court was required to issue a writ of mandate to decertify respondent's EIR. The bone of contention was whether the trial court should also enjoin respondent from proceeding with the project, e.g., the transferring of the entitlement to the 41,000 acre-feet of water per year, pending completion of the new EIR.

Appellant argued: "To allow [respondent] to use any portion of its unstudied 41,000 afy [acre feet per year] entitlement before the EIR analysis is complete will result in **new permanent water connections** that will not be able to be reversed. Once houses are in and the faucets are on, there is no way to turn back. Without the proven need for this water to serve existing users, there is no equitable justification for allowing the use of any portion of the 41,000 afy entitlement in the face of its clear consistency with CEQA policies against pre-approved projects. A fair EIR process requires that project approval not be up and running as a foregone conclusion."

The evidentiary support for this argument is found in a declaration executed in August 2002 by appellant's counsel. The declaration sought to establish respondent would have sufficient water from other sources to supply its existing customers without use of the entitlement. From these factual allegations, appellant argued any use by respondent of the entitlement would necessarily be for new customers and therefore subject to being enjoined. The declaration referenced several attached documents and included allegations grounded upon information and belief. In pertinent part it averred:

> "I am informed that [respondent] has utilized at most 3674 af [acre feet] of the subject 41,000 afy [acre feet per year] water transfer during the past year. Attached is a true copy of CLWA Production Report for 2000, 2001, and half of 2002, and also a DWR Notice to State Water Project Contractors dated May 2002. The reports speak for themselves, and reflect CLWA's use of State Water Project entitlements to its various purveyors. The allocation of SWP water was 65% in the last year, and *petitioner is informed and believes that CLWA expects an even larger allocation in the coming fiscal year to as much as 90%.* The report shows that water use is measured yearly from June to June. It is undisputed that CLWA has a 54,200 afy entitlement to SWP water that is not under any legal cloud and clearly available for use, aside from the 41,000 afy that is the subject of this litigation. Based on a 65% delivery of SWP water, CLWA's

> allocation of its undisputed 54,200 afy totals 35,230 af. The report reflects use of 38,974 af from June 2001 until June 2002; which appears to be only 3674 af more than can be supplied from the 54,200 afy entitlement. It thus appears that CLWA *may have utilized* 3674 af of its allocation from the subject 41,000 af entitlement in the past year. If the SWP allocations increase to 75% or greater, *as is apparently expected,* by doing the math it appears that the 41,000 af water transfer is not needed for existing customers of the CLWA water purveyors while the supplemental environmental review is pending." (Italics added.)

Appellant therefore sought an order enjoining respondent "from any and all use of the 41,000 afy water transfer under the current approvals."

In addition, appellant's counsel averred she had communicated with counsel in the *PCL* case and that as of August 22, 2002, "the *PCL* case remand has not yet been settled or otherwise resolved, and that the Monterey Agreement Implementation Draft EIR to be prepared by the Department of Water Resources (DWR) as required by the *PCL* decision has not yet been published." As for the status of respondent's EIR, the declaration averred that respondent's attorney had informed her "that the agency has not yet published its Draft Supplemental EIR in response to [the Court of Appeal's decision], but that it intends to prepare the EIR itself rather than await the new DWR Monterey Agreement Implementation EIR."

In opposition, respondent asked the trial court to "**issue an order allowing the Transfer of Entitlement to remain intact pending completion of a new EIR.**" In particular, respondent urged that the entitlement was "necessary to satisfy current existing and projected near-term water demand"; that a "decision to set aside the Transfer of Entitlement would cause immediate irreparable harm to the Agency and the water consumers"; and that the Transfer "has been in effect for more than three years, and there is no evidence that the Transfer has resulted in any new or increased significant adverse environmental effects."

Respondent's opposition was supported by a detailed eight-page declaration from Dan Masnada, respondent's general manager. Masnada averred that respondent had already retained consultants to prepare a new EIR and they planned to complete the process by March 2003. A portion of Masnada's declaration directly refuted the allegations made by appellant's counsel about respondent's projected water supply. In pertinent part, Masnada averred:

> "[Counsel's] declaration states that 'CLWA expects an even larger allocation made by DWR in the coming fiscal year to as much as 90%.' . . . *There is no factual basis for this statement.* There have been no indications that CLWA's SWP allocation made by DWR in the coming year will be anywhere near 90%. To the contrary, based on discussions with DWR Operations Control Office Personnel it is likely that the initial 2003 SWP allocation on December 1, 2002 will be approximately 20%, as it was last year. If dry conditions occur next year, the final SWP allocation for 2003 could remain as low as 20%.
>
> [Counsel's] Declaration also states that the CLWA Production Report 'shows that water use is measured yearly from June to June.' . . . This is incorrect. While annual water use can be measured from July to June, available SWP water supply is characterized on a calendar year basis because DWR allocates it on a calendar year basis. *[Her] accounting of water deliveries i[s] flawed.* She has utilized an approach that understates CLWA's current level of demand and projected deliveries to the retail purveyors during 2002. As discussed above, and shown in Exhibit A, CLWA's Final 2001 SWP allocation was 39%. Without the 41,000 AF in 2001, CLWA would have experienced a shortfall of 14,218 AF."

Appellant's reply to respondent's opposition did not include any additional declaration(s). Instead, its reply asserted respondent's "factual information" was "confusingly presented and misleading" and that a portion of Masnada's opinion about SWP allocations for 2003 was "complete conjecture and speculation."

After a hearing in which the parties presented argument and responded to questions from the bench, the trial court issued a writ of mandate ordering respondent to set aside its certification of the 1999 EIR and to certify a new EIR consistent with our opinion in *Friends I.* The trial court rejected appellant's request to enjoin any use of the water entitlement. It ruled: "Petitioner [appellant herein] requests that the Court also prohibit respondent from using any of the 41,000 acre feet of additional water allotted to it from the subject State Water Project. Petitioner contends that the said water will be used to approve new development that will not be able to be reversed if a Final Environmental Impact Report is not certified. Respondent contends that such a prohibition would prevent it from meeting the existing water needs in the area it services. *Both contentions appear to be speculative at this time. Respondent will not be prohibited from using the water to which it is entitled, but petitioner may renew its application for such prohibition based upon evidence of the actual use of such additional water for purposes it considers improper.*" (Italics added.)

This appeal follows.[2]

DISCUSSION

A. THE DIRECTIVE IN *FRIENDS I*

Appellant first contends the trial court misconstrued our directive in *Friends I.* Appellant's position is that our decision gave the trial court the power

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2 In July 2002, we denied respondent's motion to dismiss the appeal because denial of a *pendente lite* injunction is appealable pursuant to Code of Civil Procedure section 904.1, subdivision (a)(6).

to enjoin either all or part of the project pending certification of a new EIR but that it did not give it the power to decide, as it did in the proceedings it conducted following remand, not to enjoin any part of the project. Appellant relies upon the following language we now italicize from *Friends I*: "Like the court in *PCL, supra,* 83 Cal.App.4th at page 926 and footnote 16, we leave to the trial court's discretion whether to enjoin *all or portions* of respondent's project pending completion of an adequate EIR." (*Friends I, supra,* 95 Cal.App.4th 1373, 1388, italics added.) From that language, appellant argues "the Superior Court was not vested with the discretion to issue no injunction, but only with [the] discretion to issue a full or partial injunction."

Appellant's argument lacks merit because it ignores the clear dispositional language of our opinion which gave the trial court the authority to deny in toto a request for injunctive relief.

"Where a reviewing court has remanded a matter to the trial court with directions '. . . the trial court . . . is bound to specifically carry out the instructions of the reviewing court. . . . [A]ny material variance from the explicit directions of the reviewing court is unauthorized and void.'" (*Coffee-Rich, Inc. v. Fielder* (1975) 48 Cal.App.3d 990, 998.)

The appellate court's directions are determined by "look[ing] first to the dispositional language of the opinion--the language which constitutes the remittitur directions." (*Frankel v. Four Star International, Inc.* (1980) 104 Cal.App.3d 897, 902.) *Only if* the dispositional language is ambiguous and in need of interpretation will that language "be interpreted in light of the reasoning and holdings found in the body of the opinion. [Citations.]" (*Lesny Development Co. v. Kendall* (1985) 164 Cal.App.3d 1010, 1021.)

As set forth earlier, the pertinent portion of the dispositional language in *Friends I* read: "The judgment is reversed. The trial court shall issue a writ of

mandate vacating the certification of the EIR, shall retain jurisdiction until respondent certifies an EIR complying with CEQA consistent with the views expressed in this opinion, *and shall consider such orders it deems appropriate under section 21168.9.*" (*Friends I, supra,* 95 Cal.App.4th 1373, 1388, italics added.) The statutory provision referenced--Public Resources Code section 21168.9--is lengthy and set forth in toto below in footnote 3.[3] The definitive

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3 The statute provides:

"(a) If a court finds, as a result of a trial, hearing, or remand from an appellate court, that any determination, finding, or decision of a public agency has been made without compliance with this division, the court shall enter an order that includes one or more of the following:

"(1) A mandate that the determination, finding, or decision be voided by the public agency, in whole or in part.

"(2) If the court finds that a specific project activity or activities will prejudice the consideration or implementation of particular mitigation measures or alternatives to the project, a mandate that the public agency and any real parties in interest suspend any or all specific project activity or activities, pursuant to the determination, finding, or decision, that could result in an adverse change or alteration to the physical environment, until the public agency has taken any actions that may be necessary to bring the determination, finding, or decision into compliance with this division.

"(3) A mandate that the public agency take specific action as may be necessary to bring the determination, finding, or decision into compliance with this division.

"(b) Any order pursuant to subdivision (a) shall include only those mandates which are necessary to achieve compliance with this division and only those specific project activities in noncompliance with this division. The order shall be made by the issuance of a peremptory writ of mandate specifying what action by the public agency is necessary to comply with this division. However, the order shall be limited to that portion of a determination, finding, or decision or the specific project activity or activities found to be in noncompliance only if a court finds that (1) the

(Fn. continued.)

construction of that statute is found in our Supreme Court's opinion in *Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376. It concluded that the statute permits but does not require a court to enjoin a project while a new EIR is prepared. (*Id.* at pp. 423-425.) In deciding whether injunctive relief is appropriate, a court is to rely upon "traditional equitable principles." (*Id.* at p. 423.) Given this long-standing construction of section 21168.9,[4] it is clear our dispositional language granted the trial court the option to decline to grant any injunctive relief after it properly considered the pertinent equities. Appellant's argument that the trial court failed to follow our directions by declining to grant equitable relief is therefore without merit.

In any event, appellant engages in a crabbed interpretation of one phrase in our opinion to argue the trial court had no discretion to deny a request for

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> portion or specific project activity or activities are severable, (2) severance will not prejudice complete and full compliance with this division, and (3) the court has not found the remainder of the project to be in noncompliance with this division. The trial court shall retain jurisdiction over the public agency's proceedings by way of a return to the peremptory writ until the court has determined that the public agency has complied with this division.
>
> "(c) Nothing in this section authorizes a court to direct any public agency to exercise its discretion in any particular way. Except as expressly provided in this section, nothing in this section is intended to limit the equitable powers of the court."

4 See also *City of Santee v. County of San Diego* (1989) 214 Cal.App.3d 1438, 1456 ["Section 21168.9, as construed by the Supreme Court in *Laurel Heights,* merely grants a reviewing court the authority to stay all activity or use of a project until an agency certifies a proper EIR; it does not require it to do so. [Citation.] The court in *Laurel Heights* relied upon traditional equitable principles in deciding that injunctive relief there was not appropriate."].

injunctive relief. The sentence in which the phrase is found began with a specific reference to the *PCL* opinion: its dispositional language found at page 926, including footnote 16. That language included the same direction found in our dispositional language: the direction the trial court shall make any such orders it deems appropriate under section 21168.9. Footnote 16 read: "We earlier declined to stay implementation of the Monterey amendments and transfer of the Kern Fan Element. Consequently, the project was permitted to proceed pending disposition of this appeal. The record does not reflect the current status of the project and, in the absence of such information, we shall issue no orders concerning further implementation of the project. The trial court, acting under the authority provided by Public Resources Code section 21168.9, is the more appropriate forum to consider and rule upon requests *to enjoin all or portions of the project pending* the completion of administrative and judicial proceedings necessitated by our opinion." (*PCL, supra,* 83 Cal.App.4th 892, fn. 16 at p. 926, italics added.) Just as the *PCL* court did not intend to limit the trial court's authority by requiring it to enjoin at least a portion of the project, neither did we. We, as did the *PCL* court, were simply describing the types of requests that might be made, e.g., requests for a partial or full injunction. We did not intend to divest the trial court of its power to deny a request for injunctive relief if it either concluded that the moving party had failed to establish the predicates for relief or that, given the equities, relief was not required.

B. DENIAL OF INJUNCTIVE RELIEF

Appellant next contends: "The Superior Court's decision regarding injunctive relief was an abuse of discretion, because there is no factual basis to support the decision." (Bold omitted.) We disagree.

A decision to grant or deny a request for injunctive relief rests within the trial court's discretion. Its order will not be reversed on appeal unless an abuse of discretion is shown. It is, of course, the appellant's burden to establish an abuse of discretion. (*Cohen v. Board of Supervisors* (1985) 40 Cal.3d 277, 286.) "A trial court will be found to have abused its discretion only when it has exceeded the bounds of reason or contravened the uncontradicted evidence. [Citation.]" (*Lubavitch Congregation v. City of Long Beach* (1990) 217 Cal.App.3d 1388, 1391.)

It was appellant's burden as moving party in the trial court to establish the predicates for injunctive relief. In particular, Public Resources Code section 21168.9, subdivision (a)(2) requires the court to first find that a "specific project activity . . . will prejudice the consideration or implementation of particular mitigation measures or alternatives to the project" and that such activities "could result in an adverse change or alteration to the physical environment" before an injunction will issue. The trial court found appellant's claim of irreparable harm--new permanent water connections that will not be able to be reversed--to be speculative. In other words, it concluded appellant had failed to discharge its burden of proof.[5] However, it specifically left open the opportunity for appellant

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5 To a certain extent, appellant relies upon four documents not presented to the trial court to support its contention of abuse of discretion. Three of those documents were prepared after the trial court entered judgment in October 2002. Each document is a portion of a report prepared for respondent. Prior to the submission of briefing, we granted appellant's request to take judicial notice of these documents.

Appellant wants to use this information to show respondent is improperly representing to third parties it is entitled to the 41,000 acre-feet per year of water. Appellant argues this is proof of the irreparable harm it is suffering because the trial court declined to enjoin respondent.

Our prior grant of appellant's motion for judicial notice does not require us to consider these documents. "Although a reviewing court may take judicial notice of

(Fn. continued.)

to renew its claim "based upon evidence of the actual use of such additional water for purposes it considers improper."

Distilled to its essence, appellant's present position is nothing more than an argument the trial court was required to credit the allegations in its counsel's declaration which allegedly supported its request for injunctive relief. That is, appellant would have us find that no reasonable judge could have found its evidentiary showing insufficient. We cannot make that finding.

The evidence on this issue was conflicting. As set forth above, Masnada's declaration directly contradicted some of the allegations made by appellant's counsel. Given the (purported) deficiencies Masnada pointed out in counsel's declaration, the fact that much of counsel's declaration was based upon information and belief, and appellant's failure to file a reply declaration addressing those points with its reply memorandum, the trial court was well within its discretion to conclude that *at that point in time* appellant had failed to make the requisite showing.

Appellant argues such a conclusion is insupportable because the trial court also found respondent's trial court contention to be speculative. Not so. Appellant

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matters not before the trial court, . . . the reviewing court need not give effect to such evidence. 'Having taken judicial notice of such a matter, the reviewing court may or may not apply it in the particular case on appeal. The effect to be given to matters judicially noticed on appeal, where the question has not been raised below, depends on factors that are not evidentiary in character.' [Citation.]" (*Doers v. Golden Gate Bridge etc. Dist.* (1979) 23 Cal.3d 180, 184, fn. 1.)

In this instance, given that (1) these documents essentially constitute "new evidence" in support of appellant's request for injunctive relief and (2) the trial court explicitly anticipated appellant would renew its request before it, we decline to consider the documents on this appeal.

If appellant wishes to renew a request for injunctive relief, it can bring these documents to the trial court's attention.

is conflating two distinct points respondent made in the trial court. First, based upon a claim of irreparable harm, respondent had affirmatively sought an order that the transfer of entitlement remain in effect until the new EIR was completed. Second, respondent refuted the factual allegations about its water sources contained in the declaration executed by appellant's counsel. The trial court's finding of speculation was directed at the first point: respondent's claim it would suffer irreparable harm if the trial court denied its request for an order that the transfer remain in effect until the EIR was completed. The finding of speculation was not directed at the second point: respondent's discrete refutations of appellant's allegations. The trial court could reasonably find respondent had failed to meet its burden to establish the predicate for the relief it sought but could also reasonably find that the portions of Masnada's declaration set forth above were sufficient to show appellant's claim for relief was likewise subject to serious question and therefore grounded in speculation. We therefore reject appellant's claim that "[r]espondent's entire argument that there was no abuse of discretion is incorrectly based on evidence that the lower court determined was mere speculation, not fact."[6] (Fn. omitted.)

Lastly, we address an argument raised in the amici brief jointly filed by the Planning and Conservation League and the Citizens Planning Association of Santa

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6 Appellant cites to various comments the court made as well as questions it posed during the hearing as proof that the court grounded its decision either in facts unsupported by the evidence or on legal principles inapplicable to the case. This approach is in error. A contextual reading of the transcript of the hearing indicates the court's questions and comments were intended to gather information, to focus the parties' arguments, and to test the strength of the parties' respective positions. The "bottom line" is whether the trial court abused its discretion in finding appellant had failed to discharge its burden to establish the predicates for injunctive relief. As explained above, the court did not so abuse its discretion.

Barbara County, Inc. in support of appellant. Amici are two of the environmental organizations that were the prevailing parties in *PCL, supra,* 83 Cal.App.4th 892.

Amici first inform us that in May 2003--seven months after the trial court entered judgment in this matter--the superior court in Sacramento approved a settlement agreement entered into by the parties in the *PCL* case. Pursuant to that agreement, work has commenced on a new EIR in regard to the Monterey Agreement and related issues. The settlement agreement recognizes that the transfer underlying this lawsuit is "'subject to pending litigation in the Los Angeles Superior Court following remand from the Second District Court of Appeal'"; that "'jurisdiction with respect to that litigation should remain in the [Los Angeles Superior Court]'"; and that "'nothing in this settlement agreement is intended to predispose the remedies or other actions that may occur in that pending litigation.'"

Amici argue the trial court abused its discretion in denying appellant's request for injunctive relief because the court ignored "the specific directions of *Friends I*" that its determination on interim relief should be based upon the status of the *PCL* litigation and the new statewide EIR to be prepared for the Monterey Agreement.[7] As support for that proposition, Amici cites us to the last two paragraphs of our opinion in *Friends I.* There, after concluding that other than the *PCL*/tiering issue all of appellant's complaints about the EIR were meritless, we wrote: "This suggests that respondent may be able to cure the *PCL* problem by awaiting action by the DWR complying with the *PCL* decision, then issuing a subsequent EIR, supplement to EIR, or addendum to EIR [citations] tiering upon a newly certified Monterey Agreement EIR. Appellant itself so suggests. [¶] Like the court in *PCL, supra,* 83 Cal.App.4th at page 926 and footnote 16, we leave to

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7 Appellant raised this point in the trial court and its opening brief.

the trial court's discretion whether to enjoin all or portions of respondent's project pending completion of an adequate EIR. The trial court is in a better position than this court to determine factually the current status of the *PCL* litigation or of a new Monterey Agreement EIR." (*Friends I, supra,* 95 Cal.App.4th 1373, 1387-1388.)

Amici misapprehend our directions to the trial court. As explained above, those directions are found in the dispositional language of our opinion. That language directed the trial court, inter alia, to "consider such orders it deems appropriate under [Public Resources Code] section 21168.9." (*Ibid.*) That section grants the trial court broad powers to fashion equitable relief. (See fn. 3, *ante*, and accompanying text at pp. 10-12.) Amici's argument that the exercise of said discretion was to be based upon the status of either the *PCL* litigation or the new EIR for the Monterey Agreement is at odds with the clear dispositional language we employed. The two paragraphs in our opinion upon which amici rely were merely suggestions as to how respondent could proceed and a statement that in exercising its discretion whether to grant equitable relief pending completion of a new EIR for this project, the trial court could ascertain, and if it so chose, rely upon the status of the *PCL* litigation and new Monterey Agreement EIR.

In any event, the parties' papers in the trial court informed it of what was then the current status of both the *PCL* litigation and the new Monterey Agreement EIR and the issue was discussed at the hearing. Nothing in the record suggests the court did not consider those facts in rendering its decision, a decision that was properly framed by the specific prayers for relief each party advanced in the trial court. To a large extent, amici's position is nothing more than an attempt to reargue the motion and to do so based upon events that occurred after judgment was rendered. Because the *PCL* litigation settled *after* the trial court entered its judgment, that settlement and the status of the preparation of the new Monterey Agreement EIR are matters that can be brought to the attention of the trial court if

appellant seeks to renew its request for injunctive relief. Lastly, in order to forestall any unnecessary future litigation, we hasten to add that nothing stated in this opinion is to be construed to be an indication as to how the trial court should rule in any further proceeding(s) on any specific issue(s).

DISPOSITION

The judgment is affirmed.

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

VOGEL (C.S.), P.J.

We concur:

HASTINGS, J.

CURRY, J.

R. Bruce Tepper
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Suite 200
Los Angeles, CA 90067-1602

Division 4
Friends of the Santa Clara River
v.
Castaic Lake Water Agency
B164027

Los Angeles County Superior Court, "Statement of Decision, *California Water Impact Network v. Castaic Lake Water Agency*, Case No. BS 098724" (April 2, 2007)

California Water Impact Network v. Castaic Lake Water Agency
BS 098724

Statement of Decision on Petition for Writ of Mandate

ORIGINAL FILED
APR 02 2007
LOS ANGELES SUPERIOR COURT

Petitioners California Water Impact Network ("CWIN") and Planning and Conservation League ("PCL") petition for writ of mandate under California Environmental Quality Act ("CEQA"). The court has read and considered the moving papers, oppositions, and reply, heard oral argument, and renders the following decision.

A. Statement of the Case

Petitioner CWIN commenced its petition for writ of mandate in Ventura County Superior Court on January 24, 2005. The petition alleges that on December 23, 2004, the Castaic Lake Water Agency ("Castaic"), a public water agency and water wholesaler that treats and delivers water to water retailers in Los Angeles and Ventura Counties, approved the permanent transfer of 41,000 acre feet per year from Real Party in Interest Kern County Water Agency ("Kern") and its member unit in Kern County, Wheeler Ridge-Maricopa Water Storage District ("Wheeler Ridge"), to Castaic (the "Kern water transfer," the "Kern transfer," or the "transfer"). Castaic also purported to certify the Environmental Impact Report ("EIR") for the project (the "2004 EIR" or the "EIR"). Petitioner claims the Kern water transfer "threatens to promote large-scale urban sprawl in Ventura and Los Angeles Counties, while diverting water from important environmental and agricultural uses in Kern County forever." Petitioner alleges that the 2004 EIR is premature, and fails to comply with CEQA.

The petition alleges a cause of action for violation of CEQA in that Real Party in Interest California Department of Water Resources ("DWR"), not Castaic, should have been the lead agency for the 2004 EIR, which does not adequately describe the background on which the project is based, fails to disclose a reliance on an invalid Urban Water Management Plan, fails to adequately describe alternatives to the project, including a "no project" alternative, fails to discuss growth inducement, and inaccurately states the availability of water availability.[1]

On January 24, 2005, PCL filed its own petition for writ of mandate against Castaic in Ventura County Superior Court. The PCL petition alleges a violation by Castaic in recording a Notice of Determination on December 23, 2004, certifying the 2004 EIR and rendering its approval of the Kern water transfer. The petition purports to allege five "causes of action" for violation of CEQA in the 2004 EIR based on Castaic stealing DWR's duty to be the lead agency for the EIR, certification of a defective EIR, approval of inadequate findings, erroneous presentation of the project as already complete, and "prejudicial abuse of discretion."

On June 22, 2005, upon motion by Castaic, the Ventura County Superior Court (the Honorable Frederick H. Bysshe, Jr.) ordered the transfer of both petitions, which had been consolidated, to Los Angeles. On March 27, 2006, the case was reassigned to this court.

On June 27, 2006, the court heard the demurrers of Castaic and Real Party in Interest Kern to the consolidated petitions. The court ruled that the petitions were timely filed and were

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[1]On CWIN's oral motion, the petition's second and third causes of action have been dismissed. As a result, CWIN's petition solely concerns Castaic's compliance with CEQA in the 2004 EIR.

not barred under the doctrine of *res judicata*. The court noted that the Kern water transfer agreements are valid. While principles of *collateral estoppel* barred Petitioners from re-raising issues resolved by the Second District with respect to the 1999 EIR, this conclusion did not foreclose the petitions and the demurrers were overruled.

On July 16, 2006, the court denied Castaic's motion for a legal determination under principles of *collateral estoppel* and party admission that Castaic is the proper lead agency for preparation of the EIR for the Kern water transfer. However, Petitioners are bound by their concession that Castaic may act as the lead agency at some point for an EIR on the Kern water transfer.

B. Preliminary Issues

1. Standing and Timeliness

Petitioner PCL alleges that it is a non-profit corporation devoted to environmental protection. PCL Pet. at ¶6-7. Some of PCL's members live in the area affected by the Kern water transfer. PCL Pet. at ¶8. Petitioner CWIN alleges that it is a nonprofit public benefit corporation the purpose of which is to protect California's environment. CWIN contends that it is impacted by the Kern water transfer because its members reside in and use the Santa Clara River watershed, which is impaired by the water transfer. CWIN Pet. at ¶9. Thus, Petitioners contend that they are impacted by the project and have standing to raise the issues herein. Respondents do not contest Petitioners' standing. *See* Waste Management of Alameda County, Inc. v. County of Alameda, (2000) 79 Cal.App.4th 1223, 1233-34.

The actions are timely on CEQA issues, each having been filed on January 24, 2005, within 30 days of Castaic's Notice of Determination that the 2004 EIR had been certified, filed in various counties between December 23 and December 27, 2004. *See* Pub. Res. Code §21167(c).

2. The Administrative Record

Castaic has certified the administrative record. Pub. Res. Code §21167.6; LASC 9.24(e). The record was received in evidence at trial.

Castaic and Kern, and DWR separately ask the court to judicially notice various records. Judicial notice is the acceptance by a court without formal proof of the existence of a matter of law or fact that is relevant to an issue in the case. People v. Rowland, (1992) 4 Cal.4th 238, 268, n.6. Certain documents are subject to judicial notice. Ev. Code §451, 452. Even where subject to judicial notice, however, a document must be relevant. Id.

The California Supreme Court decision in Western States Petroleum Assn. v. Superior Court, ("Western States") (1995) 9 Cal.4th 559, 573, n.4, provides that extrinsic evidence is generally not admissible for a traditional mandamus challenging a quasi-legislative agency action. The exclusion of extrinsic evidence in a traditional mandamus action is essentially the exclusion of irrelevant evidence. Extrinsic evidence is generally not admissible for a traditional mandamus challenging a quasi-legislative agency action. Id. Such evidence may be admissible in a narrowly construed exception in which (1) the evidence in question existed before the agency made the decision, and (2) the evidence could not have been presented to the agency in the first instance in the exercise of reasonable diligence. Id. at 578. The purpose of limiting extra-record evidence is that the free use of such evidence would invade the deference to which the legislative

branch is entitled under the constitutional separation of powers. If the courts freely considered extra-record evidence in mandamus cases, the highly deferential substantial evidence standard would be turned into a *de novo* standard where the courts in effect would decide not whether an administrative decision was supported by the evidence before the agency but instead whether it was the wisest and best decision according to the courts. Id. at 572.

Castaic asks the court to judicially notice: (1) the unpublished appellate decision in Friends of the Santa Clara River v. Castaic Lake Water Agency, 2003 Cal.App. Unpub. LEXIS 11239, dated December 1, 2003 ("Friends II"), and (2) the unpublished appellate decision in California Water Network v. Castaic Lake Water Agency, 2006 Cal.App. Unpub. LEXIS 2452, dated March 23, 2003.[2] The existence of these court decisions is subject to judicial notice. Ev. Code §452(d).[3]

DWR asks the court to judicially notice (1) Amendment No. 19 to the Water Supply Contract between it and Castaic dated May 28, 2003, and (2) Notice of Preparation of EIR for the Monterey Amendment dated January 24, 2003. DWR contends that these documents are official acts of a California agency subject to judicial notice under Ev. Code section 452(c) and (d). The Notice of Preparation is an official act of DWR and is judicially noticed. However, Amendment No. 19 is not. Official acts should be limited to regulations, public announcements, and other actions the existence of which is beyond dispute. A well informed person has no way of knowing whether Amendment No. 19 is authentic and valid. Nor is it a court record under section 452(d). DWR's request for judicial notice of Amendment No. 19 is denied.

C. Statement of Facts

1. SWP

In 1951, the Legislature authorized construction of a state water storage and delivery system. Planning & Conservation League v. Department of Water Resources, (2000) 83 Cal.App.4th 892, 898. The Legislature subsequently authorized the State Water Project ("SWP"), a complex system of 28 reservoirs and dams, 26 power and pumping plants, and 600 miles of canals and aqueducts to deliver 4.23 million acre-feet of water annually to Central and Southern California. The primary source for the SWP is the drainage of the Feather River, a tributary of the Sacramento River in Northern California (hereinafter, the "Delta").

DWR is the state agency charged with the statutory responsibility to build, manage, and operate the SWP. Essentially, DWR is the wholesale provider of water to middlemen agencies. In 1961, DWR entered into individual contracts with various agricultural and urban water suppliers in the State, referred to as State Water Contractors. *See* Water Code §12937. There are 29 agencies or districts that currently are State Water Contractors.

The SWP water contracts entitled the contractors to receive an annual amount of SWP

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[2]Castaic also supplied the court with copies of its decisions on demurrer and motion for legal determination in this case, which need not be judicially noticed.

[3]Real Party Wheeler purports to join in Castaic's request for judicial notice. In its ruling on the demurrers, the court informed Wheeler of the futility of a joinder as merely a cheerleading effort. No further discussion of the purported joinder is necessary.

water in exchange for a proportionate share of financing and maintaining the SWP facilities. Each water contract contains provisions for both allocation of the amount of water available each year and costs among the contractors. Each contract identifies a Table A amount, the annual maximum amount of water which DWR agrees to deliver, if available for delivery, to each SWP contractor on an annual basis. Delivery of the Table A amount is not assured, but rather provides the basis for proportional allocation of available water among contractors. The Table A amount is specified as either agricultural or urban (M&I). Each contract also includes Article 40, which permits water transfers between contractors, and Article 41, which requires DWR approval of any transfer subject to reasonable terms and conditions. AR 2356.

Each contractor annually submits a request to DWR for water delivery in the following year, up to the amount in Table A. In a year when DWR is unable to deliver the total of contractor requests, deliveries to all contractors will be reduced. The current Table A totals are 4.17 million acre-feet per year.[4] In fact, given existing facilities and contractor demands, the SWP can only deliver an average of 2.96 million acre-feet per year.

2. The Monterey Agreement

Historically, the delivery of less than Table A totals was not a significant problem because contractor demand was less than the Table A amounts. However, in the late 1980's and early 1990's, a drought led to SWP deliveries in amounts below that requested by contractors. Articles 18(a) and (b) of the SWP water contracts addressed DWR's temporary and permanent inability to deliver the water allocations listed in Table A of the contracts by requiring agricultural contractors to accept a reduction in water first before any remaining reduction was shared by urban contractors. In 1990, agricultural contractors received only half their requested water and none in 1991. Because contractors pay their proportionate share of fixed costs regardless of how much water is delivered, the agricultural contractors were paying for water they were not receiving and they were displeased. As a result, urban and agricultural water contractors clashed over DWR's delivery obligations and the proper interpretation of Article 18. AR 45-46.

In December 1994, five State Water Contractors and and DWR reached agreement on a broad set of fourteen principles (the "Monterey Agreement"). Among other things, the Monterey Agreement changed the allocation between agricultural and urban contractors of entitlements to SWP water. The Monterey Agreement eliminated Article 18 and specified that all SWP water was to be allocated in proportion to Table A amounts. Paragraph 24 of the Monterey Agreement provides for the permanent transfer of 130,000 acre-feet from certain willing agricultural contractors, including KWCA, to urban contractors, as implemented by individual agreement. AR 2515. It also provides that individual contractors may transfer entitlements among themselves beyond the 130,000 acre feet proposed, with DWR expeditiously executing any necessary documents and approving all such contracts. Other provisions of the Monterey Agreement include a revision of water allocations during shortages, eliminating the "agriculture first" provision, and retirement of 45,000 other acre-feet of entitlement by agricultural contractors.

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[4]An "acre-foot" is the amount of water that would cover one acre one foot deep.

The Monterey Agreement provides that individual SWP contracts could be amended to conform to it. Over the next two years, 27 of the 29 Water Contractors amended their SWP contracts to implement the principles of the Monterey Agreement (collectively, the "Monterey Amendments").

In 1995, a State Water Contractor, Central Coast Water Authority ("Central"), acted as lead agency and certified a program EIR analyzing the environmental impacts of the Monterey Agreement. This program EIR also addressed Paragraph 24 (Article 53 in the Monterey Amendments) water transfers, including the Kern water transfer. In late 1995, PCL filed a lawsuit in Sacramento Superior Court challenging the program EIR, Planning & Conservation League v. Department of Water Resources, ("PCL").

3. The Kern Water Transfer Agreement

Castaic is a State Water Contractor created by the California Legislature. Its mandate is to purchase and deliver sufficient supplies of water to serve the needs of the Santa Clarita Valley. *See* Swanson v. Marin Municipal Water District, (1976) 56 Cal.App.3d 512, 524 (water district has obligation to augment available water to meet increasing demands). Castaic diverts its SWP water from the West Branch of the California Aqueduct. Castaic is one of the Water Contractors entering into the Monterey Amendments (Amendment 17 to Castaic's SWP contract).

Kern County Water Agency ("KCWA") is a special district formed by the Legislature in 1961. Wheeler Ridge is a special district formed in 1959 to provide supplemental water to agricultural lands in Kern County and is located immediately north and east of Castaic. KCWA has contracts with Wheeler Ridge and other member agencies, for KCWA's SWP water.[5]

In March 1999, Castaic entered into an agreement to purchase from Wheeler Ridge, subject to KCWA's consent, 41,000 acre-feet per year of SWP water (the Kern water transfer). The price for the transfer was $47 million in debt instruments purchased by private investors. The purpose of the transfer is to permit Castaic to serve the water demands of existing users, as well as meet a portion of future water demand from anticipated growth within the Castaic service area. AR 16. The Kern water transfer is the largest transfer under Article 53 of the Monterey Amendments, and it counts towards the 130,000 acre-feet limit. In their transfer agreement, both sides warranted that there was no pending or threatened litigation other than PCL that could affect the 41,000 acre feet SWP entitlement. AR 2562-63.[6]

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[5]In 1998, another KCWA member, Belridge Water Storage District, certified an EIR on the environmental effects of transferring 130,000 acre-feet of SWP water to unidentified purchasers. This EIR was not challenged.

[6]Castaic has been planning since 1987 to increase the supply of water to Santa Clarita Valley. At that time, Los Angeles County General Plan forecast substantial population growth in the Santa Clarita Valley. In 1988, Castaic adopted a Capital Program and Water Plan (the "Capital Program") to address the purchases, construction, and improvements necessary to meet the anticipated water demand. The Capital Program called for the purchase of SWP water from districts willing to sell, including Wheeler Ridge, and the storage of water for later use during drought conditions at Semitropic Groundwater Storage District's ("Semitropic") basins. AR

DWR's approval of the Kern water transfer was required under Articles, 15, 41, and 56 of the SWP contracts. On March 31, 1999, DWR approved the transfer by entering into Amendment 18 of Castaic's SWP contract. Amendment 18 adds Article 53(j), which provides that "in accordance with Article 53(a)" of the Monterey Amendments, Castaic's Table A annual entitlements were increased by 41,000 acre-feet. AR 2545-47. DWR and KCWA, which consented to the transfer of its water, also entered into Amendment 28 to KCWA's SWP contract, an amendment which reduced KCWA's entitlement by 41,000 acre-feet. Based on these amendments, DWR has allocated SWP water to Castaic since 1999 based on a total Table A amount of 95,000 acre-feet -- Castaic's original Table A 54,000 acre-feet plus the 41,000 acre-feet from the Kern water transfer.

On March 29, 1999, Castaic, acting as lead agency, certified an EIR for the Kern water transfer. This 1999 EIR tiered off the 1995 Monterey Amendment program EIR, the Belridge EIR, and Castaic's own 1988 EIR for the Capital Program. In April 1999, Castaic's EIR for the Kern water transfer was challenged in Friends of the Santa Clara River v. Castaic Lake Water Agency, BS056954 ("Friends"). On August 16, 2000, the trial court entered judgment, denying the petition in its entirety.

4. The PCL and Friends Decisions

In September 2000, the Third Appellate District in PCL found that DWR was the only entity with the "statewide perspective and expertise" to serve as lead agency for the Monterey Agreement program EIR. Because "the allocation of water to one part of the state has potential implications for distribution throughout the system," the court recognized DWR's principal responsibility to "facilitate the water transfers allowed under the Monterey Agreement." 83 Cal.App.4th at 907. The use of Central as lead agency for the Monterey Agreement program EIR was inappropriate. Id. at 907.

This lead agency error was not harmless because the EIR also was defective. Perhaps as a consequence of Central's lack of statewide expertise, the EIR failed to properly discuss a "no project" alternative, including the environmental impact of implementing the pre-Monterey Agreement Article 18(b)'s permanent water shortage provision. Id. at 918. This was particularly important because local land use planners rely on the "paper water" entitlements in Table A

41845.

Pursuant to the Capital Program, Castaic permanently acquired 12,700 acre-feet of SWP Table A water in 1991 from Devil's Den Water District, a SWP contractor immediately north of Castaic. This transfer was subject to DWR approval, which per Article 41 of the SWP contracts could not be unreasonably withheld. DWR approved the transfer, noting that the transferred water remained labeled for "agricultural purposes" for purposes of delivery shortages.

Also pursuant to the Capital Program, in 2002 Castaic entered into a groundwater storage or "banking" agreement with Semitropic. This action was challenged under CEQA on the basis that the Monterey Agreement required DWR to conduct an environmental review. The challenge was rejected by the appellate court, which held that DWR had no jurisdiction over Castaic's management of water; DWR merely schedules SWP water delivery to Castaic. Cal. Water Network v. Castaic Lake Water Agency, (2006) 206 Cal.App. Unpub. LEXIS 2452, 9.

rather than real, deliverable water. The question was what impacts were reasonably foreseeable from eliminating Article 18(b)'s solution to permanent water shortage? Id. at 914-15. The PCL court held that the EIR, which lacked simulation models and projections relating to land use planning and demand for water, did not adequately address this issue. Id. at 919. It directed the Sacramento Superior Court to retain jurisdiction over the action until a new EIR was prepared and certified.

Based on the Third District's PCL decision, on January 10, 2002, the Second Appellate District reversed the judgment in Friends and directed the trial court to issue a writ of mandate compelling Castaic to set aside certification of its EIR. Friends, (2002) 95 Cal.App.4th 1373. The reversal was based solely on the fact that Castaic's EIR had been tiered upon the now inadequate Monterey Agreement program EIR. The Second District rejected all of the other challenges to Castaic's EIR, finding them to be without merit. The appellate court noted that Castaic may be able to cure the defect by waiting for DWR to comply with the Third District's directive in PCL by preparing a new program EIR. Castaic could issue a subsequent EIR, a supplement to EIR, or addendum to EIR, tiering upon the new Monterey Agreement EIR.

The Friends appellate decision concluded as follows: "The judgment is reversed. The trial court shall issue a writ of mandate vacating the certification of the EIR, shall retain jurisdiction until Respondent certifies an EIR complying with CEQA consistent with the views expressed in this opinion, and shall consider such orders it deems appropriate under [Pub. Resources Code] section 21168.9."

On October 25, 2002, after remand from the court of appeal, the Friends trial court issued a Peremptory Writ of Mandate and Judgment on Remand, retaining jurisdiction until Castaic certifies an EIR that complies with CEQA and is consistent with the views expressed by the Second District. The trial court did not direct Castaic to set aside its approval of the Kern water transfer and denied the petitioner's request to enjoin Castaic from using any of the 41,000 acre feet of additional water allotted to it by the Kern water transfer. The trial court did state that the injunction request could be renewed upon a showing that the water was actually used for an improper purpose (irreversible new development).

5. Monterey Plus

On June 6, 2003, the Sacramento Superior Court approved a settlement between the parties in PCL. That settlement, known as "Monterey Plus," provides that the Monterey Agreement can proceed on an interim basis. In exchange, DWR agreed, among other things,[7] to prepare a new program EIR for implementation of the Monterey Agreement. This new EIR would include (1) information on water deliveries during the drought and recent historical period, (2) an analysis of a no project alternative, including the environmental impact of Article 18's water shortage provisions, (3) analysis of environmental impacts from changes in SWP operations and deliveries resulting from implementation of the Monterey Agreement, (4) analysis

[7]Some of the other provisions include biennial reports on project reliability, land use restrictions on the Kern Water Bank, new guidelines for permanent water transfers, new procedures for public involvement in contract changes, and funding for watershed restoration and new technical studies. AR 45048-49.

of environmental impacts of seven already completed water transfers from KWCA and member units totaling 70,000 acre-feet (Attachment E), which the parties recognized were "final," and of the Kern water transfer, which the parties acknowledged was being challenged in the pending Friends litigation in Los Angeles Superior Court, and (5) analysis of the environmental impacts from implementation of Monterey Plus. AR 48557-59. With respect to the Kern water transfer, the Monterey Plus parties agreed that "jurisdiction with respect to [Friends] should remain in that court and that nothing in this Settlement Agreement is intended to predispose the remedies or other actions that may occur in that pending litigation." The Monterey Plus did not require DWR to re-approve or disapprove any transfer.

6. The Friends II Decision

The Second District upheld the Friends trial court's decision not to grant injunctive relief for the Kern water transfer on December 1, 2003, in unpublished case no. B164027 ("Friends II"). PCL had filed an *amicus* brief supporting the petitioner in Friends II, pointing out that the Monterey Plus settlement now existed and arguing that the Friends decision required the trial court to rely on the status of PCL litigation, including the new Monterey Agreement program EIR DWR was to prepare, in deciding injunctive relief. The Friends II appellate court stated that PCL was wrong; it merely had suggested, not required, that the trial court could determine and rely on the status of the PCL case in deciding injunctive relief.

7. The 2004 EIR

After Friends, Castaic decided to prepare a revised EIR prior to DWR's preparation of a Monterey Amendment EIR. Castaic was driven by a concern that the Friends petitioner and others would use the decertification of its 1999 EIR to cloud its right to the transferred water, as well as Castaic's duty to its customers to complete the environmental documentation and finalize the Kern water transfer.

In June 2004, Castaic prepared and circulated a draft EIR that tiered only on Castaic's 1988 Capital Program EIR. Castaic concluded that it was the lead agency because it has the principal responsiblility for carrying out and implementing the project. Because the transfer is between neighboring SWP contractors, involving the withdrawal of water from a single branch of the Aqueduct, Castaic concluded that the transfer has no significant impacts on SWP operations or the water diverted from the Delta. *See* AR 13-14.

PCL served comments to the draft EIR on August 16, 2004. These comments criticized the use of Castaic as lead agency, arguing that Castaic's review was "premature" and "likely to operate at cross-purposes with DWR's statewide review." AR 1959. PCL contended that DWR, not Castaic, was required to be the lead agency under the PCL decision. Only DWR's expertise could analyze the changes in the amount of supplies available, the location and timing of deliveries, and changes in the SWP's conveyance and storage facilities for all of the proposed transfers, including the Kern water transfer. AR 1962. CWIN also timely expressed concern about Castaic's lack of authority to act as lead agency, and the potential for conflict with DWR's role. AR 578-580.

DWR, acting as a responsible agency under CEQA, commented on the draft EIR. It stated that the "document adequately and thoroughly discusses the proposed project and its

impacts. The [draft]EIR discusses the effects of the project on the environment and State Water Project (SW) and uses baseline conditions consistent with those being considered for inclusion in [DWR's EIR]. The draft also "adequately discusses the reliability of the SWP, pre- and post-Monterey Amendment conditions, future conditions, and SWP operations." DWR acknowledged that Castaic's EIR uses a model, DWRSIM, to assess the potential impact associated with the Kern transfer and that DWR's EIR will use a newer model, CALSIM II. DWR indicated that the use of a different computer model may cause slight changes in results, which may lead DWR to different conclusions than those made by Castaic in its EIR. Despite this fact, DWR concluded that the draft EIR adequately discusses the reliability of SWP, pre- and post- Monterey Amendments conditions, future conditions, and SWP operations. AR 564-65.

Castaic rejected Petitioners' concerns, and relied on DWR's comments to refute objections that its draft EIR will be inconsistent with the yet to be prepared DWR program EIR. AR 961-4. Castaic adopted findings, a mitigation monitoring program and statement of overriding considerations and certified a final EIR (the 2004 EIR).[8] The 2004 EIR describes Castaic's water program for the future needs of Santa Clarita Valley, the procedural history of the project (including the 1999 EIR), and the fact that the Kern water transfer has been implemented and ongoing since 1999. It uses two separate baselines for the project setting and evaluates environmental impacts of the Kern water transfer on the SWP, Castaic, and Wheeler Ridge. In discussing these impacts, the 2004 EIR considers three SWP scenarios: (a) with the Monterey Agreement, (b) without the Monterey Agreement, and (c) without the Monterey Agreement and with Article 18(b) permanent shortages. The EIR uses the DWRSIM model and concludes no significant direct environmental impacts will occur as a result of the project. There would, however, be indirect growth impacts as a result of water provided by the project.

8. The Petitioners Take Over from the Friends Petitioner

On January 24, 2005, CWIN and PCL filed separate petitions for writ of mandate in Ventura County concerning Castaic's compliance with CEQA in the 2004 EIR, and other issues.

On February 1, 2005, the Friends petitioner dismissed the action with prejudice. On February 7, 2005, the trial court in Friends held a hearing on Castaic's *ex parte* application to vacate the dismissal with prejudice and to discharge the writ of mandate. Castaic argued that, by dismissing, the petitioner was attempting to get the clerk, through ministerial act, to divest the court of its continuing jurisdiction over the 2004 EIR prepared in response to the court's peremptory writ of mandate. Instead, the Friends petitioner was passing the baton to CWIN and PCL for a challenge to the 2004 EIR. The trial court declined to set aside the dismissal, stating that whether the Ventura proceedings were a continuation of the Friends lawsuit was an issue of fact for the Ventura (now this) court.

On March 5, 2005, Castaic petitioned the Second Appellate District for a writ of mandate with respect to the trial court's refusal to vacate the dismissal, arguing that the trial court violated Pub. Resources Code section 21168.9 (stating that the trial court shall maintain jurisdiction over the agency's proceedings until the court has determined that the agency has complied with

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[8]On December 30, 2004, Castaic filed its return to the peremptory writ of mandate in Friends.

CEQA) because it had not yet determined that the 2004 EIR complied with CEQA Yet, under CEQA, a trial court that orders preparation of a new EIR must retain jurisdiction for a final determination of the EIR's validity.

On April 14, 2005, the Second Appellate District denied Castaic's petition for "failure to demonstrate that the 'retain jurisdiction' provision of Public Resources Code section 21168.9, subdivision (b), abrogates the entitlement to voluntary dismissal conferred by Code of Civil Procedure section 581, subdivision (b)(1)."[9]

D. CEQA

1. Standard of Review

A party may seek to set aside an agency decision for failure to comply with CEQA by petitioning for either a writ of administrative mandamus (CCP §1094.5) or of traditional mandamus. CCP §1085. A petition for administrative mandamus is appropriate when the party seeks review of a "determination, finding, or decision of a public agency, made as a result of a proceeding in which by law a hearing is required to be given, evidence is required to be taken and discretion in the determination of facts is vested in a public agency, on the grounds of noncompliance with [CEQA]." Pub. Res. Code §21168. This is generally referred to as an "adjudicatory" or "quasi-judicial" decision. Western States Petroleum Assn. v. Superior Court, ("Western States") (1995) 9 Cal.4th 559, 566-67. A petition for traditional mandamus is appropriate in all other actions "to attack, review, set aside, void or annul a determination, finding, or decision of a public agency on the grounds of noncompliance with [CEQA]." Where an agency is exercising a quasi-legislative function, such as by adopting a rule or entering into a contract, it is properly viewed as a petition for traditional mandamus. Id. at 567; Pub. Res. Code §21168.5.

At issue here is a CEQA challenge to a quasi-legislative action recorded by Castaic in a December 23, 2004 Notice of Determination approving the project, certifying the 2004 EIR, and adopting findings, a mitigation monitoring program, and a statement of overriding considerations. This procedural setting, where no administrative hearing was held or required, is governed by traditional mandamus. In determining whether to grant a petition for traditional mandamus in a CEQA case, the court may consider only whether there was a prejudicial abuse of discretion. Public entities abuse their discretion under CEQA if the agency has not proceeded in a manner required by law or if its determination or decision is not supported by substantial evidence. Western States, 9 Cal.4th at 568; Pub. Res. Code §21168.5.[10]

This requires "scrutiny of the alleged defect" depending on whether the claim is predominately "improper procedure or dispute over the facts." Vineyard Area Citizens for

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[9]The Second District later dismissed Castaic's appeal from the Friends dismissal, finding that the voluntary dismissal was not appealable. *See* H.D. Arnaiz, Ltd. v. County of San Joaquin, (2002) 96 Cal.App.4th 1357, 1364-67.

[10]The standard of review for traditional mandamus in a non-CEQA case is governed by an "arbitrary and capricious" standard, not a "prejudicial abuse of discretion" standard. The CEQA standard is the more stringent inquiry. Western States, 9 Cal.4th at 574.

Responsible Growth v. City of Rancho Cordova, ("Vineyard") (2007) 40 Cal.4th 412, 435. Whether Castaic is the proper lead agency is an procedural issue of law for the court. PCL, 83 Cal.App.4th at 905-06. Similarly, as Petitioners argue (Pet. Supp. Resp. Br. at 5), whether Castaic's 2004 EIR failed to provide certain required information and, as a result, presents uncertainties about the finality of the Kern water transfer is failing "to proceed in a manner required by CEQA" and an issue of law. Vineyard, 40 Cal.4th at 435. These issues require "a critical consideration, in a factual context, of legal principles and their underlying values." Harustak v. Wilkins, (2000) 84 Cal.App.4th 208, 212.

On the other hand, whether Castaic abused its discretion in the 2004 EIR's findings must be answered with reference to the evidence in the administrative record. This standard requires deference to the agency's factual and environmental conclusions based on conflicting evidence, but not to issues of law. Laurel Heights Improvement Assn. v. Regents of University of California, ("Laurel Heights") (1988) 47 Cal.3d 376, 393, 409. Argument, speculation, and unsubstantiated opinion or narrative will not suffice.[11] Guidelines, 15384(a), (b). The findings must be supported by "substantial evidence," defined as "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached. CEQA Guidelines §15384(a). The question whether substantial evidence exists is a question of law. *See* California School Employees Association v. DMV, (1988) 203 Cal.App.3d 634, 644.

2. CEQA

The purpose of CEQA (Pub. Res. Code §21000 *et seq.*) is to maintain a quality environment for the people of California both now and in the future. Pub. Res. Code §21000(a). "[T]he overriding purpose of CEQA is to ensure that agencies regulating activities that may affect the quality of the environment give primary consideration to preventing environmental damage." Save Our Peninsula Committee v. Montery County Board of Supervisors, (2001) 87 Cal.App.4th 99, 117. CEQA must be interpreted "so as to afford the fullest, broadest protection to the environment within reasonable scope of the statutory language." Friends of Mammoth v. Board of Supervisors, (1972) 8 Cal.3d 247, 259. Public agencies must regulate both public and private projects so that "major consideration is given to preventing environmental damage, while providing a decent home and satisfying living environment for every Californian." Pub. Res. Code §21000(g).

The Legislature chose to accomplish its environmental goals through public environmental review processes designed to assist agencies in identifying and disclosing both environmental effects and feasible alternatives and mitigations. Pub. Res. Code §21002.

Under CEQA, a "project" is defined as any activity which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment (1) undertaken directly by any public agency, (2) supported through contracts, grants, subsidies, loans or other public assistance, or (3) involving the issuance of a lease, permit,

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[11] As an aid to carrying out the statute, the State Resources Agency has issued regulations called "Guidelines for the California Environmental Quality Act ("Guidelines"), contained in Code of Regulations, Title 14, Division 6, Chapter 3, beginning at section 15000.

license, certificate, or other entitlement for use by a public agency. Pub. Res. Code §21065. The word "may" in this context means a reasonable possibility. Citizen Action to Serve All Students v. Thornley, (1990) 222 Cal.App.3d 748, 753. "Environment" means the physical conditions which exist within the area which will be affected by a proposed project, including land, air, water, minerals, flora, fauna, noise, objects of historic or aesthetic significance. Guidelines, §21060.5.

The "project" is the whole of the action, not simply its constituent parts, which has the potential for resulting in either direct or reasonably foreseeable indirect physical change in the environment. Guidelines §15378. An indirect physical change must be considered if that change is a reasonably foreseeable impact which may be caused by the project. On the other hand, a change that is "speculative or unlikely to occur is not reasonably foreseeable." Guidelines §15064(d)(3). The term "project" may include several discretionary approvals by government agencies; it does not mean each separate government approval. Guidelines §15378(c).

The EIR is the "heart" of CEQA, providing agencies with in-depth review of projects with potentially significant environmental effects. Laurel Heights, 6 Cal.4th at 1123. An EIR describes the project and its environmental setting, identifies the potential environmental impacts of the project, and identifies and analyzes mitigation measures and alternatives that may reduce significant environmental impacts. Id. Using the EIR's objective analysis, agencies "shall mitigate or avoid the significant effects on the environment... whenever it is feasible to do so. Pub. Res. Code §21002.1. The EIR serves to "demonstrate to an apprehensive citizenry that the agency has in fact analyzed and considered the ecological implications of its actions." No Oil, Inc. v. City of Los Angeles, (1974) 13 Cal.3d 68, 86. It is not required to be perfect, merely that it be a good faith effort at full disclosure. Kings County Farm Bureau v. City of hanford, (1990) 221 Cal.App.3d 692, 711-12. A reviewing court passes only on its sufficiency as an informational document and not the correctness of its environmental conclusions. Laurel Heights, 47 Cal.3d at 392. An EIR will be upheld if it suffices as an informational document; mandate will issue only if it fails to include relevant information which precludes informed decision-making and informed public participation.

"Choosing the precise time for CEQA compliance involves a balancing of factors. EIRs... should be prepared as early as feasible in the planning process to enable environmental considerations to influence project program and design and yet late enough to provide meaningful information for environmental assessment." Guidelines, §15004(b). As a general rule, public agencies shall not undertake actions concerning a proposed project that would have a significant adverse effect or limit the choice of alternatives or mitigation measures before completion of CEQA compliance. Guidelines, §15004(b)(2). "[I]n order to achieve the salutary objectives of CEQA the determination of the earliest feasible time to [prepare the CEQA document] is to be made initially by the agency itself, which decision must be respected in the absence of manifest abuse." Mount Sutro Defense Committee v. Regents of University of California, (1978) 77 Cal.App.3d 20, 36, 40.

E. Analysis

CWIN and PCL argue that DWR is required to be the lead agency for the Monterey Amendments project EIR, which will examine all water transfers on a program level. The Kern

water transfer is part of the Monterey Amendments project. Therefore, DWR is the correct lead agency to conduct the environmental review of the Kern water transfer. According to Petitioners, while Castaic may not serve as the lead agency for "first-level" environmental review of the water transfer, it may serve as lead agency for a project level EIR for the Kern water transfer.

1. Validity of the Transfer

At the outset, the court must make clear an issue greatly discussed at hearing. Petitioners contend, and Castaic and Wheeler Ridge strongly dispute, that DWR may "invalidate" the Kern water transfer when it performs the program EIR.

Under contract and validation law, the Kern water transfer contract, entered into in 1999, is valid, has been approved by DWR, and Castaic has paid Wheeler Ridge for it. Neither the parties nor DWR can terminate the Kern transfer contract. Nothing in CEQA permits a public agency to void a contract.

In Kenneth Mebane Ranches v. Superior Court, (1992) 10 Cal.App.4th 276, a flood control district sought to condemn land outside its territory in order to mitigate the environmental impact of a project within its boundaries. The appellate court held that CEQA only requires mitigation of environmental impacts where it is feasible to do so. Where mitigation is infeasible, an agency can always approve a project notwithstanding environmental impacts if it issues a statement of overriding interests. But it cannot take actions that are not legal, and hence infeasible. 10 Cal.App. at 291-92.

Thus, in evaluating the environmental effects of the Monterey Agreement, DWR may impose mitigations that are legal. But it cannot invalidate the Kern transfer. The imposition of illegal mitigations would be infeasible. *See also* Pub. Res. Code §21004 (in mitigating significant environmental impact, agency may only employ powers provided by law).[12]

This does not mean that DWR's Monterey Amendments EIR cannot affect the Kern water transfer. DWR's EIR will consider the environmental impacts of the Kern water transfer in conjunction with the Attachment E transfers which the parties in Monterey Plus agreed were completed and final. DWR conceivably could conclude that these transfers have significant environmental impacts. As a consequence, DWR might have to impose feasible mitigation measures, adopt alternatives, or make a finding of infeasibility and adopt a statement of overriding considerations.[13] If mitigations/alternatives are adopted, they could significantly impact Castaic and Wheeler Ridge. As DWR states, "the contract amendments that effectuated the transfers under the Monterey Amendment[s] do not preclude DWR in its choice of

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[12]The parties disagree on whether the Monterey Amendments are valid and final. That is, they disagree on whether the amendments can be challenged in a reverse validation action separate and apart from CEQA. Resolution of this issue is unnecessary to the court's decision.

[13]At hearing, Petitioners' counsel stated that the parties to Monterey Agreement entered into a joint statement of the possible impacts from the Amendments, citing AR 48628-29. The joint statement at those pages of the record does not discuss possible mitigations; it merely summarizes the terms of Monterey Plus.

alternatives in the Monterey Amendment[s] EIR or mitigation measures that may need to be imposed to reduce significant impacts to less than significant." DWR Br. at 20. DWR gives an example of reducing the amount of SWP water to protect water quality standards for fish in the Delta. Id. at 20. These mitigations could undermine the Kern water transfer.[14] But DWR will not be considering whether the Kern water transfer is valid; it simply does not have the authority to void that transfer. *See* Kenneth Mebane Ranches v. Superior Court, (1994) 10 Cal.App.4th 276, 292.

2. Lead Agency Law

The lead agency under CEQA is the agency that carries out a project or has primary authority for approving a project. Pub. Res. Code 121067; Guidelines §15051; *see* PCL, 83 Cal.App.4th at 904 (DWR, not Central (a State Water Contractor), had principal responsibility for carrying out the Monterey Agreement and should have been lead agency for program EIR). The role and responsibility of the lead agency is "fundamental to the CEQA process as a whole." Guidelines §15050. The identification of the proper lead agency plays a "crucial role" in the division of responsibilities among public agencies reviewing a project. PCL, 83 Cal.App.4th at 903. When determining the appropriate lead agency, the courts look to determine which agency has principal responsibility for the core project activity. Friends of Cuyamaca Valley v. Lake Cuyamaca, (1994) 28 Cal.App.4th 419, 427. The lead agency responsibility is placed upon the agency with power to approve or disapprove the project. Lexington Hills v. State of California, (1988) 200 Cal.App.3d 415, 433. Though one agency has substantial responsibility for a project, it cannot act as lead agency if another agency bears final responsibility. *See* Fullerton Joint Union High School District v. Board of Education, (1982) 32 Cal.3d 779, 795, n.15 (State Board of Education, not county, had final responsibility for school district plan). Where the project is local, such as land use decisions, the agency that has general governmental power over a project is almost always the lead agency. Where two or more agencies are involved in a project, the agency that will carry out the project shall be the lead agency. Guidelines §15051(a).

3. The Impact of the PCL Decision

Petitioners contend that the PCL decision left no doubt that DWR is the appropriate lead agency for a program-level environmental review of the water transfers in the Monterey Agreement, contrasting DWR's statewide expertise with CCWA's "provincial experience." The Monterey Amendments restructure water distribution throughout the state, and the "allocation of water to one part of the state has potential implications for distribution throughout the system." Only DWR has principal responsibility for implementation of the Monterey Amendments. Op. Br. at 11-12; *see* PCL, 83 Cal.App.4th at 904, 908. Since the Kern water transfer is part of the Monterey Amendments, DWR must perform any EIR concerning the Kern water transfer.

Petitioners' argument is a *non-sequitur*. Nothing in PCL requires DWR to perform the environmental review for the Kern water transfer. Certainly, the PCL decision requires that DWR prepare the program EIR for the Monterey Amendments, now Monterey Plus. The

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[14]The close cooperation between DWR and Castaic on the 2004 EIR reduces, but does not eliminate, the prospect that DWR will impose alternatives or mitigations.

appellate court's reason for committing this task to DWR is that CEQA requires the lead agency to be the agency with principal responsibility for the project, the project is the environmental review of the Monterey Agreement, and DWR, not CCWA, has principal responsibility for implementing the Monterey Agreement. The decision pointed out that DWR manages the SWP, and has the statewide expertise and perspective to conduct the environmental review of the Monterey Agreement, which statewide project. While CCWA may have had a substantial stake in seeing the Monterey Agreement implemented, it did not have principal responsibility for it. DWR did, and DWR is required to perform the EIR for the Monterey Agreement. 83 Cal.App.4th at 906.

However, the PCL decision does not commit DWR to conduct the EIR for the Kern water transfer, or for any site specific project conducted pursuant to the Monterey Amendments. The PCL decision plainly requires DWR to prepare the program EIR for the Monterey Amendments, and its permanent transfer of 130,000 acre feet of SWP water. But it does not even mention the Kern water transfer, which is a local water transfer of Wheeler Ridge water to a point 60 miles further south in Santa Clarita Valley. The local nature of the project makes Castaic the logical choice to act as lead agency of this transfer, and nothing in PCL requires Castaic to wait for DWR's program EIR. The Kern water transfer is simply a different project from the Monterey Amendments.

Petitioners' concession that at some point Castaic can and should act as the lead agency for the Kern water transfer EIR undermines their argument that PCL committed this task to DWR. The concession shows that Petitioners really are concerned about the timing of this project specific EIR, and not whether it was committed to DWR in the PCL decision. Petitioners contend that Castaic must wait for DWR's Monterey Amendments program EIR and tier off of it for the Kern water transfer EIR. This argument is, as Castaic describes it, that Castaic "jumped the gun" by preparing the 2004 EIR. But the argument implicitly concedes that PCL did not commit the transfer EIR to DWR.

4. The Agency with Principal Responsibility

Even if PCL did not commit environmental review of the Kern water transfer to DWR, Petitioners argue that the Kern water transfer is an integral part of the Monterey Amendments project. This is shown by Monterey Plus, which excludes the Kern water transfer from the list of transfers designated as "final" and recognizes DWR's responsibility to assess its environmental impacts as part of the programmatic review. The Kern water transfer contract itself expressly relies on the Monterey Amendments, using its provisions as authority to accomplish the Kern water transfer. Even Wheeler Ridge's amendment to its SWP contract identifies the outcome of PCL as a factor that could impact the Kern water transfer's effectiveness. All of these facts, Petitioners argue, mean that the transfer is part of the Monterey Amendments environmental review.

Petitioners further argue that the nature of a program EIR supports their position. This purpose "is to document a series of actions so related they can be characterized as one project." Friends, 95 Cal.App.4th at 1377. The Monterey Amendments, including its transfer provisions, qualify as a "series of actions so related that they can be characterized as one project." An integrated review of the entire program may provide occasion for a more exhaustive

consideration of effects and alternatives than would be practical in an EIR on an individual action, ensure consideration of cumulative actions that might be slighted on a case-by-case analysis, avoid duplicative reconsideration of basic policy considerations, and allow the lead agency to consider broad policy alternatives and program-wide mitigation measures at an early time when the agency has greater flexibility to deal with basis problems or cumulative impacts. Id. at 1377. These factors are all borne out by the 2004 EIR, which presents a series of issues (the amount of supplies available to several water agencies, the location and timing of SWP deliveries, and use of SWP conveyance and storage facilities) on which DWR has superior expertise and greater accountability than Castaic. DWR may not delegate to Castaic its responsibility to prepare the environmental review for the Kern water transfer.

Under lead agency law, Castaic may act as lead agency and prepare an EIR for the Kern water transfer. The Kern water transfer is a project separate in time from the Monterey Amendments, now Monterey Plus. The core of the project is a local transfer of water between Castaic and Wheeler Ridge. Castiac alone had the responsibility to determine the water needs of its service area and to obtain the necessary water for those needs. Castaic negotiated and entered into the transfer contract with Wheeler Ridge. Castaic performed the contract by obtaining private investors who paid $47 million to Wheeler Ridge's water, and by taking delivery from DWR. The transfer is valid and cannot be challenged. Thus, Castaic has the general governmental power over the transfer, and is presumptively the lead agency for its own project. Bakman v. Dept. of Transportation, (1979) 99 Cal.App.3d 665, 678-79. Indeed, the environmental review of water transfers is generally performed by a local, not state, agency. County of Amador v. El Dorado County Water Agency, (1999) 76 Cal.App.4th 931 (local agency's analysis of water transfer project); Save Our Carmel River v. Monterey Peninsula Water Management District, (2006) 141 Cal.App.4th 677, 701 (city was lead agency as recipient of water transfer); Friends of the Eel River v. Sonoma County Water Agency, (2003) 108 Cal.Appp.4th 859 (local agency's EIR for plan to increase diversions of water from river); Sierra Club v. West Side Irrigation District, (2005) 128 Cal.App.4th 690 (local agency's environmental review of two projects to transfer water rights).[15]

It is true that DWR has an overall interest in promoting effective water management on a statewide basis. Pursuant to this interest, DWR had the right to approve the Kern water transfer, and it did so. This does not equate to principal responsibility, however. DWR is required by statute to "facilitate" the voluntary transfer of water between local agencies. Water Code §109.

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[15]The Friends court implicitly decided that Castaic may act as lead agency for the Kern water transfer. The Friends court acknowledged that it was required to address all deficiencies in the EIR unless it made a finding of improper lead agency. Pub. Res. Code §21005(c). If Castaic was the improper lead agency for the 1999 EIR, the appellate court was obligated to say so. The Friends court concluded that the 1999 EIR's only deficiency was that it tiered from the defective Monterey Agreement program EIR. Thus, the decision necessarily implied that Castaic was the proper lead agency for the 1999 EIR.

Of course, this case concerns the 2004 EIR, not the 1999 EIR, and the court previously held that Petitioners were not bound by the Friends court's implied determination. But the project is the same, and the implicit appellate determination is entitled to weight.

Per the SWP contracts, DWR's approval of the Kern water transfer could not be unreasonably withheld. Thus, DWR's involvement in the transfer is to facilitate the transfer by approving it and providing the SWP schedule delivery. Moreover, the SWP is intended as a supplement, not the exclusive supply, of water. Water supply decisions must be made by local Water Contractors, who obtain water both from SWP and other sources.[16]

Given that the decision to enter into the Kern water transfer belonged solely to Castaic and Wheeler-Ridge, and that DWR's approval is necessary merely to facilitate the transfer, Casataic had principal responsibility for the transfer.[17]

5. Project Definition

Petitioners contend for the first time in their Supplemental Vineyard Reply and at oral argument that the correct project definition is not the Kern water transfer, but is really the Monterey Amendments, citing the court's earlier ruling on Castaic's motion for legal determination that the key issue is whether the Amendments are a "series of actions (including the Kern water transfer) so related that they should be characterized as a single project." Pet. Supp. Reply at 5.

The correct definition of the project -- whether it is the Monterey Amendments or the Kern water transfer -- is a different issue than whether Castaic can act as lead agency for the project. Although the court did allude to project definition in ruling on the earlier motion, Petitioners never raised this issue in their opening brief or reply. Instead, they raise it for the first time in a reply brief on the application of Vineyard to this case. On appeal, an issue raised without analysis or authority lacks foundation and need not be addressed. City of Arcadia v. State Water Resources Control Board, ("Arcadia") (2006) 135 Cal.App.4th 1392, 1429, 1431. Similarly, an issue raised for the first time in supplemental reply deprives the opposing party of an opportunity to analyzing the issue and defend their position. Petitioners have waived the correct project definition as an issue by not raising it earlier.

Assuming *arguendo* that the issue has not been waived, a project under CEQA includes an activity directly undertaken by a public agency which may cause either a direct physical change in the environment, or a reasonably foreseeable indirect physical change in the environment. Pub. Res. Code §21065(a). The "project" must be broadly defined, so as to ensure against avoiding environmental review by "chopping a larger project into little ones" or "piecemealing." Bozung v. Local Agency Formation Commission, (1975) 13 Cal.3d 263, 283-84. The project includes "the whole of an action" that has a potential for resulting in a direct or indirect physical change in the environment. Guidelines §15378. An accurate project description is necessary for an intelligent evaluation of the potential environmental effects of a

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[16]As Wheeler Ridge points out, DWR was not the lead agency for the 1991 Devils Den transfer or any of the Attachment E transfers listed in the Monterey Agreement.

[17]Given that DWR's approval may not be unreasonably withheld, cases holding that a state agency should prepare the EIR where it has final authority to approve a project are simply inapposite. *See* Fullerton v. State Board of Education, (1982) 32 Cal.3d 779, 795, n.15 (State Board of Education had final authority to submit plan to voters for new unified school district).

proposed activity. Mcqueen v. Board of Directors, (1988) 202 cal.App.3d 1136, 1143. The agency must avoid "piecemealing" or splitting a project into two or more segments. Otherwise, the cumulative environmental impacts of each piece may not be fairly analyzed. Burbank-Glendale-Pasadena Airport Authority v Hensler, (1991) 233 Cal.App.3d 577, 592. On the other hand, CEQA was not intended to and cannot reasonably be construed to make a project of every activity of a public agency, regardless of the nature and objective of such activity...." Simi Valley Recreation & Park District v. Local Agency Formation Commission, (1975) 51 Cal.App.3d 648, 663.

In San Joaquin Raptor/Wildlife Rescue Center v. County of Stanislaus, (1994) 27 Cal.App.4th 713, 731-32, the court held that the project description in an EIR was improperly restricted to a 633 single family residential units, a 40,500 square foot commercial center, and a 14 acre park, failing to include sewer expansion which the EIR acknowledged would be required as part of the development. Although a separate EIR was prepared for the sewer expansion, neither it nor the development project EIR referred to the growth-inducing effects of the two projects considered together. This failure to address cumulative impacts was a separate failure of the development EIR. 27 Cal.App.4h at 733. "[t]he danger of filing separate environmental documents for the same project is that considration of the cumulative impact on the environment of the two halves of the project may not occur. This danger was here realized." Id. at 734 (citation omitted). Because the EIR did not "adequately apprise all interested parties of the true scope of the project for intelligent weighing of the environmental consequences of the project" informed decision-making was precluded, the EIR was inadequate. Id.

The lesson from San Joaquin and other project definition cases is that the project should be defined broadly to ensure a complete analysis of impacts resulting from future expansion or continuation of other phases of the project.

In this case, DWR is the lead agency for the Monterey Amendments program EIR. DWR's description of its project is to improve the management of SWP supplies and operations through the Monterey Amendments. Thus, the Monterey Amendments EIR is broad in scope. The EIR will look at changing the allocation of all SWP water supplies (including deletion of agriculture first shortage provisions), retiring 45,000 acre feet of agricultural water, and establishing more efficient use of SWP facilities. As part of the analysis, it will analyze the potential impacts from permanently transferring 130,000 acre feet of water from agricultural to urban contractors per the Monterey Agreement. This analysis will look at the individual transfers, including the Kern water transfer, as they fit the entire Monterey Amendments. But DWR does not intend to consider each transfer individually; it intends to evaluate the impact of all the Attachment E transfers and the Kern water transfer as a whole. DWR Br. at 17.

Castaic's 2004 EIR project description concerns the impacts of the Kern water transfer alone. Castaic's EIR does look at cumulative impacts of the project with other projects, including the Monterey Amendments, but does not purport to assess the environmental impacts of the Monterey Amendments independent of the Kern water transfer. AR 141-42.

Castaic relies on the independent utility test to argue that the Kern water transfer is a separate project the environmental impact of which may be separately analyzed from the Monterey Amendments. The "independent utility" test has been developed in NEPA cases to determine whether multiple actions are connected so as to require an agency to consider them in

a single environmental review. Wetlands Action Network v. United Sates Army Corps. Engineers, (9th Cir. 2000) 222 F.3d 1105, 1118.[18] Pursuant to the independent utility test, where each of two projects would have taken place with or without the other, each has "independent utility" and the two are not considered so connected that an agency must consider them in a single environmental review. Native Ecosystems Council v. Dombeck, (9th Cir. 2002) 304 F.3d 886, 894. *See also* DelMar Terrace Conservancy, Inc. v. City Council of the City of San Diego, (1992) 10 Cal.App.4th 712 (freeway segment was separate project serving a viable purpose even if long-term, multi-segment plan to expand freeway never occurred, and had independent utility under CEQA).

Castaic argues that it has contemplated the Kern water transfer since 1988, when it included a transfer with Kern in its 1988 Capital Program for the Santa Clarita Valley's future water needs. For economic reasons, Wheeler Ridge, too, sought to transfer its SWP water rights since approximately 1985. Castaic concludes that the Kern water transfer would have occurred with or without the Monterey Amendments. Articles 40 and 41 of the SWP contract permitted transfers between Water Contractors, subject to DWR approval. Article 53, added to the SWP contracts by the Monterey Amendments and concerning the transfer of 130,000 acre-feet, did not "enlarge, restrict, or otherwise impact" Castaic's right to acquire water from Wheeler Ridge under Articles 40 and 41. Instead, it was merely a blanket approval of certain contemplated transfers. Castaic Op. Br. at 21. The Kern water transfer was completed, paid for, and operating since 1999. Nothing about it is tied to the outcome of the Monterey Amendments. Thus, while the transfer is part of a larger scheme (the Monterey Amendments), it is a long-planned site specific project with independent utility from the Monterey Amendments.

The court cannot conclude that the Kern water transfer would have taken place without the Monterey Amendments. True, Castaic has wanted Wheeler Ridge's SWP allocation of water since the late 1980's, and Wheeler Ridge was willing to provide it. Yet, it did not happen until after the Monterey Amendments. The contract between Castaic and Wheeler Ridge states that the transfer was taking place "in accordance with" Article 53 of the Monterey Amendments, and those Amendments change the way SWP water is allocated in California. It does not say that the transfer is being made under Article 41. Petitioners contend, and the court agrees, that only through conjecture can one conclude that Castaic and Wheeler Ridge would have entered into the transfer without the Monterey Amendments, and with Article 18's agriculture first provisions in place.[19]

Though the court cannot conclude that the Kern water transfer would have occurred without the Monterey Amendments, it can conclude that the transfer will remain in effect even if the Monterey Amendments are not approved or otherwise are mitigated under CEQA. The court

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[18]Since CEQA was modeled on the federal NEPA statute, federal decisions on NEPA are persuasive authority on CEQA issues. No Oil, Inc. v. Los Angeles, (1974) 13 Cal.3d 68, 86.

[19]When Petitioners commented on the draft EIR that any pre-Monterey Amendments transfer would be subject to Article 18's agriculture first provisions, Castaic did not say that the Kern transfer would have occurred without the Monterey Amendments. It merely responded that the transfer "could occur" either pre- or post- Monterey Amendments. AR 993.

already has indicated that the Kern water transfer is final. The parties to the transfer stated at hearing that they have no intention of rescinding it even if the Monterey Amendments are mitigated and Article 18's agriculture first provisions are in effect. This position is supported by the fact that the 2004 EIR evaluates the water supply impacts of just such a pre-Monterey Amendment Article 18 scenario. AR 186. As such, it is compelling evidence that the transfer will stand.[20]

Plainly, then, the Kern water transfer is final and will remain in place whatever happens to the Monterey Amendments. As such, the transfer has "independent utility" for purposes of environmental review. It is not so connected to the larger Monterey Amendments that the two must must be considered in a single environmental review. *See* Native Ecosystems Council v. Dombeck, 304 F.3d at 894.

6. EIR Timing

Petitioners' real argument seems to be that, whenever a program EIR is anticipated, the agency preparing an EIR for a specific project must wait for the program EIR.

This is not the law. Nothing in CEQA requires Castaic to wait for DWR's program EIR. Indeed, as a general proposition, the environmental review process should be undertaken early enough in the planning process to impact planning decisions, with the timing committed to the agency's discretion. City of Vernon v. Board of Harbor, (1988) 63 Cal.App.4th 677, 690-91. The Kern water transfer occurred almost eight years ago. It has been paid for and operating for a number of years. Castaic tried to conduct a timely environmental review, but that EIR was set aside in Friends. It is not an abuse of discretion for Castaic to want to complete the environmental review and obtain finality for the transfer without waiting for DWR's program EIR of the Monterey Amendments, now Monterey Plus.

Nor does this decision frustrate the law concerning program EIRs and tiering. The purpose of a program EIR is to document a series of actions so related that they can be characterized as one project. Friends, 95 Cal.App.4th at 1377. If the program EIR is sufficiently comprehensive, the lead agency may dispense with further environmental review for later activities within the program that are adequately covered in the program EIR. Guidelines §15618(c). Thus, the program EIR may be used to focus or simplify later environmental review, or as the basis of a tiered EIR. "Tiering" means the coverage of general matters and environmental effects in an EIR prepared for a policy, plan, program or ordinance, followed by narrower or site-specific EIRs which incorporate by reference the discussion in the prior report. *See* Pub. Resources Code §§ 21068.5, 21093 and Guideline §§ 15152, 15385. Tiering is favored "whenever feasible, as determined by the lead agency." Pub. Resources Code §21093(b). It is required where a prior EIR has been prepared and certified for a program, plan, or ordinance. Pub. Resources Code §21094(a). However, tiering is only required "where a prior environmental report has been prepared and certified for a program." Friends, 95 Cal.App.4th at 1383. It is not required, and in fact is prohibited, where the program EIR has yet to be prepared. Vineyard Area Citizens for Responsible Growth v. City of Rancho Cordova, ("Vineyard") (2007) 40 Cal.4th 412

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[20]Petitioners think so too, for their principal argument is premised on the 2004 EIR's assumption that the transfer is final for all purposes.

EIR cannot tier off of *future* environmental document).

7. Vineyard

In Vineyard, the Supreme Court addressed a county prepared EIR for a large land use development project known as "Sunrise Douglas." The principal issue was the availability of long-term water supply for the project, and the environmental impacts and mitigation for such supply. The Supreme Court analyzed the various water supply cases and distilled several principles. First, the EIR for a land use project must present sufficient facts to evaluate the pros and cons of supplying the amount of water the project will need, and not simply ignore or assume a water supply solution will be found for a development project. Second, an adequate EIR for a large project must show water supply for the entire project. It is not enough to show available water for early stages. While the agency may tier and defer analysis of certain details of later phases of long-term or complex projects, deferring analysis through tiering is appropriate when the impacts or mitigation measures are not determined by the first-tier approval and are specific to later phases. Third, the future water supplies identified and analyzed must bear a likelihood of actually being available. Finally, where there is some uncertainty about availability, CEQA requires some discussion of possible replacement sources or alternatives, and their environmental consequences.

Of particular use herein, the Supreme Court discussed the EIR's reliance on an anticipated local Water Board's master plan update, which would discuss the availability of long-term water supplies to the area and their environmental impact. The Court held that the county's EIR cannot tier from a *future* environmental document. If the environmental analysis from the Water Board's anticipated master plan update was important to understanding the long-term water supply for Sunrise Douglas, it should have been performed in the Sunrise Douglas EIR even though that might result in subsequent duplication by the Water Board's master plan update. Or, the county could have deferred analysis and approval of Sunrise Douglas until the Water Board's master plan update, then tiered the Sunrise Douglas EIR from the programmatic analysis performed by the Water Board.

The Vineyard decision shows that the timing of Castaic's project specific EIR in relation to DWR's program EIR is up to Castaic. It may either wait for DWR's program EIR and tier off of it, or prepare its own EIR for the Kern water transfer first. If it chooses the latter, Castaic may not tier off an environmental document that does not yet exist. Instead, Castaic must analyze all necessary environmental impacts and mitigations. If analysis of some portion of the Monterey Amendments is important to understanding the environmental impacts of the Kern water transfer, then analysis of that issue must be included in Castaic's EIR. But if Castaic's EIR does so, it is irrelevant that the document duplicates some of what DWR would do, or even that it may be inconsistent with DWR's analysis.[21] As DWR contends, CEQA's goal is to ensure sufficient information; it contains no prohibition against too much information. DWR Br. at 21. The timing of Castaic's EIR for the Kern water transfer is up to Castaic and Castaic alone.

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[21]As previously stated, the prospect of inconsistencies between Castaic's EIR and DWR's program EIR is diminished by Castaic's use of DWR modeling, DWR's comments and input into the 2004 EIR, and the general cooperation and coordination between the two agencies.

F. Contents of the 2004 EIR

Apart from the proper lead agency, Petitioners argue that the 2004 EIR is inadequate. Initially, the court believed that Castaic could have real problems on this issue. It is one thing for Castaic to act as lead agency on a water transfer before the program EIR is prepared; Vineyard and other case law say that Castaic may do so. But the EIR must be adequate and complete. Vineyard teaches that if analysis of some portion of the Monterey Amendments is important to understanding the environmental impacts of the Kern water transfer, then that analysis must be included in Castaic's EIR. PCL held that the "no project" alternative was particularly important for the Monterey Amendments, and the public was entitled to know what would happen if the Amendments were not approved and Article 18 was implemented in the event of water shortage. Commentators particularly wanted to know whether imposition of Article 18 might eliminate the "paper water" entitlements in the water contracts, reduce land planning decisions based on that paper water, and ultimately reduce growth and construction of additional SWP facilities. PCL, 83 Cal.App.4th at 892-3.

The court wondered whether Castaic would have the expertise to perform any analysis of the Monterey Amendments or the "no project" alternative that would be required in the 2004 EIR. However, the parties' briefs, and oral argument at hearing, have demonstrated that, with one exception, the 2004 EIR's contents are sufficiently presented. Indeed, Petitioners barely criticize the 2004 EIR's adequacy, except as it impacts the lead agency issue.

1. "Deception"

Petitioners' principal argument about content is that the 2004 EIR is deceptive in failing to make clear that the Kern water transfer is not "final." They contend that the 2004 EIR's project definition treats the Kern water transfer as an immutable *fait accompli* which fails to disclose that the "final status" of the transfer depends on the DWR's forthcoming review. According to Petitioners, the EIR improperly relies on the interim availability of the water to predict that DWR will "leave it in place," a point which the court in California Oak Foundation v. City of Santa Clarita, ("California Oak") (2005) 133 Cal.App.4th 1219, 1238, n.16 had no trouble dispatching, and also improperly states that it would be unnecessary and speculative to consider what the DWR might do to change the transfer (*See* AR 994). Pet. Op. Br. at 19-20. This false assumption that the transfer is immutable may result in land use decision-makers approving projects based on water availability "worth little more than a wish and a prayer." Id. at 20-21.

The court has determined that the transfer is final as a matter of law. Therefore, the EIR is not wrong in saying so. What Petitioners really contend is that the Kern water transfer, though final, can be affected by the DWR's program EIR through mitigations and imposition of alternatives. Yet, the EIR proceeds as if the transfer cannot be altered. As counsel described the issue at hearing, the 2004 EIR "talks about risk, but never directly informed the public about the fact that the transfer may be unwound through the Monterey Amendment EIR process." Thus, the EIR refers to the transfer as of an "*existing* 41,000 " acre feet of SWP Table A water (AR 15, 35) and states that "no permits or *other approvals* would be required other than" certification of the

EIR. AR 16.[22]

The EIR is the method for disclosure of environmental issues. Rural landowners Assn. V City Council, 43 Cal.App.3d 1013, 1020. CEQA's purpose is to compel agencies to make decisions with environmental consequences in mind, but CEQA does not and cannot guarantee that these decisions will always favor environmental concerns. Laurel Heights, 47 Cal.3d at 393. The EIR should provide sufficient analysis to allow decision-makers to make intelligent judgments about environmental consequences. Guidelines §15151. The evaluation of environmental effects need not be exhaustive, but the EIR's sufficiency is reviewed in the light of what is reasonably foreseeable. Id. Perfection is not required, but adequacy, completeness, and a good faith effort at full disclosure is. Id.

In California Oak, the court addressed the proposed development of a 584 acre industrial park project in the Santa Clarita. The City's EIR relied on the Kern water transfer for water supply, and the appellate court held that it did not adequately address the uncertainty in that water delivery. 133 Cal.App.4th at 1236. The City's comments "did little more than dismiss project opponents' concerns about water supply" and the EIR failed to discuss the adequacy and availability of water supply absent the Kern water transfer. Appendix K to the EIR did acknowledge uncertainty in the Kern water transfer, but this was insufficient in part because inforamtion "scattered here and there in EIR appendices" or a report "buried in an appendix" is not a substitute for good faith reasoned analysis. Id. at 1239 (citation omitted). Moreover, Appendix K contained no facts and analysis about the likelihood of deficit or alternative sources of supply, and was misleading about the fact that Castaic had an SWP "entitlement" without explaining that the entitlement consisted in part of "paper water." Id. at 1239-40. Hence the EIR failed as an informational document on water supply issues.

Castaic contends, and the other Respondents agree, that the 2004 EIR fully addresses the uncertainty of what DWR will do. At hearing, they contended that Petitioners really are arguing that the 2004 EIR is misleading because it does not anticipate Petitioners' argument.[23]

The EIR explains that planning for water supply to meet demands requires consideration of reliability of SWP supplies, because historical and statistical analysis show that the full Table A amount will not be available in some years. AR 41. The EIR explains that Castaic's Table A amount is the maximum SWP amount, and the amount of SWP water actually available to it varies from year to year. Id. The EIR acknowledges that DWR's allocations are based on that year's hydrological conditions, the amount of water stored in the SWP system, and contractor requests for water. AR 16. The EIR discusses the Monterey Agreement (AR 46-47), PCL and Monterey Plus. AR 17-18, 47. The EIR cautions land use planners who might rely on the EIR to predict future water supplies, that while Castaic will implement all feasible measures to obtain water "past water deliveries are not a guarantee of future delivery rates." AR 13.

The EIR considers the environmental impact of the project based on water allocation

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[22]At trial, Petitioners' counsel made plain that this issue of deception is distinct from the reliability of water delivery by DWR.

[23]Respondents' contention sounds like an argument that Petitioners failed to exhaust their administrative remedies. However, no failure to exhaust claim was made in their briefs.

scenarios of pre-Monterey Amendments without Article 18 cutbacks, pre-Monterey Amendments with Article 18 cutbacks, and post-Monterey Amendments. AR 56. The EIR argues that the project could have been authorized under Article 41, but instead was implemented under Article 53 of the Monterey Agreement. It adds that DWR is preparing a new EIR for the Monterey Amendment.

Since the Monterey Amendments change the way in which SWP water is allocated among contractors, the 2004 EIR provides three separate analyses of the project's impacts to water supply. AR 186-89. The EIR goes to great lengths to discuss the uncertainties in the Article 18 allocations. AR 187-89. For each scenario, the EIR estimates reliability based on wet, dry, and extended dry year conditions. AR 183-91. The EIR addresses direct impacts to water supply and water quality under the three water allocation scenarios. AR 202-05. It discusses indirect impacts from the growth-inducing effect of the project, and mitigations of these impacts through implementation of existing agency policies. AR 207-224. It discusses the cumulative impact of the project and other projects inside and outside the project area. AR 278-89. Finally, it addresses alternatives to the project, including a no project alternative. AR 293-300.

The EIR clearly demonstrates the variability of SWP deliveries, and covers what could happen as a result of the Monterey Amendments EIR. But Petitioners are correct that the EIR has a hole in it. The EIR does not directly explain that the project may be impacted by the outcome of the Monterey Amendments EIR. Instead, the 2004 EIR assumes there are three possible water delivery scenarios without any discussion of why or how they would occur: "Since the Monterey Amendments change the way in which SWP water is allocated among contractors, the 2004 EIR provides three separate analyses of the project's impacts to water supply." The reader is left to interpret how these allocations could come about, and must conclude on his or her own that they are three possible outcomes of challenges to the Monterey Amendments. Nor does the EIR explain how such challenges could cause these allocations to occur.

An EIR is an informational document which is supposed to provide the reader with the "analytic route the...agency traveled from evidence to action." Citizens of Goleta Valley v. Board of Supervisors, ("Goleta") (1990) 52 Cal.3d 553, 568. This means that the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions. Castaic is not required to predict the outcome of litigation, and may not be able to discuss the likelihood of each of the three allocations. However, it should have at least explained why the three scenarios are relevant and how they would occur.[24] The failure to do so leaves the reader wondering why they are pertinent. Consequently, the 2004 EIR fails to provide the analytic route by which the three alternatives are relevant.

Non-compliance with the disclosure requirements of CEQA may constitute a prejudicial abuse of discretion regardless of whether the agency would have taken the same action had it complied with CEQA. Pub. Res. Code §21005(a). Still, CEQA is subject to the established principle that there is no presumption of prejudicial error. Pub. Res. Code §21005(b). Only if the manner in which the agency failed to follow the law is prejudicial must the decision be set aside. Sierra Club v. State Board of Forestry, (1994) 7 Cal.4th 1215, 1236.

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[24]For example, the court has no idea how a pre-Monterey Amendments without Article 18 cutbacks would occur.

The issue is whether Castaic's failure to supply the analytical route for its consideration of the three allocations is prejudicial. Prejudice depends on whether the failure to include this information makes "any meaningful assessment" of the project's environmental effects impossible, in which case prejudice is presumed. Sierra Club v. State Board of Forestry, (1994) 7 Cal.4th 1215, 1236 (agency approved timber harvesting plans without requiring necessary environmental information in them).[25] Even under this standard, not every CEQA failure is prejudicial. An EIR will be upheld if the error *de minimus* or clerical in nature (Save San Francisco Bay Association v. San Francisco Bay Conservation and Development Commission (1992) 10 Cal.App.4th 908, 935), the EIR analysis is comprehensive, if not perfect, despite the error (Schaeffer Land Trust v. San Jose City Council, (1989) 215 Cal.App.3d 612, 627-28), and information which should have been included to make the EIR accurate nonetheless has no material effect on informed decision-making or informed public participation (Al Larson Boat Shop, Inc. v. Board of Harbor Commissioners, (1993) 18 Cal.App.4th 729, 747-50).

The Vineyard court reiterated that the reviewing court must focus on the nature of the defect, depending on whether the claim is predominantly one of improper procedure or a dispute over facts. Where the agency has employed the correct procedures, greater deference is given to the agency's factual conclusions, which are reviewed for substantial evidence. 40 Cal.4th at 435.

The 2004 EIR's non-compliance concerns its analytic route – why and how the three allocations are pertinent. This is not a fact issue to be supported by substantial evidence. Instead, it is a failure affecting the public's ability to make a "meaningful assessment" of the project's environmental effects. As such, it is prejudicial. *See also* Rural Land Owners Assn. v. Lodi City Council, (1983) 143 Cal.App.3d 1013, 1023 (whenever failure to comply with CEQA results in a subversion of its purposes by omitting information from the environmental review process, the error is prejudicial).[26]

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[25]One appellate court, Resource Defense Fund v. Local Agency Formation Commission, (1987) 191 Cal.App.3d 886, 897-98 has stated that "[f]ailure to comply with CEQA is necessarily prejudicial." This does not appear to be the consensus approach. *See* Dusek v. Anaheim Redevelopment Agency, (1985) 173 Cal.App.3d 1029, 1040-42 ("a minor CEQA sin or two" constituting technical defects where the public had not been misled or defrauded is not enough for prejudice).

[26]Petitioners also argue that the 2004 EIR finesses the non-final nature of the project by jumping the gun and analyzing pre-Monterey Amendments. According to Petitioners, Castaic performed a "mini-programmatic review" at AR 155-06 and App. D (AR 468-550). The charts at AR 184 and 506 show this. According to Petitioners, this is not just factual overlap; this is usurpation of DWR's responsibilities.

DWR correctly points out that Petitioners are complaining about too much information, something that CEQA does not proscribe. Petitioners have no complaint about the content of the mini-program review. To the extent that Castaic performed a task that DWR is obligated to perform, DWR may either use Castaic's analysis or perform a new one. The cooperation of DWR and Castaiac suggests that the overlapping environmental analysis will be consistent. Even if inconsistent, DWR's analysis will control for the Monterey Amendments. There is no

2. Modeling

Petitioners contend that Castaic used an obsolete DWR model, DWRSIM, for making predictions about the amount of SWP water that could be available as a result of the Kern water transfer. DWR has used CALSIM II for modeling SWP deliveries since 2000. While the EIR uses CALSIM II to look at the environmental setting, it only uses DWRSIM to look at environmental impacts. According to Petitioners, Castaic's rationale for doing so -- that DWRSIM should be used for the 1998 environmental setting -- makes no sense. Modeling is for future results, not historical analysis.

Petitioners argue that Castaic's use of an old model prejudicially overstates the reliability of SWP water delivery. App.D, Table 2-2 compares the projected 2020 deliveries based on the two different models. AR 493. The graph shows a discrepancy between the two models, particularly in the 50-70% supply range, and most glaringly in the range of drought conditions. Although the EIR does not quantify these differences, Castaic's responses to public comments presents a table that does. The table shows that the two models can differ by as much as 5000 acre-feet. Pet. Op. Br. at 23. According to Petitioners, this is not the "slight discrepancy" DWR states it is.

When a challenge is brought to studies on which an EIR is based, "the issue is not whether the studies are irrefutable or whether they could have been better. The relevant issue is only whether the studies are sufficient credible to be considered as part of the total evidence that supports the" agency's decision. Laurel Heights, 47 Cal.3d at 409 (lead agency entitled to choose and rely on expert opinion even though others may disagree). Expert testimony constitutes substantial evidence and an agency is entitled to rely on it. Uhler v. City of Encinitas, (1991) 227 Cal.App.3d 795, 805. Even where experts disagree, the agency is entitled to choose one expert's opinion over another. Laurel Heights, 47 Cal.3d at 409. The party challenging the EIR bears the burden of demonstrating that the studies on which the EIR is based "are clearly inadequate or unsupported." State Water Resources Control Board Cases, (2006) 136 Cal.App.4th 674, 795.

CEQA requires Castaic to reasonably inform the reader about the amount of water available. The EIR states that all environmental impacts from the project are driven by the amount of water delivered and the timing of delivery. AR 55. Castaic analyzed the amount of SWP water available for delivery through hydrologic modeling with computer simulations that predict the amount of water available under various hydrologic conditions. To do so, the EIR, like all EIR's had to have an environmental setting for the project. This environmental setting describes the conditions of the project as they exist at the time the Notice of Preparation is published or, if there is none, at the time the environmental analysis is commenced. This setting will normally constitute the baseline physical conditions by which an agency determines whether an impact is significant. Guidelines §15125(a).

The 2004 EIR states that its baseline 1998 environmental setting used DWRSIM, which is a model simulating the operations of the SWP, "because this is the modeling tool that was available during 1998." AR 55. DWR had used DWRSIM in 2000 to conduct a reliability study for another project. The 2004 EIR does use CALSIM II for the current environmental setting of

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usurpation of responsibility.

the project. CALSIM II was available because DWR performed a SWP Delivery Reliability Report in 2003 using CALSIM II as its model. AR 56. Although the modeling tools are different, the criteria used to input into the computer simulation has not changed significantly. Id.

The question raised by Petitioners is why use an older computer simulation model (DWRSIM) for the 1998 baseline when a newer model (CALSIM II) was available? Appendix D of the 2004 EIR, entitled "Technical Data for Hydrologic Analysis," explains that Castaic had to do so because it did not perform any model analysis of its own. Instead, Castaic relied upon DWR's expertise, and its existing model studies. *See* AR 491. DWR used DWRSIM in its 2000 study and CALSIM II in its 2003 study; Castaic relied upon those same studies and same models.

Castaic's reliance on DWR's existing studies and its expertise is an explanation, but the issue becomes whether it is an adequate one.

The answer is in Appendix D, which explains that DWRSIM has a database of monthly runoff based on historic hydrologic data for a 73 year period from 1922-74. DWRSIM takes this data and, depending on the input variables of operating constraints and water contractor demand, estimates the amount of water SWP can deliver each month over that 75 year period. Assuming that hydrologic conditions repeat, the operator can predict the amount of water available under that particular hydrologic condition and with a particular demand and operating condition. AR 491.

Appendix D then shows that DWRSIM and CALSIM II predict similar outcomes, and that the differences in their predictions can be explained. In Figures 2-1 and 2-2 of Appendix D, Castaic compares the two models' prediction of SWP water deliveries at existing demand and at predicted 2020 demand levels. AR 493. The "existing demand" for the DWRSIM model is 1998 demand. The "existing demand" for the CALSIM II model is 2001 estimated demand. The 2001 demand is higher than the 2000 demand. Consistent with reality, the model will only show delivery up to the amount of demand; SWP will not deliver more water than is asked for even if it is available. This difference in demand explains why CALSIM II shows more delivery in wet years than DWRSIM; the lower demand in 1998 limits the amount of delivery.

The difference in demand also explains in part why CALSIM II predicts a higher delivery in extremely dry conditions; 1998's lower demand means more water is left in storage from the preceding year and is available for delivery in a dry year. Appendix D says that the proof is in the pudding: comparison of DWRSIM and CALSIM II in Figure 2-2, for the year 2020 with the same level of demand for each model, shows very close prediction of SWP delivery for both models. AR 492-93.

Castaic concludes that the two models predict "generally comparable" results and their differences are minimal. AR 491, 1003. Castaic argues that, if anything, the slightly higher supplies predicted by the DWRSIM model provide a worst case scenario for purposes of growth inducing impacts; the more water the more developers will grow the Santa Clarita Valley. AR 1003-04, 1009.

Contrary to Petitioners' argument, the use of DWRSIM and not CALSIM II in the 1998 baseline study does not affect the conclusion that the study constitutes substantial evidence. Petitioners do not present expert opinion that the use of DWRSIM results in any error. They merely rely on the differences in Figures 2-1 and 2-2 of Appendix D, and Appendix D explains

the reason for the differences. As Castaic points out, Petitioners cannot point to any environmental significance to the use of DWRSIM and not CALSIM II. Therefore, Petitioners have not met their burden of demonstrating that use of DWRSIM for the 1998 baseline in the 2004 EIR was "clearly inadequate or unsupported."[27]

3. Cumulative Impacts

Petitioners contend that the 2004 EIR attempts to assess the project's impacts on the SWP without discussion why Castaic is competent to do so. As an example, the EIR rejects any significant project impact on the Delta, even though it acknowledges that differences in timing in the use of water for urban (Castaic) rather than agricultural (Wheeler Ridge) purposes would change the timing of deliveries. AR 192. Petitioners argue that the Delta is "in crisis" and there is great potential for conflict between Castaic's and DWR's respective environmental analysis. Pet. Op. Br. at 23-4.

An EIR must contain a cumulative impacts analysis of the project's environmental impact when considered in conjunction with other projects (Guidelines §15130) in order to ensure that "the entire relevant environmental picture" has been adequately considered. Laupheimer v. State of California, (1988) 200 Cal.App.3d 440, 462. A cumulative impact consists of an impact which is created as a result of the combination of the project evaluated in the EIR together with other projects causing related impacts. Guidelines §15130(a)(1). The EIR should not discuss impacts which do not result at least in part from the project being evaluated. Id. The analysis should reflect the severity and likelihood of occurrence of the impact. Guidelines §15130(b). In every case, there should be at least a preliminary search for potential cumulative environmental effects and a preliminary assessment of their significance. Laupheimer, 200 Cal.App.3d at 462-63. The detail required in a cumulative impacts discussion need not be as great as provided for the environmental impacts attributable to the project alone. Guidelines §15130(b). Generally, the EIR should list the projects producing cumulative impacts or provide a summary of projections contained in a prior certified or adopted environmental document which describe the regional conditions contributing to the cumulative impact. Guidelines §15130(b)(1). The 2004 EIR uses the list approach to discuss cumulative impacts of the project's environmental impact when considered in conjunction with other projects. AR 241-289.

Castaic argues that everything that happens with respect to the Kern water transfer happens south of the Delta, and the EIR thoroughly discusses that, including the impact of the timing of deliveries. AR 193-06. Thus, the EIR's conclusion that the project will have no direct

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[27]Castaic does not have statewide expertise on SWP reliability, but its consultants and DWR do. In commenting on Castaic's draft EIR, DWR stated that the differences between CALSIM II and DWRSIM "may cause slight changes in results, which may lead DWR to different conclusions....[in DWR's Monterey Amendments EIR]" AR 564. However, DWR also found that the draft EIR adequately and thoroughly discussed the project and its impacts, including the effects of the project on the environment and the SWP, using appropriate baseline conditions, and had a good discussion of the relationship between the Kern water transfer and Monterey Plus. DWR concluded that the draft EIR a "adequately discusses the reliability of the SWP, pre- and post- Monterey Amendment conditions, and SWP operations." AR 564-65.

significant impact on the SWP or related facilities is fully supported. Castaic contends that Petitioners really are attacking its ability to act as lead agent for a local project if the project has the potential for statewide impact. According to Castaic, this argument goes to the lead agency issue, and is incorrect as a matter of law. Castaic is qualified and required by CEQA to assess impacts that occur outside of its borders in evaluating the Kern water transfer. Citizens of Goleta Valley v. Board of Supervisors, (1990) 52 Cal.3d 553, 573.

The court does not know whether Petitioners really are attacking Castaic's expertise or the adequacy of its assessment of SWP impacts from the Kern transfer. The reason is that Petitioners' arguments are conclusionary and unsupported by analysis, authority, or many facts. Petitioners' obligation was to point out what is wrong with the analysis, or what has been omitted that was required. An issue raised without analysis or authority lacks foundation and need not be addressed. Arcadia, 135 Cal.App.4th at 1429, 1431. The court has no obligation to search the EIR's cumulative analysis section to look for defects. Their general objection requires only a general response that Castaic's cumulative impacts analysis is adequate.

4. The "No Project" Alternative

Petitioners argue that the 2004 EIR fails to address the "no project" alternative, an issue particularly important because it was the principal defect in the PCL Monterey Agreement EIR. As the PCL court stated, a "no project" alternative must discuss "existing conditions" and "what would reasonably be expected to occur in the foreseeable future if the project were not approved, based on current plans and consistent with available infrastructure and community services." 83 Cal.App.4th at 912. The Monterey Agreement EIR did not discuss the projections related to land planning, demand for water, and other impacts of reducing entitlements pursuant to Article 18(b). Id. at 919. Petitioners contend that the 2004 EIR does discuss the water supply reliability impacts of invoking Article 18(b), but not the statewide impacts the PCL court found so crucial.

The short answer to Petitioners contention is that 2004 EIR addresses a different project than the Monterey Amendments. The "no project" alternative for any EIR requires a comparison of the impacts of approving the project with the effect of not doing so. Guidelines §15126.6.(e)(1); Mira Mar Mobile Community v. City of Oceanside, (2004) 119 Cal.App.4th 477, 488-89. The only "no project alternative" that Castaic is obligated to consider is the alternative of "no Kern water transfer." Castaic has addressed this alternative by discussing groundwater sources of water and a possible moratorium. AR 291-4. Petitioners do not quibble with this analysis. But Castaic had no obligation to consider "no Monterey Amendments" as a no project alternative.[28] Indeed, it would make no sense to evaluate "no Monterey Amendments" as an alternative to the Kern water transfer.[29]

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[28]Of course, the 2004 EIR is obligated to consider invocation of Article 18(b) as a reasonably foreseeable environmental impact, and the adequacy of it doing so has been discussed.

[29]For a similar reason, Castaic need not analyze alternative uses of the SWP water in a "no project" alternative. CEQA does not require consideration of alternatives that do not meet the project objective; *i.e.*, delivery of water to Castaic's customers. *See* Guidelines §15126.6(c).

5. Post-Hoc Rationalization

Petitioners also suggest that the 2004 EIR is a post-hoc rationalization for "a decision already made." Pet. Op. Br. at 18. Pre-judging environmental decisions in order to accomplish a project is prohibited under CEQA. An agency may not commit to a project before CEQA review is completed because a fundamental purpose of an EIR is to provide decision-makers with information they can use in deciding whether to approve a project. Therefore, post-approval environmental review has been condemned. Laurel Heights, 47 Cal.3d at 394. *See* Residents Ad Hoc Stadium Com. v. Board of Trustees, (1979) 89 Cal.App.4th 274, 285. Of course, an agency contemplating a project may be presumed to favor the project, and CEQA assumes this to be inevitable. Therefore, it builds in procedural protections to insure that the decision-maker does not fail to note the facts and arguments by opponents to the EIR. Id. at 285.

Castaic had completed the transfer and performed under it for several years prior to preparing the 2004 EIR. Plainly, it desires to keep the transfer and not change it. When the 1999 was found deficient, Castaic was required under CEQA to perform a "fresh look" at the transfer's environmental impacts. With the exception of the analytical hole discussed above, it has done so. *See* City of Vernon v. Board of Harbor, (1998) 63 Cal.App.4th 677, 1523 (adequacy of EIR overcomes contention that it was a post-hoc rationalization).

G. Conclusion

Castaic may act as the lead agency for the Kern water transfer. The 2004 EIR was properly prepared except for one defect – it fails to show the analytic route as to how and why the three allocations of pre-Monterey Amendments, pre-Monterey Amendments without Article 18, and post-Monterey Amendments are relevant and would occur. The court offers no opinion on whether this failure must be rectified by addendum (Guidelines §15164), a subsequent EIR, a supplement to EIR, or a new EIR. That determination is Castaic's to make in the first instance.

The Petition for Writ of Mandate is granted in part. A writ shall issue commanding Castaic to set aside its approval of the 2004 EIR and comply with CEQA, either through the preparation of a new EIR or other environmental documentation, such as an addendum, addressing the analytic route of the three water allocations. Castaic is not directed to set aside the Kern water transfer. Judgment shall be entered in favor of Petitioners solely on this issue.

This shall serve as the court's proposed statement of decision in compliance with CRC 232(c). If there are no written objections filed, the statement shall be final. As Respondents have prevailed on all but one issue, Castaic's council is ordered to prepare a writ of mandate and judgment consistent with this decision, and serve it on all other counsel for approval as to form. After 10 days, Castaic may file the proposed writ and judgment with the court, along with a declaration stating the nature and extent of any objections received. An OSC re: judgment shall be set for April 23, 2007.

Dated: April 2, 2007

/s/ JAMES C. CHALFANT

Superior Court Judge

JAMES C. CHALFANT

Luhdorff & Scalmanini Consulting Engineers, "2007 Santa Clarita Valley Water Report" (April 2008)

2007
Santa Clarita Valley Water Report

Castaic Lake Water Agency (CLWA)
CLWA Santa Clarita Water Division
Los Angeles County Waterworks District 36
Newhall County Water District
Valencia Water Company

April 2008

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

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Executive Summary

This annual report, which is the tenth in a series that began to describe water supply conditions in 1998, provides current information about the water requirements and water supplies of the Santa Clarita Valley. The report was prepared for the imported water wholesaler, Castaic Lake Water Agency (CLWA), and for the four local retail water Purveyors that serve the Valley: CLWA Santa Clarita Water Division, Los Angeles County Waterworks District 36, Newhall County Water District, and Valencia Water Company. These entities and representatives from the City of Santa Clarita and the County of Los Angeles Department of Regional Planning meet as required to coordinate the management of imported water with local groundwater, now augmented by recycled water, to meet water requirements in the Valley.

This report provides information about local groundwater resources, State Water Project (SWP) and other imported water supplies, water conservation, and recycled water. The report reviews the sufficiency and reliability of supplies in the context of existing water demand, with focus on actual conditions in 2007, and it provides a short-term outlook of water supply and demand for 2008.

ES.1 2007 Water Requirements and Supplies

In 2007, total water requirements in the Santa Clarita Valley were about 92,300 acre-feet (af), of which about 77,500 af (84 percent) were for municipal use and the remainder (14,800 af) was for agricultural and other (miscellaneous) uses, including individual domestic uses. Total demand in 2007 was about one percent higher than in 2006, less than what was estimated in the 2006 Water Report. Water requirements in 2007 remained consistent with projections in the 2005 Urban Water Management Plan (UWMP). Total water requirements in 2007 were met by a combination of about 46,500 af from local groundwater resources (about 31,700 af for municipal and about 14,800 af for agricultural and other uses), about 45,300 af of SWP and other imported water, and about 470 af of recycled water.

Of the 46,500 af of total groundwater pumping in the Valley in 2007, about 38,800 af were pumped from the Alluvium and about 7,700 af were pumped from the underlying, deeper Saugus Formation. Alluvial pumping represented about a 4,300 af decrease from 2006, and Saugus pumping was slightly higher than in 2006, by about 400 af. Neither pumping volume resulted in any notable overall change in groundwater conditions (water levels, water quality, etc.) in either

aquifer system. Imported water deliveries to the Purveyors increased by about 4,700 af from the previous year. Water uses and supplies in 2007 are summarized in the following Table ES-1.

Table ES-1
Santa Clarita Valley
Summary of 2007 Water Supplies and Uses
(acre-feet)

Municipal		
SWP and other Imported		45,332
Groundwater (Total)		31,690
Alluvium	*25,632*	
Saugus	*6,058*	
Recycled Water		470
Subtotal		**77,492**
Agriculture/Miscellaneous		
SWP and other Imported		-
Groundwater (Total)		14,768
Alluvium	*13,141*	
Saugus	*1,627*	
Subtotal		**14,768**
Total		***92,260***

In accordance with the California Urban Water Management Planning Act, the Valley-wide UWMP was updated in 2005 to extend projected water demands through 2030, and to describe the combination of local groundwater, imported water supplies from the State Water Project and other sources, local recycled water supplies, and other water supplies planned to meet those existing and projected water demands in the Valley. The 2005 UWMP describes the reliability of local groundwater resources and the adequacy of groundwater supplies to meet groundwater demand, including consideration of the impacts of perchlorate contamination on several municipal water supply wells. The 2005 UWMP also describes the plans and ongoing work for integrated control of perchlorate migration and full restoration of perchlorate-impacted groundwater supply.

Notable details about each component of water supply in the Valley, and about the water supply outlook for 2008, include the following.

ES.2 Alluvial Aquifer

The groundwater operating plan in the 2005 UWMP includes Alluvial pumping in the range of 30,000 to 40,000 acre-feet per year (afy) in average/normal years, and slightly reduced pumping (30,000 to 35,000 afy) in dry years. Pumping from the Alluvium in 2007 was 38,800 af, which is within the operating plan range for the Alluvium.

On a long-term basis, continuing through 2007, there is no evidence of any historic or recent trend toward permanent water level or storage decline. In general, throughout a large part of the basin, Alluvial groundwater levels have generally remained near historic highs during the last 30 years. Above average precipitation in late 2004 and 2005 resulted in significant water level recovery in the eastern part of the basin, continuing the overall trend of fluctuating groundwater levels within a generally constant range over the last 30 years. These ongoing data indicate that the Alluvium remains in good operating condition and can continue to support pumping in the operating range included in the 2005 UWMP, or slightly higher, without adverse results (e.g., long-term water level decline or degradation of groundwater quality.)

Based on an integration of water quality records from multiple wells completed in the Alluvium, there have been historical fluctuations in groundwater quality, typically associated with variations in precipitation and streamflow. However, like groundwater levels, there has been no long-term trend toward groundwater quality degradation; groundwater produced from the Alluvial aquifer remains a viable municipal and agricultural water supply.

In 2002, as part of ongoing monitoring of wells for perchlorate contamination, perchlorate was detected in one Alluvial well (the SCWD Stadium Well) located near the former Whittaker-Bermite facility. The detected concentration was slightly below the then-applicable Notification Level for perchlorate (6 μg/l, which was subsequently established as the Maximum Contaminant Level for perchlorate in October 2007), and the well has been inactivated for municipal water supply since the detection of perchlorate. In early 2005, perchlorate was detected in a second Alluvial well, VWC's Well Q2. Valencia's response plan for Well Q2 was to pursue permitting and installation of wellhead treatment, followed by return of the well to water supply service in October 2005. After nearly two years of operation with wellhead treatment, including regular monitoring specified by the State Department of Public Health (DPH), all of which resulted in no detection of perchlorate in Well Q2, Valencia requested that DPH allow treatment to be discontinued. DPH approved that request in August 2007, and treatment was subsequently

discontinued. DPH-specified monthly monitoring for perchlorate continues at Well Q2; there has been no detection of perchlorate since discontinuation of wellhead treatment. All other Alluvial wells operated by the Purveyors continue to be used for municipal water supply service; those wells near the Whittaker-Bermite property are sampled in accordance with drinking water regulations and perchlorate has not been detected. As detailed in the 2005 UWMP, the ongoing inactivation of one Alluvial well due to perchlorate contamination does not limit the Purveyors' ability to produce groundwater from the Alluvium in accordance with the groundwater operating plan in the 2005 UWMP.

The ongoing characterization and plan for control and cleanup of perchlorate in the Valley has focused on the Saugus Formation. In addition, however, on-site cleanup and control activities that began in 2006, and continued through 2007, include continuation of soil cleanup on the Whittaker-Bermite site, and continuation of pumping and treatment in the Northern Alluvium on the Whittaker-Bermite site. Expanded pumping and treatment, intended to effect perchlorate containment in the Northern Alluvium, became operational in October 2007.

ES.3 Saugus Formation

The groundwater operating plan in the 2005 UWMP includes pumping from the Saugus in the range of 7,500 to 15,000 afy in average/normal years; it also includes planned dry-year pumping from the Saugus of 21,000 to 35,000 afy for one to three consecutive dry years. The 2005 UWMP recognizes the results of basin yield analyses in 2004 and 2005 which found that such short-term pumping can be recharged during subsequent wet/normal years to allow groundwater levels and storage to recover, as it has in historical periods.

Pumping from the Saugus Formation was about 7,700 af in 2007; on average, Saugus pumping has been about 6,800 afy since 1980. Both rates remain near the lower end of the range included in the UWMP. As a result of long-term relatively low pumping from the Saugus Formation, groundwater levels in that aquifer have remained generally constant to slightly increasing over the last 35 to 40 years; those trends continued in 2007.

In 1997, ammonium perchlorate was discovered in four wells completed in the Saugus Formation in the vicinity of the former Whittaker-Bermite facility located generally toward the east, on the south side of the basin. All four of those impacted wells remain out of active supply service; one of them has been permanently sealed and destroyed. In 2006, a very low level of perchlorate was detected in another Saugus municipal well (NCWD's Well NC-13). That low level detection has been interpreted to not indicate anything new about the migration of

perchlorate; however, it has also prompted additional monitoring well installation and a focused study of the Saugus Formation in that area. Results are being integrated with other groundwater remediation efforts and reviewed by the State Department of Toxic Substances Control (DTSC). All other Saugus wells owned and operated by the Purveyors are available for municipal water supply service. As part of regular operation, those wells are sampled in accordance with drinking water regulations and perchlorate has not been detected. Despite the inactivated Saugus wells, the Purveyors still have sufficient pumping capacity in other wells to meet the planned normal range of Saugus pumping in the 2005 UWMP.

Work toward the ultimate remediation of perchlorate contamination, including the restoration of impacted groundwater supply continued to progress in 2007, with focus on installation of a jointly developed plan to "pump and treat" contaminated water from two wells to stop migration of the contaminant plume, and to deliver treated water to partially replace impacted well capacity. Environmental review of the project had been completed with adoption of a Mitigated Negative Declaration in September 2005. The Final Interim Remedial Action Plan was completed and approved by DTSC in January 2006. Construction of facilities and pipelines necessary to implement the pump and treat program and to also restore inactivated well capacity began in November 2007. Construction is scheduled to be completed by the end of 2008, followed by operational start-up.

ES.4 Imported Water

Historically comprised of only its SWP Table A Amount, CLWA's imported water supplies now consist of a combination of SWP water and water acquired from the Buena Vista Water Storage District in Kern County. CLWA's contractual Table A Amount is 95,200 af of water from the SWP. Under the 2007 Water Acquisition Agreement with the Buena Vista Water Storage District (Buena Vista) and the Rosedale-Rio Bravo Water Storage District (Rosedale-Rio Bravo), Buena Vista's high flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within the Rosedale-Rio Bravo's service area on an ongoing basis. CLWA will receive 11,000 af of these supplies annually through either exchange of Buena Vista's and Rosedale-Rio Bravo's SWP supplies or through direct delivery of water to the California Aqueduct via the Cross Valley Canal.

CLWA's final allocation of SWP Table A for 2007 was 60 percent, or 57,120 af. The total available imported water supply in 2007 was 72,336 af, comprised of the 57,120 af of Table A supply, 11,000 af purchased from Buena Vista/Rosedale Rio Bravo, and 4,216 af of 2006 carryover delivered in early 2007. CLWA deliveries were 45,332 af to the Purveyors, 8,200 af to

the Rosedale-Rio Bravo Water Banking and Exchange Program, and 6,071 af to Devil's Den Ranch.

CLWA has two groundwater banking agreements with the Semitropic Water Storage District in Kern County. In accordance with those agreements, over a ten-year period (until 2012/13), CLWA can withdraw up to 50,870 af of its Table A water that was stored in 2002 and 2003 to meet future Valley demands when needed. In addition to the banking in Semitropic, CLWA finalized an agreement with the Rosedale-Rio Bravo Water Storage District in 2005 and can now bank up to 20,000 afy of surplus Table A Amount in that District's Water Banking and Exchange Program. In addition to 20,000 af previously banked in both 2005 and 2006, CLWA banked 8,200 af of water in 2007. In accordance with the provisions of that agreement, CLWA can withdraw up to a total of 42,900 af of that water, at a rate up to 20,000 afy, to meet Valley water demands when needed. Additionally, as part of the Buena Vista Water Acquisition Agreement, CLWA is entitled to 22,000 af of water that was stored in the Rosedale Rio-Bravo Water Banking and Exchange Program in 2005 and 2006 on CLWA's behalf. With the addition of those supplies, CLWA now has a recoverable total of 64,900 af in the Rosedale Rio-Bravo Water Banking and Exchange Program.

Since SWP water deliveries are subject to reduction when dry conditions occur in Northern California, the UWMP includes programs, like the Semitropic and Rosedale-Rio Bravo programs, for enhancing water supply reliability during such occurrences. A capital improvement program funded by CLWA has been established to provide facilities and additional water supplies needed to firm up SWP water supplies during times of drought.

ES.5 Recycled Water

Recycled water service was initiated in July 2003 in accordance with CLWA's Draft Reclaimed Water System Master Plan (2002). The amount of recycled water used for irrigation purposes, at a golf course and in roadway median strips, was approximately 470 af in 2007. CLWA completed programmatic CEQA analysis in early 2007 for full implementation of the recycled water system as outlined in the Master Plan.

ES.6 2008 Water Supply Outlook

In 2008, total water demands are expected to be about 95,800 af, consistent with the growth rate and related water demand projections in the 2005 UWMP. It is expected that water demands in

2008 will continue to be met with a generally similar mix of water supplies comprised of local groundwater, supplemental SWP and other imported water, and recycled water.

As of February 22, 2008, the allocation of water from the SWP is 35 percent of CLWA's Table A Amount, or 33,320 af. Combined with local groundwater from the two aquifer systems (42,500 af), total Flexible Storage Account (6,060 af), net carryover of SWP Table A allocation from 2007 (12,146 af), annual acquisition through the Buena Vista Water/Rosedale Rio-Bravo Water Acquisition Agreement (11,000 af), and recycled water (500 af), the total available water supplies for 2008 are nearly 106,000 af. As a result, CLWA and the Purveyors anticipate having more than adequate supplies to meet all water demands in 2008.

In August 2007, a federal court ruled that certain operational changes were required of the SWP in order to protect the endangered Delta smelt. Thereafter, DWR prepared an update to its 2005 SWP Delivery Reliability Report, which is issued biennially to indicate how much SWP water is available during varying hydrologic scenarios (i.e., normal and dry years). The Draft SWP Delivery Reliability Report 2007, issued in December 2007, by DWR reduces the long-term reliability of SWP supply from 77 percent to 66-69 percent. The discussion of SWP supply should be tempered, though, by noting that while the Draft SWP Delivery Reliability Report 2007 represents a reasonable scenario with respect to long-term reliability, recent reductions in supply close the gap between the available supply and demand in the future, thereby making the CLWA service area more subject to shortages in certain dry years. Accordingly, the reduction in SWP supply reinforces the need to continue diligent efforts to conserve potable water and increase the use of recycled water, both to meet the goals in the 2005 UWMP and to maximize utilization of potable water supplies. CLWA and the retail water Purveyors are working with Los Angeles County and the City of Santa Clarita in preparing a water conservation ordinance and the enforcement mechanisms to aggressively implement water use efficiency in the CLWA service area. In terms of short-term water supply availability, CLWA has determined that, while current operational changes of the SWP are in effect, there are sufficient supplemental water supplies, including SWP water, to augment local groundwater and other water supplies such that overall water supplies will be sufficient to meet projected 2008 water requirements as reflected herein.

In any given year, SWP supplies may be reduced due to dry weather conditions or regulatory factors. During such an occurrence, the remaining water demands are planned to be met by a combination of alternate supplies such as returning water from CLWA's accounts in the Semitropic Groundwater Storage Program and the Rosedale-Rio Bravo Water Banking and Exchange Program, deliveries from CLWA's flexible storage account in Castaic Lake Reservoir,

local groundwater pumping, short-term water exchanges, and participation in DWR dry-year water purchase programs in accordance with the 2005 Urban Water Management Plan. CLWA has now banked excess 2002 and 2003 SWP Table A water in the Semitropic Groundwater Storage Program; it has banked excess 2005 and 2006 SWP Table A water in the Rosedale-Rio Bravo Water Banking and Exchange Program; and it has banked water purchased in 2005 and 2006 through the Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement in the Rosedale-Rio Bravo Water Banking and Exchange Program. CLWA banked another 8,200 af in the Rosedale-Rio Bravo Water Banking and Exchange Program in 2007. CLWA can draw upon its accounts as needed, pursuant to the terms of the banking agreements. The banked excess 2002 and 2003 SWP Table A water in Semitropic represents nearly 51,000 af of recoverable water for drought water supply. The banked excess in 2005 and 2006, augmented by banked water acquired through the Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement in 2005, 2006 and 2007, now represent a total of 64,900 af of recoverable water for drought water supply from the Rosedale-Rio Bravo Banking and Exchange Program.

Drought periods may affect available water supplies in any single year and for a duration usually not longer than three consecutive years. It is important to note that hydrologic conditions vary from region to region throughout the state. Dry conditions in Northern California affecting SWP supply may not affect local groundwater and other supplies in Southern California, and the reverse situation can also occur (as it did in 2002 and 2003). For this reason, CLWA and the Purveyors have emphasized developing a water supply portfolio that is diverse, especially in dry years. Diversity of supply is considered a key element of reliability, giving Valley water Purveyors the ability to draw on multiple sources of supply to ensure reliable service during dry years, as well as during normal and wet years.

I. Introduction

1.1 Background

For most residents of the Santa Clarita Valley (Valley), domestic water service is provided by four retail water Purveyors. They are the Castaic Lake Water Agency's (CLWA) Santa Clarita Water Division (SCWD), Los Angeles County Waterworks District 36 (LA36), Newhall County Water District (NCWD), and Valencia Water Company (VWC). Together, the Purveyors provide water to about 68,000 service connections. Castaic Lake Water Agency (CLWA) contracts for State Water Project water delivered from Castaic Lake where it is treated, filtered, and disinfected at two treatment plants before distribution to the Purveyors. Staff of these entities meet regularly to coordinate the supply of water in the Valley. Their respective service areas are shown in Figure I-1.

Water supply for a small fraction of Valley residents is provided by individual private water supply wells. The locations, construction details, annual pumpage and other information about these private wells are not currently available. CLWA has been working with private well owners to receive information about their wells for incorporation in future reports and for planning purposes. Pumping as reported herein includes an estimate of groundwater pumped from private wells; it is expected that this estimate will be refined in the future as more information about the private wells is obtained.

In addition to municipal and individual private water uses in the Valley, there remains an agricultural water demand that is predominately dependent on local groundwater for its water supply. Accordingly, ongoing agricultural water requirements and the use of local groundwater to meet those requirements are considered in analyses and reports on water supplies such as this report.

Over the last 20 years, CLWA and the Purveyors have reviewed and reported on the availability of water supplies to meet all water requirements in the Valley. Those reports have also addressed local water resources, most notably groundwater, in the region. Past studies have assessed the condition of local groundwater aquifers, their hydrogeologic characteristics, aquifer storage capacity, operational yield and recharge rate, groundwater quality and contamination, and the ongoing conjunctive use of groundwater and imported water resources.

Other efforts have included developing drought contingency plans, coordinating emergency response procedures and implementing Valley-wide conservation programs. In 1985, the Purveyors prepared the area's first Urban Water Management Plan (UWMP.) Information in the plan was coordinated among CLWA and the Purveyors to provide accurate, comprehensive and consistent water supply and demand information for long term planning purposes. In accordance with the California Urban Water Management Planning Act, the Valley-wide UWMP was most recently updated in 2005 to extend water demand projections through 2030, and to describe the combination of local groundwater, imported water supplies from the State Water Project, local recycled water supplies, and planned other water supplies to meet the existing and projected water demands in the Valley. The 2005 UWMP describes the reliability of local groundwater resources and the adequacy of groundwater supplies to meet that component of overall water supply. The 2005 UWMP also describes the impacts of perchlorate contamination on several municipal water supply wells, and the plans and ongoing work for integrated control of perchlorate migration and full restoration of perchlorate-impacted groundwater supply.[1]

1.2 Purpose and Scope of the Report

The purpose of this report, which is the tenth in a series of annual water reports that began to describe water supply conditions in 1998, is to provide current information about the available water supplies and demands of the Santa Clarita Valley. CLWA and the Purveyors have prepared this series of reports in response to a request made by the Los Angeles County Board of Supervisors in 1998. Over the last few years, this series of reports has also served as an annual summary of groundwater conditions in the Valley in fulfillment of the commitment in the Santa Clarita Valley Groundwater Management Plan, adopted in 2003, to regularly report on implementation of that Plan. This report was prepared for Castaic Lake Water Agency, for CLWA's Santa Clarita Water Division, for Los Angeles County Waterworks District 36, for Newhall County Water District, and for Valencia Water Company. It continues a format for providing information regarding water uses and the availability of water supplies on an annual basis. It is intended to be a helpful resource for use by water planners and local land use planning agencies. This report is complemented by the more detailed UWMP for the area, which provides longer-term water supply planning over a 25-year period, and by a number of other technical reports, some of which are specifically referenced herein.

[1] The 2005 UWMP is currently subject of an ongoing legal challenge in the form of a petition for writ of mandate and complaint for declaratory and injunctive relief filed in February 2005 by California Water Impact Network and Friends of the Santa Clara River in Los Angeles County Superior Court. In August 2007, the Superior Court ruled in favor of CLWA and the retail water purveyors, affirming that the 2005 UWMP was properly prepared based on substantial evidence in the record. In October 2007, the Petitioners filed a notice of appeal and this appeal is pending.

1.3 Santa Clarita Valley Water Purveyors

As introduced above, four retail water Purveyors provide water service to most residents of the Santa Clarita Valley. Brief summary descriptions of those four Purveyors are as follows.

Castaic Lake Water Agency Santa Clarita Water Division has a service area that includes a portion of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Saugus, Canyon Country, and Newhall. Water is supplied from both groundwater and CLWA turnouts to about 27,900 service connections.

Los Angeles County Waterworks District 36 has a service area that encompasses approximately 7,635 acres in the Hasley Canyon area and the unincorporated community of Val Verde. LACWWD 36 has about 1,400 service connections. The District has traditionally obtained its full water supply from a connection to the CLWA's Castaic Conduit and continued to do so in 2007.

Newhall County Water District's service area includes portions of the City of Santa Clarita and unincorporated portions of Los Angeles County in the communities of Newhall, Canyon Country, Valencia, and Castaic. NCWD supplies water from both groundwater and CLWA turnouts to approximately 9,500 service connections.

Valencia Water Company's service area serves about 29,400 service connections in a portion of the City of Santa Clarita and in the unincorporated communities of Castaic, Newhall, Saugus, Stevenson Ranch, and Valencia. VWC supplies water from both groundwater and CLWA turnouts; VWC also delivers recycled water for a small amount of non-potable use.

1.4 The Upper Santa Clara River Hydrologic Area and East Groundwater Subbasin

The Upper Santa Clara River Hydrologic Area (HA), as defined by the California Department of Water Resources (DWR), is located almost entirely in northwestern Los Angeles County. The area encompasses about 654 square miles comprised of flat valley land (about 6 percent of the total area) and hills and mountains (about 94 percent of the total area) that border the valley area. The mountains include the Santa Susana and San Gabriel Mountains to the south and the Sierra Pelona and Leibre-Sawmill Mountains to the north. Elevations range from about 800 feet on the valley floor to about 6,500 feet in the San Gabriel Mountains. The headwaters of the Santa Clara

River are at an elevation of about 3,200 feet at the divide separating this hydrologic area from the Mojave Desert.

The Santa Clara River and its tributaries flow intermittently from Lang Station westward about 35 miles to Blue Cut, just west of the Los Angeles-Ventura County line, where it forms the outlet for the Upper Santa Clara River Hydrologic Area. The principal tributaries of the River in the Santa Clarita Valley are Castaic Creek, San Francisquito Creek, Bouquet Creek, and the South Fork of the Santa Clara River. In the Santa Clarita Valley, the Santa Clara River receives treated wastewater discharge from the Saugus and Valencia Water Reclamation Plants, which are operated by the Sanitation Districts of Los Angeles County.

The Santa Clara River Valley East Groundwater Subbasin, beneath the Santa Clarita Valley in the Upper Santa Clara River HA, is the source of essentially all local groundwater used for water supply in the Santa Clarita Valley. Below Blue Cut, the Santa Clara River continues westward through Ventura County to its mouth near Oxnard. Along that route, the River traverses all or parts of six groundwater basins in Ventura County (Piru, Fillmore, Santa Paula, Oxnard Forebay, Oxnard Plain and Mound) as shown in Figure I-2.

There are two primary precipitation gages in the Santa Clarita Valley, the Newhall-Soledad 32c gage and the Newhall County Water District gage (Figure I-3). The National Climatic Data Center (NCDC) and Los Angeles County Department of Public Works (LADPW) have maintained records for the Newhall-Soledad 32c gage since 1931. Newhall County Water District has maintained records for the NCWD gage since 1979. The cumulative records from these two gages correlate very closely, with the NCWD gage recording approximately 25 percent more precipitation than the Newhall-Soledad 32c gage. This is likely due to the location of the NCWD gage, which is at the base of the mountains rimming the southern edge of the Santa Clarita Valley.

The Santa Clarita Valley is characterized as having an arid climate. Historically, intermittent periods of less-than-average precipitation have typically been followed by periods of greater-than-average precipitation in a cyclical pattern, with each wetter or drier period typically lasting from one to five years. Long-term precipitation records for the Newhall-Soledad 32c gage are illustrated in Figure I-3. The long-term average precipitation is 17.9 inches (1931-2007). Figure I-3 also shows the yearly departure from mean annual precipitation. In general, periods of less-than-average precipitation have been longer and more moderate than periods of greater-than-average precipitation. Recently, the periods from 1971 to 1976, 1984 to 1991 and 1999 to 2003 have been drier than average; the periods from 1977 to 1983 and 1992 to 1996 have been wetter

than average. More recently, wet conditions that began in late 2004, continued into early 2005, ultimately resulting in about 37 inches of measured precipitation, or slightly more than 200 percent of long-term average precipitation, in that year. Those significantly wet conditions contributed to substantial groundwater recharge and decreased water demand that year. In contrast, total precipitation in 2006 was slightly less than 14 inches, or about 4 inches below the long-term average, but water requirements were still about "normal" (as projected in the 2005 UWMP) and there were no dramatic changes in groundwater conditions, as described herein. 2007 was notably dry, with total precipitation slightly less than 6 inches, about 12 inches below normal. Despite that condition, however, water demand was about as estimated for average conditions in the 2005 UWMP, and not as great as the short-term projection in the 2006 Water Report. In 2008, precipitation has been near normal, at approximately 14 inches for the early part of the year.

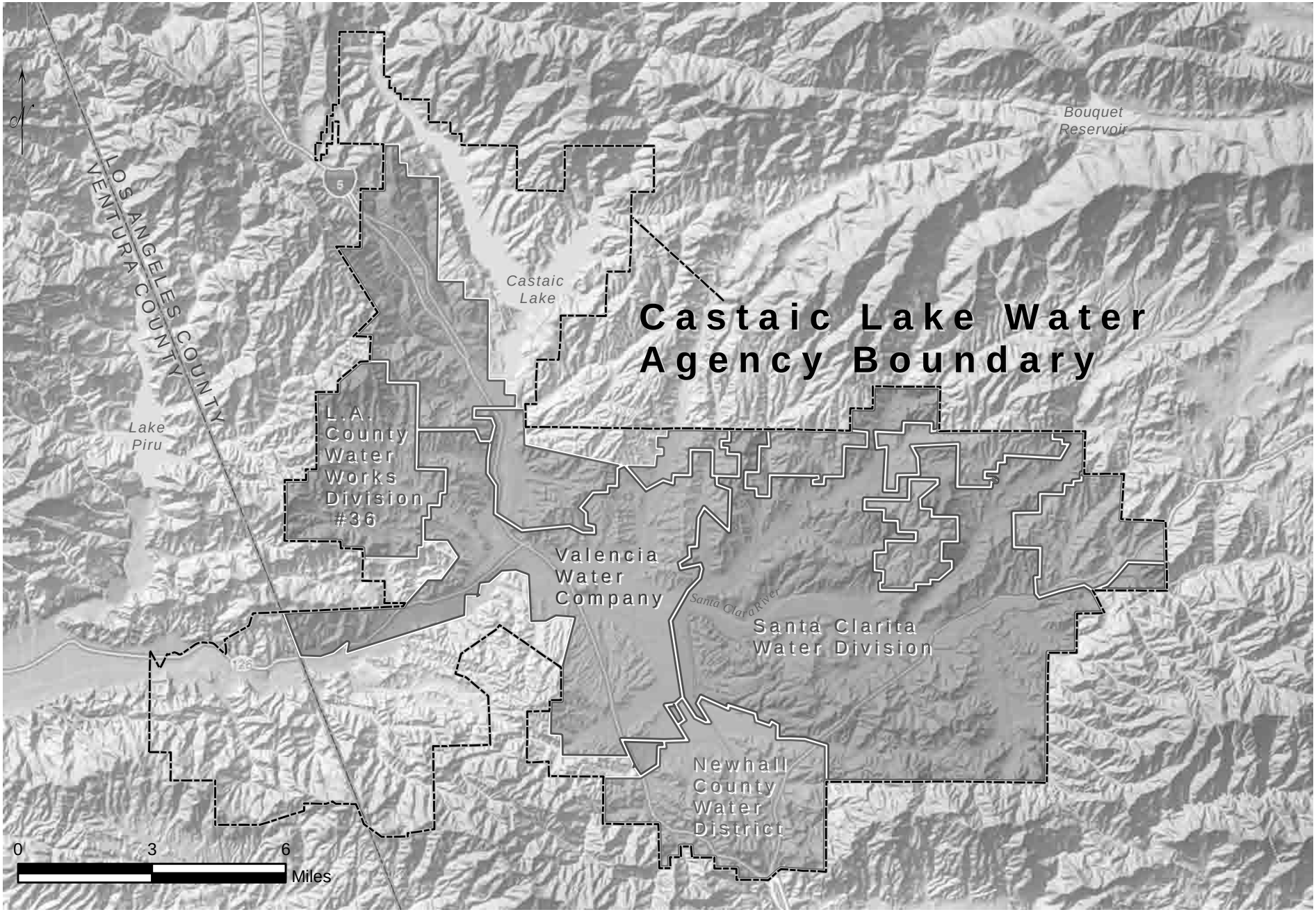

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Figure I-1
CLWA and Purveyor Service Areas

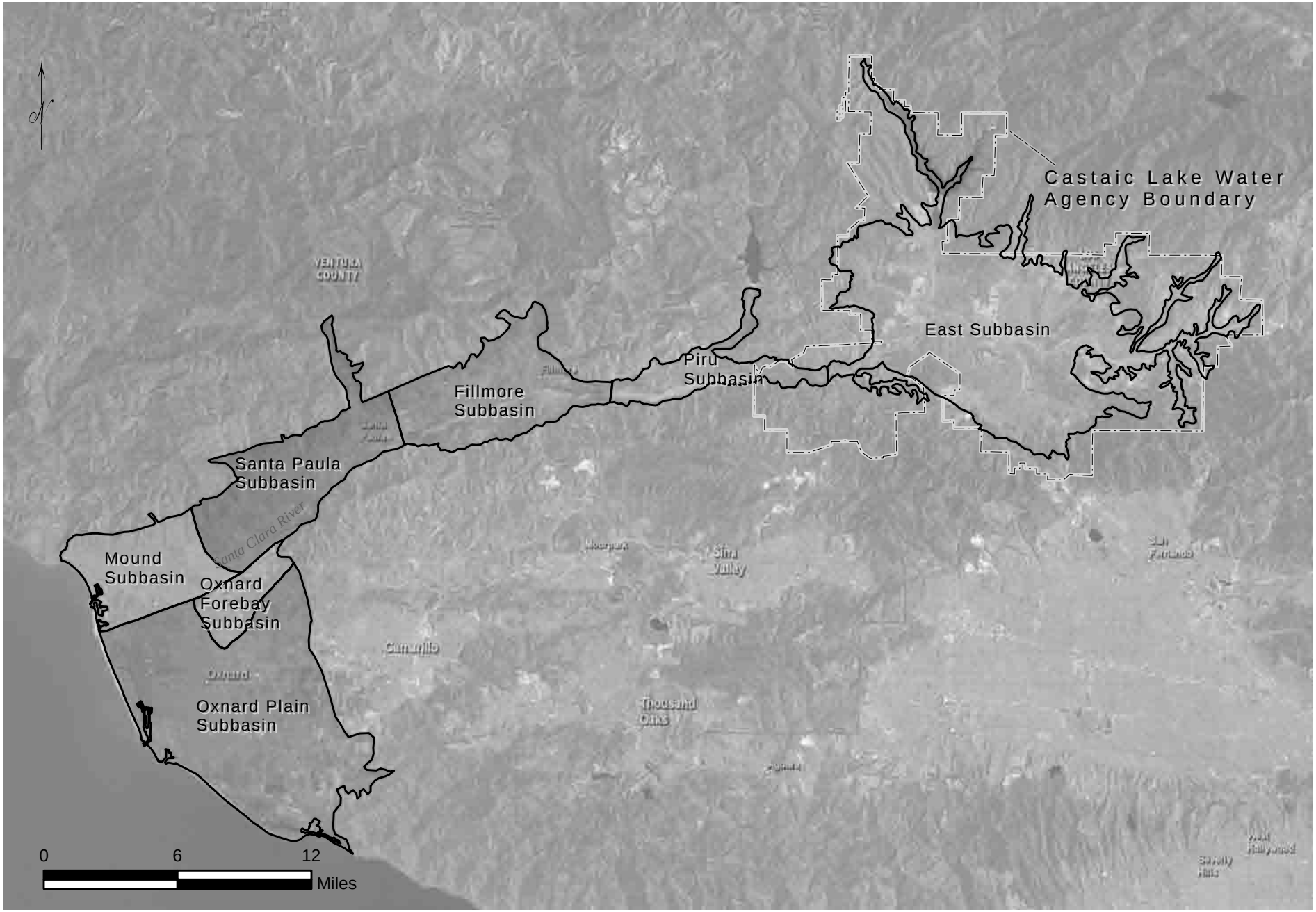

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Figure I-2
Santa Clara River Groundwater Subbasins

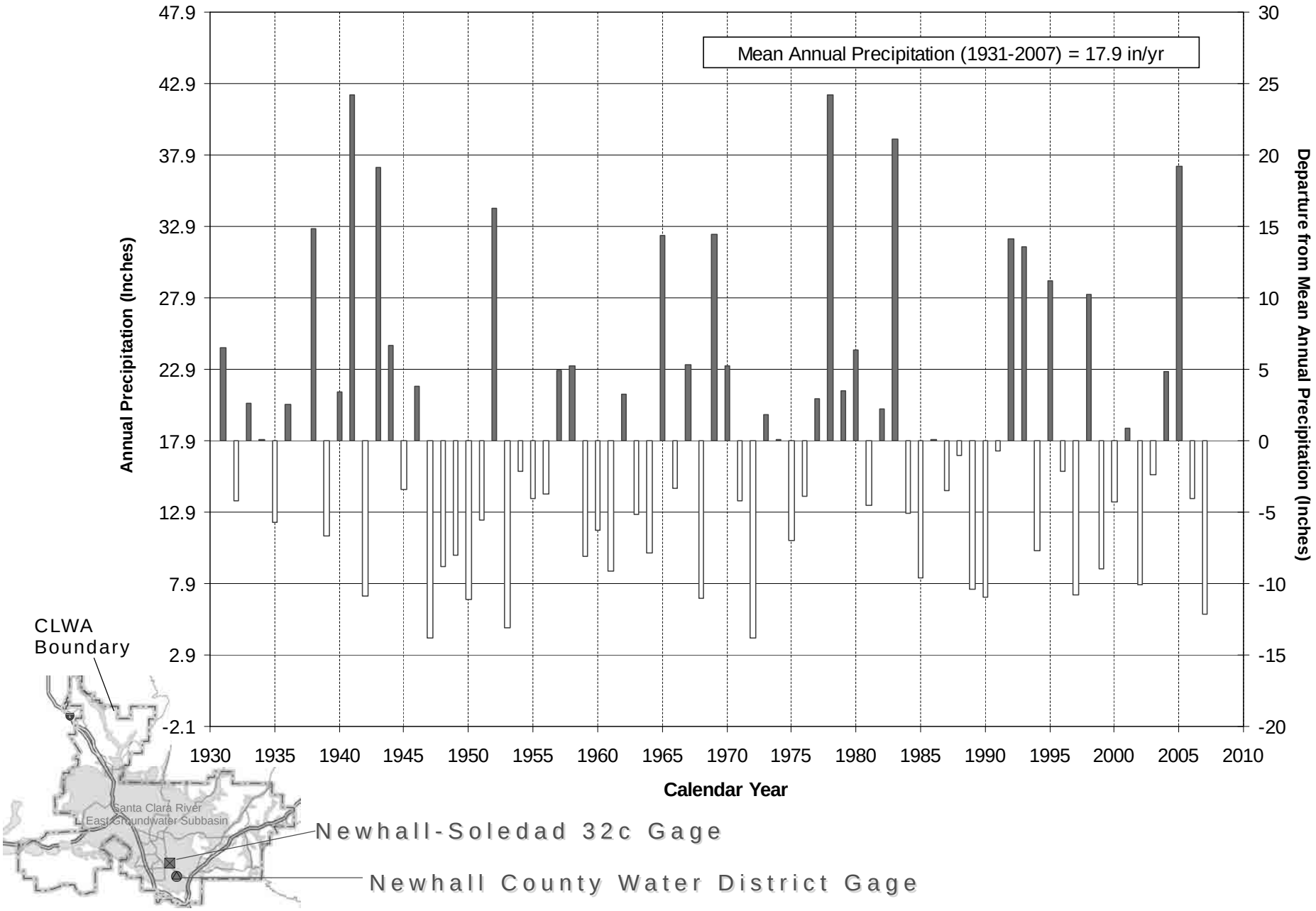

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Figure I-3
Annual Precipitation and Departure from Mean Annual Precipitation
Newhall-Soledad 32c Gage

II. 2007 Water Requirements and Supplies

In 2007, total water use in the Santa Clarita Valley was 92,300 af, an increase of 900 af from the previous year. Of the total water demand, 77,500 af (84 percent) were for municipal use and the remaining 14,800 af (16 percent) were for agricultural and other (miscellaneous) uses, including individual domestic uses. These total water demands were met by a combination of about 46,500 af from local groundwater resources (about 31,700 af for municipal supply and about 14,800 af for agricultural and other uses), about 45,300 af of SWP and other imported water, and about 470 af of recycled water.

Compared to the previous year, total water demand in the Santa Clarita Valley increased by about one percent in 2007. Actual water use in 2007 was less than the short-term projected water requirement of 99,000-102,000 acre-feet presented in last year's Water Report. The increase in water use in 2007 is attributed to an increase of about 800 municipal service connections, from 67,400 in 2006 to 68,200 in 2007 and a less than typical use of water for agricultural irrigation after a return to normal in 2006 following the extremely wet conditions of 2005. Water use in 2007 was somewhat inconsistent with the analysis of weather impacts on water usage in the 2005 Urban Water Management Plan, in that water requirements were not significantly above the average projections in the 2005 UWMP. As summarized in that Plan, examination of historical water use patterns in the Valley since 1980, when State Water Project deliveries began, shows that weather variations have influenced water use by nine to ten percent of normal, or average, use. In hotter, dry years, water demands have been as much as nine percent higher than normal while in cooler, wet years, water demands have been as much as ten percent less than normal. In 2005, extended and significantly wet conditions resulted in a water demand that was about six percent below the average projection in the 2005 UWMP. In 2006 and 2007, although precipitation was below average, total water requirements for all uses in the Valley were basically the same as the average projections in the 2005 UWMP.

The uses of local and imported water supplies to meet municipal water requirements since 1980, when the importation of SWP water began, are summarized in Table II-1. Water supply utilization by each individual municipal Purveyor is tabulated in Tables II-2 through II-5 for the same period of time. Notable with regard to municipal water requirements is that, through 2006, total municipal demand (77,500 af) was slightly below (by about 1,200 af) the projections in the 2005 UWMP.

Water supply utilization for all agricultural and other non-municipal uses is summarized in Table II-6 and tabulated by three categories of agricultural and other users in Table II-7. The latter category of Small Private Domestic, Irrigation and Golf Course Uses in Table II-7 includes an estimated 500 af of small private pumping from the Alluvium.

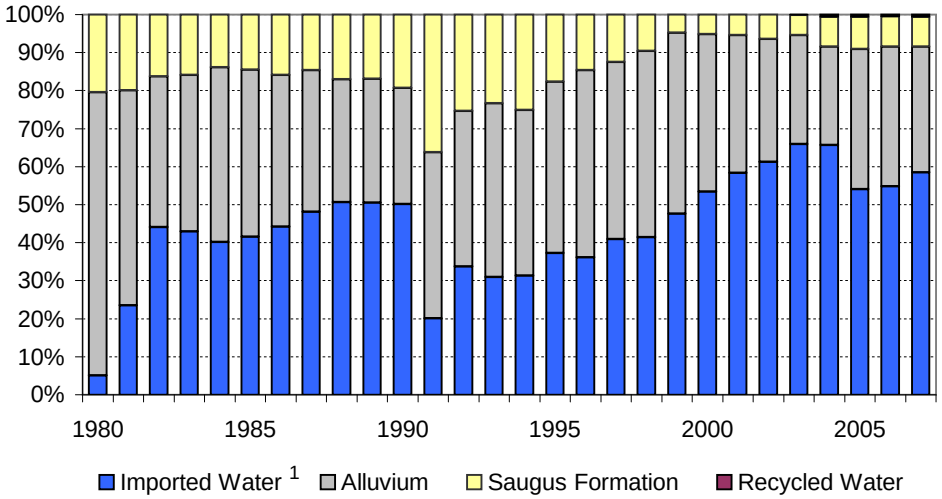
Water supply utilization for all uses in the Santa Clarita Valley, again for the period 1980 to present, is summarized in Table II-8. The trends in utilization of local groundwater and imported water, complemented by the recent addition of recycled water, are graphically illustrated in Figure II-1. As can be seen by inspection of Table II-8 and Figure II-1, total water use in the Valley has nearly linearly increased since the early 1980's, with some weather-related fluctuations in certain years. The resultant increase in total water demand, since the inception of supplemental SWP importation, has been from about 37,000 acre-feet in 1980 to the mid-80,000 acre-feet per year range through 2000-2005, to slightly more than 92,000 acre-feet in 2007. As can also be seen by inspection of Table II-8 and Figure II-1, most of that increase in water demand has been met with increasing importation of SWP water, most recently complemented by other imported water as discussed herein. Since the early 1990's, following a decade of decreased groundwater use during the initial period of SWP importation, total groundwater pumping has fluctuated from year to year, but has remained within a fairly narrow range of about 38,000 to 50,000 acre-feet per year through 2007.

Table II-1
Water Supply Utilization by Municipal Purveyors*
(Acre-Feet)

* includes CLWA-SCWD, LACWD 36, NCWD and VWC

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	*Recycled Water*	**Total**
1980	1,125	16,625	4,569	-	**22,319**
1981	5,816	14,056	4,950	-	**24,822**
1982	9,659	8,684	3,569	-	**21,912**
1983	9,185	8,803	3,398	-	**21,386**
1984	10,996	12,581	3,809	-	**27,386**
1985	11,823	12,519	4,140	-	**28,482**
1986	13,759	12,418	4,975	-	**31,152**
1987	16,285	12,630	4,962	-	**33,877**
1988	19,033	12,197	6,404	-	**37,634**
1989	21,618	13,978	7,217	-	**42,813**
1990	21,613	13,151	8,302	-	**43,066**
1991	7,968	17,408	14,417	-	**39,793**
1992	13,911	16,897	10,458	-	**41,266**
1993	13,393	19,808	10,151	-	**43,352**
1994	14,389	20,068	11,531	-	**45,988**
1995	16,996	20,590	8,087	-	**45,673**
1996	18,093	24,681	7,373	-	**50,147**
1997	22,148	25,273	6,752	-	**54,173**
1998	20,254	23,898	4,706	-	**48,858**
1999	27,282	27,240	2,728	-	**57,250**
2000	32,579	25,216	3,193	-	**60,988**
2001	35,369	22,055	3,267	-	**60,691**
2002	41,768	22,097	4,360	-	**68,225**
2003	44,419	19,397	3,581	50	**67,447**
2004	47,205	18,590	5,701	420	**71,916**
2005	38,034	26,025	5,948	418	**70,425**
2006	40,646	27,189	5,872	419	**74,126**
2007	45,332	25,632	6,058	470	**77,492**

Percent Contribution of Water Supplies

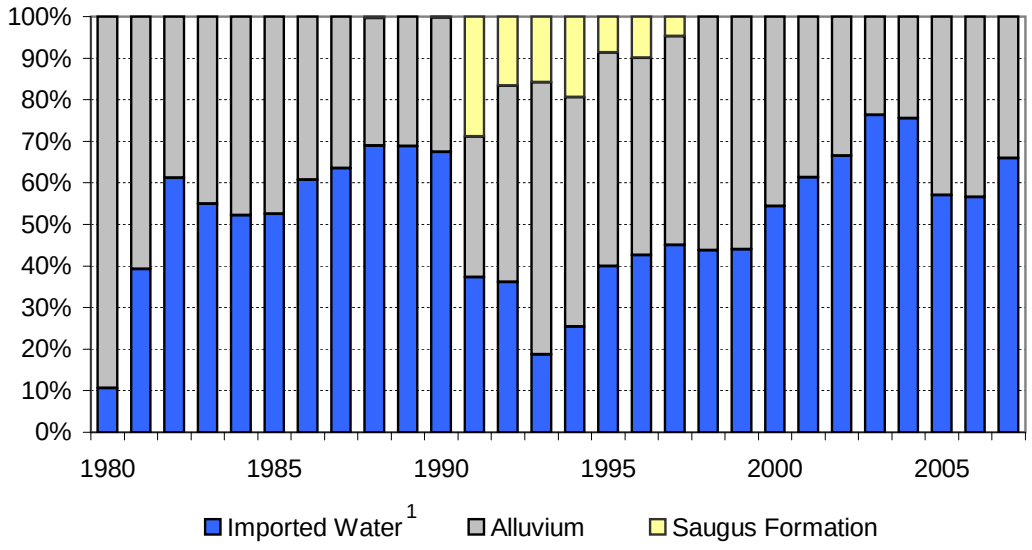


1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-2
Water Supply Utilization by CLWA Santa Clarita Water Division
(Acre-Feet)

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	**Total**
1980	1,125	9,460	0	**10,585**
1981	4,602	7,109	0	**11,711**
1982	6,454	4,091	0	**10,545**
1983	5,214	4,269	0	**9,483**
1984	6,616	6,057	0	**12,673**
1985	6,910	6,242	0	**13,152**
1986	8,366	5,409	0	**13,775**
1987	9,712	5,582	0	**15,294**
1988	11,430	5,079	63	**16,572**
1989	12,790	5,785	0	**18,575**
1990	12,480	5,983	40	**18,503**
1991	6,158	5,593	4,781	**16,532**
1992	6,350	8,288	2,913	**17,551**
1993	3,429	12,016	2,901	**18,346**
1994	5,052	10,996	3,863	**19,911**
1995	7,955	10,217	1,726	**19,898**
1996	9,385	10,445	2,176	**22,006**
1997	10,120	11,268	1,068	**22,456**
1998	8,893	11,426	0	**20,319**
1999	10,772	13,741	0	**24,513**
2000	13,751	11,529	0	**25,280**
2001	15,648	9,896	0	**25,544**
2002	18,921	9,513	0	**28,434**
2003	20,668	6,424	0	**27,092**
2004	22,045	7,146	0	**29,191**
2005	16,513	12,408	0	**28,921**
2006	17,146	13,156	0	**30,302**
2007	20,669	10,686	0	**31,355**

Percent Contribution of Water Supplies



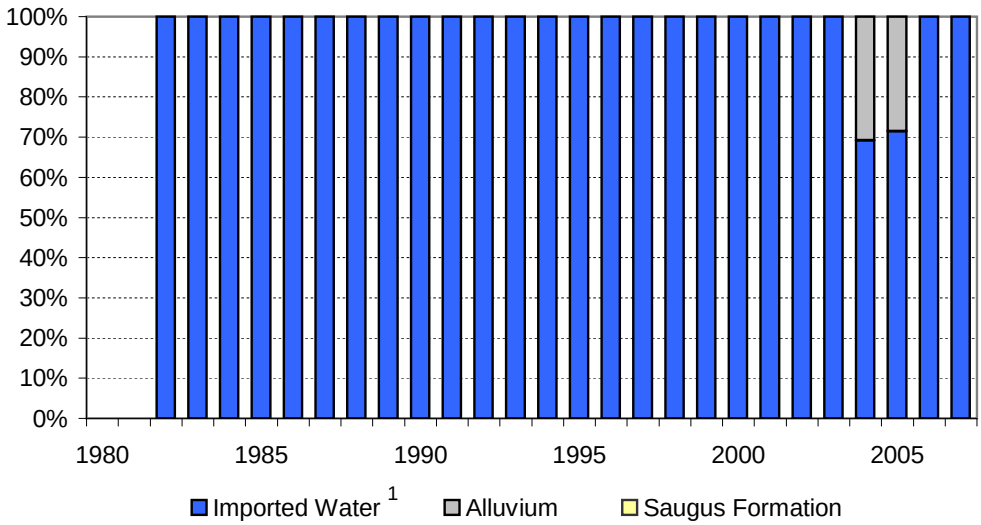
1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-3
Water Supply Utilization by Los Angeles County Waterworks District 36
(Acre-Feet)

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	**Total**
1980	0	-	-	**0**
1981	0	-	-	**0**
1982	145	-	-	**145**
1983	207	-	-	**207**
1984	240	-	-	**240**
1985	272	-	-	**272**
1986	342	-	-	**342**
1987	361	-	-	**361**
1988	434	-	-	**434**
1989	457	-	-	**457**
1990	513	-	-	**513**
1991	435	-	-	**435**
1992	421	-	-	**421**
1993	465	-	-	**465**
1994	453	-	-	**453**
1995	477	-	-	**477**
1996	533	-	-	**533**
1997	785	-	-	**785**
1998	578	-	-	**578**
1999	654	-	-	**654**
2000	800	-	-	**800**
2001	907	-	-	**907**
2002	1,069	-	-	**1,069**
2003	1,175	-	-	**1,175**
2004	854	380	-	**1,234**
2005	857	343	-	**1,200**
2006	1,289	-	-	**1,289**
2007	1,406	-	-	**1,406**

Groundwater purchased from Los Angeles County Honor Farm

Percent Contribution of Water Supplies

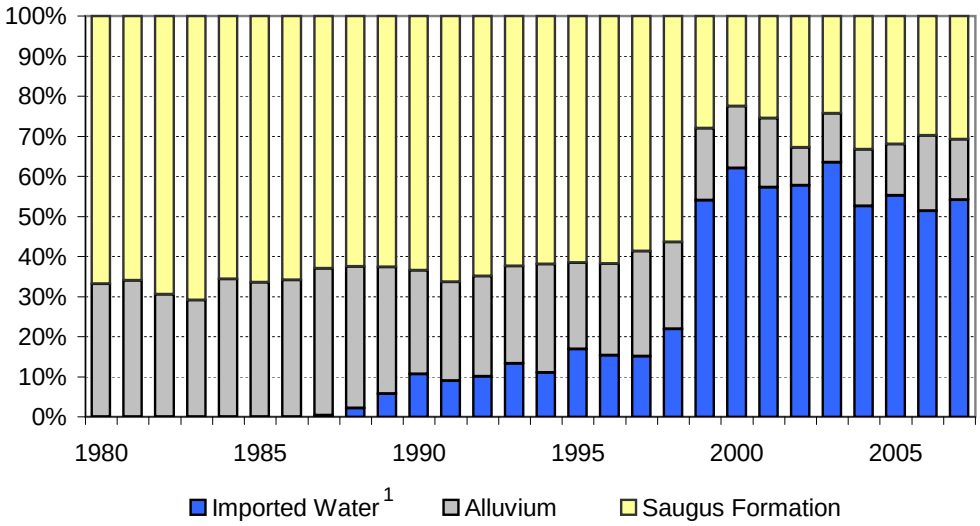


1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-4
Water Supply Utilization by Newhall County Water District
(Acre-Feet)

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	**Total**
1980	0	1,170	2,363	**3,533**
1981	0	1,350	2,621	**3,971**
1982	0	1,178	2,672	**3,850**
1983	0	1,147	2,787	**3,934**
1984	0	1,549	2,955	**4,504**
1985	0	1,644	3,255	**4,899**
1986	0	1,842	3,548	**5,390**
1987	22	2,127	3,657	**5,806**
1988	142	2,283	4,041	**6,466**
1989	428	2,367	4,688	**7,483**
1990	796	1,936	4,746	**7,478**
1991	675	1,864	4,994	**7,533**
1992	802	1,994	5,160	**7,956**
1993	1,075	1,977	5,068	**8,120**
1994	906	2,225	5,103	**8,234**
1995	1,305	1,675	4,775	**7,755**
1996	1,213	1,803	4,871	**7,887**
1997	1,324	2,309	5,168	**8,801**
1998	1,769	1,761	4,557	**8,087**
1999	5,050	1,676	2,622	**9,348**
2000	6,024	1,508	2,186	**9,718**
2001	5,452	1,641	2,432	**9,525**
2002	5,986	981	3,395	**10,362**
2003	6,572	1,266	2,513	**10,351**
2004	5,896	1,582	3,739	**11,217**
2005	5,932	1,389	3,435	**10,756**
2006	5,898	2,149	3,423	**11,470**
2007	6,478	1,806	3,691	**11,975**

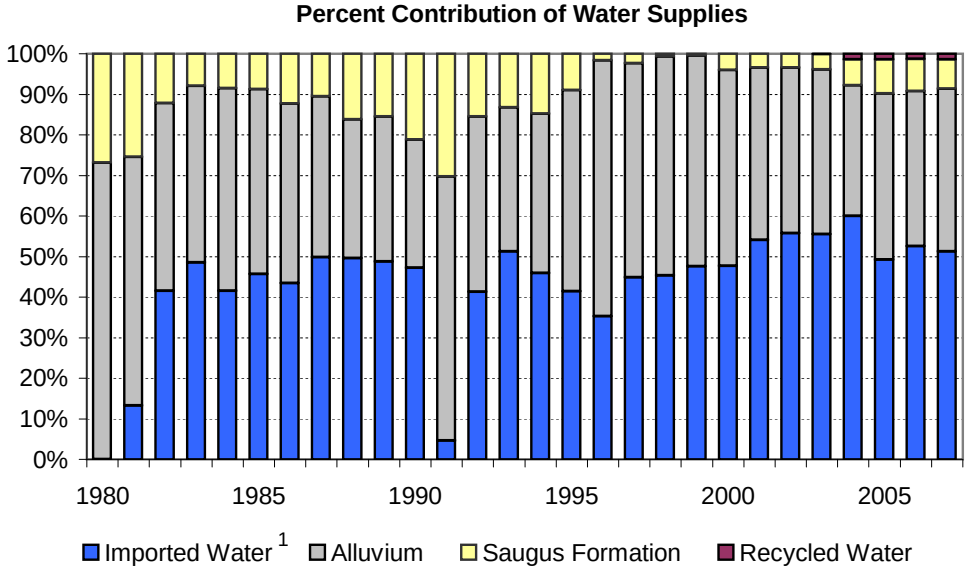
Percent Contribution of Water Supplies



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-5
Water Supply Utilization by Valencia Water Company
(Acre-Feet)

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	*Recycled Water*	**Total**
1980	0	5,995	2,206	-	**8,201**
1981	1,214	5,597	2,329	-	**9,140**
1982	3,060	3,415	897	-	**7,372**
1983	3,764	3,387	611	-	**7,762**
1984	4,140	4,975	854	-	**9,969**
1985	4,641	4,633	885	-	**10,159**
1986	5,051	5,167	1,427	-	**11,645**
1987	6,190	4,921	1,305	-	**12,416**
1988	7,027	4,835	2,300	-	**14,162**
1989	7,943	5,826	2,529	-	**16,298**
1990	7,824	5,232	3,516	-	**16,572**
1991	700	9,951	4,642	-	**15,293**
1992	6,338	6,615	2,385	-	**15,338**
1993	8,424	5,815	2,182	-	**16,421**
1994	7,978	6,847	2,565	-	**17,390**
1995	7,259	8,698	1,586	-	**17,543**
1996	6,962	12,433	326	-	**19,721**
1997	9,919	11,696	516	-	**22,131**
1998	9,014	10,711	149	-	**19,874**
1999	10,806	11,823	106	-	**22,735**
2000	12,004	12,179	1,007	-	**25,190**
2001	13,362	10,518	835	-	**24,715**
2002	15,792	11,603	965	-	**28,360**
2003	16,004	11,707	1,068	50	**28,829**
2004	18,410	9,862	1,962	420	**30,654**
2005	14,732	12,228	2,513	418	**29,891**
2006	16,313	11,884	2,449	419	**31,065**
2007	16,779	13,140	2,367	470	**32,756**

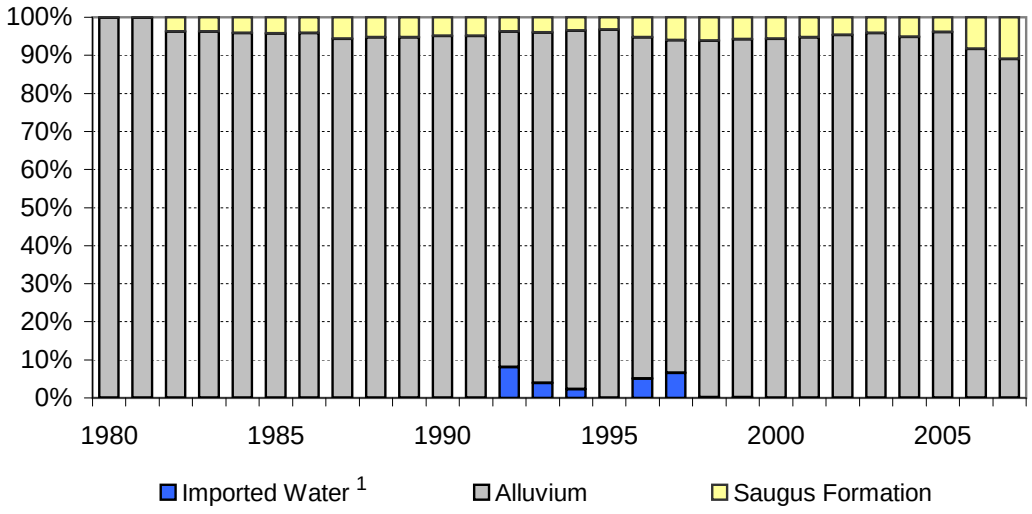


1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-6
Water Supply Utilization for Agricultural and Other Uses
(Acre-Feet)

Year	*Imported Water* [1]	*Alluvium*	*Saugus Formation*	**Total**
1980	0	14,831	20	**14,851**
1981	0	16,737	20	**16,757**
1982	0	13,184	521	**13,705**
1983	0	11,483	454	**11,937**
1984	0	14,737	640	**15,377**
1985	0	12,828	575	**13,403**
1986	0	11,787	510	**12,297**
1987	0	10,012	599	**10,611**
1988	0	9,451	524	**9,975**
1989	0	9,743	542	**10,285**
1990	0	10,725	559	**11,284**
1991	0	9,779	500	**10,279**
1992	987	10,694	466	**12,147**
1993	443	10,318	459	**11,220**
1994	311	13,065	494	**13,870**
1995	6	13,874	473	**14,353**
1996	780	13,757	813	**15,350**
1997	1,067	14,326	993	**16,386**
1998	12	12,750	849	**13,611**
1999	20	16,166	988	**17,174**
2000	3	14,721	887	**15,611**
2001	0	15,489	873	**16,362**
2002	0	16,179	800	**16,979**
2003	0	14,203	626	**14,829**
2004	0	14,787	803	**15,590**
2005	0	12,280	505	**12,785**
2006	0	15,872	1,440	**17,312**
2007	0	13,141	1,627	**14,768**

Percent Contribution of Water Supplies



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

Table II-7
Individual Water Supply Utilization by Agricultural and Other Users
(Acre-Feet)

	Newhall Land and Farming			***Los Angeles County Honor Farm***			***Small Private Domestic, Irrigation and Golf Courses Uses***		
Year	*Alluvium*	*Saugus Formation*	**Total**	*Alluvium*	*Imported Water* [1]	**Total**	*Alluvium* [2]	*Saugus Formation* [3]	**Total**
1980	11,331	20	**11,351**	3,000	0	**3,000**	500	0	**500**
1981	13,237	20	**13,257**	3,000	0	**3,000**	500	0	**500**
1982	9,684	20	**9,704**	3,000	0	**3,000**	500	501	**1,001**
1983	7,983	20	**8,003**	3,000	0	**3,000**	500	434	**934**
1984	11,237	20	**11,257**	3,000	0	**3,000**	500	620	**1,120**
1985	9,328	20	**9,348**	3,000	0	**3,000**	500	555	**1,055**
1986	8,287	20	**8,307**	3,000	0	**3,000**	500	490	**990**
1987	6,512	20	**6,532**	3,000	0	**3,000**	500	579	**1,079**
1988	5,951	20	**5,971**	3,000	0	**3,000**	500	504	**1,004**
1989	6,243	20	**6,263**	3,000	0	**3,000**	500	522	**1,022**
1990	8,225	20	**8,245**	2,000	0	**2,000**	500	539	**1,039**
1991	7,039	20	**7,059**	2,240	0	**2,240**	500	480	**980**
1992	8,938	20	**8,958**	1,256	987	**2,243**	500	446	**946**
1993	8,020	20	**8,040**	1,798	443	**2,241**	500	439	**939**
1994	10,606	20	**10,626**	1,959	311	**2,270**	500	474	**974**
1995	11,174	20	**11,194**	2,200	6	**2,206**	500	453	**953**
1996	12,020	266	**12,286**	1,237	780	**2,017**	500	547	**1,047**
1997	12,826	445	**13,271**	1,000	1,067	**2,067**	500	548	**1,048**
1998	10,250	426	**10,676**	2,000	12	**2,012**	500	423	**923**
1999	13,824	479	**14,303**	1,842	20	**1,862**	500	509	**1,009**
2000	11,857	374	**12,231**	1,644	3	**1,647**	1,220	513	**1,733**
2001	12,661	300	**12,961**	1,604	0	**1,604**	1,224	573	**1,797**
2002	13,514	211	**13,725**	1,602	0	**1,602**	1,063	589	**1,652**
2003	10,999	122	**11,121**	2,273	0	**2,273**	931	504	**1,435**
2004	10,991	268	**11,259**	2,725	0	**2,725**	1,071	535	**1,606**
2005	8,648	6	**8,654**	2,499	0	**2,499**	1,133	499	**1,632**
2006	11,477	934	**12,411**	3,026	0	**3,026**	1,369	506	**1,875**
2007	9,968	971	**10,939**	2,085	0	**2,085**	1,088	656	**1,744**

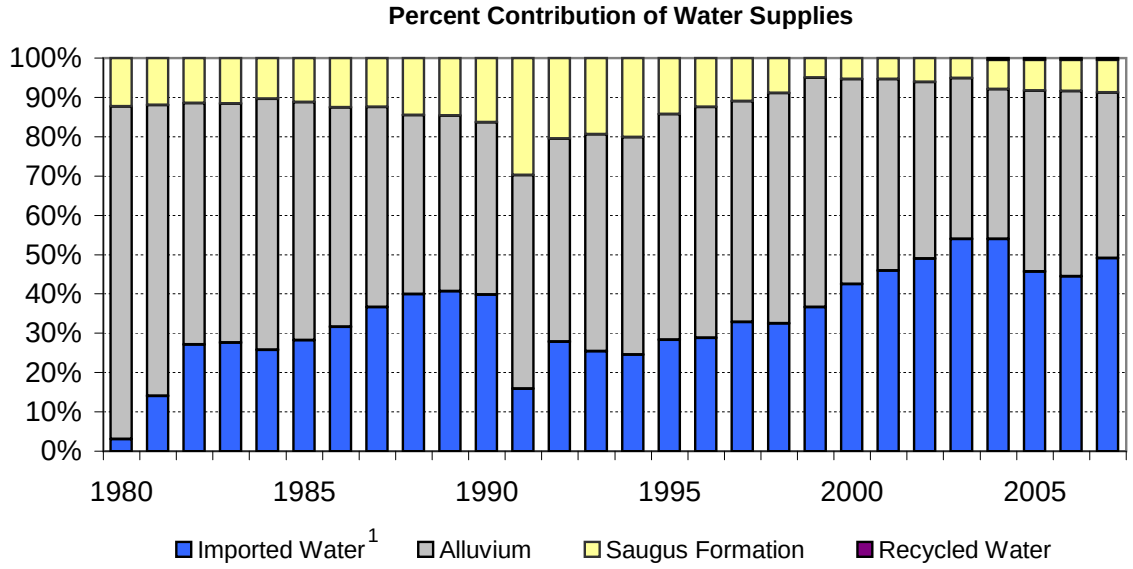
1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

2. Robinson Ranch Golf Course irrigation and estimated private pumping.

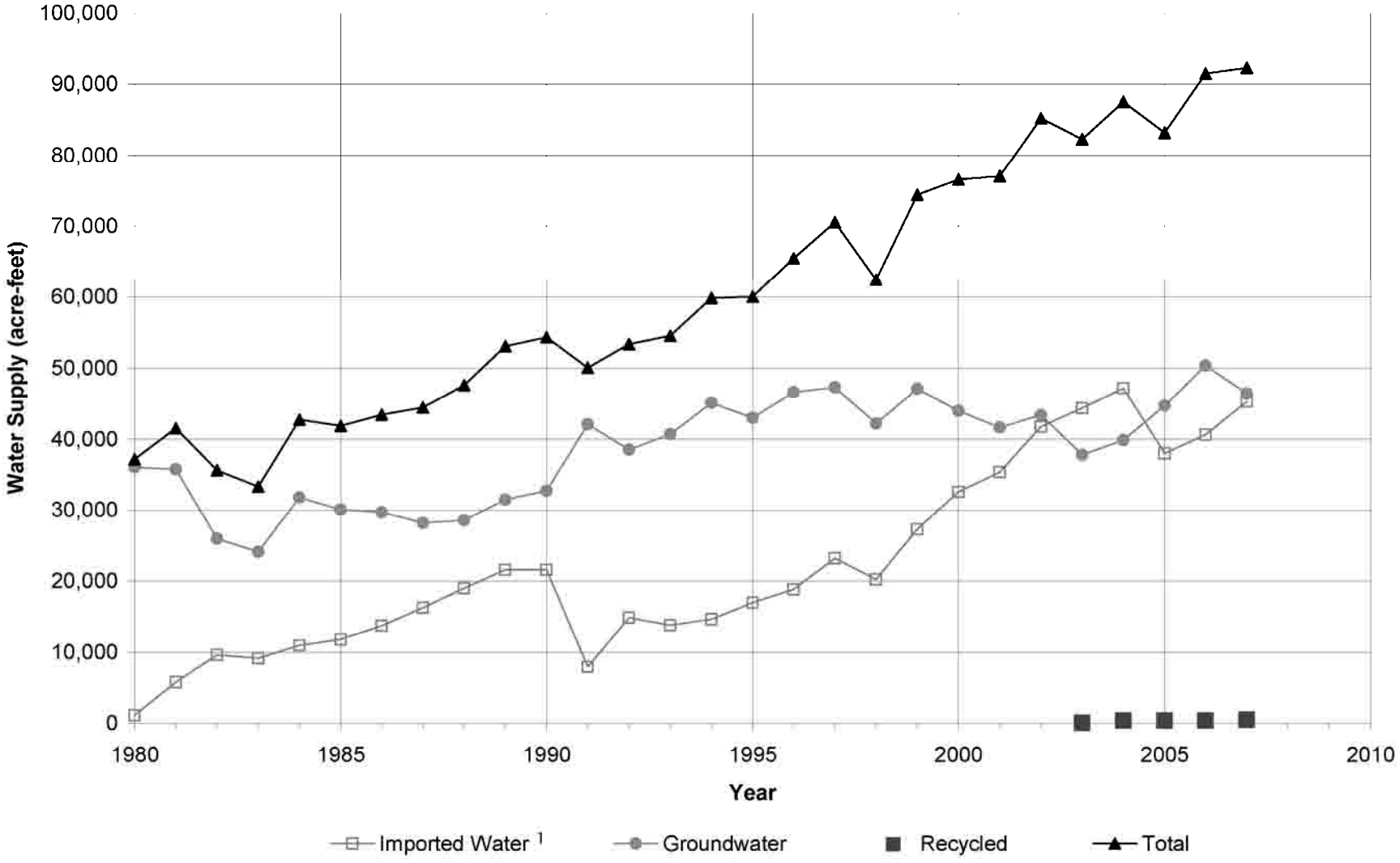
3. Valencia Country Club and Vista Valencia Golf Course irrigation.

Table II-8
Total Water Supply Utilization for Municipal, Agricultural and Other Uses
(Acre-Feet)

Year	*Imported Water*[1]	*Alluvium*	*Saugus Formation*	*Recycled Water*	**Total**
1980	1,125	31,456	4,589	-	**37,170**
1981	5,816	30,793	4,970	-	**41,579**
1982	9,659	21,868	4,090	-	**35,617**
1983	9,185	20,286	3,852	-	**33,323**
1984	10,996	27,318	4,449	-	**42,763**
1985	11,823	25,347	4,715	-	**41,885**
1986	13,759	24,205	5,485	-	**43,449**
1987	16,285	22,642	5,561	-	**44,488**
1988	19,033	21,648	6,928	-	**47,609**
1989	21,618	23,721	7,759	-	**53,098**
1990	21,613	23,876	8,861	-	**54,350**
1991	7,968	27,187	14,917	-	**50,072**
1992	14,898	27,591	10,924	-	**53,413**
1993	13,836	30,126	10,610	-	**54,572**
1994	14,700	33,133	12,025	-	**59,858**
1995	17,002	34,464	8,560	-	**60,026**
1996	18,873	38,438	8,186	-	**65,497**
1997	23,215	39,599	7,745	-	**70,559**
1998	20,266	36,648	5,555	-	**62,469**
1999	27,302	43,406	3,716	-	**74,424**
2000	32,582	39,937	4,080	-	**76,599**
2001	35,369	37,544	4,140	-	**77,053**
2002	41,768	38,276	5,160	-	**85,204**
2003	44,419	33,599	4,207	50	**82,276**
2004	47,205	33,377	6,503	420	**87,505**
2005	38,034	38,305	6,453	418	**83,210**
2006	40,646	43,061	7,312	419	**91,438**
2007	45,332	38,773	7,684	470	**92,260**



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

LUHDORFF & SCALMANINI
CONSULTING ENGINEERS

Figure II-1
Total Water Supply Utilization
Santa Clarita Valley

III. Water Supplies

Prior to 1980, local groundwater extracted from the Alluvium and the Saugus Formation was the sole source of water supply in the Santa Clarita Valley. Since 1980, local groundwater supplies have been supplemented with imported SWP water supplies, augmented in 2007 by acquisition of additional supplemental water from the Buena Vista Water Storage District. Those water supplies were also augmented by the initiation of deliveries from CLWA's recycled water program in 2003. This section describes the groundwater resources of the Santa Clarita Valley, SWP and other imported water supplies, and CLWA's recycled water program.

3.1 Groundwater Basin Yield

The groundwater basin generally beneath the Santa Clarita Valley, identified in the State Department of Water Resources' Bulletin 118 as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), is comprised of two aquifer systems. The Alluvium generally underlies the Santa Clara River and its several tributaries, and the Saugus Formation underlies practically the entire Upper Santa Clara River area. The mapped extent of the Santa Clara River Valley East Subbasin in DWR Bulletin 118 and its relationship to the extent of the CLWA service area are illustrated in Figure III-1. The subbasin boundary approximately coincides with the outer extent of the Alluvium and Saugus Formation.

A 2001 Update Report on both the Alluvium and Saugus Formation Aquifers (Slade, 2002), which updated analyses and interpretation of hydrogeologic conditions from earlier reports (Slade, 1986 and 1988), included extensive detail on major aspects of the groundwater basin. Notable parts of the Update Report relative to groundwater supply included findings that:

- Analysis of historical groundwater levels and production indicates that there have been no conditions that would be illustrative of groundwater overdraft.

- Utilization of operational yield (as opposed to perennial yield) as a basis for managing groundwater production would be more applicable in this basin to reflect fluctuating utilization of groundwater in conjunction with imported SWP water.

- Operational yield of the Alluvium would typically be 30,000 to 40,000 afy for wet and normal rainfall years, with an expected reduction into the range of 30,000 to 35,000 afy in dry years.

- Operational yield of the Saugus Formation would typically be in the range of 7,500 to 15,000 afy on a long-term basis, with possible short-term increases during dry periods into a range of 15,000 to 25,000 afy, and to 35,000 afy if dry conditions continue.

Following on the 2001 Update Report, the groundwater component of overall water supply in the Valley derives from a groundwater operating plan to meet water requirements (municipal, agricultural, small domestic) while maintaining the basin in a sustainable condition (i.e., no long-term depletion of groundwater or interrelated surface water). This operating plan also addresses groundwater contamination issues in the basin, all consistent with the adopted Groundwater Management Plan. The groundwater operating plan is based on the concept that pumping can vary from year to year to generally rely on increased groundwater use in dry periods and increased recharge during wet periods, and to collectively assure that the groundwater basin is adequately replenished through various wet/dry cycles.

The groundwater operating plan, summarized in Table III-1, is as follows:

Alluvium – Pumping from the Alluvial Aquifer in a given year is related to local hydrologic conditions in the eastern Santa Clara River watershed. Pumping is expected to typically range between 30,000 and 40,000 afy during normal and above-normal rainfall years. Due to hydrogeologic constraints in the eastern part of the basin, pumping is expected to be typically reduced to between 30,000 and 35,000 afy during locally dry years.

Saugus Formation – Pumping from the Saugus Formation in a given year is related to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping is expected to typically range between 7,500 and 15,000 afy. Planned dry-year pumping from the Saugus Formation is expected to range between 15,000 and 25,000 afy during a drought year and can increase to between 21,000 and 25,000 afy if SWP deliveries are reduced for two consecutive years, and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such high pumping is expected to typically be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.

Table III-1
Groundwater Operating Plan for the Santa Clarita Valley

Aquifer	Groundwater Production (af)			
	Normal Years	**Dry Year 1**	**Dry Year 2**	**Dry Year 3**
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**

In 2004, as part of analyzing the restoration of perchlorate-impacted groundwater supply in the Valley, a numerical groundwater flow model was developed and calibrated for use in analyzing the response of the groundwater basin to long-term operation at the operational yields noted above, with focus on perchlorate extraction and the control of perchlorate migration in the basin. That groundwater flow model was then utilized in 2005 to specifically analyze the sustainability of groundwater supplies in both the Alluvium and the Saugus Formation through a long-term (78 year) hydrologic period that was selected to examine groundwater basin response to variations in pumping in accordance with the operating plan. Resultant projections of groundwater levels, groundwater storage, and surface water flows showed the basin to respond in a long-term sustainable manner, with no chronic depletion of groundwater levels, storage, or stream flows. The analysis of groundwater sustainability was summarized in a Basin Yield Report (CH2M Hill and LSCE, 2005), which included the following findings:

- The groundwater basin has historically been, and continues to be, in good operating condition and not in overdraft conditions, as indicated by historical data.

- The groundwater plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for one or more years without creating long-term adverse impacts to the groundwater system and the Santa Clara River.

- The groundwater operating plan for the Alluvium and the Saugus Formation can be used for long-term water supply planning purposes. In particular, although increased pumping from the Saugus Formation during dry periods can be expected to cause short-term declines in groundwater levels, it is not projected to cause permanent declines in groundwater discharges or streamflow. Saugus groundwater levels can be expected to

recover to pre-drought conditions when pumping is reduced in subsequent wet to normal years.

- The strategy around which the groundwater operating plan was designed (maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus pumping during years when SWP supplies are significantly reduced because of drought conditions) is viable on a long-term basis.

- The historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the groundwater operating plan.

3.2 Alluvium – General

The spatial extent of the aquifers used for groundwater supply in the Valley, the Alluvium and the Saugus Formation, are illustrated in Figure III-1. Geologic descriptions and hydrogeologic details related to both aquifers are included in several technical reports including Slade (1986, 1988 & 2002), CH2M Hill (2005) and LSCE (2005), and in the 2005 Urban Water Management Plan.

Consistent with the 2001 Update Report (Slade), the 2005 Basin Yield Report (CH2M Hill and LSCE), and the 2005 UWMP, the management practice of the Purveyors continues to be to rely on groundwater from the Alluvium for part of the overall municipal water supply, whereby total pumping from the Alluvium (by municipal, agricultural, and small private pumpers) is in accordance with the groundwater operating plan, 30,000 to 40,000 afy in wet and normal years, with possible reduction to 30,000 to 35,000 afy in dry years. Such operation will maximize use of the Alluvium because of the aquifer's ability to store and produce good quality water on a sustainable basis, and because the Alluvium is capable of rapid recovery of groundwater storage in wet periods. As with many groundwater basins, it is possible to intermittently exceed a long-term average yield for one or more years without long-term adverse effects. Higher pumping for short periods may temporarily lower groundwater storage and related water levels, as has been the case in the Alluvium several times since the 1930's. However, subsequent decreases in pumping limit the amount of water level decline. Normal to wet-period recharge results in a rapid return of groundwater levels to historic highs. Historical groundwater data collected from the Alluvium over numerous hydrologic cycles continue to provide assurance that groundwater elevations, if locally lowered during dry periods, recover in subsequent average or wet years.

Such water level response to rainfall is a significant characteristic of permeable, porous, alluvial aquifer systems that occur within large watersheds. In light of these historical observations, complemented by the long-term sustainability analysis using the numerical groundwater flow model, there is ongoing confidence that groundwater will continue to be a sustainable source of water supply at the rates of pumping described in the Basin Yield Report, now incorporated in the 2005 UWMP.

Long-term adverse impacts to the Alluvium could occur if the amount of water extracted from the aquifer were to exceed the amount of water that recharges the aquifer over an extended period. However, the quantity and quality of water in the Alluvium and all significant pumping from the Alluvium are routinely monitored, and no long-term adverse impacts have ever been evident. Ultimately, the Purveyors have identified cooperative measures to be taken, if needed, to ensure sustained use of the aquifer. Such measures include but are not limited to the continuation of conjunctive use of imported SWP surface water with local groundwater, artificial recharge of the aquifer with local runoff or other surface water supplies, financial incentives discouraging extractions above a selected limit, expanded use of other water supplies such as recycled water, and expanded implementation of demand-side management, including conservation.

3.2.1 Alluvium – Historical and Current Conditions

Total pumping from the Alluvium in 2007 was about 38,800 af, a decrease of 4,300 af from the preceding year. Total Alluvium pumping was within the groundwater operating plan range. Of the total Alluvial pumping in 2007, about 25,650 af (66 percent) was for municipal water supply, and the balance, about 13,150 af (34 percent), was for agriculture and other smaller uses, including individual domestic uses. In a longer-term context, there has been a change in municipal/agricultural pumping distribution since SWP deliveries began in 1980, toward a slightly higher fraction for municipal water supply (from about 50 percent to more than 60 percent of Alluvial pumpage), which reflects the general land use changes in the area. Ultimately, on a long-term average basis since the beginning of imported water deliveries from the SWP, total Alluvial pumping has been almost 31,700 afy, which is at the lower end of the range of operational yield of the Alluvium. That average has been higher over the last decade, about 38,900 afy, which remains within the range of operational yield of the Alluvium. The overall historic record of Alluvial pumping is illustrated in Figure III-2.

Groundwater levels in various parts of the basin have historically exhibited different responses to both pumpage and climatic fluctuations. During the last 20 to 30 years, depending on location,

Alluvial groundwater levels have remained nearly constant (generally toward the western end of the basin), or have fluctuated from near the ground surface when the basin is full, to as much as 100 feet lower during intermittent dry periods of reduced recharge (generally toward the eastern end of the basin). For illustration of the various groundwater level conditions in the basin, the Alluvial wells have been grouped into areas with similar groundwater level patterns, as shown in Figure III-3. The groundwater level records have been organized into hydrograph form (groundwater elevation vs. time) as illustrated in Figures III-4 and III-5. Also shown on these plots is an annual marker indicating whether the year had a below average amount of rainfall. The wells shown on these plots are representative of the areas, showing the range of values (highest to lowest elevation) through the area, and containing a sufficiently long-term record to illustrate trends over time.

The 'Mint Canyon' area, located at the far eastern end of the groundwater basin, and the nearby 'Above Saugus WRP' and 'Bouquet Canyon' areas generally exhibit similar groundwater level responses. Those parts of the Alluvium have historically experienced a number of alternating wet and dry hydrologic conditions (Figure III-4) during which groundwater level declines have been followed by returns to high or mid-range historic levels. As shown in Figure III-6, the Purveyors decreased total Alluvial pumping from the 'Mint Canyon' area steadily from 2000 through 2003, and correspondingly increased pumping in the 'Below Saugus WRP', and 'Below Valencia WRP' areas. In spite of a continued period of below-average precipitation from 1999 to 2003, that progressive decrease in pumping resulted in a cessation of groundwater level decline in the 'Mint Canyon Area'. Subsequent wet conditions in late 2004, continuing into 2005, resulted in full recovery of groundwater storage. With such high groundwater levels, pumping in the 'Mint Canyon' area was increased in 2005 and 2006, with no significant change in groundwater levels in 2005 and a slight decrease in 2006. Partly in response to decreased pumping in that area in 2007, groundwater levels slowed their decrease, leveled off, or increased in late 2007 and early 2008 with the onset of seasonal precipitation.

In the 'Bouquet Canyon' area, pumping has remained relatively constant for the last ten years, and water levels have fluctuated with consecutive wet or dry years. During and since the most recent wet conditions of 2004 and 2005, water levels have been within historic mid-range levels. This groundwater level response to wet/dry years and pumping is typical for these areas of the basin. When water levels are low, well yields and pumping capacities in these areas can be impacted. The affected Purveyors typically respond by increasing use of Saugus Formation and imported (SWP) supplies, as shown in Table II-8. The Purveyors also shift a fraction of the Alluvial pumping that would normally be supplied by these eastern areas to areas further west,

where well yields and pumping capacities remain fairly constant because of smaller groundwater level fluctuations.

In the western parts and lower elevations of the Alluvium, groundwater levels respond to pumping and precipitation in a similar manner, but to an attenuated or limited extent of those situated in the eastern, higher elevations areas. As shown in the western group of hydrographs in Figure III-5, groundwater level fluctuations become more subtle moving westward and lower in the Valley. The 'Below Saugus WRP' area, along the Santa Clara River immediately downstream of the Saugus Water Reclamation Plant, and the 'San Francisquito Canyon' area generally exhibit similar groundwater level trends. In this middle part of the basin, historical groundwater levels were lower in the 1950's and 60's than current levels. Groundwater levels in this area notably recovered as pumping declined through the 1960's and 1970's. They have subsequently sustained generally high levels for much of the last 30 years, with three dry-period exceptions: mid-1970's, late 1980's to early 1990's, and the late 1990's to early 2000's. Recoveries to previous high groundwater levels followed both of the short dry-period declines in the 1970's and 1990's. More recently, groundwater levels recovered significantly in both areas, to historic highs, following a wetter-than-average year in 2004 and significantly wet 2005. Since 2005, pumping has remained relatively constant in the 'Below Saugus WRP' area, while 'San Francisquito Canyon' area pumping has been double the amount of previous years. Coupled with the dry 2006-2007 period, water levels had seen varying degrees of decline until they leveled off with the onset of a 'near-normal' amount of seasonal precipitation in 2008.

The 'Castaic Valley' area is located along Castaic Creek below Castaic Lake. Below that and along the Santa Clara River, downstream of the Valencia Water Reclamation Plant, is the 'Below Valencia WRP' area, where discharges of treated effluent from the Valencia WRP to the Santa Clara River contribute to groundwater recharge. In the 'Castaic Valley' area, groundwater levels continue to remain fairly constant, with slight responses to climatic and other fluctuations, since the 1950's (Figure III-5). Small changes in groundwater levels in 2007 were consistent with other short-term historical fluctuations. The long-term, generally constant trend remained through 2007. The 'Below Valencia WRP' area groundwater levels exhibit slight, if any, response to climatic fluctuations, and have remained fairly constant since the 1950's despite, over the last 20 years, a notable increase in pumping that continued through 2007 in that area (Figure III-5 and III-6).

In summary, depending on the period of available data, all the history of groundwater levels in the Alluvium shows the same general picture: recent (last 30 years) groundwater levels have exhibited historic highs; in some locations, there are intermittent dry-period declines (resulting

from use of some groundwater from storage) followed by wet-period recoveries (and associated refilling of storage space). On a long-term basis, whether over the last 27 years since importation of supplemental SWP water, or over the last 40 to 50 years (since the 1950's - 60's), the Alluvium shows no signs of water level-related overdraft, i.e., no trend toward decreasing water levels and storage. Consequently, pumping from the Alluvium has been and continues to be sustainable, well within the operational yield of that aquifer on a long-term average basis, and also within the operating yield in almost every individual year.

3.3 Saugus Formation – General

Saugus wells operated by the Purveyors are located in the southern portion of the basin south of the Santa Clara River (Figure III-7). Consistent with the 2001 Update Report (Slade) and the 2005 Basin Yield Report (CH2M Hill and LSCE), the Purveyors utilize the Saugus in accordance with the groundwater operating plan, in the range of 7,500 to 15,000 afy in average/normal years, with planned dry-year pumping of 15,000 to 35,000 afy for one to three consecutive dry years, when shortages to CLWA's SWP water supplies could occur. Such high pumping would be followed by periods of lower pumping (7,500 to 15,000 afy in average/normal years as noted above) in order to allow recharge to recover water levels and storage in the Saugus. Maintaining the substantial volume of water in the Saugus Formation is an important strategy to help maintain water supplies in the Santa Clarita Valley during drought periods.

3.3.1 Saugus Formation – Historical and Current Conditions

Total pumping from the Saugus in 2007 was about 7,700 af, or about 400 af more than in the preceding year. Of the total Saugus pumping in 2007, most (nearly 6,100 af) was for municipal water supply, and the balance (1,600 af) was for agricultural and other irrigation uses. Historically, groundwater pumping from the Saugus peaked in the early 1990's and then steadily declined through the remainder of that decade. Since then, Saugus pumping had been in the range of about 4,000 to 6,500 afy, with the increase to about 7,300 af in 2006. On a long-term average basis since the importation of SWP water, total pumping from the Saugus Formation has ranged between a low of about 3,700 afy (in 1999) and a high of nearly 15,000 afy (in 1991); average pumping from 1980 to present has been about 6,800 afy. These pumping rates remain well within, and generally at the lower end of the range of operational yield of the Saugus Formation. The overall historic record of Saugus pumping is illustrated in Figure III-8.

Unlike the Alluvium, which has an abundance of wells with extensive water level records, the water level data for the Saugus Formation are limited by both the distribution of the wells in that Formation and the periods of water level records. The wells that do have water level records extending back to the mid-1960's indicate that groundwater levels in the Saugus Formation were highest in the mid-1980's and are currently higher than they were in the mid-1960's (Figure III-9). Based on these data, there is no evidence of any historic or recent trend toward permanent water level or storage decline.

Consistent with the 2001 Update Report (Slade), the 2005 Basin Yield Report (CH2M Hill and LSCE), and the 2005 UWMP, the Purveyors continue to maintain groundwater storage and associated water levels in the Saugus Formation so that supply is available during drought periods, when Alluvial pumping might be reduced and/or SWP supplies also decreased. The period of increased pumping during the early 1990's is a good example of this management strategy. Most notably, in 1991, when SWP deliveries were substantially reduced, increased pumping from the Saugus made up almost half of the decrease in SWP deliveries. The increased Saugus pumping over several consecutive dry years (1991-1994) resulted in short-term declining groundwater levels, reflecting the use of water from storage. However, groundwater levels subsequently recovered when pumping declined, reflecting recovery of groundwater storage in the Saugus Formation.

3.4 Imported Water

CLWA obtains water supplies from the State Water Project (SWP), which is owned and operated by the California Department of Water Resources (DWR). CLWA is one of 29 contractors holding long-term SWP contracts with DWR. SWP water originates as rainfall and snowmelt in northern and central California. Runoff is stored in Lake Oroville, which is the project's largest storage facility. The water is then released from Lake Oroville down the Feather River to the Sacramento River and through the Sacramento-San Joaquin Delta. Water is diverted from the Delta into the Clifton Court Forebay, and then pumped into the 444-mile long California Aqueduct. SWP water is temporarily stored in San Luis Reservoir, which is jointly operated by DWR and the U.S. Bureau of Reclamation. Prior to delivery to CLWA, SWP supplies are stored in Castaic Lake, located at the end of the West Branch of the California Aqueduct.

CLWA's service area covers approximately 195 square miles (124,800 acres), including the City of Santa Clarita and surrounding unincorporated communities. CLWA obtains SWP water from a SWP terminal reservoir, Castaic Lake. The water is treated, filtered and disinfected at CLWA's Earl Schmidt Filtration Plant and Rio Vista Water Treatment Plant, which have a

combined treatment capacity of 86 million gallons per day. Treated water is delivered from the treatment plants by gravity flow to each of the four Purveyors through a distribution network of pipelines and turnouts. At present, CLWA delivers water to the four Purveyors through 25 potable turnouts as schematically illustrated in Figure III-10.

In 2007, CLWA fulfilled the following major accomplishments in order to enhance, preserve, and strengthen the quality and reliability of existing and future supplies:

- continued participation in a long-term water banking program with Rosedale-Rio Bravo Water Storage District and delivered 8,200 af of water into storage, as recommended in the UWMP,
- continued implementation of the AB 3030 Groundwater Management Plan,
- continued implementation of the water conservation Best Management Practices,
- completed design and commenced construction of treatment and distribution facilities for restoration of groundwater supply wells impacted by perchlorate contamination,
- continued cooperative effort with the U.S. Army Corps of Engineers for characterization studies of the former Whittaker-Bermite site and in a task force effort with the City of Santa Clarita, local legislators, and state agencies to effect the cleanup and remediation of all aspects of the former Whittaker-Bermite site, including perchlorate contamination of local groundwater,
- completed design and construction of the temporary Honby Pipeline and continued design of the Honby Pipeline Phase II,
- completed construction of the Sand Canyon Reservoir and placed the Sand Canyon Pipeline, Pump Station and Reservoir in service,
- continued recycled water service, and
- certified an Environmental Impact Report for the Recycled Water Master Plan.

3.4.1 State Water Project Table A Supplies

Each SWP contractor has a specified water supply amount shown in Table A of its contract that currently totals approximately 4.1 million af. The term of the CLWA contract is through 2038 and is renewable after that year. Although the SWP has not been fully completed, the SWP can deliver all of the 4.1 million af of Table A Amounts during certain wet years.

CLWA has a contractual Table A Amount of 95,200 af per year of water from SWP.[1] On November 29, 2006, the initial allocation for 2007 was announced as 60 percent and it remained unchanged for the year. CLWA's final allocation of Table A Amount for 2007 was 60 percent, or 57,120 af.

In addition to its Table A Amount, CLWA has access to 4,684 af of "flexible storage" in Castaic Lake. In 2005, CLWA also negotiated an agreement with the Ventura County SWP contractors to allow CLWA to utilize their flexible storage account of 1,376 af. In combination, this provides total flexible storage of 6,060 af, which is maintained in Castaic Lake for use in a future dry period or an emergency. This amount was available in 2007, but was not utilized due to other available supplies.

As delineated in Table III-2, with the 60 percent Table A allocation and other supplies, including 4,216 af of carryover from 2006, CLWA had total available supply of 72,336 af in 2007. CLWA deliveries were 45,332 af to the Purveyors, 6,071 af to Devil's Den Ranch and 8,200 af to Rosedale-Rio Bravo Water banking, leaving about 12,146 af of Table A Amount available for carryover to 2008.

In 2005, CLWA completed an agreement to participate in a long-term water banking program with Rosedale-Rio Bravo Water Storage District in Kern County. CLWA delivered 20,000 af of its Table A water into storage in both 2005 and 2006. CLWA delivered another 8,200 af into that storage account in 2007. This long-term program will allow the storage of 100,000 af at any one time, and will provide significant dry year reliability for the Santa Clarita Valley.

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[1] Of CLWA's 95,200 af annual Table A Amount, 41,000 afy was permanently transferred to CLWA in 1999 by Wheeler Ridge-Maricopa Water Storage District, a member unit of the Kern County Water Agency. CLWA's EIR prepared in connection with the 41,000 afy water transfer was challenged in Friends of the Santa Clara River v. Castaic Lake Water Agency (Los Angeles County Superior Court) ("Friends"). On appeal, the Court of Appeal held that since the 41,000 afy EIR tiered off the Monterey Agreement EIR that was later decertified, CLWA would also have to decertify its EIR as well and prepare a revised EIR. CLWA was not prevented from using any water that is part of the 41,000 afy transfer. Under the jurisdiction of the Los Angeles County Superior Court, CLWA prepared and circulated a revised Draft EIR for the transfer. CLWA approved the revised EIR in late 2004 ("2004 EIR") and lodged the EIR with the Los Angeles Superior Court. Thereafter, the case was dismissed with prejudice (i.e., permanently).

In January 2005, two new challenges to CLWA's 2004 EIR were filed in the Ventura County Superior Court by the Planning and Conservation League ("PCL") and by the California Water Impact Network ("CWIN"); these cases were consolidated and transferred to Los Angeles County Superior Court, Planning and Conservation League v. Castaic Lake Water Agency (Los Angeles County Superior Court,) ("PCL Action"). In May 2007, a final Statement of Decision was filed by the trial court in the PCL Action. It included a determination that the transfer is valid and cannot be terminated or unwound. The trial court did find one defect in the 2004 EIR, requiring Judgment to be entered against CLWA. The defect, however, did not relate to the environmental conclusions reached in the 2004 EIR. CLWA has been ordered to set aside its certification of the 2004 EIR, correct the defect and report back to the Court. The Writ issued by the Court as part of the Judgment specifically states that the Judgment does not call for CLWA to set aside the transfer. In July 2007, Petitioners filed a Partial Notice of Appeal and CLWA subsequently filed a Notice of Cross Appeal. The matter is currently pending before the Second District Court of Appeal, Division Four. It is expected that all briefs will be filed, and the matter argued and submitted to the Court of Appeal for a decision by the end of 2008.

3.4.2 Other Imported Water Supplies

In early 2007, CLWA finalized a Water Acquisition Agreement with the Buena Vista Water Storage District (Buena Vista) and the Rosedale-Rio Bravo Water Storage District (Rosedale-Rio Bravo) in Kern County. Under this Program, Buena Vista's high flow Kern River entitlements (and other acquired waters that may become available) are captured and recharged within Rosedale-Rio Bravo's service area on an ongoing basis.[2] CLWA will receive 11,000 af of these supplies annually through either exchange of Buena Vista's and Rosedale-Rio Bravo's SWP supplies or through direct delivery of water to the California Aqueduct via the Cross Valley Canal.

3.4.3 Imported Water Supply Reliability

The Department of Water Resources issued its Draft State Water Project Delivery Reliability Report 2007. This report is intended to assist SWP contractors in assessing the adequacy of the SWP component of their overall supplies. The report is updated with new information and calculations of delivery reliability every two years. The Draft addresses the effect of interim remedies ordered by a federal court to protect the endangered Delta smelt under the federal Endangered Species Act and potential climate change. The injunction will be in force until a new Biological Opinion (BO) is in place. DWR would then be required to obtain a take permit that would incorporate mitigation requirements; however, impacts on water supply reliability are not expected to be greater than those incorporated in the injunction. The Reliability Report, factoring in these items, reduced the long-term reliability from 77 percent to 66-69 percent during normal year hydrology. CLWA staff reassessed the impact of the Reliability Report on the CLWA reliability analysis contained in the Agency's 2005 UWMP. It concluded that current and anticipated supplies are available to meet anticipated water supply needs. Once a BO is completed, CLWA will confirm with DWR that the current reliability assessment is applicable.

Groundwater banking and conjunctive use offer significant opportunities to improve water supply reliability for CLWA. Groundwater banking is the process of storing available supplies of water in groundwater basins during wet years or when supplemental water is otherwise available. During dry periods, or when imported water supply availability is reduced, banked

[2] A CEQA action was filed by California Water Impact Network (CWIN) in November 2006 challenging the adequacy of CLWA's EIR on the acquisition of 11,000 af from the Buena Vista Water Storage District and Rosedale-Rio Bravo Water Storage District. In November 2007, a Los Angeles Superior Court ruled in favor of CLWA on all points. In January 2008, CWIN filed a notice of appeal and at present the matter is pending.

water can be recovered from groundwater storage to replace, or firm up, the imported water supply deliveries.

As described herein, CLWA has entered into two groundwater banking programs and now has, in aggregate, over 115,000 acre-feet of recoverable water in banked groundwater storage outside the local groundwater basin. The first component of overall groundwater banking is the result of two 10-year agreements between CLWA and Semitropic Water Storage District whereby, in dry years, CLWA can withdraw up to 50,870 af of 2002 and 2003 SWP Table A water that it stored in Semitropic to meet Valley demands when needed. More recently, after banking 8,200 acre-feet of its SWP Table A water in 2007 in the long-term Rosedale-Rio Bravo Water Banking and Exchange Program in Kern County, CLWA now has a recoverable total of 64,900 acre-feet in that groundwater storage bank (i.e., 75,200 af less contractual losses)

Conjunctive use is the purposeful integrated use of surface water and groundwater supplies to maximize water supply from the two sources. CLWA and the Purveyors have been conjunctively utilizing local groundwater and imported (SWP) surface water since the initial importation of SWP water in 1980. The groundwater banking programs described above allow CLWA to firm up the imported water component of conjunctive use in the Valley by storing surplus SWP and other water, in wet years, in groundwater basins outside the Valley, thus allowing recovery and importation of that water as needed in dry years to maintain a greater overall amount of imported surface water to be used conjunctively with local groundwater, further supporting the sustainable use of local groundwater at the rates in the groundwater operating plan.

3.5 Water Quality – General

Water delivered by the Purveyors consistently meets drinking water standards set by the Environmental Protection Agency (EPA) and the California Department of Public Health (DPH). An annual Consumer Confidence Report is provided to all Santa Clarita Valley residents who receive water from one of the four water retailers. There is detailed information in that report about the results of quality testing of the groundwater and treated SWP water supplied to the residents of the Santa Clarita Valley during 2007. Several constituents of particular local interest are discussed in more detail below.

Total Trihalomethanes

In 2002, the United States Environmental Protection Agency implemented the new Disinfectants and Disinfection Byproducts Rule. In part, this rule establishes a new MCL of 80 μg/l (based on

an annual running average) for Total Trihalomethanes (TTHM). TTHMs are byproducts created when chlorine is used as a means for disinfection. CLWA and the Purveyors implemented an alternative method of disinfection, chloramination, in 2005 to maintain compliance with the new rule and future regulations relating to disinfection byproducts. TTHM concentrations have remained significantly below the MCL since implementation of alternative disinfection.

Perchlorate

Perchlorate has been a water quality concern in the Valley since 1997 when it was originally detected in four Saugus wells operated by the Purveyors in the eastern part of the Saugus Formation, near the former Whittaker-Bermite facility. In late 2002, perchlorate was detected in a fifth municipal well, in this case an Alluvial well (SCWD's Stadium Well) also located near the former Whittaker-Bermite site. In early 2005, perchlorate was detected in a second Alluvial well (VWC's Well Q2) near the former Whittaker-Bermite site. In 2006, a very low concentration of perchlorate was detected in another Saugus well (NCWD's Well NC-13), near one of the originally impacted wells. However, that detection has been interpreted to not be an indication of continued perchlorate migration in a westerly direction. Subsequent monitoring well installation has been completed and a focused study of the Saugus Formation near this latest detection has been commenced. Results of this study and any subsequent recommended actions will be incorporated into the overall groundwater remediation and removal actions submitted by Whittaker-Bermite and reviewed by the State Department of Toxic Substances Control (DTSC) as discussed below.

Wells with perchlorate concentrations exceeding the then-applicable Action Level (18 µg/l) or, more recently, the then-applicable Notification Level (6 µg/l)[3] were removed from active water supply service. One of the Alluvial wells was returned to active water supply service, with treatment, in late 2005 as discussed below; the other impacted wells remain out of service. The 2005 UWMP specifically addressed the adequacy of groundwater supply in light of the inactivation of the impacted Alluvial and Saugus wells; and it addressed the plan and schedule for restoration of perchlorate-impacted wells, including the protection of existing non-impacted wells. As summarized in the 2005 UWMP, the inactivation of the impacted wells does not constrain the ability to meet the groundwater component of water supply in the Valley.

In 2000, CLWA and the impacted Purveyors had filed a lawsuit against Whittaker Corporation (the former owner of the contaminated property) and Santa Clarita LLC and Remediation Financial, Inc. (the owners of record at that time). The lawsuit sought to have defendants pay all necessary costs of response, removal of the contaminant, remedial actions, and any liabilities or

[3] The Maximum Contaminant Level (MCL) for perchlorate was set at 6 µg/l by the State Department of Public Health in October 2007.

damages associated with the contamination. An Interim Settlement and Funding Agreement was reached in 2003. Although that Agreement expired in January 2005, the parties, under DTSC oversight, jointly developed a plan to "pump and treat" contaminated water from two of the Purveyors' impacted wells to stop migration of the contaminant plume and to restore the municipal groundwater supply that has been impacted by perchlorate. The parties also continued negotiations intended to achieve a long term settlement to the litigation through 2006, and a final settlement was completed and executed in April 2007.

In 2007, the impacted Purveyors (SCWD, NCWD, and VWC) and CLWA continued working toward implementation of a jointly developed plan that will combine pumping from two of the impacted wells and a water treatment process to restore the impacted pumping capacity and control the migration of contamination in the aquifer. The development and implementation of a cleanup plan for the Whittaker-Bermite site and the impacted groundwater is being coordinated among CLWA, the impacted Purveyors, the State DTSC, and U.S. Army Corps of Engineers. DTSC is the lead agency responsible for regulatory oversight of the Whittaker-Bermite site.

In February 2003, DTSC and the impacted Purveyors entered into a voluntary cleanup agreement entitled *Environmental Oversight Agreement*. Under the Agreement, DTSC is providing review and oversight of the response activities being undertaken by the Purveyors related to the detection of perchlorate in the impacted wells. Under the Agreement's Scope of Work, the impacted Purveyors have prepared a Work Plan for sampling the production wells, prepared a report on the results and findings of the production well sampling, prepared a draft Human Health Risk Assessment, prepared a draft Remedial Action Workplan, completed the evaluation of treatment technologies, and completed an analysis to show the integrated effectiveness of a project to restore impacted pumping capacity, extract perchlorate for treatment, and control the migration of perchlorate in the Saugus Formation. Environmental review of that project was completed in 2005 with adoption of a mitigated Negative Declaration. The Final Interim Remedial Action Plan for containment and extraction of perchlorate was completed and approved by DTSC in January 2006. Design of the treatment facilities and related pipelines is complete. Construction of those facilities and pipelines to implement the pump and treat program and to also restore inactivated well capacity began in November 2007 and is scheduled to be completed, followed by operational startup, by the end of 2008.

On the Whittaker-Bermite site, soil remediation activities in operating unit subareas started in 2005. Groundwater pump and treat operations in the Northern Alluvium, which also started in 2005, continued through 2007. Expanded pumping, intended to effect perchlorate containment as well as treat 'hot spots' in the Northern Alluvium, became operational in October 2007. Also,

on the Whittaker-Bermite site, remediation work in the Saugus Formation has been initiated and expected to be underway in 2008. Additional objectives of this project include the reduction of further transport of contaminants to regional groundwater and reduction of the size of the contaminant mass in deep/perched zones.

As noted above, perchlorate was detected in a second Alluvial well, VWC's Well Q2, in early 2005. In response, Valencia removed the well from active service, and commissioned the preparation of an analysis and report assessing the impact of, and response to, the perchlorate contamination of that well. Valencia's response for Well Q2 was to obtain permitting for installation of wellhead treatment, followed by installation of treatment facilities and returning the well to water supply service in October 2005. After nearly two years of operation with wellhead treatment, including regular monitoring specified by the State Department of Public Health (DPH), all of which resulted in no detection of perchlorate in Well Q2, Valencia requested that DPH allow treatment to be discontinued. DPH approved that request in August 2007, and treatment was subsequently discontinued. DPH-specified monthly monitoring for perchlorate continues at Well Q2; there has been no detection of perchlorate since discontinuation of wellhead treatment.

3.5.1 Groundwater Quality – Alluvium

Groundwater quality is, of course, a key factor in assessing the Alluvial aquifer as a municipal and agricultural water supply. Groundwater quality details and long-term conditions, examined by integration of individual records from several wells completed in the same aquifer materials and in close proximity to each other, have been discussed in previous annual Water Reports and in the 2005 UWMP. There were no changes in groundwater quality in 2007 that would change any of the fluctuations, trends, or other groundwater quality conditions as illustrated in Figures III-11 and III-12. In summary, those conditions include: no long-term overall trend and, most notably, no long-term decline in Alluvial groundwater quality; a general groundwater quality "gradient" from east to west, with lowest dissolved mineral content to the east, increasing in a westerly direction; and periodic fluctuations in some parts of the basin, where groundwater quality has inversely varied with precipitation and stream flow. Those variations are typically characterized by increased mineral concentrations through dry, lower stream flow, and lower recharge conditions, followed by lower mineral concentrations through wetter, higher stream flow, higher recharge conditions.

The presence of long-term consistent water quality patterns, although intermittently affected by wet and dry cycles, supports the conclusion that the Alluvial aquifer remains a viable ongoing water supply source in terms of groundwater quality.

3.5.2 Groundwater Quality – Saugus Formation

As discussed above for the Alluvium, groundwater quality is a key factor in also assessing the Saugus Formation as a municipal and agricultural water supply. As with groundwater level data, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. However, integration of individual records from several wells has been used to examine general water quality trends. Based on those records, water quality in the Saugus Formation has not historically exhibited the precipitation-related fluctuations seen in the Alluvium. Based on available data over the last 50 years, groundwater quality in the Saugus has exhibited a slight overall increase in dissolved mineral content as illustrated in Figure III-13. More recently, several wells within the Saugus Formation have exhibited an additional increase in dissolved mineral content, similar to short-term changes in the Alluvium, possibly as a result of recharge to the Saugus Formation from the Alluvium. Dissolved mineral concentrations in the Saugus Formation remain below the Secondary (aesthetic) Upper Maximum Contaminant Level. Groundwater quality within the Saugus will continue to be monitored to ensure that degradation to the long-term viability of the Saugus as an agricultural or municipal water supply does not occur.

3.5.3 Imported Water Quality

CLWA operates two water treatment plants, the Earl Schmidt Filtration Plant located near Castaic Lake and the Rio Vista Water Treatment Plant located in Saugus. CLWA produces water that meets drinking water standards set by the U.S. EPA and DPH. SWP water has different aesthetic characteristics than groundwater with lower dissolved mineral concentrations (total dissolved solids) of approximately 280 to 314 mg/l, and lower hardness (as calcium carbonate) of 130 to 170 mg/l.

3.6 Recycled Water

Recycled water is available from two existing water reclamation plants operated by the Sanitation Districts of Los Angeles County. In 1993, CLWA prepared a draft Reclaimed Water System Master Plan that outlined a multi-phase program to deliver recycled water in the Valley. CLWA previously completed environmental review on the construction of Phase I of the project,

which will deliver 1,700 afy of water. Deliveries of recycled water began in 2003 for irrigation water supply at a golf course and in roadway median strips. In 2007, recycled water deliveries were 470 af.

Surveys conducted by CLWA indicate an interest for recycled water by existing water users as well as future development when it becomes available. In 2002, CLWA produced an updated Draft Recycled Water Master Plan. Overall, the program is expected to ultimately recycle up to 17,400 af of treated (tertiary) wastewater suitable for reuse on golf courses, landscaping and other non-potable uses, as set forth in the UWMP.

In 2007, CLWA completed California Environmental Quality Act (CEQA) analysis of the Recycled Water Master Plan (2002). This analysis consisted of a Program Environmental Impact Report (PEIR) covering the various options for a recycled water system as outlined in the Master Plan. The PEIR was certified by the CLWA Board in March 2007.

3.7 Santa Clara River

The Memorandum of Understanding (MOU) between the Santa Clarita Valley Purveyors and the United Water Conservation District, which manages surface and groundwater resources in seven groundwater basins in the Lower Santa Clara River Valley Area, was a significant accomplishment when it was prepared and executed in 2001. The MOU initiated a collaborative and integrated approach to data collection; database management; groundwater flow modeling; assessment of groundwater basin conditions, including determination of basin yield amounts; and preparation and presentation of reports, including continued annual reports such as this one for current planning and consideration of development proposals, and also including more technically detailed reports on geologic and hydrologic aspects of the overall stream-aquifer system. Meetings of the MOU participants have continued, and integration of the Upper (Santa Clarita Valley) and Lower (United WCD) Santa Clara River databases has been accomplished. As discussed above, a numerical groundwater flow model of the entire Santa Clarita groundwater basin was developed and calibrated in 2002-2004. Subsequent to its initial use in 2004 for assessing the effectiveness of various operating scenarios to restore pumping capacity impacted by perchlorate contamination (by pumping and treating groundwater for water supply while simultaneously controlling the migration of contaminated groundwater), the model was used in 2005 for evaluation of basin yield under varying management actions and hydrologic conditions. The results completed the determination of sustainable operating yield values for both the Alluvium and the Saugus Formation, which are now incorporated in the 2005 UWMP.

On occasion, issues have been raised about whether use and management of groundwater in the Santa Clarita Valley have adversely impacted surface water flows into Ventura County. Part of the groundwater modeling work has addressed the surface water flow question as well as groundwater levels and storage. While the sustainability of groundwater has logically derived primarily from projected long-term stability of groundwater levels and storage, it has also derived in part from modeled simulations of surface water flows and the lack of stream flow depletion by groundwater pumping. In addition, the long-term history of groundwater levels in the western and central part of the basin, as illustrated in Figures III-4 and III-5, supports the modeled analysis and suggests that groundwater has not been lowered in such a way as to induce infiltration from the river and thus impact surface water flows. Finally, long-term stream flow data gauged near the County line show notably higher flows from the Santa Clarita Valley into the uppermost downstream basin, the Piru Basin, over the last 30 to 35 years, as illustrated in Figure III-14.

Table III-2
2007 CLWA Imported Water Supply and Disposition
(acre-feet)

Supply		
Net 2006 Carryover to 2007 [1]		4,216
Buena Vista/Rosedale Rio-Bravo		11,000
2007 Final SWP Allocation [2]		57,120
Total 2007 Imported Water Supply		**72,336**
Disposition		
Purveyor Deliveries (Total)		45,332
CLWA SCWD	*20,669*	
Valencia Water Company	*16,779*	
Newhall County Water District	*6,478*	
Los Angeles County WWD 36	*1,406*	
CLWA/DWR/Purveyor Metering[3]		587
Rosedale – Rio Bravo Water Banking and Exchange Program		8,200
Devil's Den from Table A		4,424
Devil's Den from 2006 Carryover to 2007		1,647
2007 Table A Carryover to 2008[4]		12,146
Total 2007 Imported Water Disposition		**72,336**

1. Amount used by CLWA, based on final DWR delivery accounting; total 2006 carryover was 38,484 af.

2. Final 2007 allocation was 60% of contractual Table A amount of 95,200 acre-feet, which did not change from the intial allocation:

Initial allocation, November 29, 2006	60%

3. Reflects meter reading differences.

4. Total 2007 Table A carryover to 2008.

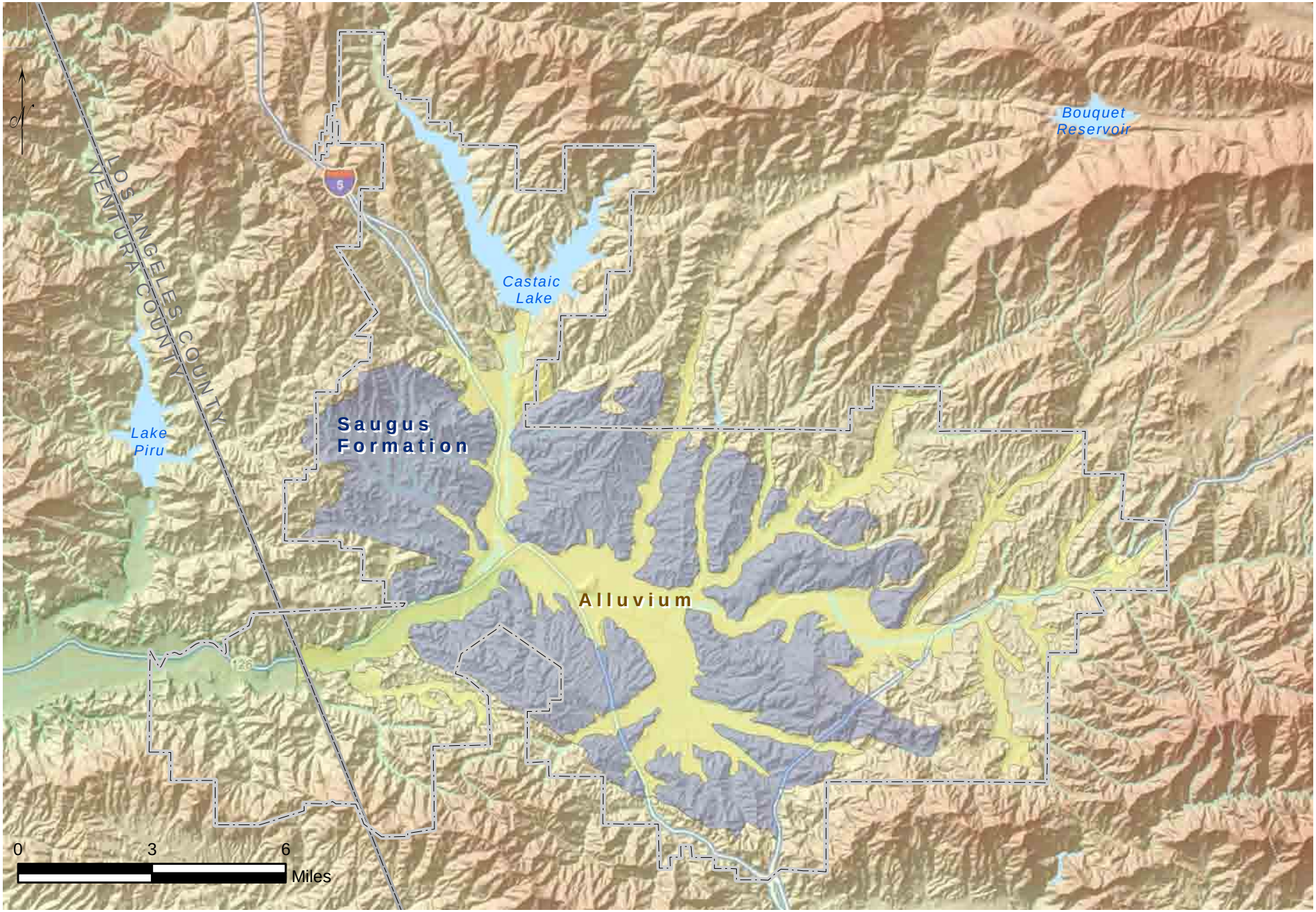

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Figure III-1
Alluvium and Saugus Formation
Santa Clara River Valley, East Groundwater Subbasin

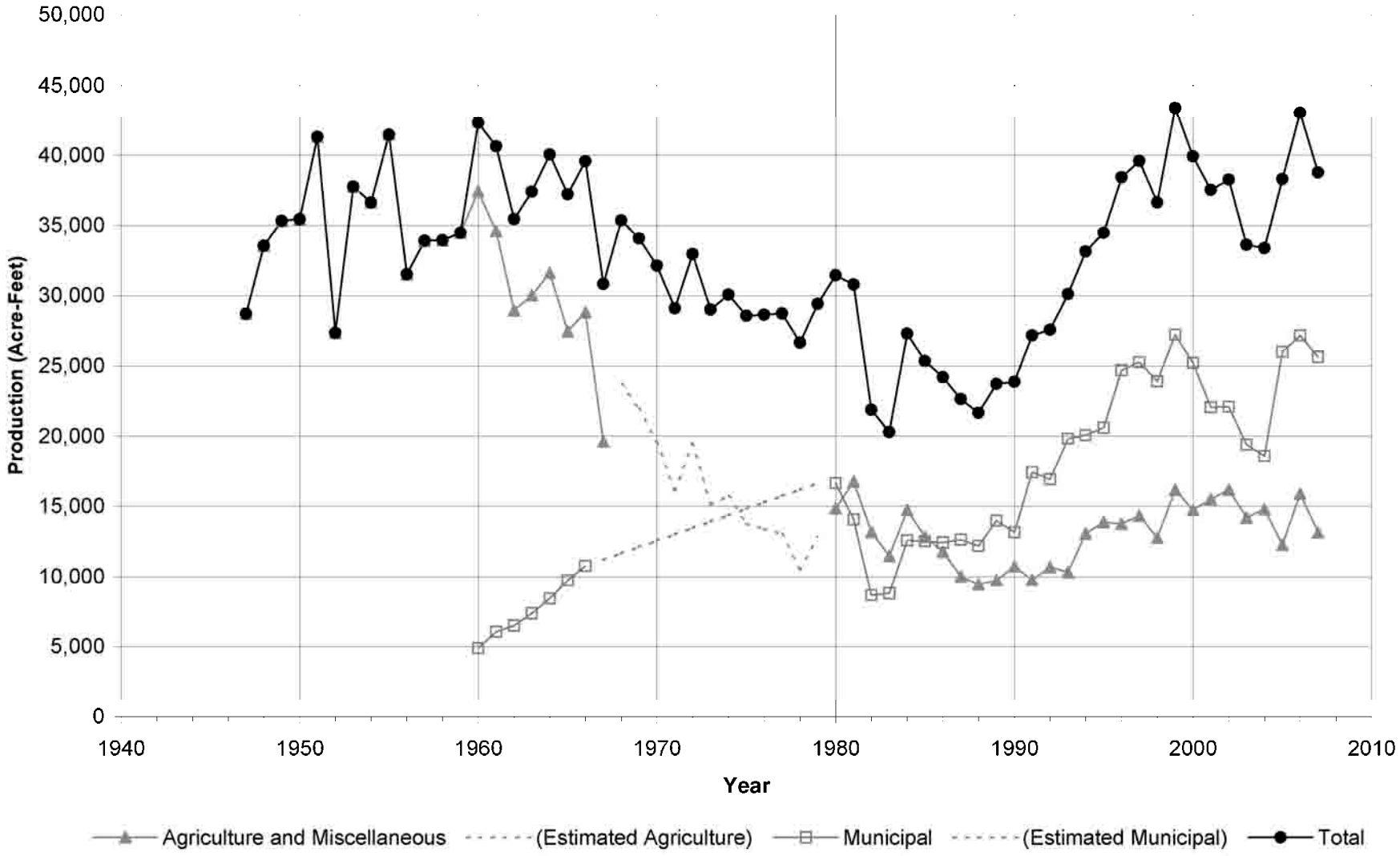

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Figure III-2
Groundwater Production - Alluvium
Santa Clara River Valley, East Groundwater Subbasin

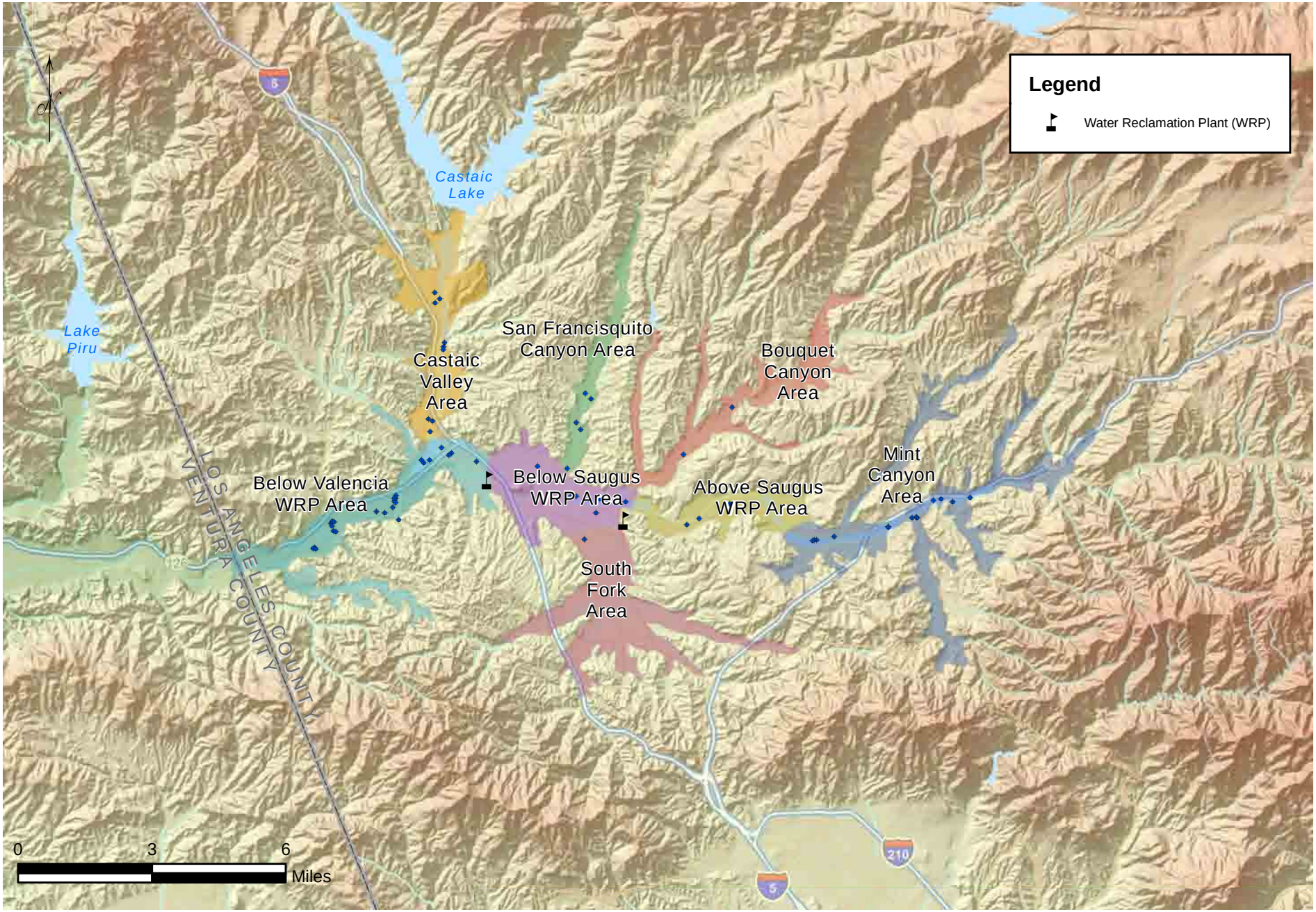

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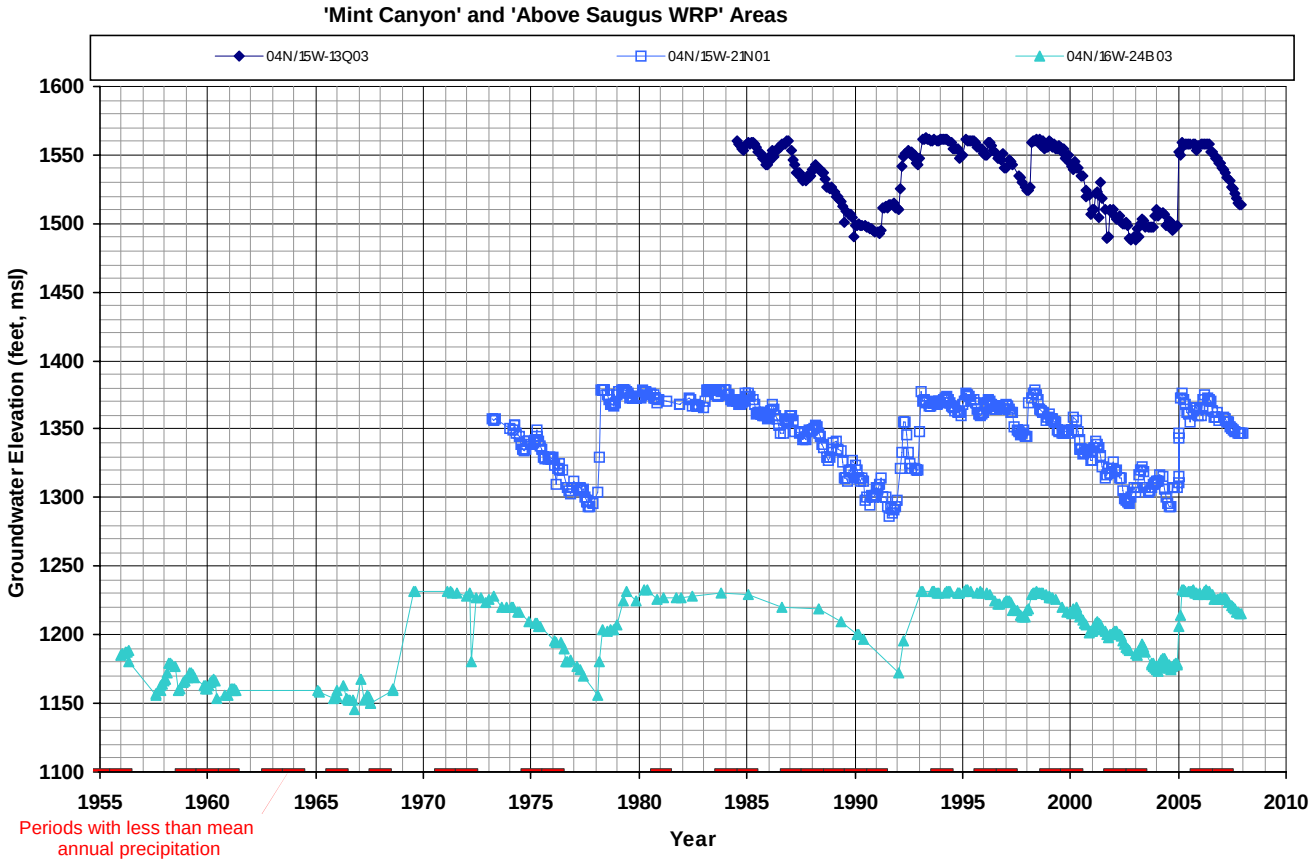
Figure III-3
Alluvial Well Locations By Area
Santa Clara River Valley, East Groundwater Subbasin



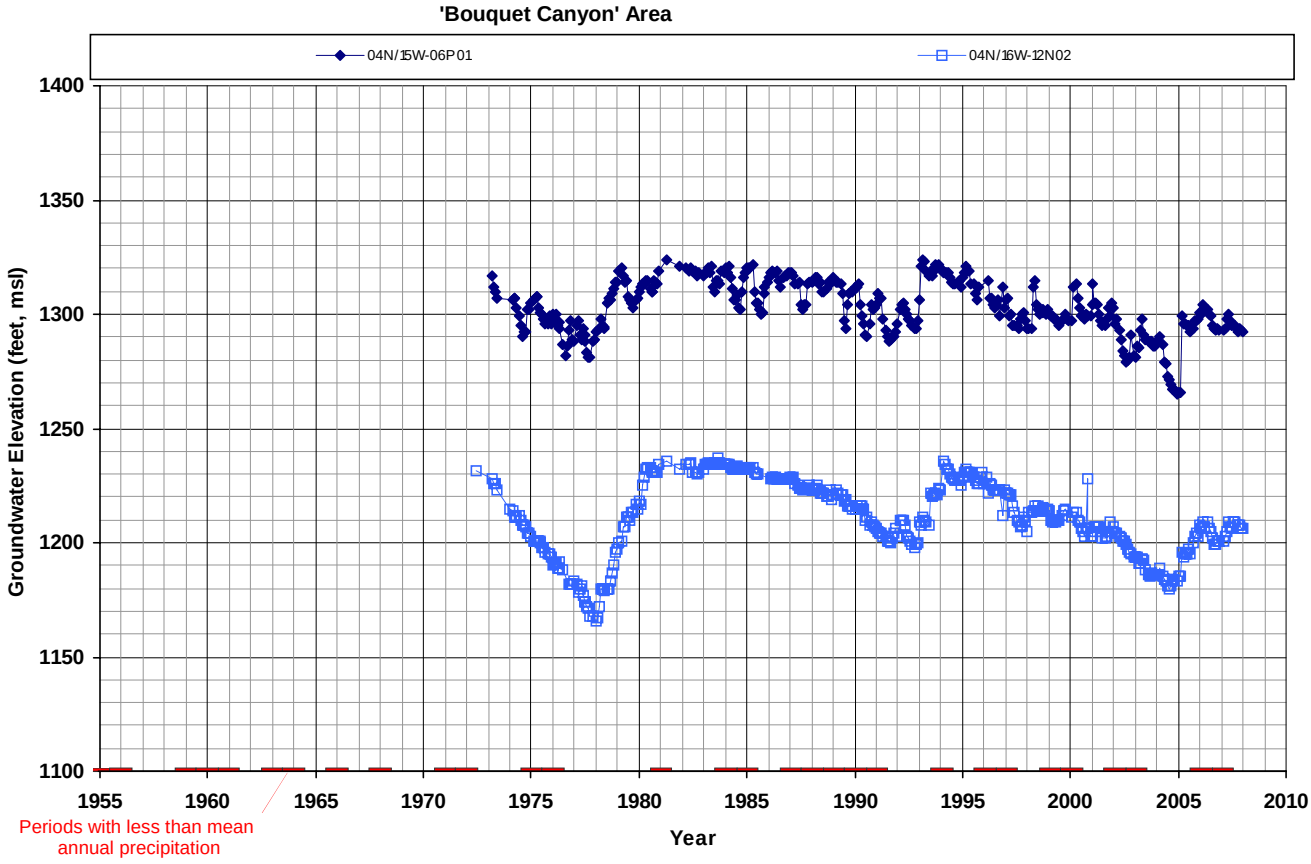


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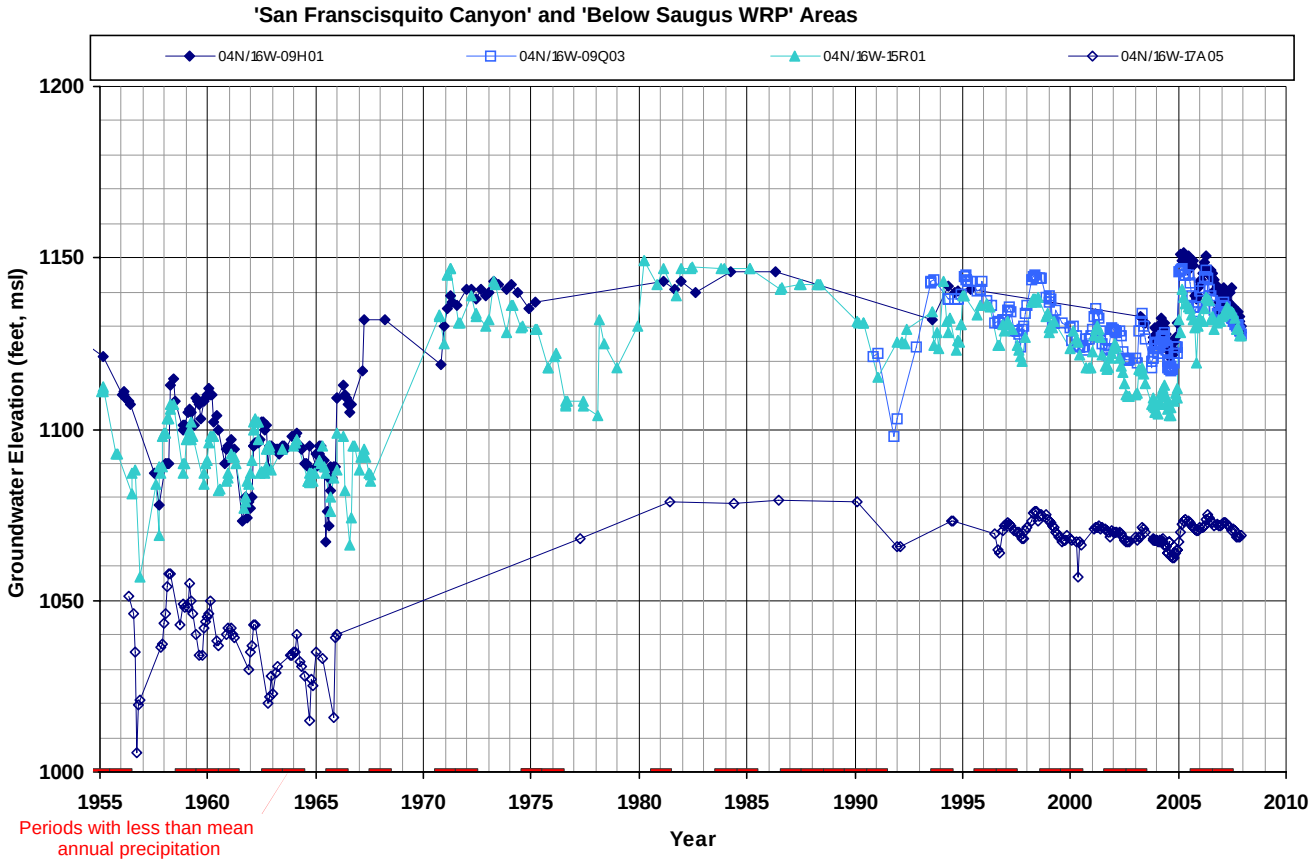
Figure III-4
Groundwater Elevations in Eastern Santa Clarita Valley Alluvial Wells



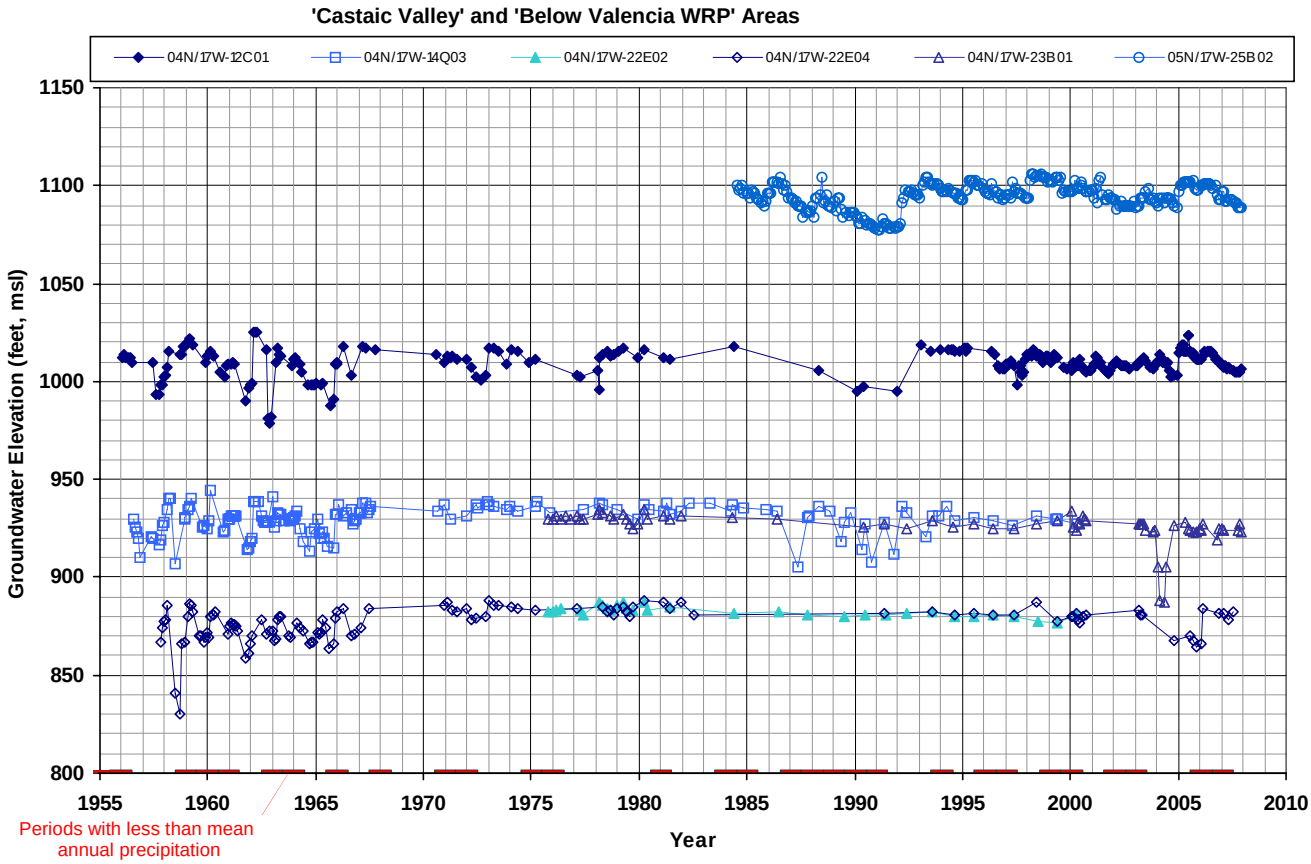


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Figure III-5
Groundwater Elevations in Western Santa Clarita Valley Alluvial Wells

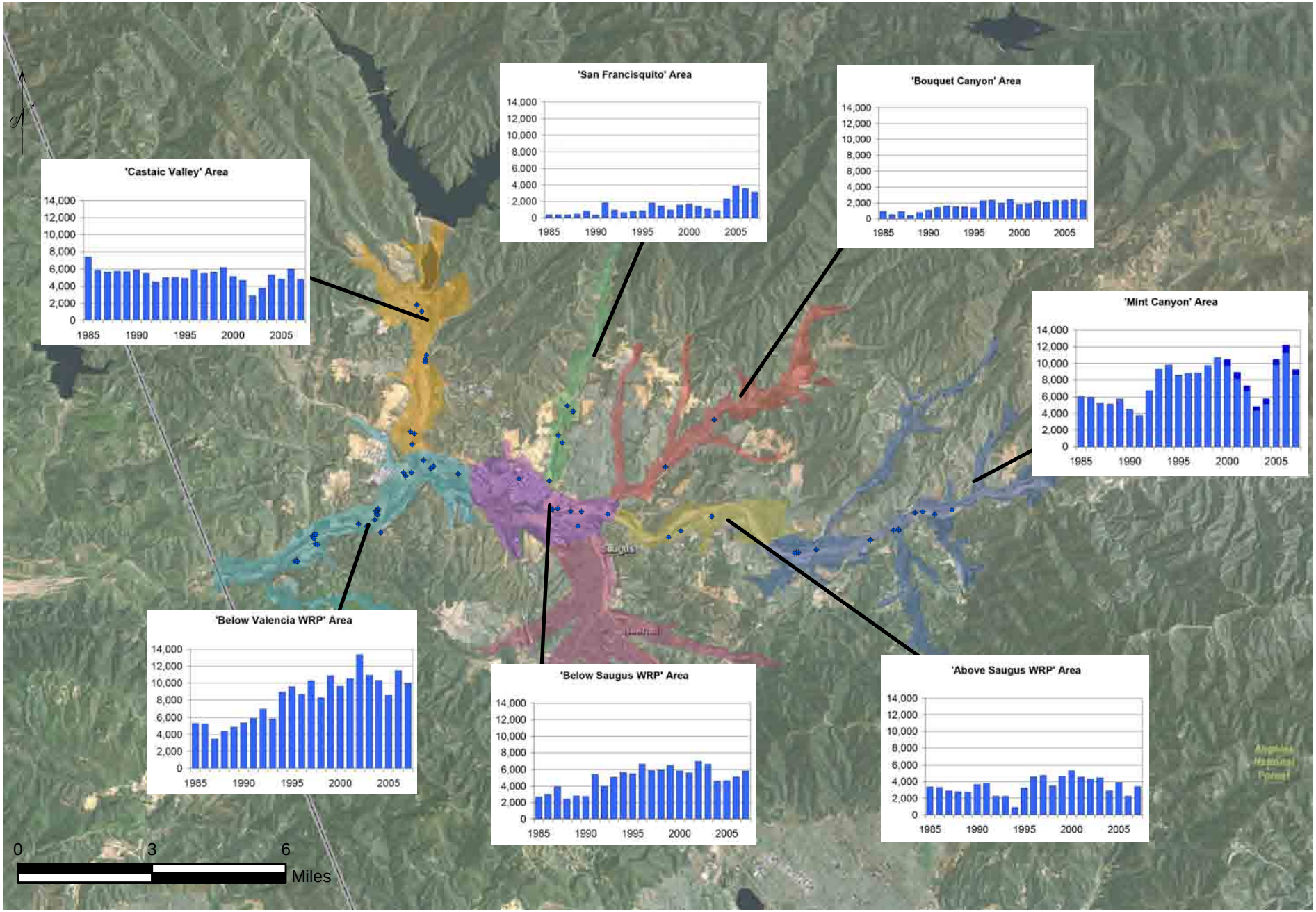

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Figure III-6
Annual Groundwater Production from Alluvium by Area (Acre-feet)
Santa Clara River Valley, East Groundwater Subbasin

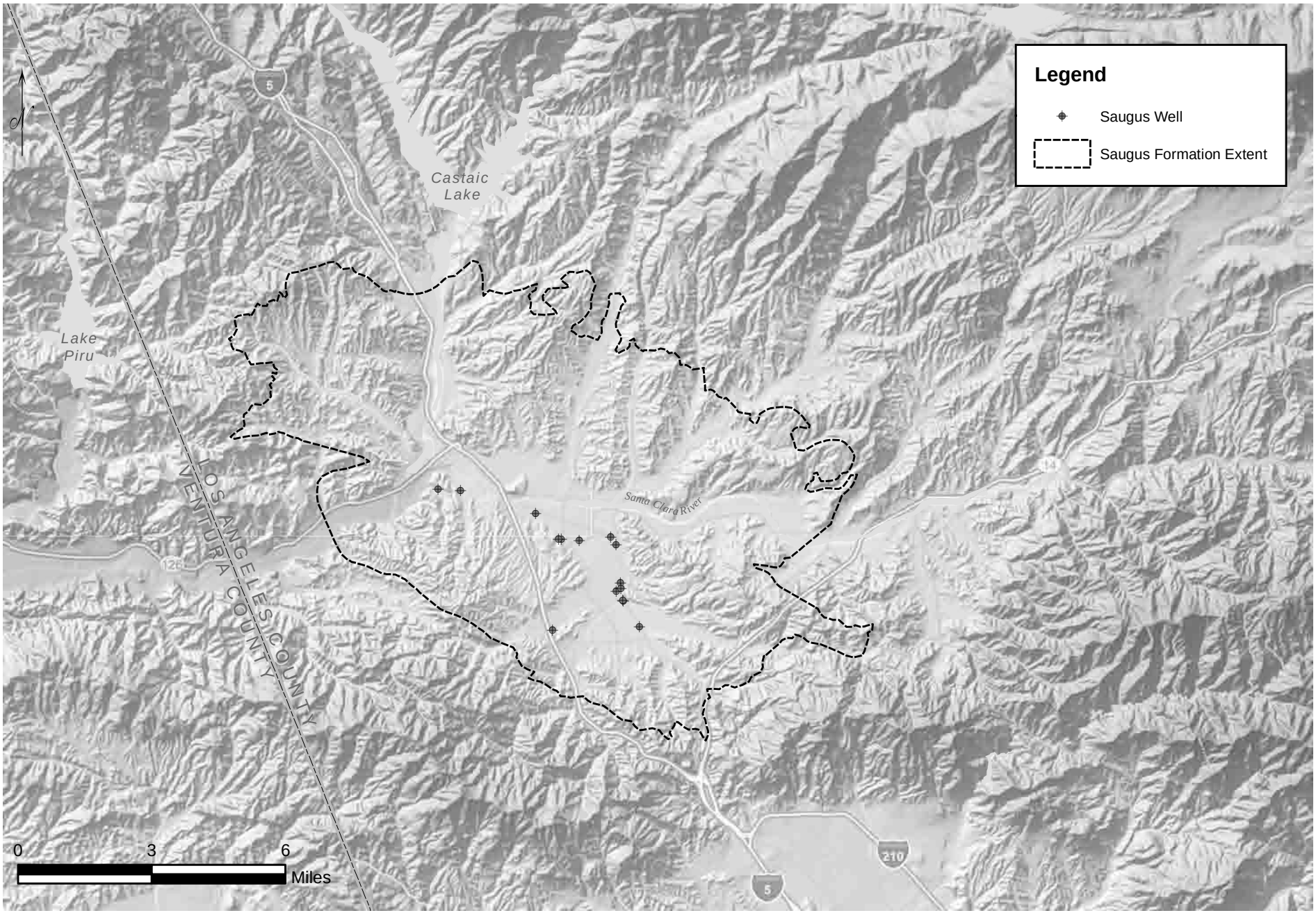

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Figure III-7
Saugus Well Locations
Santa Clara River Valley, East Groundwater Subbasin

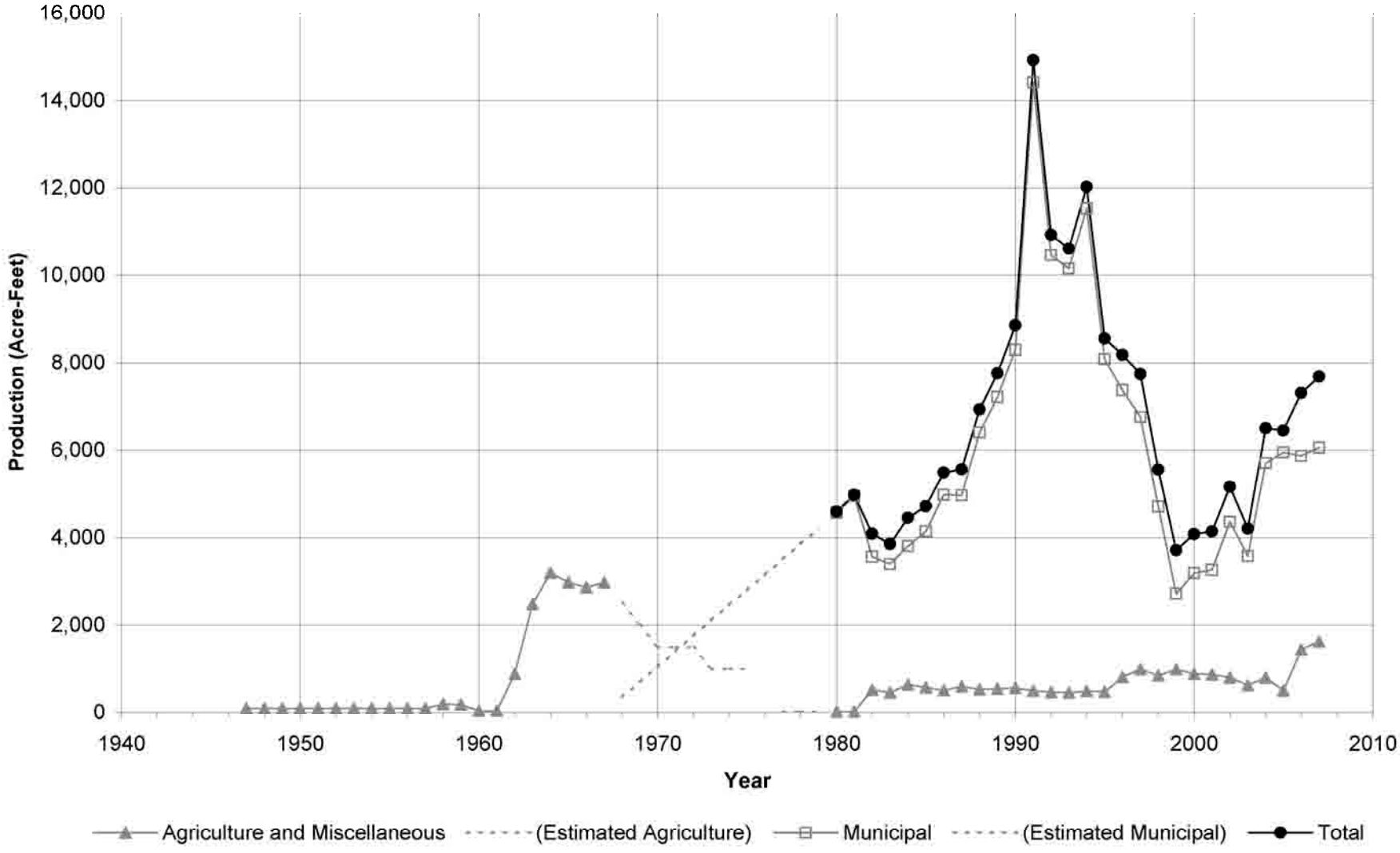

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Figure III-8
Groundwater Production - Saugus Formation
Santa Clara River Valley, East Groundwater Subbasin

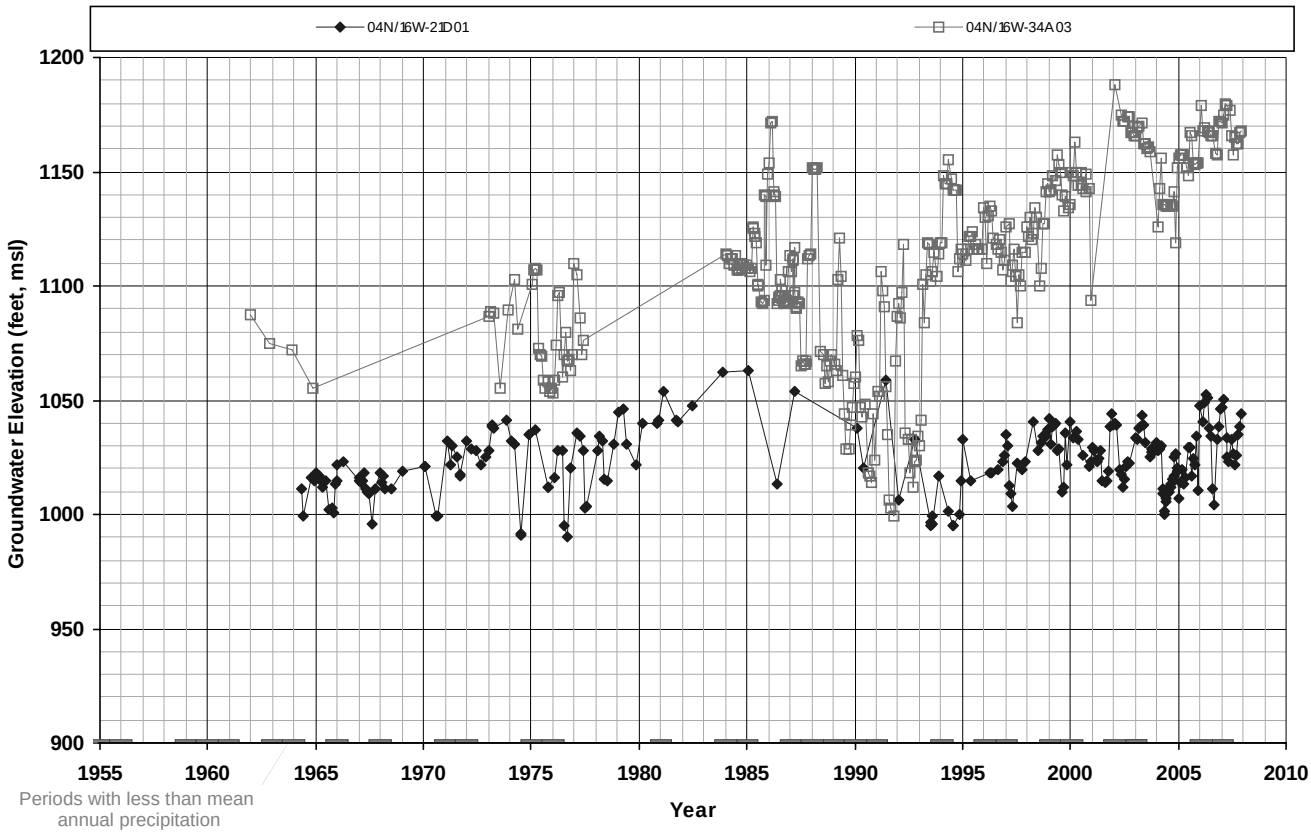

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Figure III-9
Groundwater Elevations in Saugus Wells

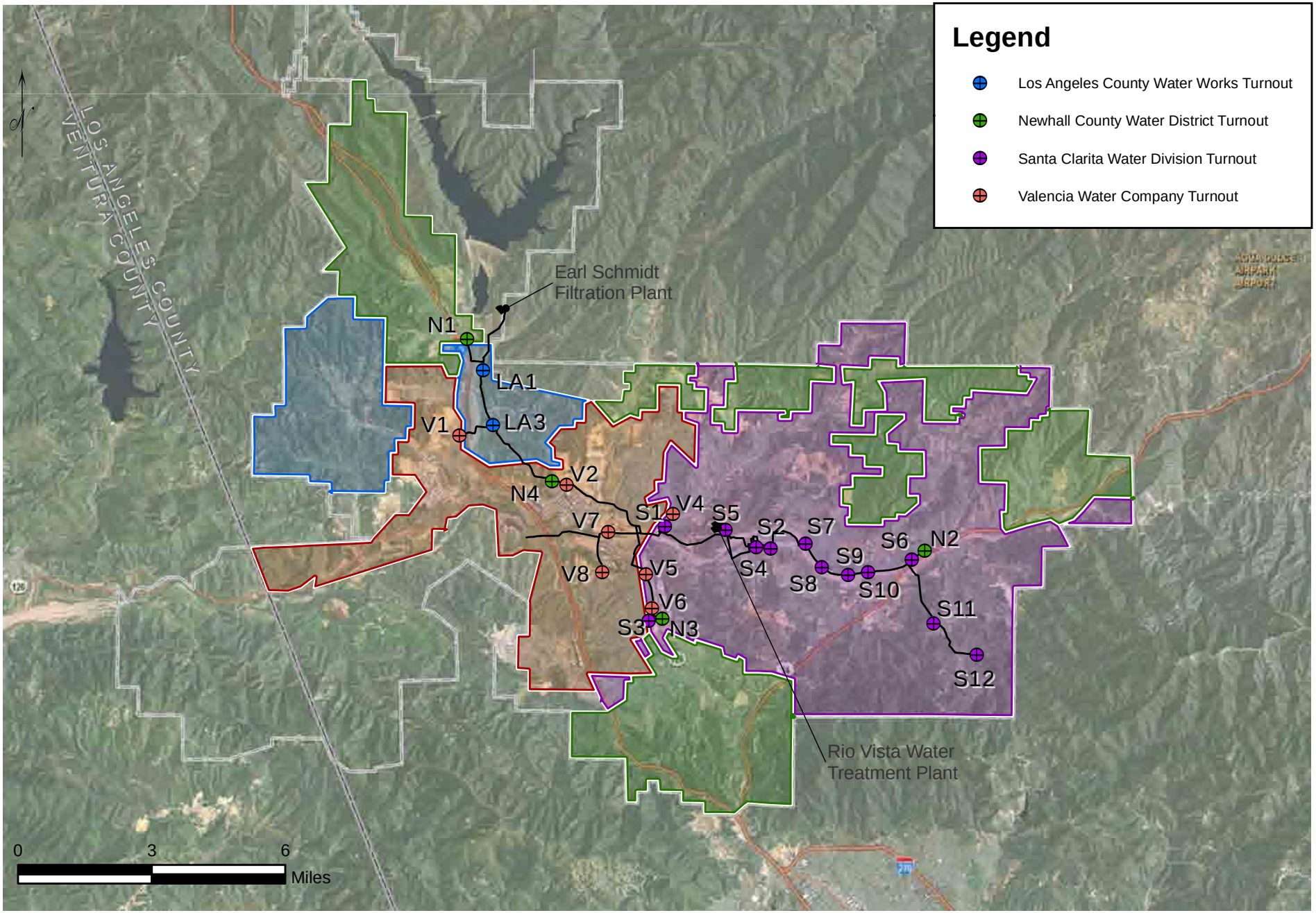

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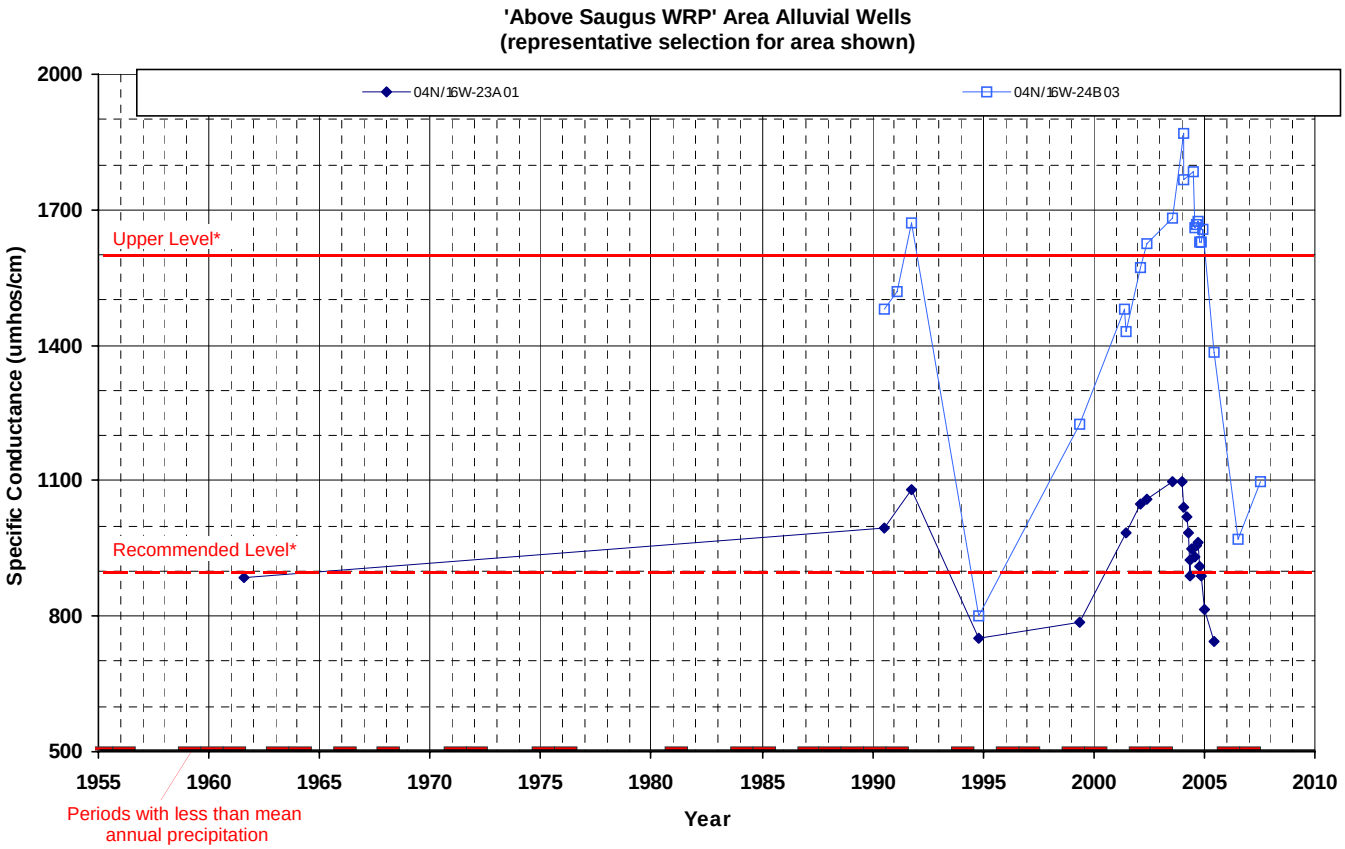
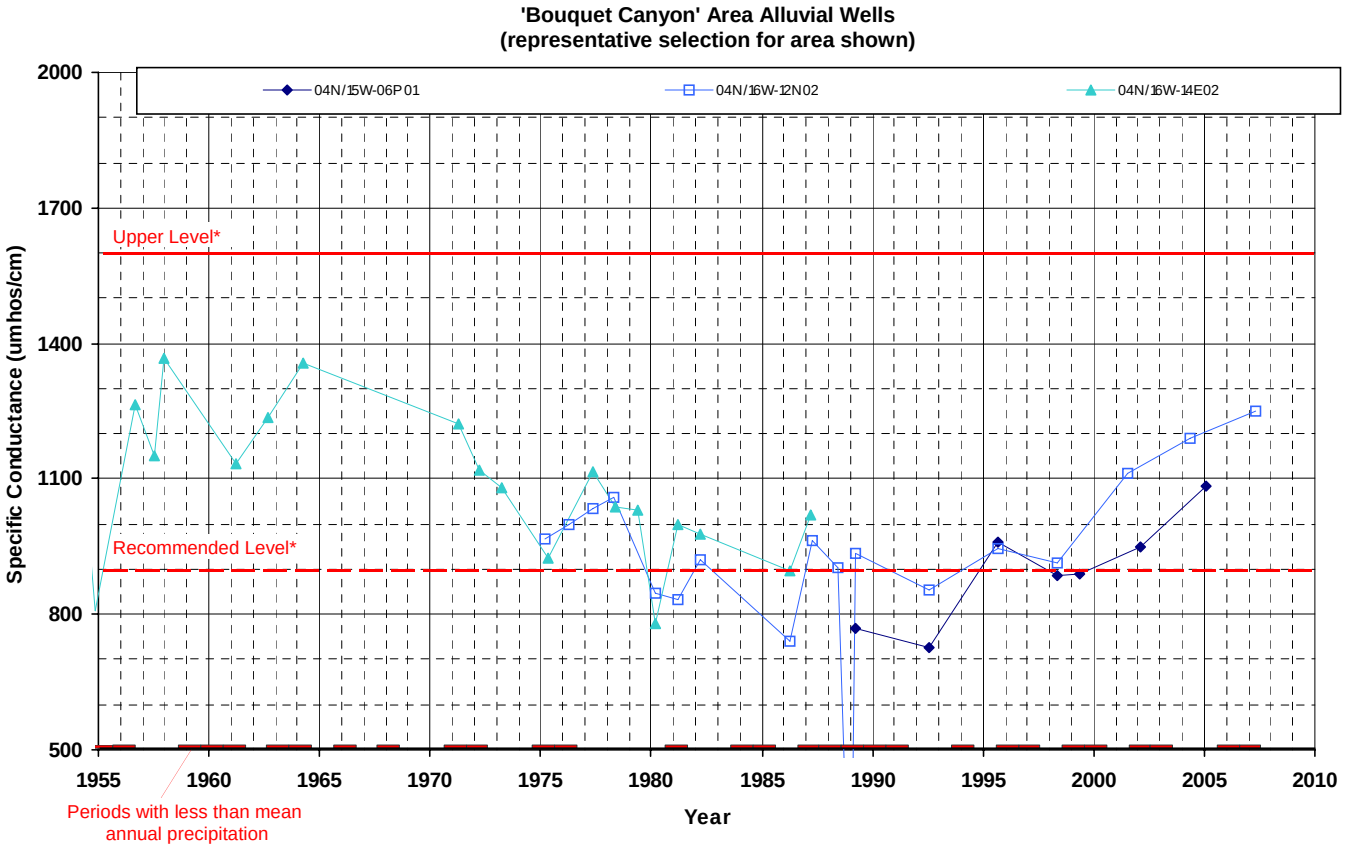
Figure III-10
Treated Water Distribution System
Castaic Lake Water Agency





*California Department of Public Health Secondary Maximum Contaminant Level

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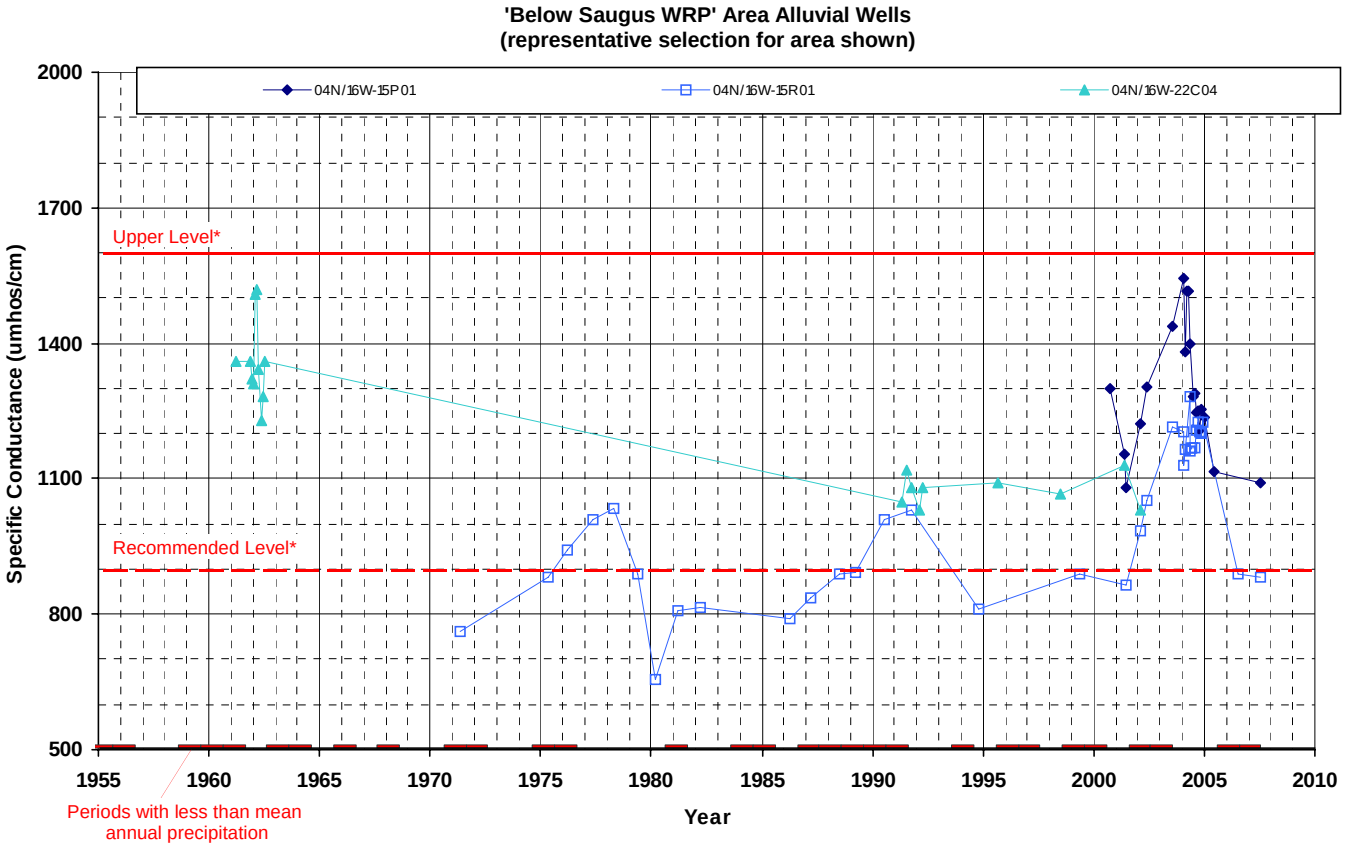
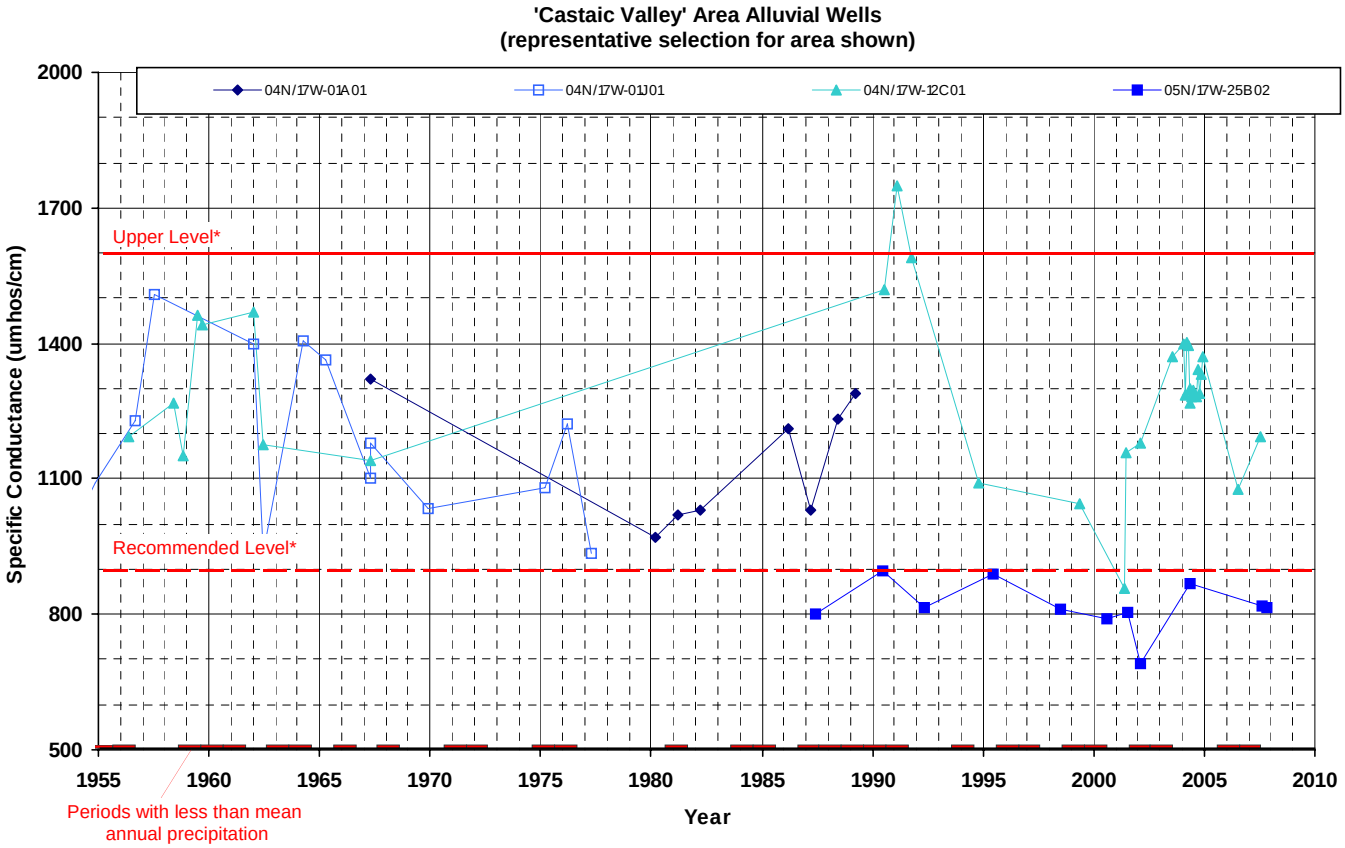
Figure III-11
Groundwater Quality in Eastern Santa Clarita Valley Alluvial Wells





*California Department of Public Health Secondary Maximum Contaminant Level

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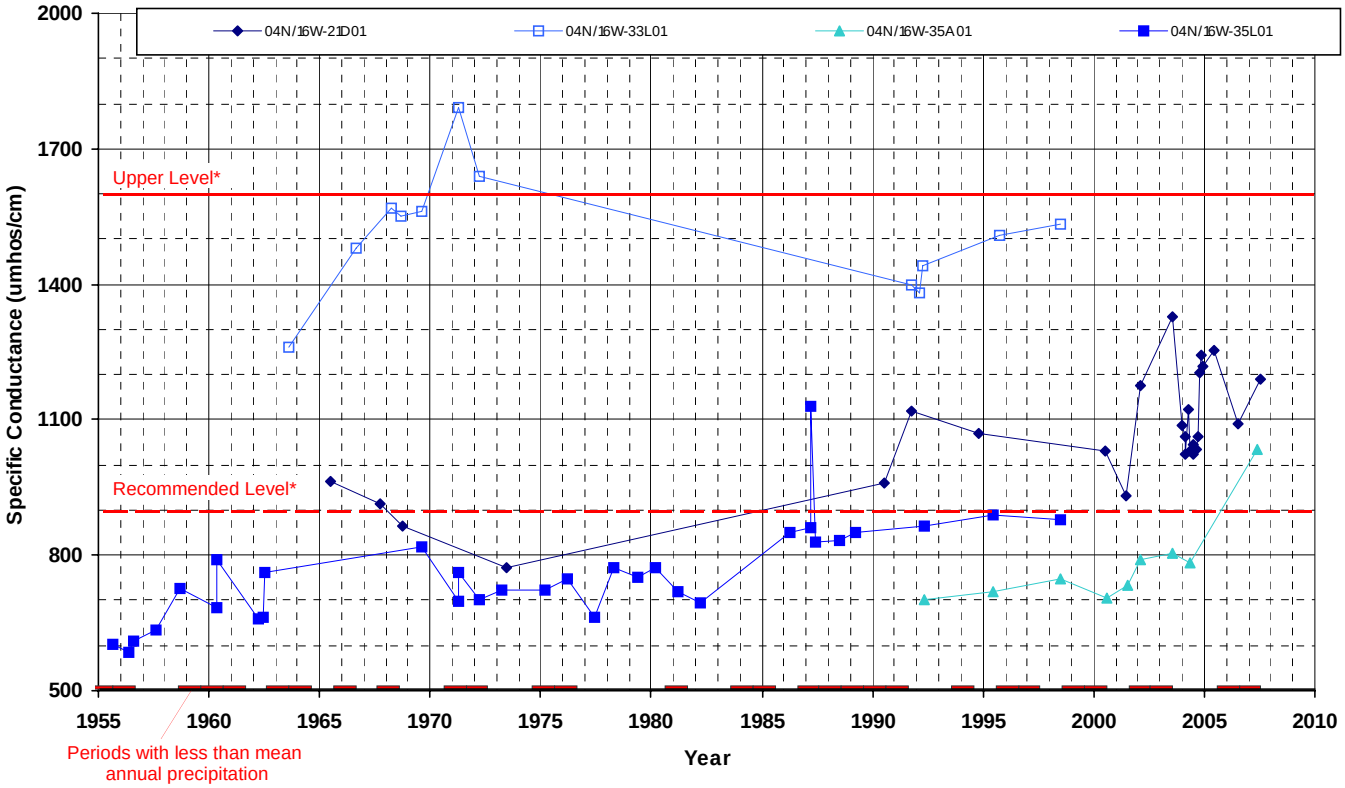
Figure III-12
Groundwater Quality in Western Santa Clarita Valley Alluvial Wells



*California Department of Public Health Secondary Maximum Contaminant Level

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Figure III-13
Groundwater Quality in Saugus Wells

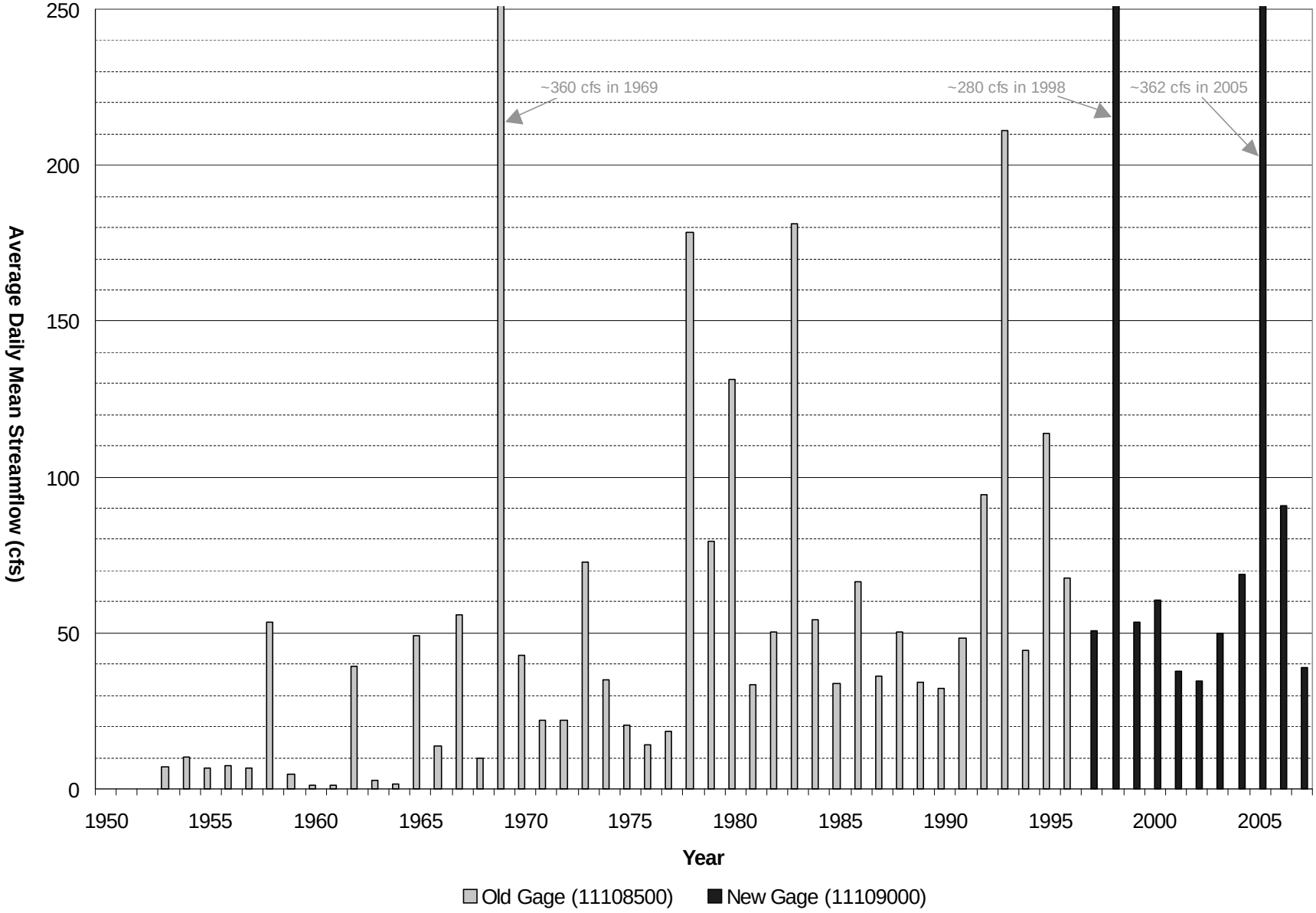

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Figure III-14
Annual Average of Daily Mean Streamflow
Santa Clara River at Los Angeles - Ventura County Line

IV. Summary of 2007 Water Supply and 2008 Outlook

As discussed above, total water demands in the Santa Clarita Valley were 92,300 af in 2007. This represented an increase of about one percent from total demand in 2006. Of the total demand in 2007, about 77,500 af were for municipal water supply, and the balance (14,800 af) was for agricultural and other uses, including individual domestic uses. As also discussed herein, the total demand in 2007 was met by a combination of local groundwater, SWP and other imported water, and by a small amount of recycled water.

The water demand in 2007 was the same as the average projection in the UWMP, but lower than the short-term projected demand that was estimated in the 2006 Water Report. For illustration, historical water use from 1980 through 2007 is plotted in Figure IV-1; also shown with that historical record are the projected total water demands in the UWMP through 2030. As discussed in the 2005 UWMP, year-to-year fluctuations in historical water demand have ranged from about ten percent below to about nine percent above the average or "normal" projection that would describe the long-term historical trend in the Valley's total water demand. The primary factor causing the year-to-year fluctuations is weather. In the short term, wetter years have typically resulted in decreased water demand, and drier years have typically resulted in higher water demand. Extended drier periods, however, have resulted in decreases in demand due to conservation and water shortage awareness. The decline in water demand toward the end of the 1987-92 drought is a good example of such reduced demand. A good recent example of wet-year effects on water demand was 2005, where extremely wet conditions resulted in total water requirements about six percent below the average projection in the UWMP.

The average water demand projection in the 2005 UWMP for 2008 is 95,800 acre-feet for all water uses in the Valley. In light of approximately normal hydrologic conditions of early 2008, and in light of the lack of precipitation-related effects on water demand over the last two years, water demand in 2008 is expected to be as projected in the 2005 UWMP.

It is expected that both municipal and agricultural water demands in 2008 will be met with a generally similar mix of water supplies as in previous years, notably local groundwater and imported SWP water, complemented by recycled water that will continue to supply a small fraction of total water demand.

As of February 22, 2008, the allocation of water from the SWP in 2008 is 35 percent of CLWA's Table A Amount, or 33,320 af. Combined with local groundwater from the two aquifer systems (42,500 af), total Flexible Storage Account water (6,060 af), net carryover SWP water from 2007 (12,146 af), annual acquisition from Buena Vista Water District (11,000 af), and recycled water (500 af), the total available water supplies for 2008 are nearly 106,000 af. Consequently, CLWA and the Purveyors anticipate having more than adequate supplies to meet all water demands in 2008. Projected 2008 water supplies and demand are summarized in Table IV-1.

In August 2007, a federal court ruled that certain operational changes were required of the SWP in order to protect the endangered Delta smelt. Thereafter, DWR prepared an update to its 2005 Reliability Report, which is issued biennially to indicate how much SWP water is available during varying hydrologic scenarios (i.e., normal and dry years). The Draft SWP Delivery Reliability Report 2007, issued in December 2007 by DWR, reduces the long term reliability of SWP supply from 77 percent to 66-69 percent. The discussion of SWP supply should be tempered, though, by noting that while the Draft SWP Reliability Report represents a reasonable scenario with respect to long term reliability, recent reductions in supply close the gap between the available supply and demand in the future, thereby making the CLWA service area more subject to shortages in certain dry years. Accordingly, the reduction in SWP supply reinforces the need to continue diligent efforts to conserve potable water and increase the use of recycled water, both to meet the goals in the 2005 UWMP and to maximize utilization of potable water supplies.

As discussed in Chapter V, CLWA and the retail water purveyors are working with Los Angeles County and the City of Santa Clarita in preparing a water conservation ordinance and the enforcement mechanisms to aggressively implement water conservation in the CLWA service area. In terms of short-term water supply availability, CLWA has determined that, while current operational changes of the SWP are in effect, there are sufficient supplemental water supplies, including SWP water, to augment local groundwater and other water supplies such that overall water supplies will be sufficient to meet projected 2008 water requirements as reflected herein.

In addition to the regular water supplies described above to meet projected demand in 2007, a total of nearly 51,000 af of recoverable water has been stored in the Semitropic Groundwater Storage Bank in Kern County. Nearly 64,900 af of recoverable water have also been stored in the long-term Rosedale-Rio Bravo Water Banking and Exchange Program, also in Kern County. Total recoverable water in Kern County storage banks is now more than 115,000 af. That component of overall water supply is separately reflected in Table IV-1 because it is intended for future dry-year supply and will not be used for 2008 water supply.

CLWA has implemented a number of projects that are part of an overall program to provide facilities needed to firm up imported water supplies during times of drought. These involve water conservation, surface and groundwater storage, water transfers and exchanges, water recycling, additional short-term pumping from the Saugus Formation, and increasing CLWA's imported supply. This overall strategy is designed to meet increasing water demands while assuring a reasonable degree of supply reliability.

Part of the overall water supply strategy is to provide a blend of groundwater and imported water to area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and location in the Valley is an operational decision and varies over time due to source availability and operational capacity of Purveyor and CLWA facilities. The goal is to conjunctively use the available water resources so that the overall reliability of water supply is maximized.

For long-term planning purposes, water supplies and facilities are added on an incremental basis and ahead of need. It would be economically unsound to immediately, or in the short term, acquire all the facilities and water supplies needed for the next twenty to thirty years. This would unfairly burden existing customers with costs that should be borne by future customers. There are many ongoing efforts to produce an adequate and reliable supply of good quality water for Valley residents. Water consumers expect that their needs will continue to be met with a high degree of reliability and quality of service. To that end, CLWA's and the Purveyors' stated reliability goal is to deliver a reliable and high quality water supply for their customers, even during dry periods. Based on conservative water supply and demand assumptions contained in the 2005 UWMP for the next 25 years, in combination with conservation of non-essential demand during certain dry years, CLWA and the Purveyors believe implementing their water plan will successfully achieve this goal.

Table IV-1
2008 Water Supply and Demand
(acre-feet)

Projected 2008 Demand [1]		**95,800**
Available 2008 Water Supplies		
Local Groundwater		42,500
Alluvium [2]	*35,000*	
Saugus Formation [3]	*7,500*	
Imported Water		62,526
Table A Amount [4]	*33,320*	
Net Carryover from 2007 [5]	*12,146*	
Buena Vista/Rosedale-Rio Bravo[6]	*11,000*	
Flexible Storage Account (CLWA) [7]	*4,684*	
Flexible Storage Account (Ventura County) [7]	*1,376*	
Recycled Water		500
Total Available 2008 Supplies		**105,526**
Additional Dry Year Supplies [8]		
Semitropic Groundwater Storage Bank		50,870
2002 Account[9]	*21,600*	
2003 Account[9]	*29,270*	
Rosedale-Rio Bravo Water Banking and Exchange Program		64,898
2005 and 2006 Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement[10]	*22,000*	
2005 Banking of Table A[11]	*17,800*	
2006 Banking of Table A[11]	*17,800*	
2007 Rosedale Rio-Bravo Banking[11]	*7,298*	
Total Additional Dry Year Supplies		**115,768**

1. Interpolated from 2005 and 2010 projections in 2005 UWMP.

2. The Alluvium represents 30,000 – 40,000 afy of available supply under wet-normal conditions, and 30,000 – 35,000 afy under dry conditions. Available supply in 2008 is shown to be mid-range for average/wet conditions, or upper end of range for dry conditions.

3. The Saugus Formation represents 7,500 – 15,000 afy of available water supply under non-drought conditions, and up to 35,000 afy under increasingly dry conditions. Available supply in 2008 is shown to be limited to average/wet conditions; no short-term increase in Saugus Formation pumping is required or shown for 2008 water supply.

4. CLWA's SWP Table A amount is 95,200 af. The 2008 allocation, as of February 22, 2008, is 35 percent (33,320 af).

5. Amount used by CLWA in 2007; total carryover was 38,484 af.

6. 2007 annual supply from Buena Vista / Rosedale-Rio Bravo Water Acquisition Agreement.

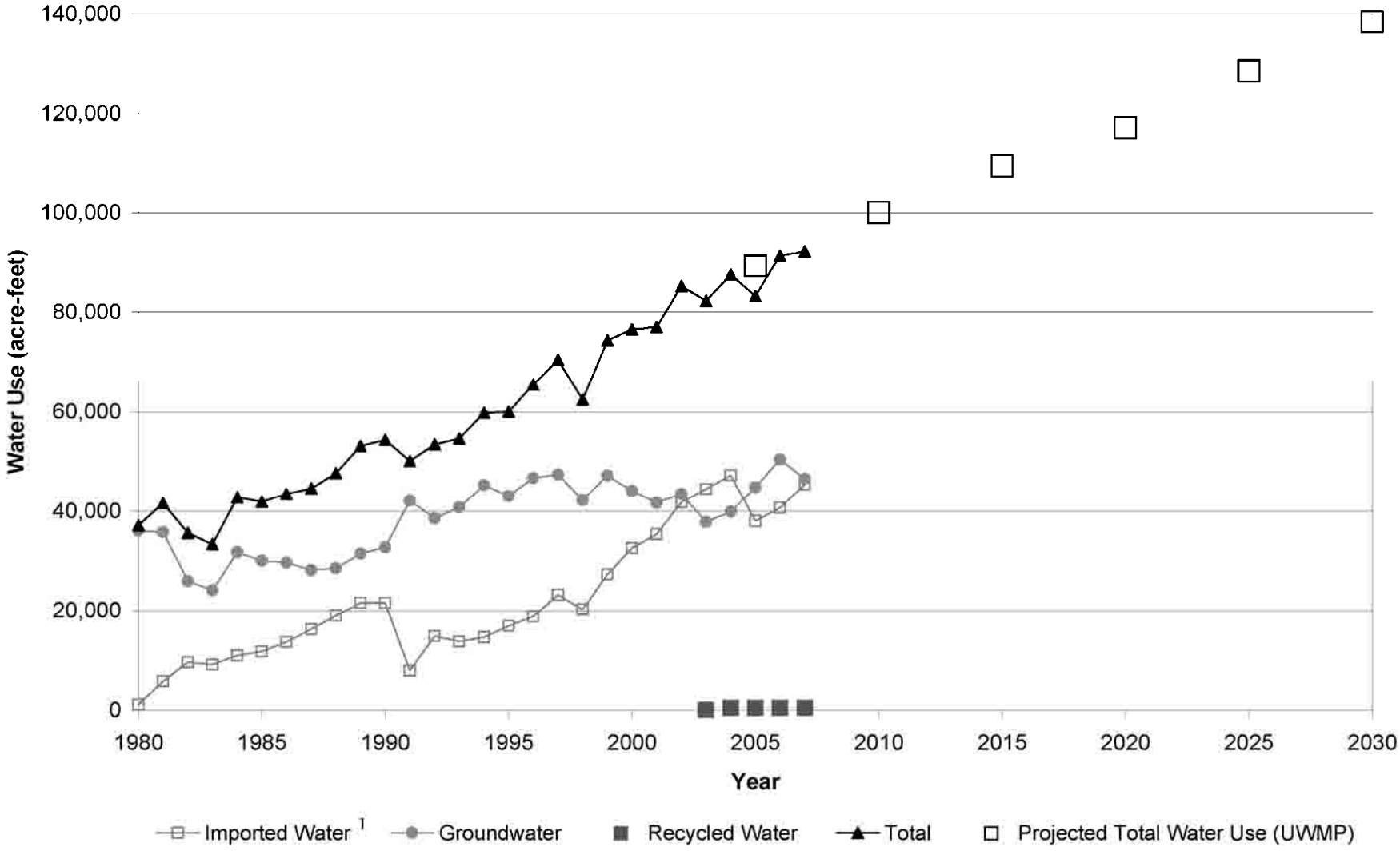
7. CLWA can directly utilize up to 4,684 af of storage capacity in Castaic Lake. By agreement in 2005, CLWA can also utilize 1,376 af of Ventura County SWP contractors' flexible storage capacity in Castaic Lake.

8. Does not include other reliability measures available to CLWA and the retail water Purveyors. These measures include short-term exchanges, participation in DWR's dry-year water purchase programs, local dry-year supply programs and other future groundwater storage programs.

9. Net recoverable water after banking 24,000 af and 32,522 af in 2002 and 2003, respectively.

10. Water stored in Rosedale-Rio Bravo Water Banking and Exchange Program pursuant to the Buena Vista/Rosedale-Rio Bravo Water Acquisition Agreement.

11. Net recoverable water after banking 20,000 af in 2005 and 2006, and banking 8,200 af in 2007.



1. Reflects State Water Project through 2006; includes imported water from State Water Project and Buena Vista WSD Agreement beginning in 2007.

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Figure IV-1
Historical and Projected Water Use
Santa Clarita Valley

V. Water Conservation

The California Urban Water Conservation Council (CUWCC) was formed in 1991 through the Memorandum of Understanding (MOU) Regarding Urban Water Conservation in California. The urban water conservation Best Management Practices (BMPs) included in the MOU are intended to reduce California's long-term urban water demands. While the BMPs are currently implemented by the MOU signatories on a voluntary basis, they are specified as part of the Demand Management Measures section of the Urban Water Management Planning Act.

Water conservation can achieve a number of goals, such as:

- Meeting legal mandates
- Reducing average annual potable water demands
- Reducing sewer flows
- Reducing demands during peak seasons
- Meeting drought restrictions

CLWA signed the urban MOU in 2001 on behalf of its wholesale service area, and pledged to implement several BMPs at a wholesale support level (listed below). NCWD signed the MOU in 2002 and VWC signed the MOU in 2006, on behalf of their respective retail service areas. As separate MOU signatories and in their respective roles as retailers, NCWD is committed to implementing all BMPs that are feasible and applicable in their service areas. Efforts are made to coordinate with CLWA and the other Purveyors wherever possible to maximize efficiency and ensure the cost effectiveness of NCWD's conservation program.

In coordination with the Purveyors, CLWA has been implementing the following BMPs (which pertain to wholesalers) for several years (some prior to signing the MOU in 2001):

BMP 3	System Water Audits, Leak Detection and Repair
BMP 7	Public Information Programs
BMP 8	School Education Programs
BMP 10	Wholesale Agency Programs
BMP 11	Conservation Pricing
BMP 12	Water Conservation Coordinator

CLWA and the Purveyors have been implementing these BMPs valley-wide. Since 2001, CLWA has also instituted implementation of BMP 2 (Residential Plumbing Retrofits) and BMP 14 (Residential ULFT Replacement Programs) on behalf of the Purveyors.

In addition to these efforts, in September 2006 CLWA installed a weather station at its headquarters adjacent to the Rio Vista Water Treatment Plant. This station became part a network of over 120 automated weather stations in the state of California that make up the California Irrigation Management Information System (CIMIS). The Department of Water Resources (DWR) manages the system which has a primary purpose of making available to the public, free of charge, information useful in estimating crop water use for irrigation scheduling.

NCWD has initiated implementation of the remaining BMPs that are specific to retail water suppliers:

BMP 1	Water survey programs for single-family residential and multi-family residential customers
BMP 3	System water audits, leak detection and repair
BMP 4	Metering with commodity rates for all new connections and retrofit of existing connections
BMP 5	Large landscape conservation programs and incentives
BMP 6	High-efficiency clothes washing machine financial incentive programs
BMP 9	Conservation programs for commercial, industrial, and institutional (CII) accounts
BMP 11	Conservation pricing
BMP 12	Conservation coordinator
BMP 13	Water waste prohibition

Reports to the CUWCC on BMP implementation by CLWA and the Purveyors were included in the 2005 UWMP.

Additional savings are occurring Valley-wide due to state interior plumbing code requirements that have been in effect since 1992, as well as due to changes in lot size and reduction in exterior square footage of new housing and commercial developments. These have begun to impact overall demand in the Valley. The Valley's water suppliers continue to monitor water demand trends through time to assess those factors that are accounting for the reduction, and to attempt to quantify them.

Most recently with regard to water conservation, CLWA and the retail water Purveyors entered into an MOU in 2007 to prepare a Santa Clarita Valley Water Conservation Strategic Plan. The purpose of the plan is to prepare a comprehensive long-term conservation plan for the Santa Clarita Valley by adopting objectives, policies and programs designed to promote proven and cost effective conservation practices. A consultant has been hired to prepare the plan which will include significant input from stakeholders and the community at large. The plan will provide a detailed study of existing residential and commercial water use and will develop programs and projects that will result in more efficient delivery and use of water by valley residents. The plan is expected to be completed in 2008. In addition to this effort, the water Purveyors are working with City and County agencies to develop a landscape irrigation ordinance for the Santa Clarita Valley. This ordinance will focus primarily on new construction aimed at reducing overall water demands by requiring efficient landscape design and delivery systems. Implementation of the ordinance is expected in late 2008 or 2009, depending on review and adoption by the City and County.

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Dated December 2003

Groundwater Management Plan

Santa Clara River Valley Groundwater Basin, East Subbasin

Los Angeles County, California

CASTAIC LAKE WATER AGENCY

December, 2003

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I. Introduction

Castaic Lake Water Agency

Castaic Lake Water Agency (CLWA) was formed in 1962 as a State Water Project Contractor to provide wholesale water supply from the State Water Project (SWP) to retail water purveyors in the Upper Santa Clara River area, most notably to Newhall County Water District, Los Angeles County Waterworks District No. 36, Santa Clarita Water Company and Valencia Water Company. In 2001, as part of legislation authorizing CLWA to provide retail water service to individual municipal customers in addition to its ongoing wholesale water supply, Assembly Bill 134 included a requirement that CLWA prepare a groundwater management plan in accordance with the provisions of Water Code Section 10750 et seq., which was originally enacted by, and is commonly known as, Assembly Bill 3030. This groundwater management plan has been prepared to satisfy the requirements of AB 134 and to both complement and formalize a number of existing water supply and water resource planning and management activities in the CLWA service area.

The CLWA service area encompasses all of the existing and currently planned municipal water service areas of the Upper Santa Clara River area, i.e. the suburban areas generally proximate to the Santa Clara River in Los Angeles County, generally between hills of the San Gabriel Mountains and the Santa Susana Mountains on the north and south, and between the Los Angeles/Ventura County line and Lang Station on the west and east, respectively. The extent of the CLWA service area and the geographical locations of the individual water purveyors within the CLWA service area are illustrated in Figure 1-1.

Santa Clara River Valley Groundwater Basin, East Subbasin

The groundwater basin generally beneath the CLWA service area, identified in DWR Bulletin 118 as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), is comprised of two aquifer systems, the Alluvium generally underlying the Santa Clara River and its several tributaries, and the Saugus Formation which underlies much of the entire Upper Santa Clara River area. The mapped extent of the Santa Clara River Valley East Subbasin in Bulletin 118, which is approximately the outer extent of the Alluvium and the Saugus Formation, and its

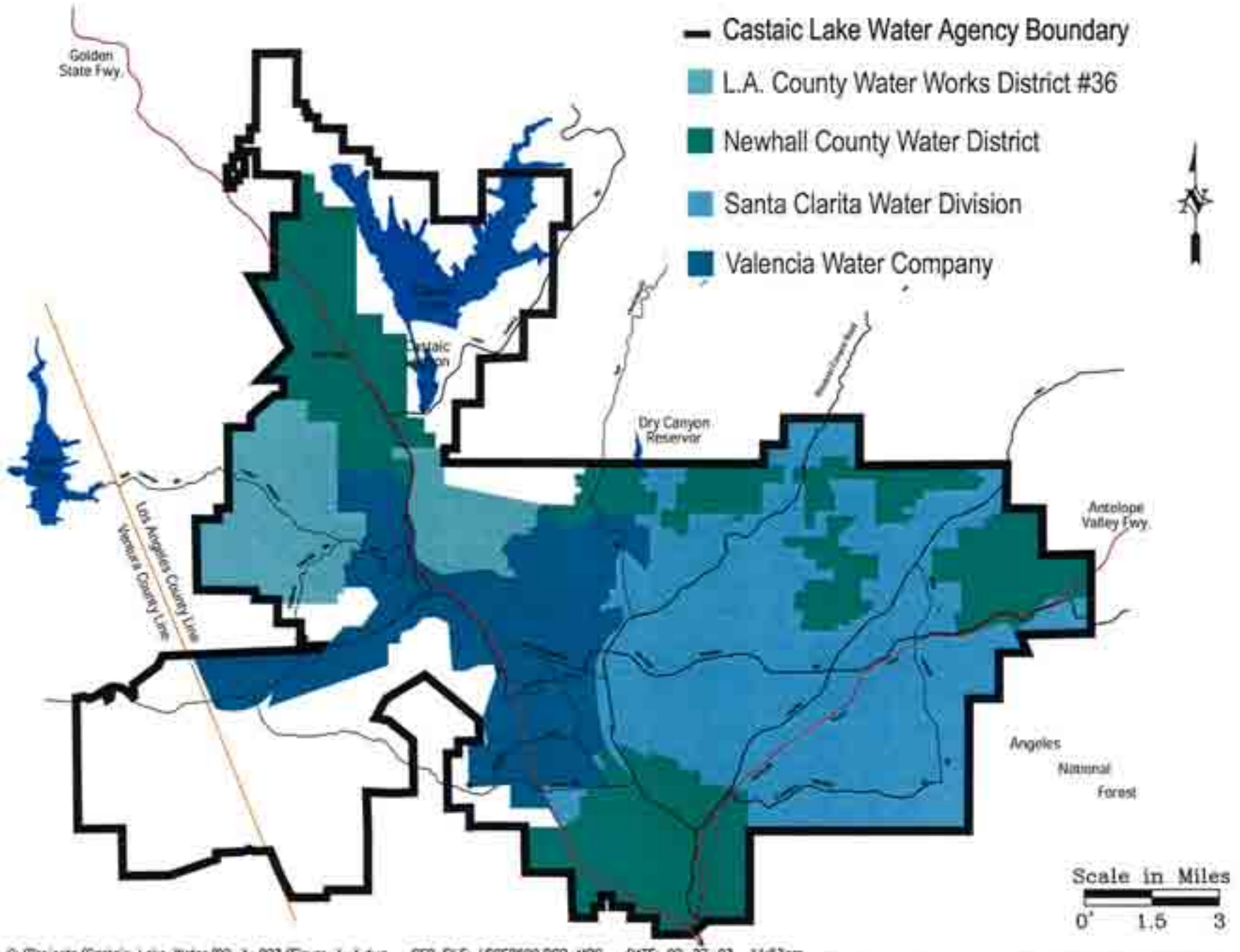

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Figure 1-1
CLWA and Purveyors' Service Areas

relationship to the extent of the CLWA service area are illustrated in Figure 1-2.

The two aquifer systems that comprise the groundwater basin are described in detail in this plan. For purposes of this plan, the groundwater basin is encompassed by the CLWA service area, and CLWA is the logical public water supply agency to prepare and implement a groundwater management plan for the Santa Clara River Valley East groundwater subbasin.

Overview of Water Requirements and Supplies

Historically, while development of local water supplies dates back at least 100 years, the earliest complete records of water use in the basin date from the late 1940's, when practically all water demand was for agricultural use. From that time through the early 1960's, agricultural water use, which was solely supplied by local groundwater, ranged from about 27,000 to about 42,000 acre-feet per year (afy). Over the succeeding three decades, agricultural water use progressively declined, into the range of about 8,000 to 10,000 afy, followed by a slight increase into the range of about 12,000 to 15,000 afy over the last ten years. Current projections are for agricultural water use to substantially decline, to about 7,000 afy, over the next 20 years.

Significant municipal water use in the basin did not begin until the early 1960's, when municipal uses, which were met exclusively at that time by local groundwater, were in the range of about 5,000 to 10,000 afy. By 1980, when supplemental surface water from the State Water Project (SWP) began to be imported to the basin, municipal water demands had increased to about 22,000 afy. Since then, municipal water demands have further increased, to their current level of about 61,000 afy, about 60 percent of which is supplied by SWP water, with the balance supplied by local groundwater. Current projections are for municipal water requirements to increase to about 106,000 afy over the next 20 years.

Historical and projected water requirements and supplies in the basin are discussed in more detail in Section IV of this Plan.

Water Code Section 10750 et. seq.

In 1992, the California State Legislature adopted Assembly Bill 3030 (AB 3030); that legislation was subsequently incorporated into the Water Code, Section 10750 et seq., to encourage local public agencies/water purveyors to adopt a formal plan to manage groundwater resources within

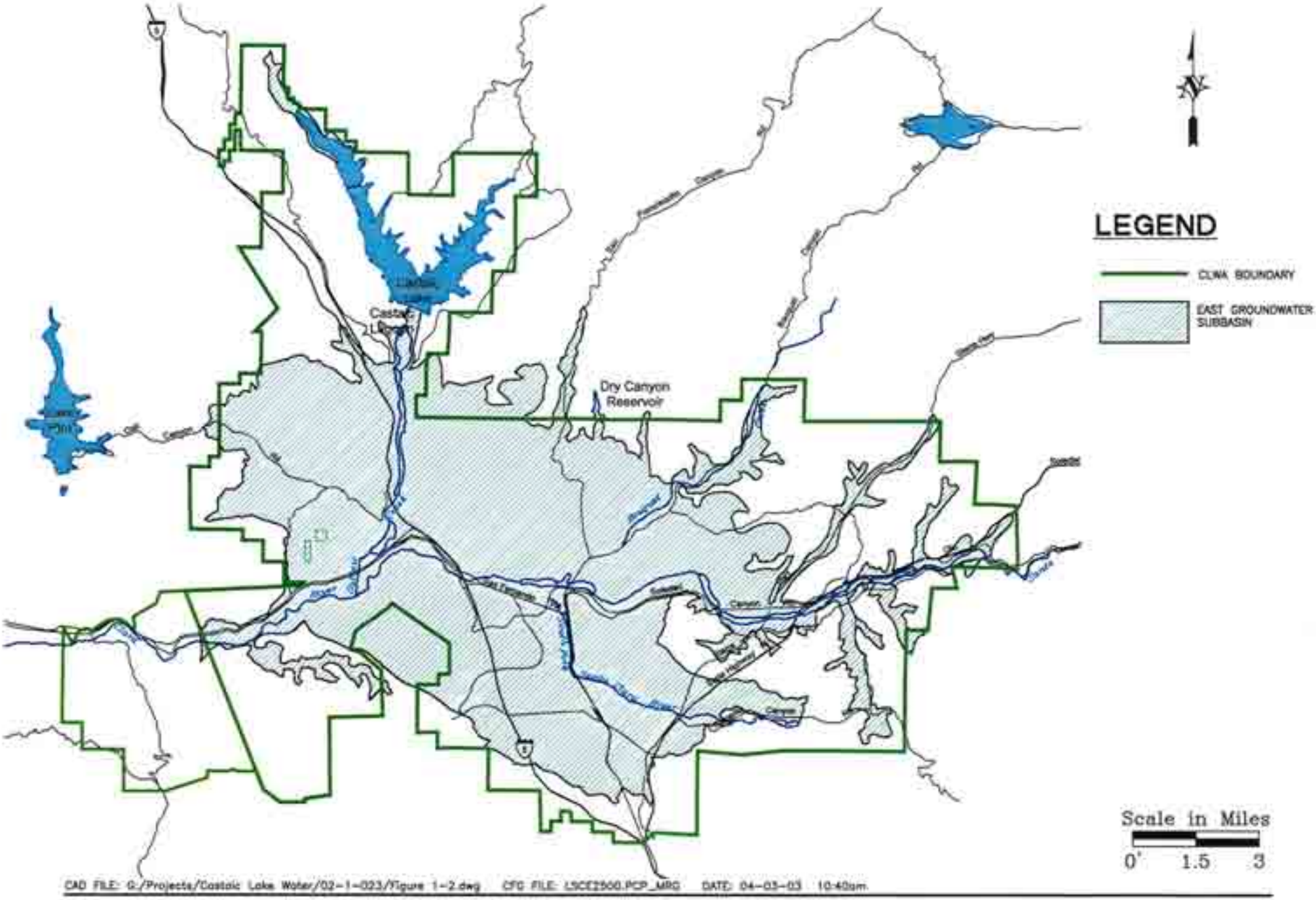

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Figure 1-2
Santa Clara River Valley
East Groundwater Subbasin

their jurisdictions. Within the scope of Water Code Section 10753.8, a local groundwater management plan can potentially include up to twelve specific components. Although the plan need not be restricted to those specific components, the listed components are quite broad and cover essentially all of the groundwater management elements which are part of this plan or are likely to be considered for implementation into this plan in the foreseeable future. To a considerable extent, a number of the groundwater management activities listed in Water Code Section 10753.8 have been implemented in the Santa Clara River Valley East groundwater subbasin as part of an organized effort by the local municipal water purveyors, including CLWA, to manage the groundwater basin within its sustainable yield for the benefit of local water supply, and also to integrate management of the basin with the management of surface and groundwater immediately downstream on the Santa Clara River, in this case specifically with United Water Conservation District in Ventura County, as discussed in more detail herein.

The potential components of a groundwater management plan listed in Water Code Section 10753.8 include:

- the control of saline water intrusion.
- identification and management of wellhead protection areas and recharge areas.
- regulation of the migration of contaminated groundwater.
- the administration of a well abandonment and well destruction program.
- mitigation of conditions of overdraft.
- replacement of groundwater extracted by water producers.
- monitoring of groundwater levels and storage.
- facilitating conjunctive use operations.
- identification of well construction policies.
- the construction and operation by the local agency of groundwater contamination cleanup, recharge, storage, conservation, water recycling, and extraction projects.
- the development of relationships with state and federal regulatory agencies.
- the review of land use plans and coordination with land use planning agencies to assess activities which create a reasonable risk of groundwater contamination.

In 2002, the Legislature adopted Senate Bill 1938 (SB 1938) to amend and add to Water Code Section 10750 et seq. regarding the implementation of local groundwater management plans. While the provisions of SB 1938 did not alter the potential components of a local groundwater management plan, as listed above, it did add the following notable provisions:

- The local agency, in preparing a groundwater management plan, shall make available to the public a written statement describing how interested parties may participate in developing the plan; for purposes of carrying out the preceding requirement, the local agency may appoint, and consult with, a technical advisory committee consisting of interested parties. AB 134 actually anticipated this last item by requiring CLWA to form an Advisory Committee to review its Plan. The membership of the Advisory Committee was specified to consist of one representative from each retail water purveyor within CLWA and one representative from each groundwater producer within CLWA who pumped more than 100 acre-feet in the preceding water year (2000). In conformance with that requirement, CLWA formed an Advisory Committee consisting of representatives from the following organizations, who collectively fulfill the description of the membership specified in AB134:

    - CLWA Santa Clarita Water Division
    - Los Angeles County Sheriff's Department
    - Los Angeles County Waterworks District No. 36
    - Newhall County Water District
    - Newhall Land and Farming Company
    - Robinson Ranch
    - Valencia Water Company

- In order to qualify for funding assistance for groundwater projects or groundwater quality projects, for funds administered by DWR, a local agency must accomplish all the following relative to groundwater management:

    - prepare and implement, or participate in, or consent to be subject to, a groundwater management plan, a basin-wide management plan, or other integrated regional water management program or plan that meets the provisions listed below.

    - include groundwater management components that address monitoring and management of water levels, groundwater quality degradation, inelastic land subsidence, and changes in surface flows and quality that either affect groundwater or are affected by groundwater pumping.

- include provisions to cooperatively work with other public (and presumably private) entities whose service area or boundary overlies the groundwater basin.

- include mapping of the groundwater basin, as defined in DWR's Bulletin 118, and the boundaries of the local agency subject to the plan, plus the boundaries of other local agencies that overlie the basin.

- adopt monitoring protocols designed to detect changes in groundwater levels, groundwater quality, inelastic land subsidence (for basins where subsidence has been identified as a potential problem), and flow and quality of surface water that either directly affect groundwater, or are directly affected by groundwater pumping.

Of the potential groundwater management activities listed in Water Code Section 10753.8, those already being investigated and actively implemented as part of less formal groundwater management by the purveyors include avoidance of overdraft, implementation of conjunctive use, monitoring of groundwater levels and quality, initiation of groundwater contamination control, analysis of basin yield for ongoing avoidance of overdraft, and annual analysis and reporting on basin conditions. The historic focus of informal groundwater management in the Santa Clara River Valley East groundwater subbasin has been on water supply, quantity and quality, to avoid conditions of overdraft, primarily by augmenting local groundwater supplies with a supplemental, imported surface water supply from the State Water Project. More recently, efforts have been added to include ongoing monitoring and the compilation of data into a data management system that is integrated with a comparable database system for the downstream surface water resources and groundwater basins on the Santa Clara River. Recent efforts have also included initiation of a process to develop a numerical groundwater flow model of the basin for analysis of basin response to various water supply, recharge, and conjunctive use management alternatives that might be applicable for the basin. The potential groundwater management provisions not historically implemented have been those more focused on groundwater contamination; however, very recent activities have added this component to local groundwater management as a result of impacts on several municipal water supply wells from a former munitions manufacturing site in the basin, as discussed in more detail herein.

In summary, in many respects, the local municipal water purveyors, including CLWA, have

already begun developing and implementing important parts of a formal local groundwater management program as part of developing reliable water supplies for in-basin needs. To ensure the reliability of the groundwater component of water supplies to meet existing and projected demands, those parts of local groundwater management planning already include monitoring, formulation of a data base, and integration with the database for adjoining downstream basins, analysis of groundwater conditions and annual reporting on water conditions in the basin, initiation of groundwater flow modeling, ongoing conjunctive use of local groundwater and imported SWP supplies, and initiation of investigation and control of localized groundwater contamination. The groundwater management plan described herein can be envisioned as a formalization, and some expansion, of those ongoing management efforts in the Santa Clara River Valley East groundwater subbasin.

The balance of this plan is organized to first establish a set of management objectives, or goals, for the basin; to then describe existing groundwater basin conditions, including areas of concern and identified problems; to present historical and projected water demands in the basin; and to finally present a set of groundwater management actions which, in aggregate, are the elements of this groundwater management plan.

II. Management Objectives (Goals) for the Basin

Prior to 1980, all water supplies in the Upper Santa Clara River Area were developed from local groundwater. Since 1980, the major water purveyors within the CLWA service area have developed their water supplies from a combination of local groundwater and imported supplemental surface water from the State Water Project (SWP). CLWA is the state SWP Contractor which holds the contract for SWP water. CLWA also operates the treatment and distribution system for delivery of SWP water to the local purveyors. Some imported SWP water has historically been delivered for non-municipal uses although, in aggregate, total non-municipal uses have been almost negligible (less than one percent).

A relatively small fraction of water supply in the area is still devoted to agricultural and other irrigation, and essentially all of that remains developed from groundwater. Over the last two decades, that use has been in a range between about 10,000 and 17,000 acre-feet per year.

The development and importation of a supplemental surface water supply from the State Water Project represents the first of a number of water resource and water supply management actions, all of which are formalized in this plan, aimed at what can be considered to be the overall goals or objectives for the basin. In no priority, those management objectives for the basin can be expressed as follows:

1. Development of an integrated surface water, groundwater, and recycled water supply to meet existing and projected demands for municipal, agricultural, and other water supply; since pumpage for other uses is from the same aquifer system, this objective includes agricultural, small community, non-agricultural irrigation, and individual domestic uses.

2. Assessment of groundwater basin conditions to determine a range of operational yield values that will make use of local groundwater conjunctively with SWP and recycled water to avoid groundwater overdraft and the undesirable effects associated with it. In effect, this objective equates to more detailed quantification of the yield of the basin in order to continue to avoid overdraft, consistent with what has historically been the case in the basin. In addition to avoiding the traditional overdraft symptoms

and effects, e.g. chronic water level decline, loss of groundwater storage, onset of land subsidence, groundwater quality degradation, a corresponding basin objective is to manage groundwater levels and associated groundwater discharge to the Santa Clara River at the west end of the basin, and thus not adversely impact surface and groundwater discharges to the downstream basin(s).

3. Preservation of groundwater quality for beneficial use in the basin, and for beneficial use of surface water and groundwater discharges from the basin. Included in this management goal will be the active characterization and solution of any groundwater contamination problems, through cooperation with responsible parties or through independent action if timely action by responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. Preservation of interrelated surface water resources. Included in this management goal will be the maintenance of appropriate surface water flows and non-degradation of surface water quality as a result of managing groundwater conditions to meet the other management goals for the basin.

Quantitatively, the preceding goals translate into general preservation of groundwater levels and quality in the Alluvial aquifer system consistent with the last 30 years, including fluctuations through seasonal demands and local hydrologic variations (wet and dry periods). As discussed in more detail in the next chapter, the hydrogeologic setting in the area has resulted in smaller Alluvial groundwater level fluctuations toward the western half of the basin (generally west of Bouquet Canyon), and larger fluctuations to the east. However, largely due in part to the importation of supplemental surface water over the last 20 years, and the integrated or conjunctive use of that supplemental water with local groundwater, there has been no chronic decline in groundwater levels or storage. A continuation of such basin conditions, possibly complemented by management actions to decrease the historical water level fluctuations in the eastern part of the basin, will accomplish the second basin objective (continued avoidance of overdraft as has been the ongoing historical condition in the basin) while continuing to utilize local groundwater to meet part of projected water requirements. Corresponding management actions to sustain recharge and not overdraft groundwater storage will accomplish the third basin objective by replenishing the aquifer system with sufficient water to sustain what has been generally consistent quality of groundwater on a long-term basis.

In general, the same goals of preservation of groundwater levels and quality pertain to the Saugus Formation as well as to the Alluvium. However, while those goals are generally expected to equate to Alluvial pumping rates comparable to recent historical pumping, the Saugus Formation may be intermittently utilized at higher than historical pumping rates for dry-period and/or emergency water supply. Interpretation of historical pumping fluctuations and corresponding aquifer response suggests that such intermittent utilization of a small fraction of the Saugus' large storage capacity can successfully contribute to a firming of local water supplies while still accomplishing all the management objectives listed above, primarily via reduction in Saugus pumping during wet-normal conditions, possibly complemented by management actions to accelerate recharge of the Saugus.

III. Groundwater Basin Conditions

Occurrence of Groundwater

Groundwater in the Santa Clara River Valley East groundwater subbasin occurs in two aquifer systems, the Alluvium associated with the Santa Clara River and its tributaries, and the Saugus Formation. There are also some scattered outcrops of Terrace deposits in the basin that likely have the capacity to contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and have consequently not been developed for water supply.

The Alluvial aquifer system, of Quaternary to Holocene (Recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The Alluvium is deepest along the center of the present river channel, with a maximum thickness of about 200 feet near the area known as Saugus. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the basin and, in the tributaries, becomes a mere veneer in their upper reaches. The spatial extent of the Alluvium throughout the basin is illustrated in Figure 3-1.

The Alluvium is the most permeable of the local aquifer units. Based on well yields and aquifer testing, transmissivity values in the range of 50,000 to 500,000 gallons per day per foot (gpd/ft) have been reported for the Alluvium, with the higher values where the Alluvium is thickest in the center of the valley and generally west of Bouquet Canyon (Slade 1986 and 2002). The amount of groundwater in storage can vary considerably because of the effects of recharge, discharge and pumping from the aquifer. The maximum storage capacity of the Alluvium has been estimated to be about 240,000 acre-feet (af) (Slade, 1986 and 2002).

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units: the lowermost, geologically older Sunshine Ranch member, which is of mixed marine to terrestrial (non-marine) origin; and the overlying, or upper, portion of the Formation which is entirely terrestrial in origin. The Sunshine Ranch Member of the Saugus Formation has a maximum thickness of about 3,000 to 3,500 feet in the central part of the valley;

however, due to its marine origin and fine-grained nature, it is not considered to be a viable source of groundwater for municipal or other comparable supply. Above the Sunshine Ranch Member, the Saugus Formation is coarser grained, consisting mainly of lenticular beds of sandstone and conglomerate that are interbedded with lesser amounts of sandy mudstone, which were deposited in stream channels, flood plains, and alluvial fans by one or more ancestral drainage systems in the valley. The sand and gravel units that represent aquifer materials in the upper part of the Saugus Formation are generally located between depths of about 300 and 2,500 feet. The spatial extent of the Saugus Formation throughout the basin is illustrated in Figure 3-1.

While much thicker and more spatially extensive throughout the basin when compared to the Alluvium, and while significant in terms of groundwater storage and individual well capacity, the Saugus Formation has typically lower values of transmissivity, in the range of 80,000 to 160,000 gpd/ft, with the higher values in the upper portions of the Formation (Slade, 1988 and 2002). The storage capacity of the Saugus has most recently been estimated to be 1.65 million acre-feet between depths of 300 feet and 2,500 feet (or the base of the Saugus or the base of fresh water if shallower than 2,500 ft.) (Slade, 2002).

Historical Groundwater Development

Of the two aquifer systems in the basin, the predominant development of groundwater for agricultural and municipal water supply has historically been from the Alluvium, a condition that remains the case at present. Prior to 1980, all water supply in the valley was developed from local groundwater; since 1980, local groundwater has been supplemented by imported surface water from the State Water Project. Details of historical water requirements, and water supplies to meet those requirements, are discussed and illustrated in Chapter IV of this Plan.

In general, over the last two decades, since the inception of SWP deliveries in 1980, total pumpage from the Alluvium has ranged from a low of about 20,000 afy (in 1983) to slightly more than 43,000 afy (in 1999). For comparison, agricultural pumpage from the Alluvium throughout the 1950's was consistently in the range of about 33,000 to 41,000 afy. During that same time, municipal pumpage was quite small, less than 4,000 afy. Overall, over the last two decades, there has been a change in municipal/agricultural pumping distribution, toward a slightly higher fraction for municipal water supply (from about 50% to nearly 60% of alluvial pumpage) which is indicative of the general land use changes in the area.

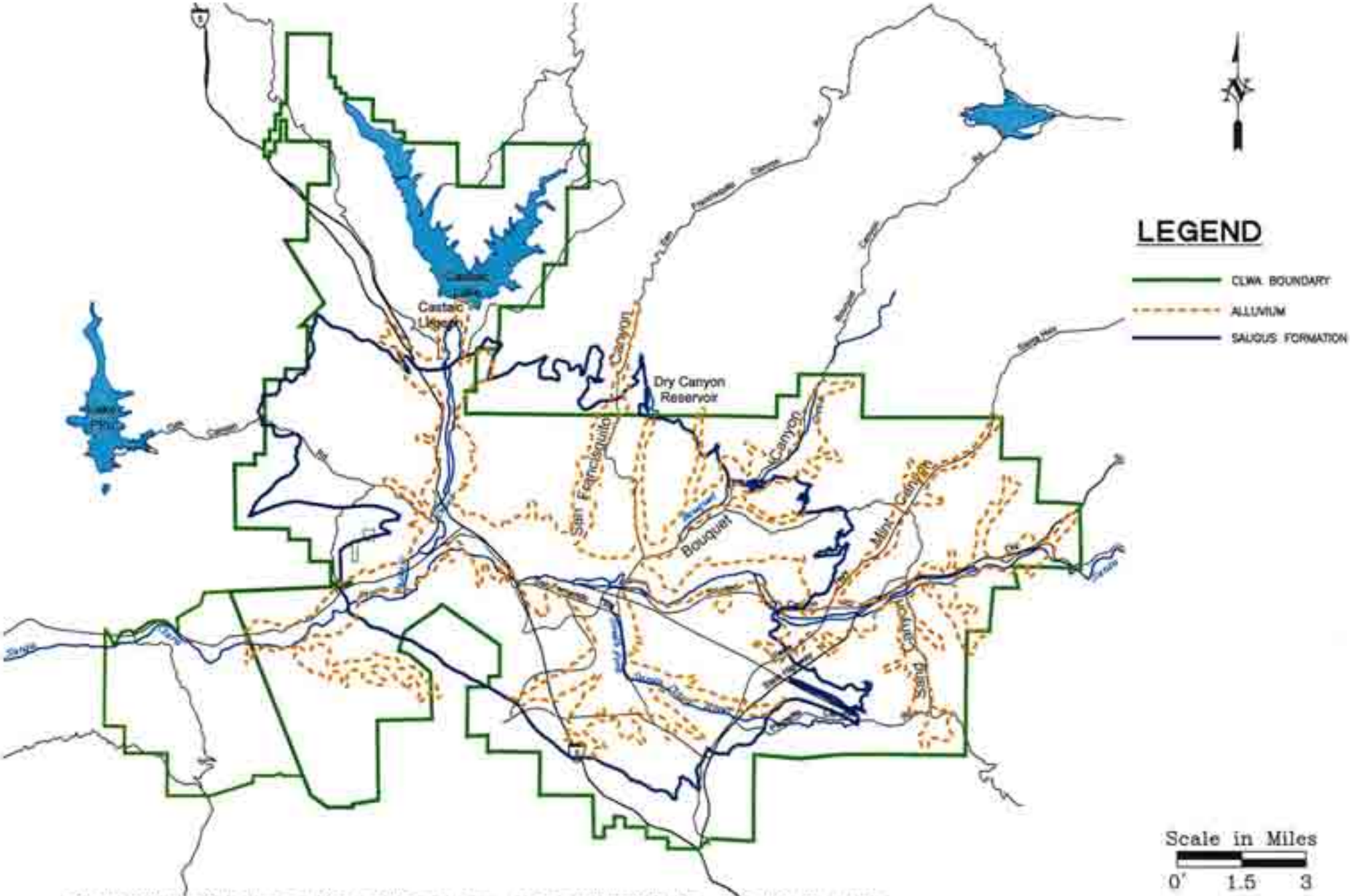

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Figure 3-1
Alluvial and Saugus Formations
Santa Clara River Valley East Groundwater Subbasin

Since 1980, total pumpage from the Saugus Formation has ranged between about 3,850 afy and nearly 15,000 afy; average pumpage over that period has been about 6,900 afy. The great majority of pumpage from the Saugus is for municipal supply (nearly 6,300 afy, or 92 percent, on average). For comparison, although historical Saugus pumping records prior to 1980 are limited, there appears to have been essentially no pumping from the Saugus prior to 1960 (on the order of about 100 af in most years, beginning in 1948), and some increased pumping for agricultural water supply beginning in about 1962 (about 900 af). The largest amount of agricultural pumping from the Saugus was during the mid-1960's, when annual Saugus pumpage was about 3,000 af. Agricultural pumping from the Saugus declined to near zero by the late 1970's, but has been generally in the 500 to 1,000 afy range since 1982. There was no Saugus pumpage for municipal supply in the early 1960's; limited data suggests that municipal pumping from the Saugus began in the 1970's, and reached nearly 5,000 afy by 1980-81. The most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions.

Groundwater Monitoring Network and Program

There is no formal groundwater monitoring network of wells for groundwater level measurements and/or groundwater quality sampling in the basin. Consequently, one component of this Plan is to formalize both a network of wells for groundwater monitoring and a program for water level measurements, water quality sampling, and other pertinent groundwater data collection (Primary Plan Element 1). Despite the lack of an existing formal groundwater monitoring network and program, however, there is a significant amount of historical groundwater data, some of which dates back into the 1940's, on which to base reasonable assessments of groundwater conditions in the basin. For example, groundwater level measurements have been made over varying periods of record in a total of 154 wells, mostly alluvial wells, throughout the basin. Similarly, groundwater quality data, consisting of varying numbers of constituents analyzed, are available from some wells, but a much smaller number than is the case for groundwater level data. These data, along with direct measurements or indirect estimates of pumpage, primarily from high capacity municipal and agricultural wells, allow for analysis of groundwater basin conditions, as discussed in this Plan, and also provide the bases on which a groundwater model can be developed (Primary Plan Element 3) and on which various management criteria such as operational yield, baseline groundwater quality, etc. can be determined (Primary Plan Elements 3, 6, etc.).

Groundwater Levels and Storage

Groundwater level data in various parts of the basin illustrate basin response to the historical pumpage from the Alluvium. Organized into hydrograph form (depth to groundwater or groundwater elevation vs. time), historical groundwater levels were lower in the 1950's and 60's than current levels in the middle to western part of the basin, logically in response to the higher pumpage of the 1950's before the importation of SWP water and the associated increase in return flows to the river that have augmented groundwater recharge in that part of the basin. Groundwater levels in those areas notably recovered as pumpage declined through the 1960's and 1970's. They have subsequently sustained generally high levels for much of the last 30 years, with two dry-period exceptions: mid-1970's and late 1980's - early 1990's; recoveries to previous high groundwater levels have followed both of those dry-period declines. Based on this data, there is no evidence of any historic or recent trend toward permanent water level or storage decline. In general, throughout the Alluvium, groundwater levels have been generally higher over the last 30 years than was consistently the case for the preceding 20 years (1950's - 60's).

During the last 20 to 30 years, in essentially all the alluvial portions of the basin, groundwater levels have fluctuated from near the ground surface when the basin is full, to as much as 100 feet lower during intermittent dry periods of reduced recharge. Selected hydrographs of groundwater elevations illustrate the above described conditions throughout the basin. Figure 3-2 illustrates groundwater level conditions and trends at multiple locations in the Alluvium along the main channel of the Santa Clara River, from east near the mouth of Sand Canyon, to the area between Mint Canyon and Bouquet Canyon, to farther west immediately below the mouth of Bouquet Canyon. Similar long-term conditions are evident in the tributary canyons.

A comment about some of the groundwater fluctuations illustrated in Figure 3-2 is appropriate since they are illustrative of the most substantial intermittent changes in the basin. As noted above, the Alluvium has historically experienced a number of alternating wet and dry hydrologic conditions as illustrated in Figure 3-2. Since the Alluvium is thinner to the east, the fluctuations in water levels of 75 to 100 feet impact well yields and pumping capacities when water levels are occasionally lower. When that occurs, as is currently the case due to locally dry hydrologic conditions, the affected purveyors shift a portion of their water demands to imported SWP water, thus reducing pumpage and reducing drawdown of water levels. Recovery of groundwater levels

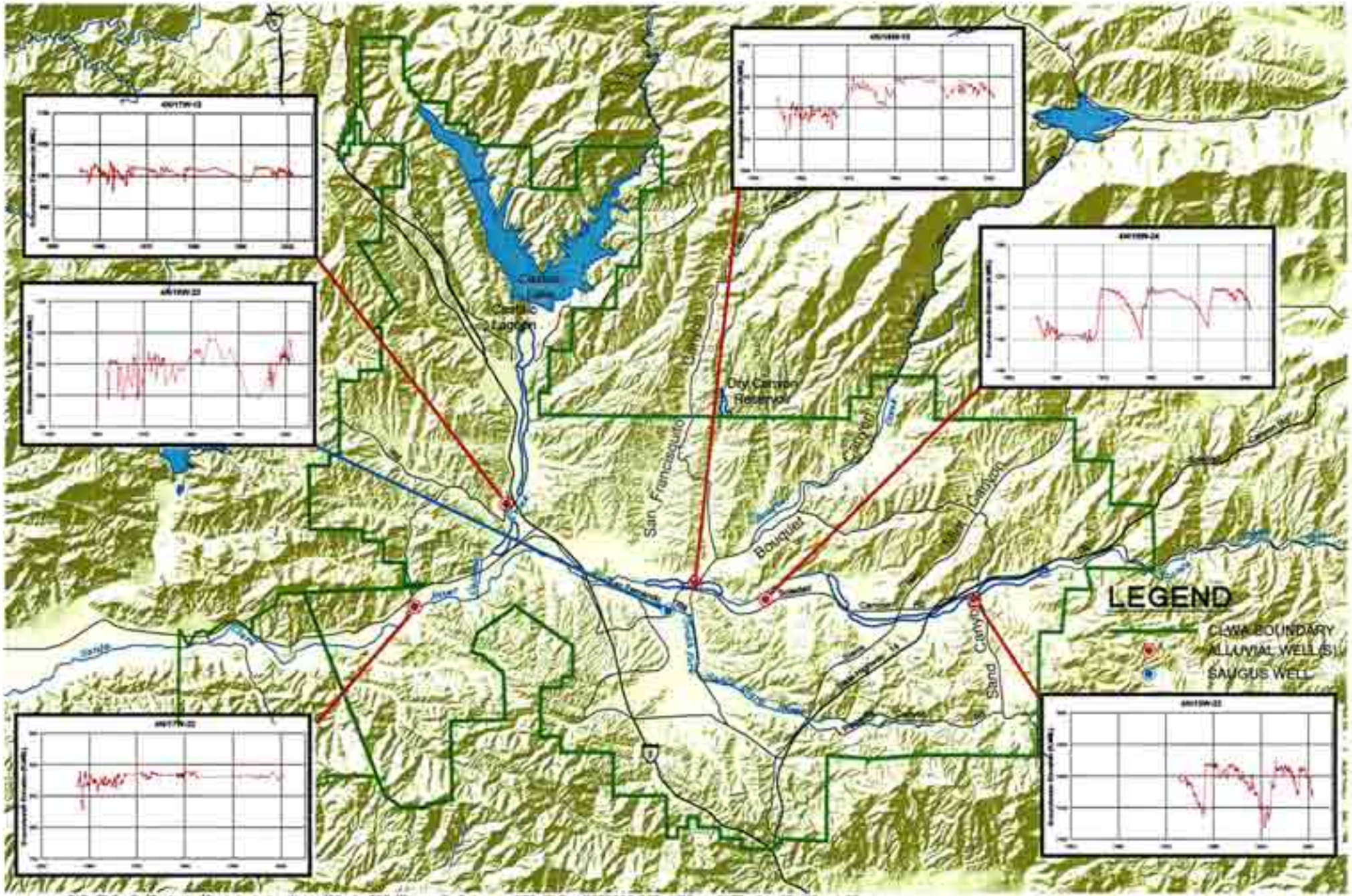

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Figure 3-2
Historical Groundwater Elevations
Santa Clara River Valley East Groundwater Subbasin

and storage occurs upon a return of stream flow to contribute to natural recharge.

Depending on the period of available data, all the hydrographs of alluvial groundwater levels show the same general picture: recent (last 30 years) groundwater levels are generally higher than over the preceding 20 years. In some locations, there are intermittent dry-period declines (and an associated use of some groundwater from storage) followed by wet-period recoveries (and associated refilling of storage space). On a long-term basis, whether over the last 20 years since the inception of conjunctive use via importation of SWP water, or over the last 40 to 50 years, the Alluvium shows no signs of water level-related overdraft, i.e., no trend toward decreasing groundwater levels and storage, a condition that is intended to be maintained via implementation of this Plan, e.g. via Primary Plan Elements 3 and 5.

Unlike the Alluvium, there are limited Saugus water level data; however, the limited data indicate that, although there have been seasonal water level changes in response to pumpage, the long-term trend in the Saugus (over the last 35 to 40 years) has been one of relative groundwater level stability (see, for example, Figure 3-2). There is no trend toward a sustained decline in Saugus water levels or storage that would be indicative of overdraft.

Land subsidence as a result of groundwater extractions is a concern in a number of groundwater basins in California. The potential for land subsidence caused by groundwater extractions derives from a combination of the geologic makeup of the aquifer materials and the history of groundwater level fluctuations. In the Santa Clara Valley East Subbasin, the most notable groundwater level fluctuations have occurred in the Alluvium to the east of Bouquet Canyon, with the greatest fluctuations (up to nearly 100 feet) recorded in the vicinity of Sand Canyon. Fortunately, those fluctuations have been intermittent, and have varied directly with local wet and dry conditions. From a subsidence perspective, they have also fluctuated in an unconfined aquifer that is comprised of essentially all coarse-grained material. The lack of any significant fine-grained material in the aquifer where groundwater levels have fluctuated results in two notable local conditions in regards to subsidence: there is no recorded historical subsidence or indirect evidence of its occurrence, i.e. subsidence-related impacts on surface structures, drainage facilities, etc.; and there is minimal potential for inelastic subsidence to occur in response to ongoing groundwater level fluctuations in the Alluvium.

The Saugus Formation contains a greater fraction of fine-grained material interbedded with the coarser aquifer materials that yield water to wells. Consequently, the Saugus has a greater

potential to undergo consolidation, with attenuant subsidence impacts at the ground surface, if groundwater levels are substantially lowered for long time periods. Historical Saugus pumping has not caused such conditions to occur. Current water supply planning, as described in this Plan, is to rely on the Saugus Formation for a relatively small component of water supply on an ongoing basis, with intermittent increased pumping during dry periods.

The long-term objective for groundwater management, as described in this Plan, is to not overdraft either the Alluvium or the Saugus, i.e. to not chronically lower groundwater levels. Satisfaction of the latter objective will have the correlative impact of minimizing the potential for inelastic land subsidence attributable to pumping from the Saugus Formation; combined with the lack of fine-grained material in the Alluvium, satisfaction of that objective will also have the correlative impact of ensuring the improbability of any subsidence attributable to pumping from that aquifer.

Groundwater Quality

Groundwater quality is, or course, a key factor in assessing both the Alluvial aquifer and the Saugus Formation as municipal and agricultural water supplies. At present, however, there is no convenient long-term record of water quality, i.e. water quality data in one or more wells that span several decades and continue to the present. Thus, in order to examine a long-term record of water quality in the Alluvium, an integration of individual records from several wells, completed in the same aquifer materials and in close proximity to each other, can be used to generally show long-term trends in groundwater quality. Figure 3-3 illustrates groundwater quality conditions and trends at multiple locations in the Alluvium along the main channel of the Santa Clara River from the area near the mouth of Mint Canyon, to areas immediately above and near the mouth of Bouquet Canyon, to the area below San Francisquito Canyon. Based on these records of groundwater quality, there have been historical fluctuations in concentrations of total dissolved solids (TDS), as well as corresponding fluctuations of individual constituents of TDS. In general, however, and similar to groundwater levels, there has been no long-term trend toward groundwater quality degradation.

Groundwater quality variations are common throughout the Alluvium and generally correlate inversely with precipitation and stream flow: wet periods have produced substantial recharge of higher quality (low TDS) water and dry periods have resulted in the notable declines in water levels described above, with a corresponding increase in TDS (and individual component

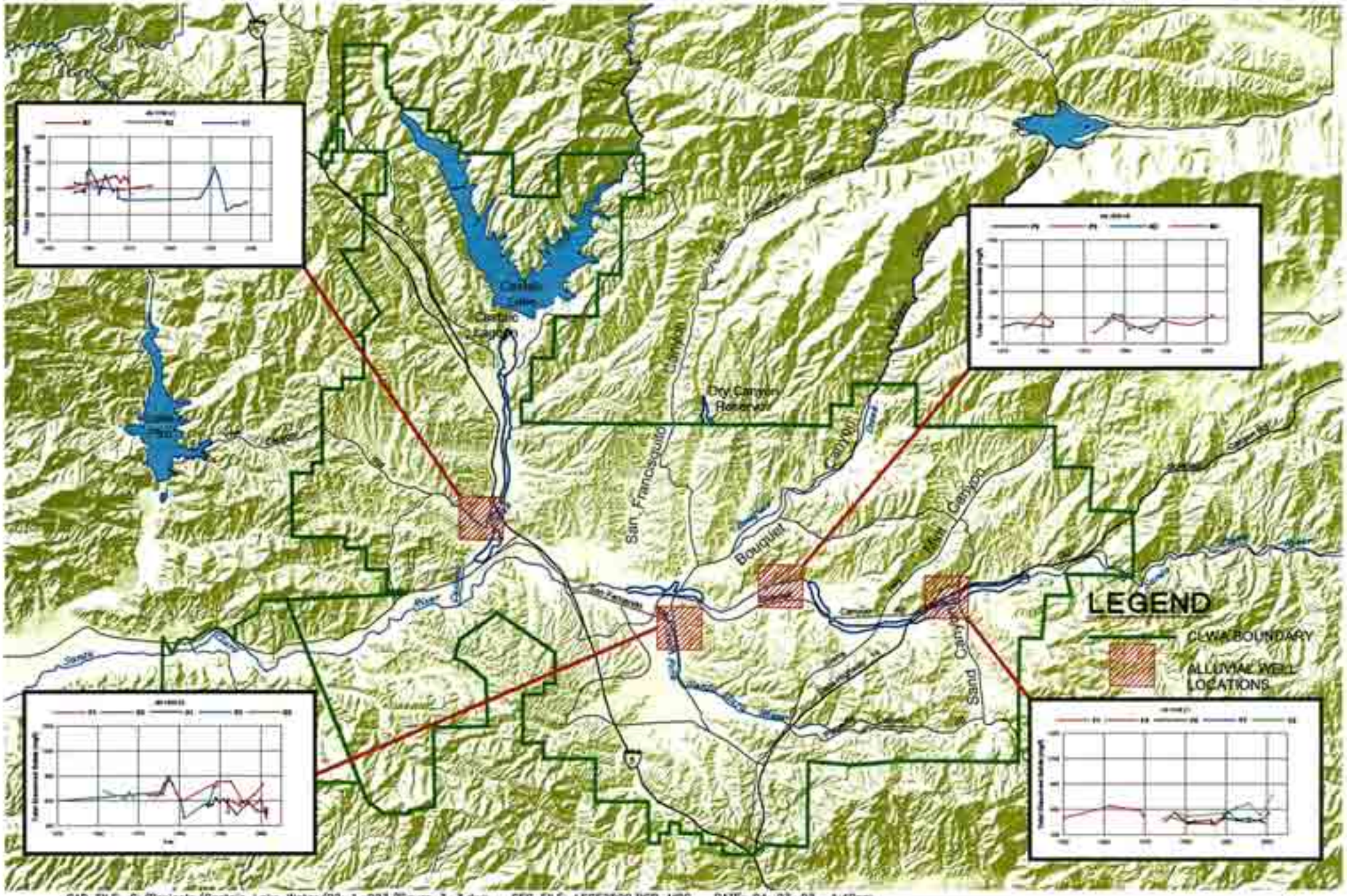

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Figure 3-3
Historical Groundwater Quality by Section
Santa Clara River Valley East Groundwater Subbasin

constituents) in the deeper parts of the Alluvium.

Due to a much more limited number of wells and the limited spatial extent of groundwater development in the Saugus Formation, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. Based on the most complete historical record, over the last 35 years, however, groundwater quality in the Saugus has remained generally constant. The Saugus Formation is, on a groundwater quality basis, a viable agricultural and municipal water supply.

The most notable groundwater quality issue in the basin centers around the detection and impact of perchlorate on several Saugus wells and one Alluvial well in the central part of the basin near the location of the former Whittaker Bermite facility, which is immediately southeast of the confluence of the main Santa Clara River and its South Fork tributary. In 1997, routine water quality sampling detected the presence of perchlorate in four municipal wells completed in the Saugus Formation (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 11, and Valencia Water Company Well 157). While there remains no primary or secondary drinking water standard for perchlorate, and although only some of the detected concentrations of perchlorate in the Saugus wells exceeded the Action Level established by the State Department of Health Services at that time (18 ug/l), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service since then.

More recently, in late 2002, routine water quality sampling of Alluvial wells detected perchlorate in one of them (CLWA Santa Clarita Water Division Stadium Well) at a concentration which slightly exceeds the current Action Level (4 ug/l). This well has also been voluntarily inactivated, and remains removed from municipal water supply service.

This Plan, notably through Primary Plan Elements 1, 6 and 8, is intended to incorporate both short-term and long-term groundwater quality considerations in the management of the groundwater basin in order to formalize groundwater quality monitoring and assessment, to investigate and correct groundwater contamination problems, and to preserve or improve groundwater quality for ongoing water supply as well as for avoiding adverse water quality impacts on interconnected surface waters.

Areas of Concern and Identified Problems

A number of concerns have been expressed about groundwater conditions in the basin. While not all of the expressed concerns have been substantiated, they are listed and briefly discussed here, and they are addressed in the management objectives for the basin, intended to be achieved via implementation of the various primary and secondary elements in this Plan.

At present, the most notable concern in the basin is the impact of perchlorate contamination on a number of municipal water supply wells, thus affecting the available pumping capacity from some municipal wells. While perchlorate impacts on a few wells do not preclude the ability to pump groundwater in accordance with existing water supply plans, activities to characterize the contamination, and ultimately to control it and treat it, have been initiated in order to return the impacted wells' pumping capacity to water supply service. Primary Element 8 is included in this Plan to formalize the addressing of groundwater contamination issues in the basin.

Concern has also been expressed that groundwater development in the basin will adversely impact the quantity and/or quality of surface flows leaving the basin via the Santa Clara River. Such concern extends to the potential impact on groundwater in the next downstream basin, the Piru Basin in Ventura County. While there are no established provisions regarding surface flows out of the Santa Clara River Valley East subbasin, Primary Element 2 is included in this Plan to formally address the monitoring and management of surface water flows and quality within, and flowing out of, the basin. Some work is already ongoing related to this area of concern via a Memorandum of Understanding (MOU) among CLWA, other retail water purveyors within CLWA's service area, and United Water Conservation District, which manages surface water and groundwater in the downstream basins on the Santa Clara River in Ventura County. That cooperative effort, which is incorporated into this Plan via Primary Element 9, includes integration of databases, development of a numerical groundwater flow model, and interpretation and reporting on surface water and groundwater conditions.

A third expressed concern in the basin, is that groundwater is already overdrafted. Associated with that expressed concern is a related issue that reliance on overdrafted groundwater results in an overstated water supply in the basin. As discussed earlier in this section, long-term groundwater levels, storage, and quality all indicate the basin is in balance (i.e., no overdraft exists). As also discussed above, the importation of supplemental surface water over the last 23 years, and the associated initiation of conjunctive use operations have directly resulted in an

overall adequacy of water supplies while sustaining an undepleted groundwater supply. Primary Elements 3, 4 and 5 are key parts of this Plan to more formally quantify the yield of the groundwater basin, and to continue to meet overall water requirements via continuation of conjunctive use of local groundwater with imported supplemental surface water, ultimately complemented by integration of recycled water for non-potable water supply (Primary Element 7).

Finally with regard to areas of concern in the basin, the historically larger fluctuations in the eastern part of the basin have been highlighted for their impacts on private wells in that area. Some focused study has been done to address whether certain pumping directly affects private wells in Sand Canyon; its conclusions were that such direct effects were not occurring. Subsequently, a nearby development contracted for delivery of up to 120 acre-feet of imported SWP water from CLWA in order to reduce its use of groundwater for domestic and irrigation water supply. Primary Element 1 is partly intended to acquire site-specific data regarding private wells, their locations, the aquifers in which they are completed, their yields and pumping capacities as well as their quality, and their water level records. Primary Element 3 is partly intended to analyze such data in order to assess whether local aquifer depletion is occurring and, if so, what remedy is appropriate.

IV. Historical and Projected Water Requirements and Supplies

Historical Water Requirements

The initial development of water supplies in the Santa Clarita area began in the 1800's for irrigation on the San Francisquito Ranch after its purchase by Henry Mayo Newhall. While there are some records in the form of waterworks drawings that show early diversion and distribution facilities on the ranch in 1911 and some mapping of well locations in the 1930's, the earliest complete records of water use date from shortly after the end of World War II. From 1947 through the mid 1960's, groundwater pumping for agriculture ranged from about 27,000 to about 42,000 acre-feet per year (afy). For most of the same period, until 1960, there are no detailed records of water use for municipal supply. The first records of municipal water use begin in 1960, when municipal water requirements were about 5,000 afy; by the mid-1960's, municipal water requirements had increased to about 10,000 afy. Throughout that time, all municipal water supply was from local groundwater.

From the mid-1960's through about 1980, groundwater pumping for agricultural water supply declined into the range of about 10,000 to 15,000 afy. In the late 1980's through the early 1990's, agricultural groundwater pumping further declined into the range of about 8,000 to 10,000 afy; over about the last ten years, agricultural water requirements, which continue to be fully met by local groundwater pumping, have been in the range of about 12,000 to 15,000 afy. The history and trends of agricultural water use in the basin are illustrated in Figure 4-1.

Detailed records of municipal water use are not available from the mid-1960's through 1980, when imported surface water was first used in the basin for municipal water supply. However, the available municipal water use data at the beginning and at the end of that period, combined with estimated declining agricultural water use for the same period, suggest there was a generally steady increase in municipal water use from about 11,000 af in 1966 to about 22,000 af in 1980. Since then, municipal water use has increased to about 68,000 afy. With the addition of imported surface water from the State Water Project beginning in 1980, however, groundwater pumping for municipal supply declined in the early 1980's. Throughout the 1990's, municipal

pumping fluctuated between about 27,000 and 32,000 afy. The history and trend of municipal groundwater use in the basin are illustrated in Figure 4-1.

As noted above, until 1980, all water supply in the basin was from local groundwater. Imported surface water was first available from the State Water Project (SWP) in 1980, when a total of 1,125 af were imported into the basin. Since then, importations of SWP water have increased in two separate steady trends, interrupted by a notable decrease at the end of, and following, the 1987-1992 drought period: a steady increase beginning in 1980, to about 21,600 afy in each of 1989 and 1990, followed by a substantial decrease, to less than 8,000 af in 1991, and then a steady increase back to about 21,000 afy in 1997 and 1998, followed by further increases to nearly 42,000 af in 2002. The history and trends in importation of SWP water to the basin are illustrated in Figure 4-2, which also illustrates the historical trends in groundwater pumping and total water use in the basin since the importation of SWP water.

In the context of this groundwater management plan, the historical utilization of imported SWP water to augment local groundwater represents the initiation of conjunctive use of surface water and groundwater supplies, a groundwater management principle which is intended to be continued via adoption of Primary Element 5 of this plan.

Projected Water Requirements

Detailed projections of municipal water requirements were most recently completed as part of the Urban Water Management Plan prepared by CLWA and the municipal water purveyors (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) in 2000. Those projections, which are forecast for a 20-year period, also recognize an ongoing but decreasing agricultural water demand over the same period, from about 15,000 afy in 2005 to about 7,000 afy by 2020. The municipal water demand projections in the Urban Water Management Plan are derived from utilization and interpretation of multiple projection methods, including per-capita water-use applied to population projections; extrapolation of number of service connections (using two different projection techniques, an average rate and an accelerated rate projection) applied to the rate of service connection additions since 1990; and land use projections combined with unit water use factors on multiple land use categories (urban, including residential, commercial, industrial and recreational; irrigated agricultural; and vacant and open space). The water demand projections in the Urban Water Management Plan also consider weather effects (variations due to hot-dry years vs. cool-wet years) and conservation

Historical Groundwater Production
Upper Santa Clara Valley Groundwater Basin
East Subbasin

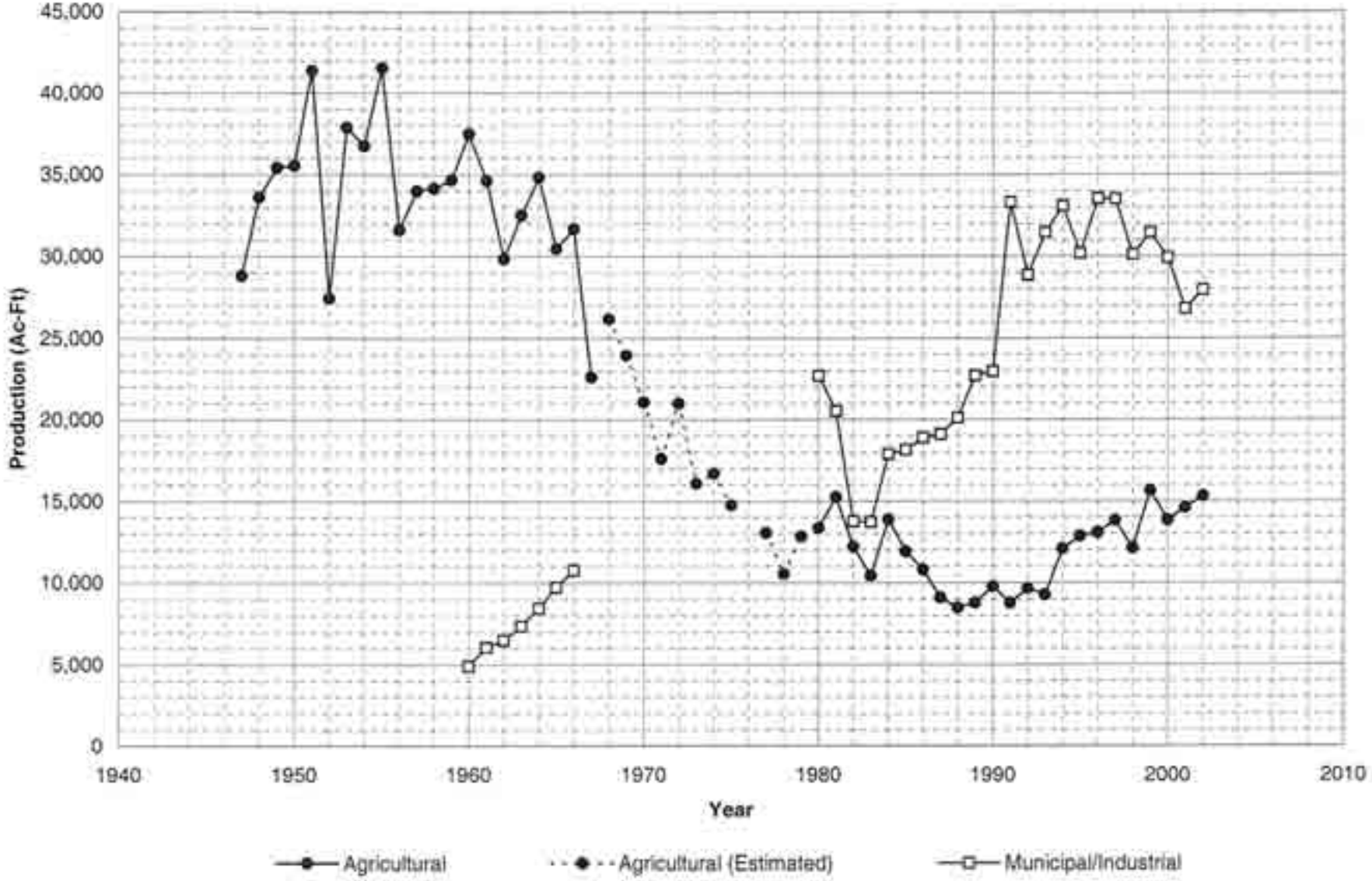


Figure 4-1

effects on water usage.

The net result of application and interpretation of the various water demand projection methods in the 2000 Urban Water Management Plan is summarized in Figure 4-2, which reflects projected urban and agricultural water demand through 2020, absent potential increased conservation savings, which are estimated to be ten percent of urban water demand. Numerically, urban water use without increased conservation savings is projected to increase to nearly 67,000 afy by 2005, and then continue to increase to 106,000 afy by 2020. As noted above, agricultural water use over the same period is projected to decrease to 15,000 afy by 2005, followed by an ongoing decrease to 7,100 afy by 2020. In addition to the graphical presentation of projected water demands in the basin through 2020 in Figure 4-2, projected water demands are tabulated, both with and without potential increased conservation savings, in Table 4-1.

Table 4-1
Projected Normal/Average Year Water Demands
(acre-feet per year)

	2005	**2010**	**2015**	**2020**
Urban Agriculture	66,600 15,100	77,700 12,400	90,900 9,800	106,000 7,100
Total Projected Demand	**81,700**	**90,100**	**100,700**	**113,100**
Increased Conservation Savings	6,600	7,700	9,100	10,600
Total Projected Demand *(with increased conservation)*	**75,100**	**82,400**	**91,600**	**102,500**

Existing and Projected Water Supplies

As noted above, existing water supplies to meet current water demands are comprised of local groundwater and imported SWP surface water. In 2001, for example, to meet a total water demand of nearly 76,800 af, local groundwater pumping amounted to 41,400 af, (about 54% of total demand) and imported SWP water amounted to 35,400 af (about 46% of total demand).

Water supplies to meet projected water demands are expected to continue to be primarily a combination of local groundwater and imported SWP surface water, augmented by local recycled

Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin

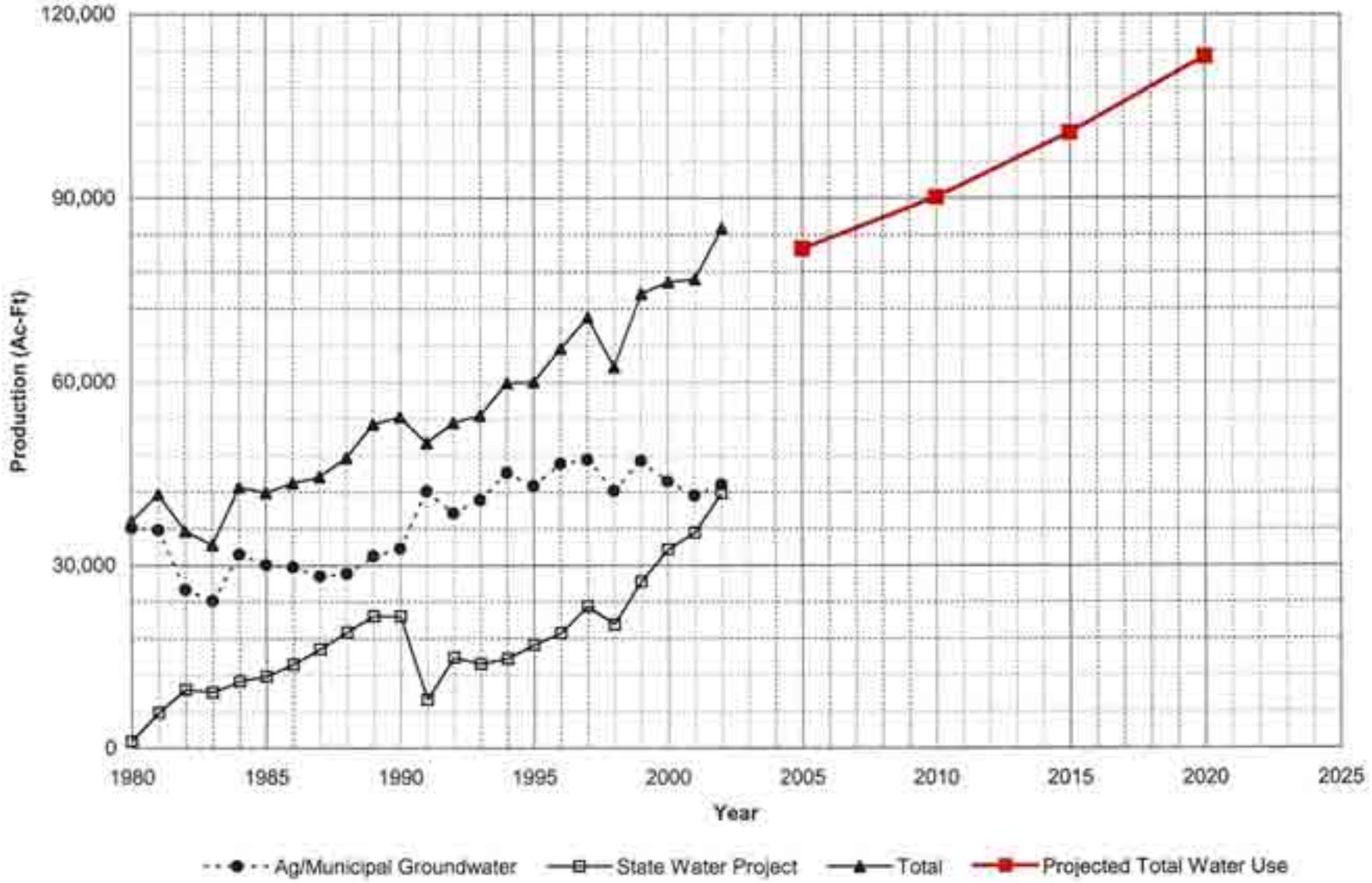


Figure 4-2

water and possibly some water supply derived from water transfers and desalination outside the basin.

Local Groundwater - Local groundwater has historically been developed from the two aquifers that comprise the groundwater basin, the Alluvium that underlies the Santa Clara River and its tributaries, and the Saugus Formation that underlies much of the CLWA service area. Those two aquifers, and the groundwater basin they comprise, are the focus of this groundwater management plan. Based on historical experience and observation of groundwater conditions, it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that are generally comparable to what has historically been pumped, 30,000 to 40,000 afy from the Alluvium and 7,500 to 15,000 afy from the Saugus Formation. It is also expected that there is some additional development potential in the Saugus Formation, in the range of 10,000 to 20,000 af which might be intermittently extracted during one or more dry years when supplemental imported water supplies might be reduced. Ultimately, it is expected that local groundwater will continue to be a component of water supply in the basin at appropriate production levels from both aquifers. The intent of this groundwater management plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, i.e. avoidance of overdraft (Primary Plan Element 3), no degradation of quality (Primary Plan Element 6), no adverse impacts to surface waters (Primary Plan Element 2), all via continuation of conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Primary Plan Element 5) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Primary Plan Elements 1 and 2).

Supplemental (SWP) Surface Water - CLWA has a Table A contract amount of 95,200 af of water from the SWP. CLWA's original contract, signed in 1963, was for 23,000 af; that Table A amount was later increased to 41,500 af. In 1988, CLWA purchased a Table A amount of 12,700 af from Devil's Den Water District, and it acquired another 41,000 af of Table A amount in 1999 from Kern County Water Agency and its member district, the Wheeler Ridge-Maricopa Water Storage District. There is ongoing CEQA-related litigation over the most recent acquisition of the 41,000 af Table A amount. However, there has been no invalidation of the completed agreement to transfer the 41,000 af Table A amount to CLWA and current water supply planning includes that Table A amount as CLWA corrects the CEQA technicality by preparing a new EIR to address the environmental consequences of the transfer.

Recycled Water - In 1993, CLWA prepared a draft Recycled Water System Master Plan that outlined a multi-phase program to integrate recycled water into the overall water supply system in the basin. Phase I of that project, which will deliver approximately 1,700 afy, began deliveries of recycled water for golf course irrigation in mid-2003. Overall, by 2020, recycled water is expected to ultimately reclaim up to 17,000 afy of treated waste water suitable for irrigation of golf courses, landscaping, and other non-potable uses.

V. Elements of the Groundwater Management Plan

As part of long-term water supply planning in the Santa Clara River Valley East groundwater subbasin, Castaic Lake Water Agency (CLWA) and the municipal water purveyors in the basin, in concert with other groundwater pumpers in the basin, began conjunctive use operations in 1980 by importing supplemental surface water from the State Water Project and integrating it with local groundwater to meet all the water requirements in the basin. Prior to that time, and continuing to the present, various groundwater pumpers and other entities in the basin, including CLWA, have collected groundwater and related data on which historical and ongoing analyses of groundwater basin conditions have been made. Those monitoring efforts and basin analyses have allowed CLWA and other entities in the basin to progressively define and understand basin conditions, and to continue to meet increasing water demands over the last 23 years. Information derived from the monitoring and management efforts to date has allowed the various public and private pumpers in the basin to continue to rely on the groundwater basin for some or all of their water supply without significant concern that the resource was either overdrafted or otherwise negatively impacted.

In light of the preceding, complemented most recently by the Memorandum of Understanding process that has initiated integrated management with United Water Conservation District, which serves as the manager of adjacent downstream basins on the Santa Clara River (as described in Primary Element 9), local groundwater management has already been initiated consistent with the opportunity provided by Water Code Section 10753. However, despite those ongoing accomplishments, CLWA recognizes the concerns and issues that are discussed herein relative to groundwater and the adequacy of water supplies in the basin. With that recognition, and in part prompted by the requirements of AB 134, CLWA has prepared this broader-based groundwater management plan.

To continue historical groundwater management activities and to address identified concerns and issues related to groundwater and water supply in the area, this Groundwater Management Plan has been developed to provide a framework for present and future actions. As has been the case for the groundwater management activities by CLWA and other local entities over the past 23 years, it is expected that this plan will be updated as new data are developed, particularly in light

of the key role that groundwater monitoring (water levels and quality) has played, and will continue to play, in defining groundwater conditions and aquifer response to management actions.

The management objectives, or goals, for the Santa Clara River East groundwater basin include the following:

Goal 1: Development of Local Groundwater for Water Supply
Goal 2: Avoidance of Overdraft and Associated Undesirable Effects
Goal 3: Preservation of Groundwater Quality
Goal 4: Preservation of Interrelated Surface Water Resources

To accomplish those goals, with recognition of the opportunities encouraged by Water Code Section 10750 et seq. for local agency management of groundwater resources, this plan incorporates a number of components which are divided into primary, or essential, elements and secondary, or potential, elements. In both categories, the elements formally recognize the effectiveness of a number of ongoing water resource management activities. They recognize the need for additional activity, such as expanded conjunctive use of supplemental surface water, and recycled water, with local groundwater. They also reflect the wider focus on local groundwater management, such as continuing cooperation with the municipal water purveyors and other pumpers in the basin, and with other water resource management entities on the Santa Clara River, most notably United Water Conservation District, to address the impacts of regional resource opportunities and/or challenges. In summary, this Groundwater Management Plan will enable CLWA, the retail water purveyors, and their neighbors to continue use of local groundwater for regular water supply, to expand their use of local groundwater during dry periods or emergencies, and to work with other agencies via implementation of the following management plan elements.

Primary (Essential) Plan Elements

1. Monitoring of Groundwater Levels, Quality, Production and Subsidence
2. Monitoring and Management of Surface Water Flows and Quality
3. Determination of Basin Yield and Avoidance of Overdraft
    - wet and dry period pumping
    - control of well field drawdown

4. Development of Regular and Dry Year/Emergency Water Supply
5. Continuation of Conjunctive Use Operations
6. Long Term Salinity Management
7. Integration of Recycled Water
8. Identification and Mitigation of Soil and Groundwater Contamination
    - involvement with other local agencies in investigation, cleanup, and closure
9. Development and Continuation of Local, State and Federal Agency Relationships
10. Groundwater Management Reports

Secondary (Potential) Elements

1. Continuation of Public Education and Water Conservation Programs
2. Identification and Management of Recharge Areas and Wellhead Protection Areas
    - involvement in land use planning process
3. Identification of Well Construction, Abandonment, and Destruction Policies
    - water quality protection
    - manage vertical distribution of pumpage
4. Provisions to Update the Groundwater Management Plan

Primary Element 1 - Monitoring of Groundwater Levels, Quality, Production, and Subsidence

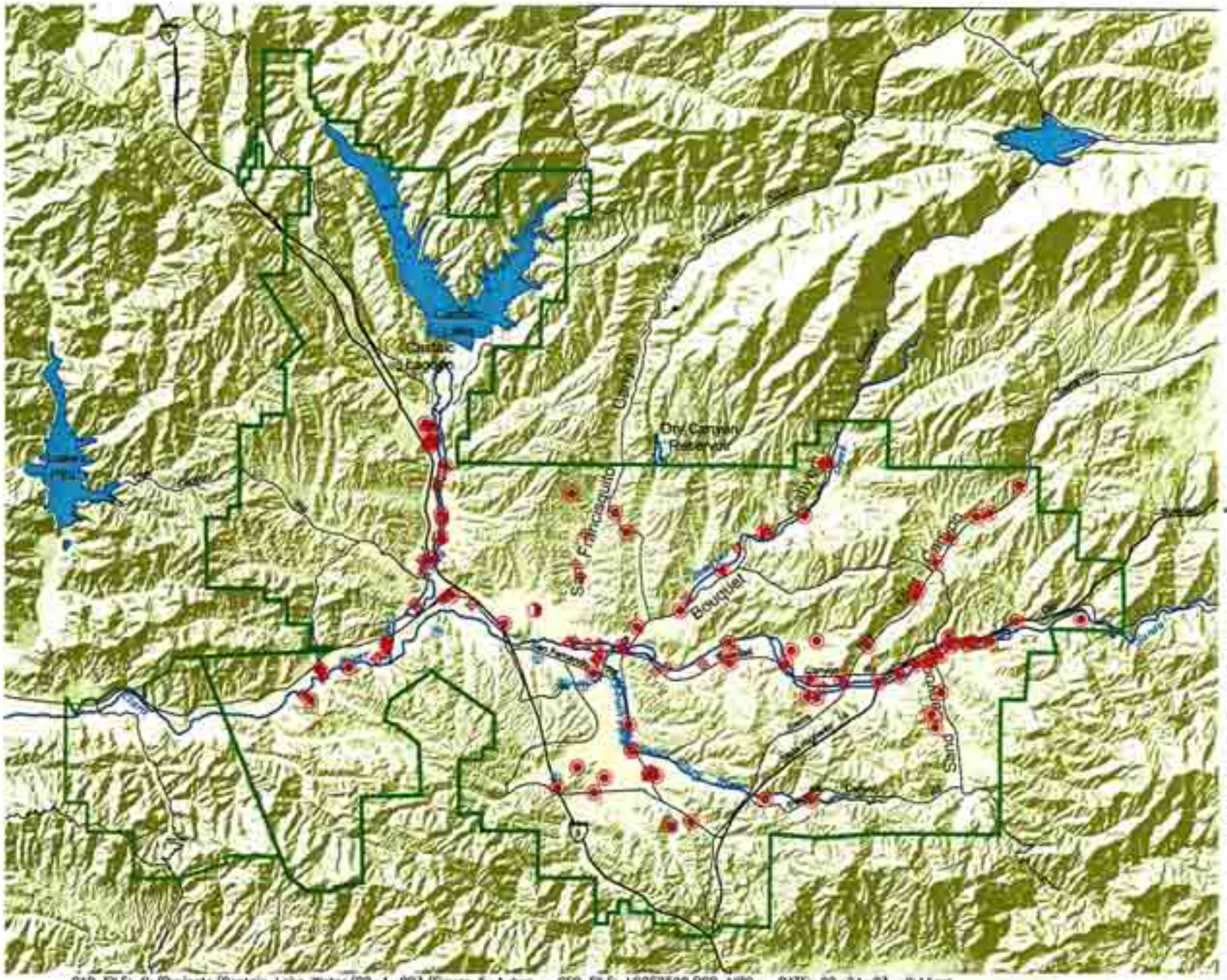
Prior to 1980, all water supply in the Upper Santa Clara River Area was developed from local groundwater; since 1980, imported surface water has become an increasing component of overall water supply in the area, but groundwater continues to meet all agricultural water demand and a significant part of municipal water demand. As a result of the long term development and use of groundwater in the area, there is a fairly substantial amount of historical groundwater level data, and a useful amount of groundwater quality data and groundwater pumping data that has been collected in the basin. All the available historical groundwater level, quality, and pumping data have been organized into a computerized data base for the Upper Santa Clara River Area. That data base, while separate, has been coordinated with an equivalent data base maintained by United Water Conservation District for the downstream basins on the Santa Clara River. The intent of database coordination has been to facilitate interpretation and reporting on groundwater and other water resource related issues by the respective agencies overlying the various basins along the river.

The networks of wells from which groundwater level and groundwater quality data have been collected are illustrated in Figures 5-1 and 5-2. The networks are comprised of a combination of active production wells, inactive production wells, and dedicated monitoring wells, shown on Figures 5-1 and 5-2. Data collection has historically varied from randomly infrequent to regularly scheduled but infrequent (e.g. semi-annual). The historical data collection efforts cannot be classified as an organized area-wide program of groundwater data collection, there are generally sufficient data available on which to interpret basin conditions. Ultimately, it is recognized that monitoring of existing wells, and expansion of the network of both production and monitoring wells, are key to accomplishing all the goals for the basin in this management plan. Monitored groundwater levels, quality, and pumping will collectively provide the basis for defining basin conditions and developing operational protocols that allow conjunctive use to support ongoing groundwater supply while avoiding undesirable conditions such as chronically depressed groundwater levels or degraded groundwater quality. Thus, a primary element of this plan is to develop and implement a groundwater monitoring program that is comprised of a network of wells, mostly as illustrated in Figures 5-1 and 5-2, but possibly expanded to include some dedicated monitoring wells as well as some potential new production wells. The frequencies and types of groundwater data collection will vary as a function of specific monitoring objectives in various parts of the basin. For initial implementation purposes , basin-wide groundwater monitoring protocols (locations and types of measurements, frequencies, etc.) are included in the Appendix to this Plan.

It should be noted, in light of the lack of historical subsidence and the low potential for it to occur as discussed in Section III above, that no formal subsidence monitoring is planned, i.e. no extensometers, fixed-point ground surveys or remote sensing. However, if the analysis of planned additional dry-year pumping indicates the potential for subsidence attributable to lower groundwater levels, monitoring or other appropriate action (e.g. re-distributed or reduced pumping) will be undertaken.

Primary Element 2 - Monitoring and Management of Surface Water Flows and Quality

The geologic and hydrologic configuration of the groundwater basin and the Santa Clara River system that overlies the aquifers in the basin is such that the River and the Alluvial aquifer can directly interact. Further, although the Saugus Formation has hydraulic characteristics that indicate it to be locally confined, groundwater can move between the Alluvium and the Saugus. The net result of the overall river-aquifer configuration is that groundwater is readily recharged



LEGEND

- ACTIVE ALLUVIAL WELL
- INACTIVE ALLUVIAL WELL
- ACTIVE SAUGUS WELL
- INACTIVE SAUGUS WELL
- SAUGUS MONITORING WEL
- UNKNOWN ALLUVIAL WELL
- CLWA BOUNDARY

Scale in Miles

0' 1.5 3

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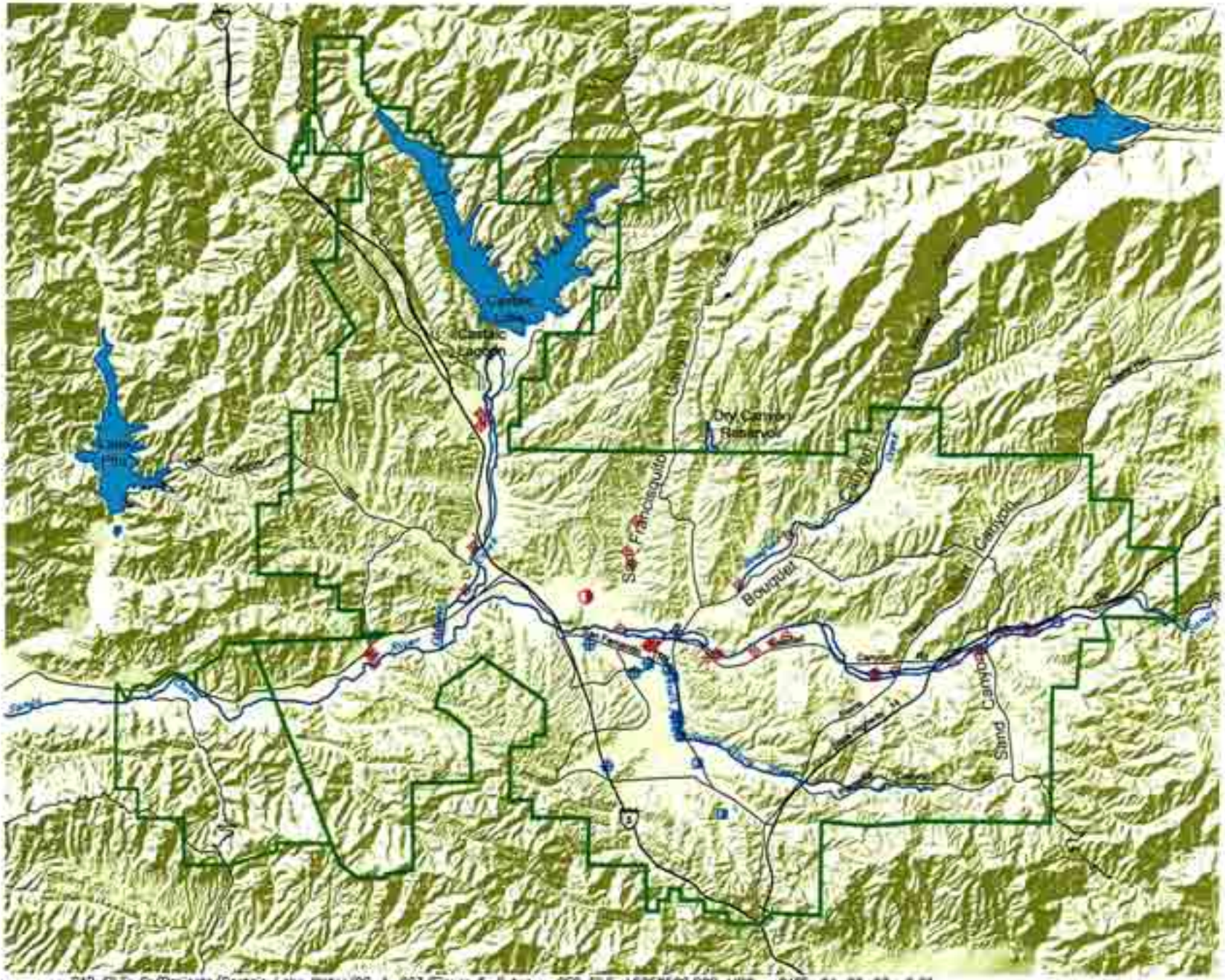
Figure 5-1
Water Level Monitoring Well Network
Santa Clara River Valley East Groundwater Subbasin



LEGEND

- ACTIVE ALLUVIAL WELL
- INACTIVE ALLUVIAL WELL
- ACTIVE SAUGUS WELL
- INACTIVE SAUGUS WELL
- CLWA BOUNDARY

Scale in Miles

0' 1.5 3

CAD FILE: G:/Projects/Castaic Lake Water/02-1-023/Figure 5-2.dwg CFG FILE: LSCE2500.PCP_MRG DATE: 04-03-03 9:36am

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Figure 5-2
Water Quality Monitoring Network
Santa Clara River Valley East Groundwater Subbasin

by periodic natural surface water flows in parts of the basin, generally to the east of Bouquet Canyon; and groundwater discharges to the river in other parts of the basin, generally to the west of Bouquet Canyon. As a result of the latter groundwater discharges to the river, in combination with treated waste water discharges from the two local regional treatment plants, there is a significant surface water outflow from the basin in the Santa Clara River. That surface water flow to the west across the County line has increased over the last 20 years (Figure 5-3).

When considered in concert with the other elements of this groundwater management plan, a number of challenges related to surface water flow and quality are evident. First, knowledge of surface flow rates and quality, and variations in both, will be essential to incorporating surface water considerations into management of the interconnected aquifer system. Thus, monitoring of surface water flows and quality will be part of this plan; and the resultant data will be incorporated in the database of groundwater data that results from implementation of this element and Primary Element 1.

Secondly, continuation of some surface flow and non-degradation of surface water quality would appear to be appropriate objectives, particularly as recycled water use is integrated into the overall water supply in the basin, and as dry-year dependence on groundwater increases. Those issues have begun to be addressed in the MOU process with neighboring United Water Conservation District, as described in Primary Element 9 of this Plan, but they will be addressed on a more comprehensive basis as monitored data is collected, as a numerical groundwater flow model is developed and utilized (Primary Element 3), and as recycled water becomes part of the integrated water supply (Primary Element 7). Basin management of surface water flows and quality will also relate to potential groundwater management actions intended to augment yield, e.g. artificial groundwater recharge (Primary Elements 3 and 5), and groundwater management actions intended to preserve groundwater quality (Primary Element 6). For initial implementation purposes, surface water monitoring protocols (locations and types of measurements, frequencies, etc.) are included in the Appendix to this Plan.

In light of the preceding, this plan element is included in the overall groundwater management plan to address surface water flows and quality in concert with analysis and management of groundwater levels and quality. The implementation of this plan element will be essential to accomplishment of the fourth management objective (goal) for the basin.

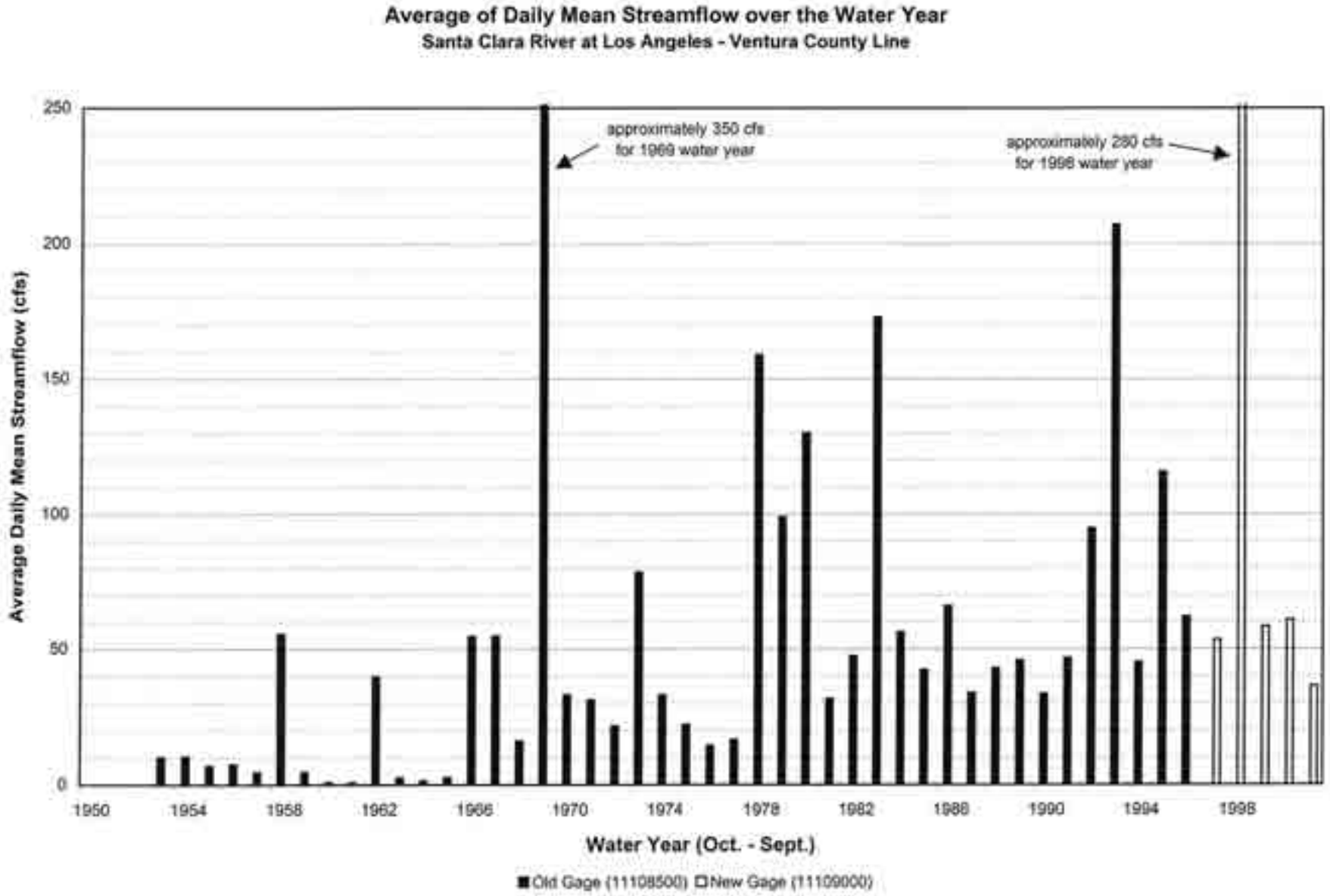
Average of Daily Mean Streamflow over the Water Year
Santa Clara River at Los Angeles - Ventura County Line
approximately 350 cfs
for 1969 water year
approximately 280 cfs
for 1998 water year
Average Daily Mean Streamflow (cfs)
250
200
150
100
50
0
1950
1954
1958
1962
1966
1970
1974
1978
1982
1986
1990
1994
1998
Water Year (Oct. - Sept.)
Old Gage (11108500)
New Gage (11109000)

Figure 5-3

Primary Element 3 - Determination of Basin Yield and Avoidance of Overdraft

In order to accomplish all the goals for the basin, it will be essential to determine what yield can be developed on both a regular and an intermittent (dry period or emergency) basis. Such a determination of basin yield will be made to accomplish the main objective of operating within the yield of the groundwater basin, avoidance of overdraft.

On a long-term basis, there has not been any widespread, steady degradation of groundwater conditions that might be indicative of overdraft, i.e. decrease in groundwater levels or storage as a result of pumping in excess of the yield of the basin. There have been, and continue to be, short-term fluctuations in groundwater levels that are basically related to variations in local hydrological conditions, alternating increases and decreases in storage in response to wet and dry conditions (and associated fluctuations in recharge and pumping). Such fluctuations are typical of groundwater basin conditions in any conjunctive use setting, such as in this basin; groundwater is utilized from storage during dry years, or dry periods, and that storage is replenished during alternate wet years, or periods. The observation of these historical groundwater conditions, in combination with knowledge of pumpage from both the Alluvial and Saugus Aquifers, has led to current operational practices as well as general expectations regarding the approximate yield of the local groundwater system.

While historical operating experience, complemented by observed groundwater conditions, is an appropriate basis for generally planning for available groundwater supplies, it is possible and appropriate to more precisely analyze the basin to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. The MOU process described in Primary Element 9 of this Plan includes the development of a numerical groundwater flow model which is intended to be utilized for determination of the yield of the basin under existing land use and under existing groundwater and surface water development conditions. It is also expected to be used for implementation of this Plan Element to assess the yield of the basin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e. wet and dry periods that affect the availability of imported surface water.

The ultimate intent of this Plan Element is to develop an understanding and quantification of the yield of the basin, under varying hydrologic conditions and developing local cultural conditions,

so that groundwater development and use can be managed in such a way to meet an appropriate fraction of total water demand while avoiding levels of groundwater use that would result in overdraft conditions. Thus, implementation of this Plan Element is essential to accomplishing the first and second management objectives (goals) for the basin.

Primary Element 4 - Development of Regular and Dry Year/Emergency Water Supply

The most recent updated Urban Water Management Plan (UWMP, December 2000) prepared by CLWA and the retail water purveyors in the basin (Newhall County Water District, Santa Clarita Water Company and Valencia Water Company) includes plans to develop 30,000 to 40,000 acre-feet per year (afy) from the Alluvial aquifer and 7,500 to 15,000 afy from the Saugus Formation in average/normal years. Both ranges of numbers are consistent with recent historical pumping that has not resulted in any indication of overdraft or other undesirable conditions. The UWMP also includes plans to slightly reduce Alluvial pumping in dry years (in recognition of historical experience with decreased groundwater levels in the eastern part of the basin during dry periods) to 30,000 to 35,000 afy, while potentially increasing dry-period Saugus pumping to 21,000 to 35,000 afy depending on the duration of dry conditions.

A major consideration in this plan is the accomplishing ~~of~~ this element in concert with Primary Element 3, i.e. development of both regular and dry year/emergency groundwater supply within the yield of the basin in order to avoid overdraft. Toward that goal, the model described in Primary Element 3 will be used to analyze projected results, i.e. groundwater levels, storage and stream flow impacts, in order to design the optimal distribution of pumpage or to refine the ranges of regular or dry period/emergency pumping volumes. The result will facilitate a water transmission and distribution design, and will also facilitate planning for supplemental water supplies and planning for proactive recharge activities to augment basin yield as necessary to meet water supply requirements. Thus, implementation of this Plan Element, within the confines of Primary Element 3, will be essential to accomplishment of the first management objective (goal) for the basin.

Primary Element 5 - Continuation of Conjunctive Use Operations

Beginning with the initial delivery of imported surface water from the State Water Project (SWP) in 1980, CLWA and the retail water purveyors in the basin have been practicing the conjunctive

use of imported surface water and local groundwater. Conjunctive use in this setting has consisted of meeting water demands with a combination of imported surface water and local groundwater. Groundwater pumping has remained within a range that has not caused any evidence of overdraft, or associated undesirable impacts, and has fluctuated within that range to meet a larger fraction of water demand during periods of reduced surface water availability, such as at the end of the 1987-1992 drought and for several years immediately thereafter. Imported surface water use, on the other hand, progressively increased from 1980 through 1990, substantially decreased in the early 1990's due to extended drought conditions in Northern California, returned slowly to pre-drought levels over about a five year period, and has progressively increased again since 1996. The historical trend in water demand and the trends in groundwater and imported (SWP) surface water use to meet that demand are illustrated in Figure 5-4.

Conjunctive use of local groundwater and imported surface water will continue to be a key element in meeting all the goals for the basin, most notably utilizing groundwater for water supply without overdrafting the basin. Historical experience with groundwater pumping and aquifer response to varying hydrologic conditions has shown that the groundwater basin can support notable variations in pumping during wet and dry periods, but it cannot support continuous pumping at rates high enough to meet total local water demand. Thus, utilization of imported surface water in conjunction with local groundwater is essential to the management of groundwater for water supply without overdrafting that resource.

As part of conjunctively using surface water and groundwater, it is recognized that, particularly when the surface water supply is imported from the State Water Project, there will be variations in the amount of available surface water supply from year to year. Similarly, there are expected to be variations in local groundwater conditions as a function of local hydrologic conditions which affect, among other things, the natural recharge to the groundwater basin from year to year. In the case of this basin, local (Southern California) hydrology which affects local groundwater conditions may not necessarily be the same as the hydrology in a distant (i.e., northern California) location that directly affects the availability of supplemental, imported surface water in any given year. Thus, conjunctive use management is necessary to ensure that the groundwater basin is maintained to meet a regular component of water supply and to also provide a larger component of water supply during "dry periods" that affect supplemental surface water availability. Conjunctive use management is similarly important to ensure that local groundwater can be replenished, via reduced pumping and/or as a result of wetter local

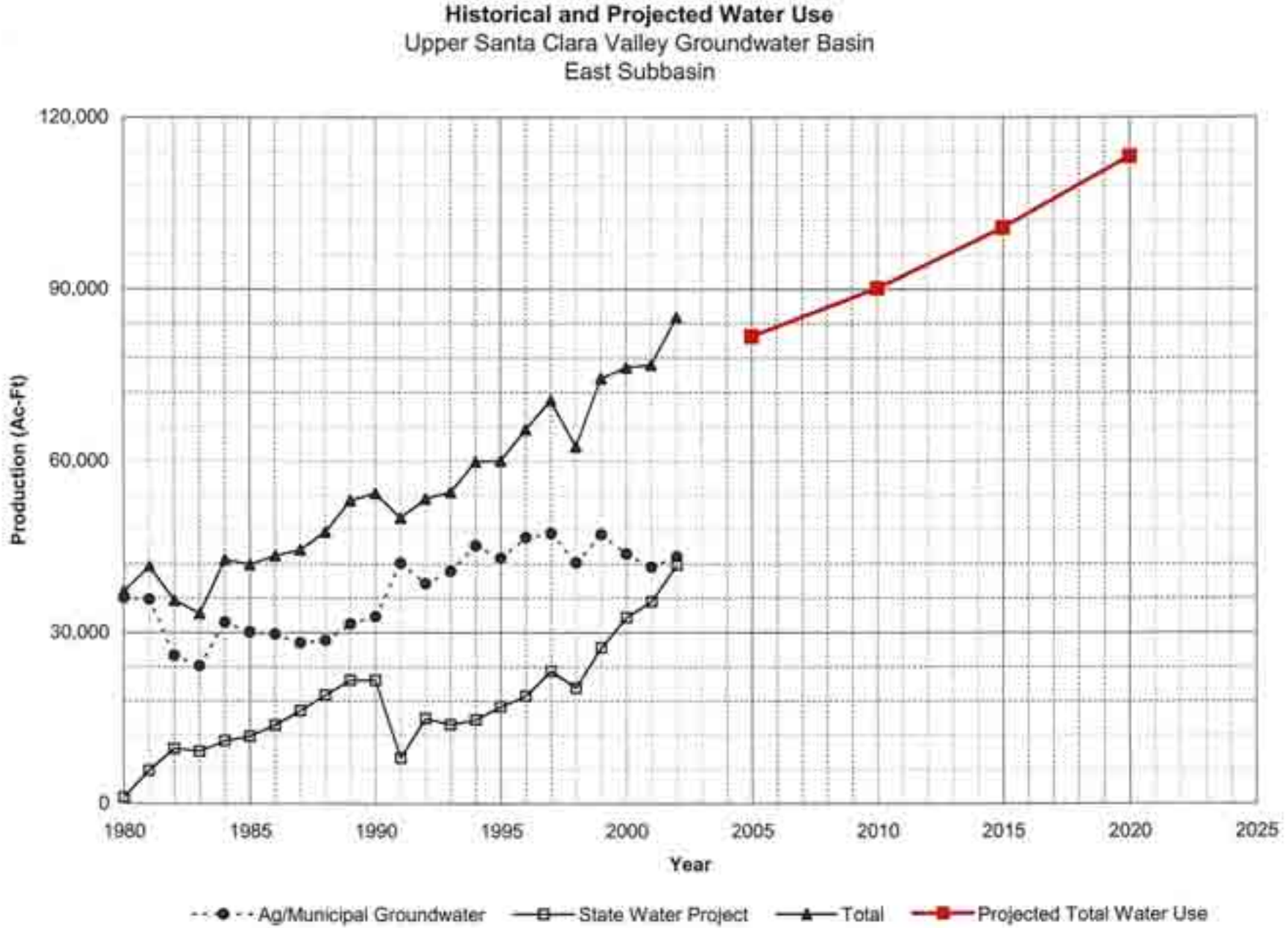
Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin
120,000
90,000
60,000
30,000
0
Production (Ac-Ft)
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year
Ag/Municipal Groundwater
State Water Project
Total
Projected Total Water Use

Figure 5-4

hydrologic conditions, during periods of wet/normal surface water availability. In light of all the preceding, implementation of this Plan Element is essential to accomplishing all the management objectives (goals) for the basin.

Primary Element 6 - Long Term Salinity Management

In general, groundwater quality in the basin is such that groundwater supplies meet standards for beneficial use in the basin, most of which is for municipal (domestic) use but some of which remains for agricultural and some other irrigation (non-domestic) use. There also have been no notable historical trends of groundwater quality degradation in the basin over time. However, a number of geologic and hydrologic factors suggest that observations and interpretation of groundwater quality warrant attention to ensure long-term preservation of groundwater quality. Notable among those geologic and hydrologic factors are: 1) the largely "closed" geologic nature of the aquifer system at the western limit of the basin (other than a thin section of Alluvium beneath the Santa Clara River, there is no continuity of aquifer materials between the Santa Clara River Valley East groundwater subbasin and the next downstream groundwater basin on the Santa Clara River, the Piru Basin in Ventura County); 2) the predominant groundwater flow direction in the basin toward the west, where there is the lack of continuity of aquifer materials for groundwater outflow; 3) a certain amount of rising groundwater discharge into the Santa Clara River; and 4) an increasing discharge of treated waste water into the Santa Clara River toward the western end of the basin which, when accounting for the planned use of a substantial amount of recycled water in the Basin (Primary Element 7) will result in higher salt concentrations than other sources of water supply in the Basin. The combination of the preceding factors suggests that, on a long-term basis, there could be an accumulation of dissolved minerals in the aquifer system if salinity is not managed in a way to avoid undesirable groundwater quality degradation. Consequently, this primary element is included in the overall groundwater management plan to include the interpretation of groundwater quality data (Primary Element 1) and to incorporate groundwater quality as an important consideration in the implementation of the other elements of the plan, most notably Continuation of Conjunctive Use Operations (Primary Element 5), Integration of Recycled Water (Primary Element 7), and Identification and Cleanup of Contaminated Groundwater (Primary Element 8). The Long Term Salinity Management element of the plan is essential to accomplishing the third management objective (goal) of preserving groundwater quality in the basin.

Primary Element 7 - Integration of Recycled Water

In 1993, CLWA prepared a Reclaimed Water System Master Plan that outlined a multi-phase program to deliver highly treated, recycled water in the Valley. At that time, potential recycled water uses in excess of 10,000 afy, of which about 9,000 afy were located within the CLWA service area, were identified. The first phase of the Reclaimed Water System Master Plan to deliver 1,700 afy has been environmentally reviewed and is being implemented, with initial deliveries having commenced in August 2003.

The 1993 recycled water plan expected to reclaim up to 10,000 afy. CLWA has been updating that plan to ultimately provide up to about 17,000 afy for irrigation and other non-potable uses. It has also been recognized that, if the Newhall Ranch project is approved, total annual demands for recycled water in the area could ultimately approach 20,000 afy.

This plan element is included in the groundwater management plan primarily because recycled water use in the Valley will supplant a substantial fraction of fresh water demand that would otherwise be met with potable water from some combination of pumped groundwater and imported surface (SWP) water. With total municipal, agricultural and other water demands projected to increase from about 75,000 afy at present to slightly more than 100,000 afy by 2020, the progressive increase in recycled water use from 1,700 afy to as much as 17,000 to 20,000 afy, recycled water use would reduce demands on potable sources (groundwater and imported SWP water) by up to nearly 20 percent. Accomplishment of this Plan Element will benefit the accomplishment of Elements 3 and 4, and will also contribute to the accomplishment of all four of the Basin Goals.

Primary Element 8 - Identification and Mitigation of Soil and Groundwater Contamination

As in numerous other groundwater basins in California, there have been a number of leaking underground storage tanks or other similar situations which have released organic constituents into soil, and possibly into groundwater, in the basin. None of those has impacted municipal or other water supply wells and, consequently, there has been no adverse impact on groundwater supply in municipal or other water supply systems in the basin. However, the detection of perchlorate in the discharge from four Saugus wells (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 11, and Valencia Water Company Well 157) in 1997, followed by the detection of perchlorate in one Alluvial well (CLWA Santa Clarita Water Division Stadium Well) in 2002, has led to the inactivation of all those wells.

They remain out of municipal water supply service to date.

Experts retained by CLWA have opined that the cause of perchlorate contamination in the Saugus Formation is former operations associated with munitions manufacturing on property formerly owned by Whittaker-Bermite Corporation, which is immediately adjacent to all the impacted wells. Investigation and characterization of the perchlorate contamination, and initiation of control and cleanup are ongoing; however, remediation actions have not yet commenced. Consequently, the municipal water purveyors continue to be impacted by the loss of water supply capacity of the impacted wells. Associated with that loss is a concern about the migration of perchlorate contamination in a generally downgradient direction, toward other active wells completed in the Saugus Formation and the Alluvium and toward other potential well sites. In light of both the inactivation of wells and the potential downgradient impact on the aquifers, CLWA and the other retail water purveyors had initiated both legal action against responsible parties and technical investigation of the contamination. Recently the parties have entered into an interim settlement agreement which is intended to complete investigation and characterization of the contamination in a collaborative effort. This effort will facilitate and expedite remediation actions.

The primary purpose for technical investigation of the perchlorate contamination by CLWA and the other municipal purveyors is to ultimately recover the currently unavailable water supply capacity that has resulted from the inactivation of impacted wells. Conceptually, that may be accomplished by some combination of reactivation of impacted wells and new well construction. CLWA has joined with the U.S. Army Corps of Engineers in a study to develop information about the contamination. CLWA and the retail water purveyors have also independently commissioned an assessment to conclude what treatment technology is appropriate for removal of perchlorate from pumped groundwater; they have also independently commissioned the application of a numerical groundwater flow and quality model to determine an optimal pumping program for 1) perchlorate removal from the aquifer, 2) control of its migration in the aquifer, and 3) restoration of impacted pumping capacity for water supply. With data derived from that work, CLWA and the other purveyors are preparing to submit an application to the State Department of Health Services, by late 2004, for a permit to return to pumping from the locally impaired Saugus Formation. The proposed pumping would be combined with approved wellhead treatment to render the treated water suitable for municipal supply. In addition to the latter objective to recover currently inactivated water supply, the proposed pumping would be designed and operated to remove contaminated groundwater and to control any further migration

of contaminated groundwater toward other Saugus wells to the west. CLWA and the retail water purveyors then expect to be able to design and implement, alone or in concert with responsible parties, a contamination control and treatment program at or near their impacted wells that can, in part, make groundwater available for municipal or other beneficial use. They also expect that such a program will provide some hydraulic and associated water quality protection for other parts of the aquifer system to keep contamination from impacting other wells or other parts of the aquifers in which water supply wells might be completed.

Regarding the balance of the aquifer system, water supply planning to date (i.e. the current Urban Water Management Plan) includes expanded development of the Saugus Formation for dry-period and emergency water supply. Data development and control and treatment of groundwater contamination in the Saugus Formation will be critical to accomplishing that water supply plan. In terms of this groundwater management plan, accomplishment of this plan element will contribute to the accomplishment of all four management objectives (goals) for the basin.

Primary Element 9 - Development and Continuation of Local, State and Federal Agency Relationships

As the local SWP contractor, CLWA has long-established working relationships with local and state agencies that will continue on an ongoing basis. By nature of its primary function, CLWA will continue to interact with state agencies, most notably the Department of Water Resources, on the operation of the State Water Project. The latter, of course, has been the source of supplemental imported surface water that has made the initiation and continuation of conjunctive use operations possible since 1980. It will also be the primary component, with local groundwater, in continuation of conjunctive use operations in the future (Primary Element 5 of this Plan).

CLWA is the treated surface water provider to all the retail water purveyors, including Newhall County Water District, Los Angeles County Waterworks District No. 36, Valencia Water Company, and its own Santa Clarita Water Division. CLWA has a historical and ongoing working relationship with all those local agencies, as well as with other local groundwater pumpers, to manage water supplies to effectively meet water demands within the available yields of imported surface water and local groundwater. In fact, the Advisory Council convened to assist in the preparation of this Plan is comprised representatives of all the local water purveyors

and significant groundwater pumpers.

A local Memorandum of Understanding (MOU) process among CLWA, other purveyors within CLWA's service area, and United Water Conservation District (UWCD) in neighboring Ventura County is a classic illustration of a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive plan, most notably in Primary Elements 1 through 5. In 2001, out of a willingness to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, those agencies prepared and executed the MOU that initiated a collaborative and integrated approach to several of the aspects of water resource management that are now included in this Plan. UWCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the East Subbasin of the Santa Clara River Valley that is the focus of this Plan. United is thus a logical partner in the cooperation of management efforts to accomplish the objectives (goals) for this basin, particularly as they relate to preservation of surface water resources that flow through the respective basins. As a result of that MOU, the cooperating agencies have integrated their database management efforts (part of Primary Elements 1 and 2 of this Plan), have initiated the development of a numerical groundwater flow model (for utilization in Primary Elements 3, 4 and 5 of this Plan), and are continuing to prepare reports on the status of basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

A local extension of the interaction among CLWA, the retail water purveyors, and UWCD is an ongoing working relationship with the City of Santa Clarita. CLWA and the retail water purveyors meet regularly with City staff and also present water supply conditions via study sessions with the City Council on a routine basis. It is expected that the implementation of this Plan will result in the availability of a broader range of information transfer with the City relative to the existing and future water supply to its residents. An additional expectation of this Plan with respect to the relationship among CLWA, the retail water purveyors, and the City is the intent of CLWA and the purveyors to provide input to the City as a reviewer of proposed development relative to any potential contamination of groundwater associated with such proposed development. CLWA provides input to the City, as suggested in Water Code Section 10753.8, via review of land use plans and coordination with the City Planning Department to identify and assess any development-related activities which might pose a risk of groundwater contamination. By expressing this expectation of its groundwater management plan, CLWA is not intending to insert itself into the jurisdiction or authorization of any other land use permitting

agency; rather, CLWA is intending to provide review and input to the land use permitting process to protect the groundwater supply against any potential contamination that might occur as a result of any given development project.

This Primary Element is included in this Plan to formalize the historical local and state agency working relationships as part of comprehensively managing local groundwater, in concert with imported surface water and local recycled water, to accomplish all the management objectives (goals) for the basin.

Primary Element 10 - Groundwater Management Reports

As briefly described in the Introduction of this Plan, local groundwater management planning already includes, among several other activities, analysis of groundwater conditions and preparation of annual reports on groundwater and all other aspects of water resources and water supplies in the Santa Clara River Valley East groundwater basin. In addition, recently formalized cooperative work with neighboring UWCD includes both regular reporting on the status of groundwater conditions and specific reporting on geologic and hydrologic aspects of the overall stream-aquifer system. For example, documentation of the numerical groundwater modeling work currently in progress is expected to be the first of the latter reports in the next year.

Beginning in 1998, CLWA and the retail water purveyors in the basin have prepared a series of annual reports, known locally as the Santa Clarita Valley Water Report, to describe all aspects of water supply and water resource conditions in the basin. That report provides current information to local City and County land use agencies, and to other interested parties, about current water requirements, use of groundwater and treated imported surface water to meet those water requirements, groundwater conditions (pumping, groundwater levels and quality, etc.), local surface water conditions, the status of imported surface water supplies including details of delivered SWP water in the reported year as well as an up-to-date summary of available imported SWP water for the next year, a short-term projection of water requirements in the next year, and other appropriate details about water requirements and supplies such as, for example, the status of introducing recycled water as a component of non-potable water supply.

In light of the frequency and comprehensive nature of the annual Water Reports, and also in light of the planned preparation of more detailed technical reports on various aspects of the basin as appropriate, the continued preparation of those reports will serve as regular and

complete reporting on all aspects of this groundwater management plan.

Secondary Element 1 - Continuation of Public Education and Water Conservation Programs

CLWA has provided water conservation and public education programs that will continue and will be expanded as a complement to and an element of this groundwater management plan. The expansion of water conservation will largely stem from CLWA's having signed the "Memorandum of Understanding Regarding Water Conservation in California" (Urban MOU) in 2001, which made CLWA a wholesaler member of the California Urban Water Conservation Council. CLWA has thus committed to implementation of cost-effective water conservation measures known as Best Management Practices (BMPs) that are included in the Urban MOU and are intended to reduce California's long-term urban water demands. The BMPs have been incorporated into the water demand management measures section of the Urban Water Management Planning Act.

Water conservation and related public education measures have generally been developed in California to achieve the following goals:

- meet legal mandates
- reduce average annual potable water demands
- reduce sewer flows
- reduce water demands during peak seasons
- meet drought restrictions.

As a wholesaler of imported surface water CLWA has implemented the following BMPs for several years prior to signing the MOU:

- distribution system water audits, leak detection and repair
- public information
- school education
- wholesale agency assistance
- conservation pricing
- conservation coordinator.

As a signatory to the MOU, CLWA's water conservation and public education program will expand to include the following BMPs found to be locally cost-effective, as detailed in the 2000 Urban Water Management Plan for CLWA and the Santa Clarita Valley retail purveyors.

- water survey programs for single-family residential and multi-family residential programs
- residential plumbing retrofits
- metering with commodity rates for all new connections and retrofit of existing connections
- large landscape conservation programs and incentives
- high-efficiency washing machine rebate programs (when also provided by local energy providers or wastewater utilities)
- conservation programs for commercial, industrial, and institutional accounts
- wholesale agency programs to financially or otherwise support water conservation efforts by retailers (this measure will be expanded)
- residential ultra-low-flow toilet replacement program.

This Secondary Element, while identical to independent CLWA efforts in water conservation and public education, is incorporated in this Plan to complement other Plan elements, and to move toward accomplishment of all management objectives (goals) for the groundwater basin.

Secondary Element 2 - Identification and Management of Recharge Areas and Wellhead Protection Areas

The 1986 Amendments to the federal Safe Drinking Water Act (SDWA) established a new Wellhead Protection Program (WPP) to protect groundwater that supplies drinking water wells for public water systems. Each state was required to prepare a WPP and submit it to the USEPA by June 19, 1989. However, California did not develop an active state-wide Wellhead Protection Program at that time. Subsequently, in 1996, reauthorization of the SDWA established a related program called the Source Water Assessment Program. In 1999, the California Department of Health Services (DHS) Division of Drinking Water and Environmental Management developed its Drinking Water Source Assessment Program (DWSAP), and EPA approved it. The overall objective of the DWSAP is to ensure that the quality of drinking water sources is protected.

As discussed in Section 1 of this Plan, the potential groundwater management plan component

"identification and management of wellhead protection areas and recharge areas" is stated, even in the most recently amended version of Water Code Section 10753.8, as one that "may" be included. However, the wellhead protection aspect of this component, which was optional when AB 3030 was adopted, is now essentially required as a result of the 1996 SDWA reauthorization. In California, the DWSAP satisfies the mandates of both the 1986 and 1996 SDWA amendments. The California DWSAP includes delineation of the areas (i.e., protection areas or Groundwater Protection Zones) surrounding an existing or proposed drinking water source where contaminants have the potential to migrate and reach that source. The program includes preparation of an inventory of activities that may lead to the release of contaminants within these zones. The activities, referred to in the DWSAP as Potentially Contaminating Activities, include such land uses as gas stations and dry cleaners, as well as many other land uses. The activities also include known contaminant plumes regulated by local, state, and federal agencies. The zones, which are calculated based on local hydrogeological conditions and also well operation and construction parameters, represent the approximate area from which groundwater may be withdrawn during 2, 5, and 10 year time periods. These zones also represent the area in which contaminants released to groundwater could migrate and potentially affect the groundwater extracted by wells located within the designated zones. The DWSAP assessment also includes a risk or vulnerability ranking based on a combined numerical score that results from points assigned to various evaluations conducted as part of the DWSAP process. This ranking provides a relative indication of the potential susceptibility of drinking water sources to contamination.

Although DHS is responsible for conducting drinking water source assessments for systems existing prior to the adoption of the California program, DHS has encouraged purveyors to perform their own assessments. Assessments for existing systems were due at the end of 2002; however, DHS received an extension allowing its assessment work to be completed by May 2003. Permitting of a new water supply well requires that a DWSAP be completed as part of the permit process, and this is responsibility of the applicant. Within CLWA, DWSAP assessments have been completed for the three municipal water purveyors who utilize groundwater for some of their water supply, including 15 for the CLWA Santa Clarita Water Division, 20 for Valencia Water Company, and 13 for Newhall County Water District.

The results of the DWSAPs can be used as a planning tool to guide land use development in the vicinity of water sources. The DWSAPs prepared for water sources in the basin should, in some fashion, be reviewed every five years and updated more frequently as appropriate. The collective DWSAP information can also be integrated with other management activities (e.g., the

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geographical position of potential or existing contaminating activities can be incorporated in the monitoring program database; plume extents, as available, can be graphically displayed by aquifer and isoconcentrations) to aid siting of new wells, particularly when contaminant migration problems are also evaluated with respect to local hydrogeological conditions and the potential influence of nearby wells on plume migration.

In addition to the wellhead protection program that is focused on wells that are sources of drinking water, a broader aspect of this Plan Element is protection of the overall recharge areas of the aquifer system in the basin. As discussed in Section III, the most developed aquifer, the Alluvium, has experienced historical fluctuations in groundwater levels in the eastern portion of the basin, but has had essentially constant groundwater levels in the western portion of the basin. The characteristic difference between the two portions of the basin, generally divided at the confluence of the Santa Clara River and its Bouquet Canyon tributary, is the perennial flow in the Santa Clara River to the west of that location versus the intermittent flow in the river to the east. The intermittent fluctuations in groundwater levels east of Bouquet Canyon are indicative of rapid response, i.e. recharge, from streamflow when it is present. Similarly, the relatively constant groundwater levels west of Bouquet Canyon are indicative of ongoing response, i.e. recharge, from the perennial flow in the river. In light of those conditions, part of this Plan Element is intended to protect the overall channel system of the Santa Clara River and its tributary system, notably where they overlie Alluvial aquifer materials of significant extent. Protection in this case is intended to mean preservation of the infiltration capacity of the stream channel so that both intermittent and perennial flows can continue to recharge the aquifer as has historically occurred.

Finally, with regard to protection of recharge areas, it is expected that additional exploration and development of the Saugus Formation, for additional water supply as described in this Plan, will lead to further understanding of the locations and mechanisms for recharge of that aquifer, which is exposed at the surface throughout much of the area of this Plan. As that understanding evolves, part of this Plan Element will be to identify means of ensuring that significant portions of Saugus recharge are not compromised by land development activities.

This Plan Element is included to incorporate the DWSAP efforts and the overall protection of groundwater recharge into the local groundwater management plan. Completion of DWSAP efforts to comply with state DHS requirements and preservation of overall aquifer recharge are key parts of accomplishing the first and third management objectives (goals) for the basin.

Secondary Element 3 - Identification of Well Construction, Abandonment, and Destruction Policies

Well construction permitting in the basin is administered by the Los Angeles County Health Department, which effectively implements the State Well Standards for water wells, monitoring wells, and cathodic protection wells. Permitting of municipal supply wells is also within the purview of the State Department of Health Services. One goal of this management plan for the area, protection and preservation of groundwater quality requires that all wells be properly constructed and maintained during their operational lives, and properly destroyed after their useful lives, so that they not adversely affect groundwater quality by, for example, serving as conduits for movement of contaminants from the ground surface and/or from a poor quality aquifer to one of good quality. Toward that end, this element is included in the overall plan to support well construction and destruction policies, and to participate in their implementation in the Basin, particularly with regard to surface and inter-aquifer well sealing and proper well destruction, which are critical in the management of a multiple aquifer system that has some connection with the Santa Clara River and its tributaries.

Secondary Element 4 - Provisions to Update the Groundwater Management Plan

The primary and secondary elements of this local area groundwater management plan reflect the current understanding of the occurrence of groundwater in the Santa Clara River East Valley groundwater subbasin, and specific problems or areas of concern about that resource. Those management elements are designed to achieve specified goals to develop local groundwater for regular and dry year/emergency water supply while protecting and preserving groundwater quantity and quality for overlying beneficial use into the foreseeable future, and while also protecting and preserving valuable surface water resources that are directly related or connected to groundwater. While the groundwater management plan provides a framework for present and future actions, new data will be developed as a result of implementing the plan. That new data could define conditions which will require modifications to currently definable management actions. As a result, this plan is intended to be a flexible document which will be reviewed and updated to modify existing elements and/or incorporate new elements as appropriate in order to recognize and respond to future groundwater and surface water conditions. Although not intended to be a rigid schedule, review and updating of this plan will initially be conducted in five years, with subsequent future updates scheduled as appropriate at that time. In accordance with Primary Element 10, the retail purveyors and CLWA will continue to produce the Santa

Clarita Valley Water Report on an annual basis. Data and information from these reports will be compiled and utilized as part of the review and updating of this plan.

Appendix I

Groundwater and Surface Water Monitoring Protocols

The CLWA Groundwater Management Plan includes two Elements (Primary Elements 1 and 2) that relate directly to ongoing, and expanded as appropriate, monitoring of key hydrologic quantities associated with the implementation of the Plan. Notable among the data to be collected are groundwater levels, groundwater quality, pumpage from water supply wells, and surface water flows and quality. Other hydrologic data such as precipitation are intended to be measured and maintained in accordance with the standards in place for the respective precipitation gage stations in the Valley; consequently, this Appendix does not address the specific establishment of protocols for precipitation gaging. On another matter of hydrologic data, land subsidence, the Plan discusses the low probability for subsidence in the Valley, particularly as related to historical groundwater pumping from both the Alluvial and Saugus Formation aquifers. Consequently, the Appendix does not address the establishment of protocols for measuring land subsidence. As noted in the Plan, if future analysis of increased pumping from the Saugus Formation, as currently planned, suggests changes in groundwater levels that might be conducive to inelastic subsidence, the need for subsidence monitoring will be reconsidered at that time; and some combination of land surface elevation surveying, remote sensing of land surface deformation, and measurement of earth consolidation via extensometers would be considered as part of establishing protocols for monitoring subsidence.

Groundwater Monitoring

For purposes of Plan implementation, the most essential groundwater-related data are water levels, water quality, and pumpage. Consequently, the following discussion of monitoring protocols focuses on those hydrologic parameters.

Groundwater Levels - The distribution and frequency of current groundwater level measurements in Alluvial wells and in Saugus Formation wells are illustrated in Figures A1 and A2, respectively. Tables A1, A1a and A2 show the dates that groundwater level measurements were made in Alluvial and Saugus Formation wells. As discussed in the Plan, for the Alluvium, the distribution of monitoring is sufficient to interpret water level and groundwater storage trends. Thus, it is intended that the fundamental distribution and frequency of Alluvial groundwater level measurements remain generally as illustrated in Figure A1: general semi-annual measurements complemented by some quarterly measurements dispersed throughout the Alluvial aquifer. The only exception to the preceding intention is in the western-most portion of the Alluvium, where agricultural pumping remains the water supply objective and water level measurements are primarily annual. In part to conform to the balance of Alluvial groundwater

level measurements, and more importantly to monitor stream-aquifer connection near the western, or downgradient, end of the Alluvium in the basin, it is the intent of Plan implementation to increase that water level monitoring to semi-annual to quarterly frequency.

In the Saugus Formation, the distribution of groundwater level measurements is limited by the number and location of wells; the locations in Figure A2 reflect where the Saugus has been developed for water supply. Ultimately, as future exploration and development of the Saugus expand, it is expected that the distribution of groundwater level measurements will expand to those future well locations. For Plan implementation purposes, the existing monthly frequency of water level monitoring is intended to continue.

Water level measurement methodology, which is dominated by utilization of electric sounders, is expected to remain largely unchanged. Some calibrated airlines and possibly some dedicated electro-hydraulic transducers are expected to complement electric sounders in certain wells. All those water level measurement methods are sufficiently accurate to satisfy the needs to which the resultant data is to be put.

Groundwater Quality - The distribution and frequency of current groundwater quality monitoring in Alluvial wells and in Saugus Formation wells are illustrated in Figures A3 and A4, respectively. Tables A3 and A4 show the dates that groundwater quality (total dissolved solids) was monitored in Alluvial and Saugus wells. For the most part, the distribution and frequency of water quality sampling are sufficient to interpret general quality trends. One notable constraint in the Alluvium, however, is the discontinuation of water quality data collection in some wells since 1988, mostly toward the western, or downgradient, end of the basin. In order to restore an ongoing historical record, part of Plan implementation will be to attempt to re-establish regular, i.e. yearly to triennial, water quality sampling and analyses in those wells with some form of historical water quality record. In the same vein, part of Plan implementation will include selection of a number of wells in key locations, e.g. near the mouths of canyons, for semi-annual analysis of indicator parameters as a basis for assessing seasonal or other variations in groundwater quality.

Finally with regard to groundwater quality, the spatial limitations on Saugus water quality data are comparable to the limitations related to Saugus groundwater levels, but as a result of the limited, localized development of the Saugus for water supply. While the regular monitoring of quality will continue via Plan implementation, the expansion of Saugus water quality data is expected to follow the expanded exploration and development of that aquifer as described for

groundwater levels above.

Production (Pumpage) - The great majority of water supply wells in the basin are now dedicated to municipal supply; consequently, those wells are equipped with production meters which allow direct monitoring of pumpage on any desired frequency, e.g. instantaneous flow rate, or cumulative volumes on a daily, monthly, or other frequency. A few wells remain dedicated to agricultural water supply, and those wells are not equipped with flow meters. However, long-standing practice at all those wells has been to meter power consumption for each well and to combine that data with the results of annual pump performance testing in order to indirectly compute approximate pumpage from each agricultural well. That methodology is sufficiently accurate for ongoing documentation of pumpage and interpretation of basin response to pumping; it is also sufficiently accurate for groundwater flow model input as part of assessing basin yield, all as part of this Plan. Consequently, implementation of this Plan includes regular reading of flow meters on municipal supply wells and continued indirect computation of agricultural pumpage from the remaining agricultural water supply wells in the basin.

Surface Water Monitoring

Part of Plan implementation is the development of a surface water quality monitoring network. Of particular concern is establishing a surface water quality data set that, combined with groundwater data, will allow for a more detailed analysis of stream-aquifer interactions. The data of primary interest for this and other Plan purposes are surface water flow and surface water quality, discussed below.

Surface Water Flow - The existing surface water flow monitoring network within the basin consists of stream flow gaging stations along the Santa Clara River and its tributaries, and measurements of discharge to the River from the Saugus and Valencia Water Reclamation Plants. Monitoring of stream flow gages along the River and its tributaries has been mostly sporadic and limited to times prior to 1977, although measurements at some gages resumed in 2002. One exception is the gage at the Los Angeles-Ventura County line, where the daily mean stream flow was monitored from 1953 to 1996; the gage was replaced with one downstream near Piru in 1996. The Los Angeles County Sanitation Districts monitors the average discharge flow of treated wastewater from the Saugus and Valencia Water Reclamation Plants to the Santa Clara River.

Plan implementation will include evaluating the distribution, future accessibility and

configuration of the existing stream flow gaging stations to determine if they will be suitable for inclusion in the ongoing surface water flow monitoring network. Plan implementation will further include installation and operation of gage station modifications, as well as installation and operation of additional dedicated gaging stations as determined to be required.

Surface Water Quality - Surface water quality has been analyzed at many locations along the Santa Clara River and its tributaries but, with few exceptions, the data is limited to several measurements at each location. Water quality in the Santa Clara River at the Los Angeles-Ventura County line was analyzed on a semi-annual basis from 1951 to 1988, and is currently measured quarterly by United Water Conservation District. Since 2002, the Los Angeles County Department of Public Works has monitored water quality in the Santa Clara River near Interstate 5 during four wet weather events and at two other times each year to comply with the requirements of a National Pollution Discharge Elimination System (NPDES) permit that covers the County and 84 incorporated cities. The Saugus and Valencia Water Reclamation Plants also monitor the quality of the treated wastewater they discharge to the Santa Clara River as part of compliance with the requirements of their NPDES permits

Plan implementation will include identifying key locations for future surface water quality monitoring, identification of constituents of concern and monitoring frequency for each location, and implementation of appropriate sampling and analytical methodology at the selected key sites.

Table A1
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

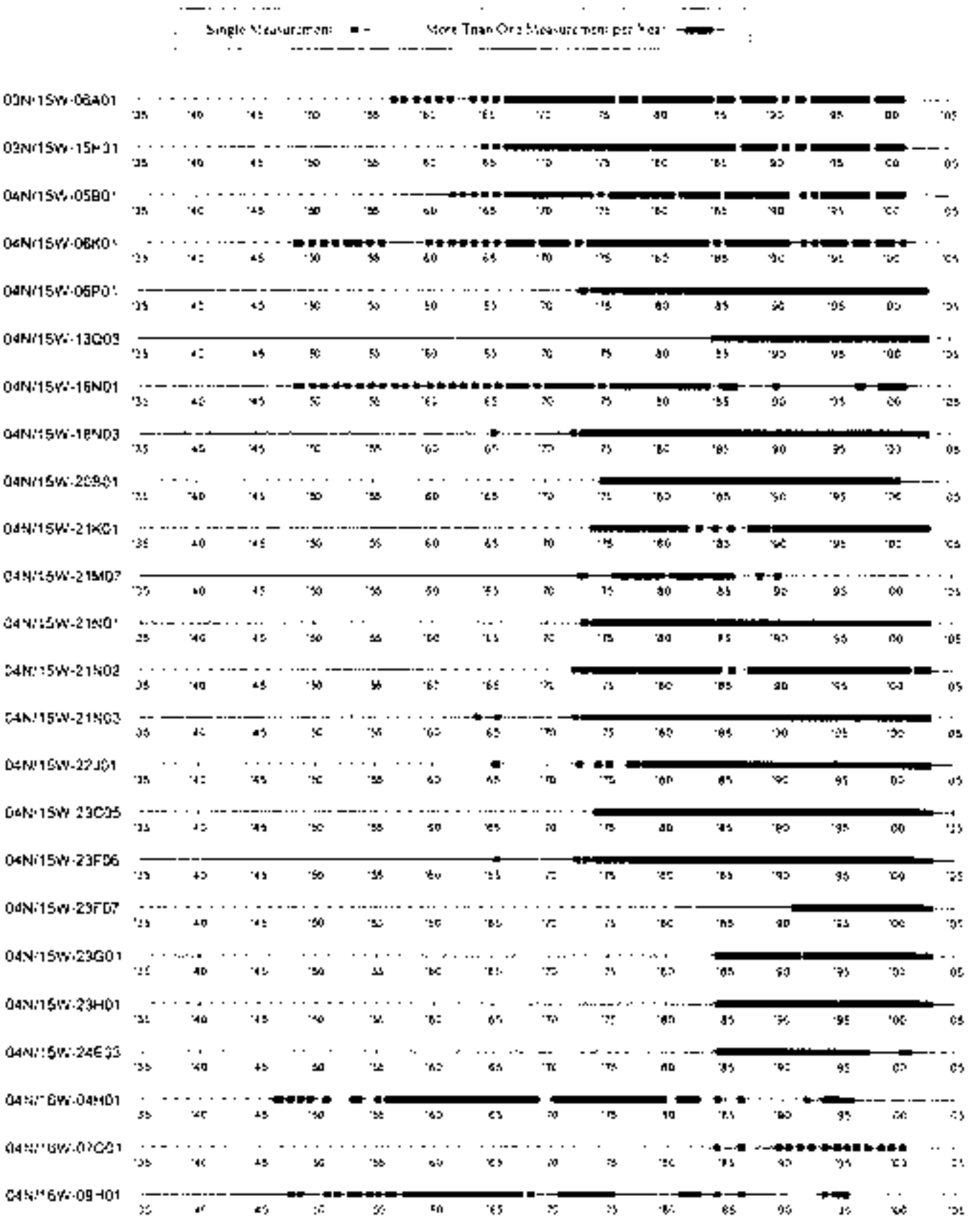


Table A1 - Continued
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

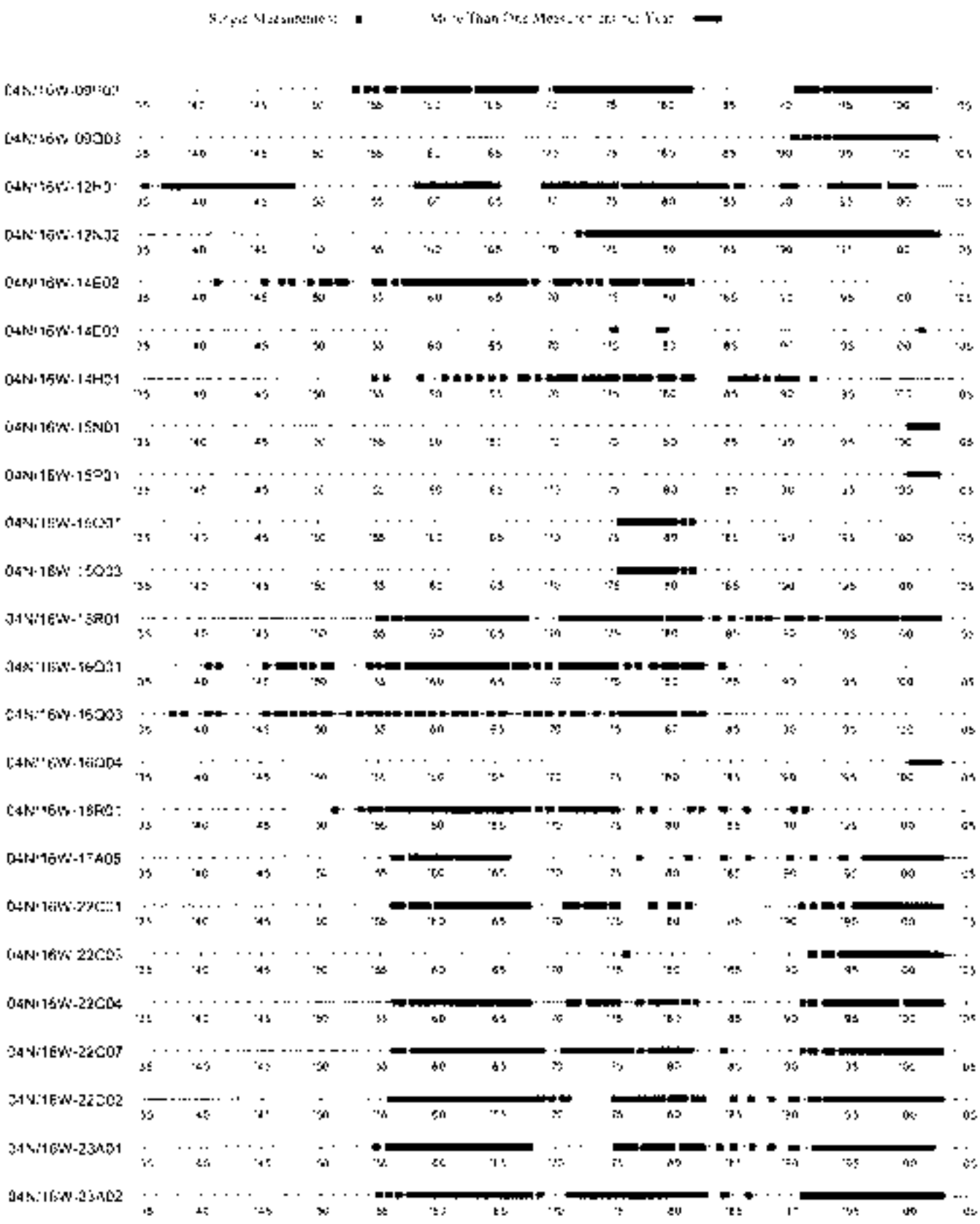


Table A1 - Continued
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

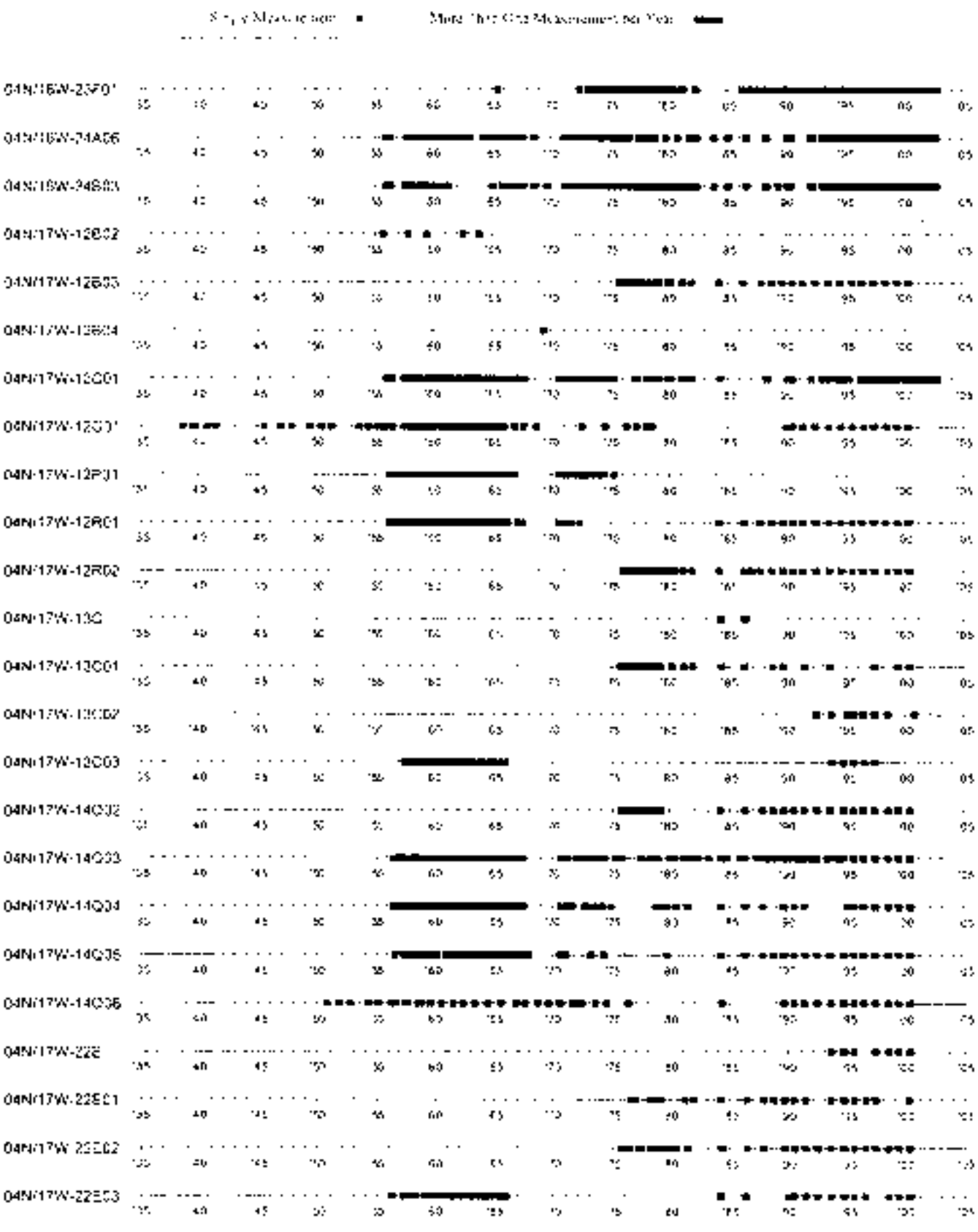


Table A1 - Continued
Dates of Historic Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

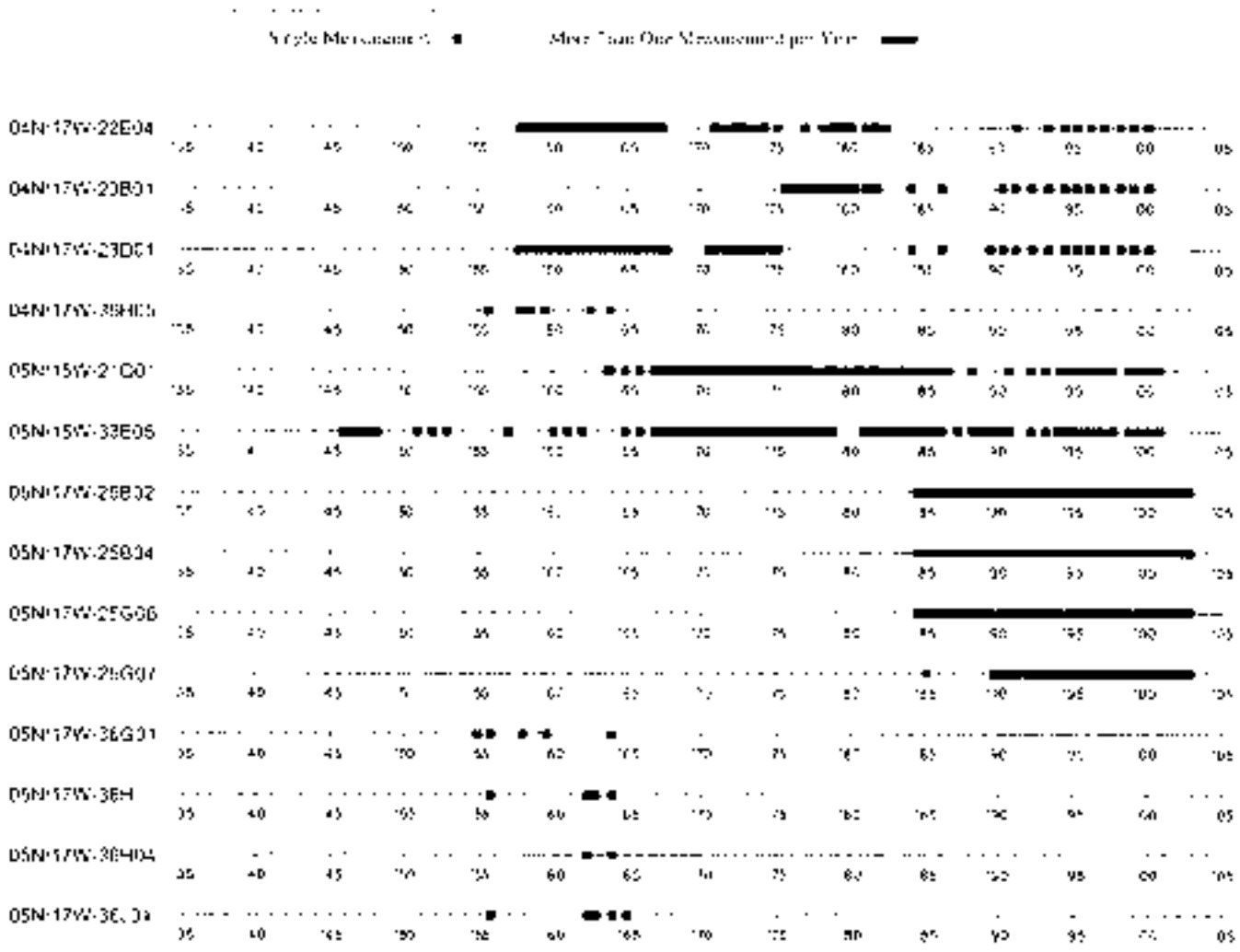
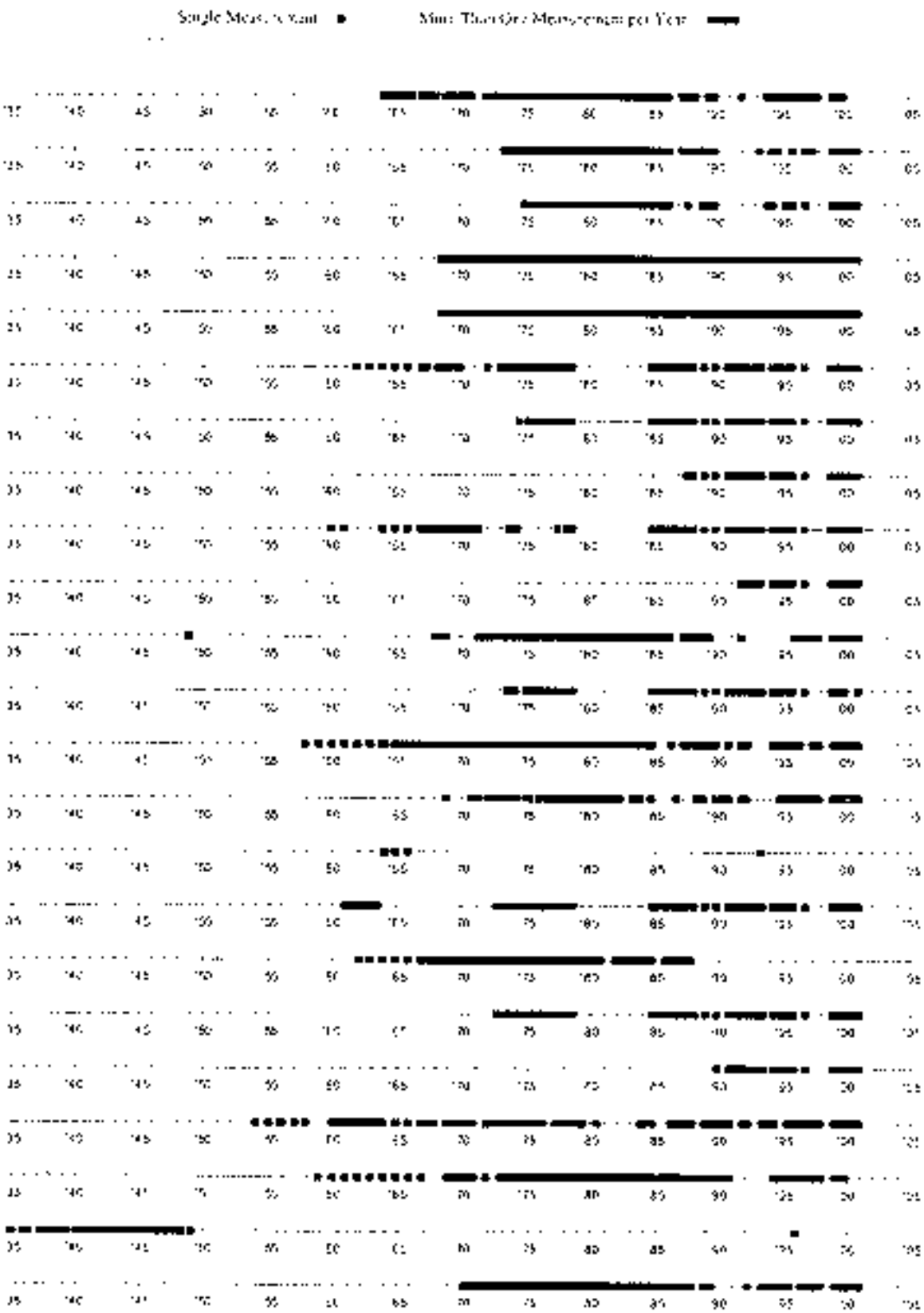


Table A1a
Dates of Historic Water Level Measurements in LACFCD Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbbasin



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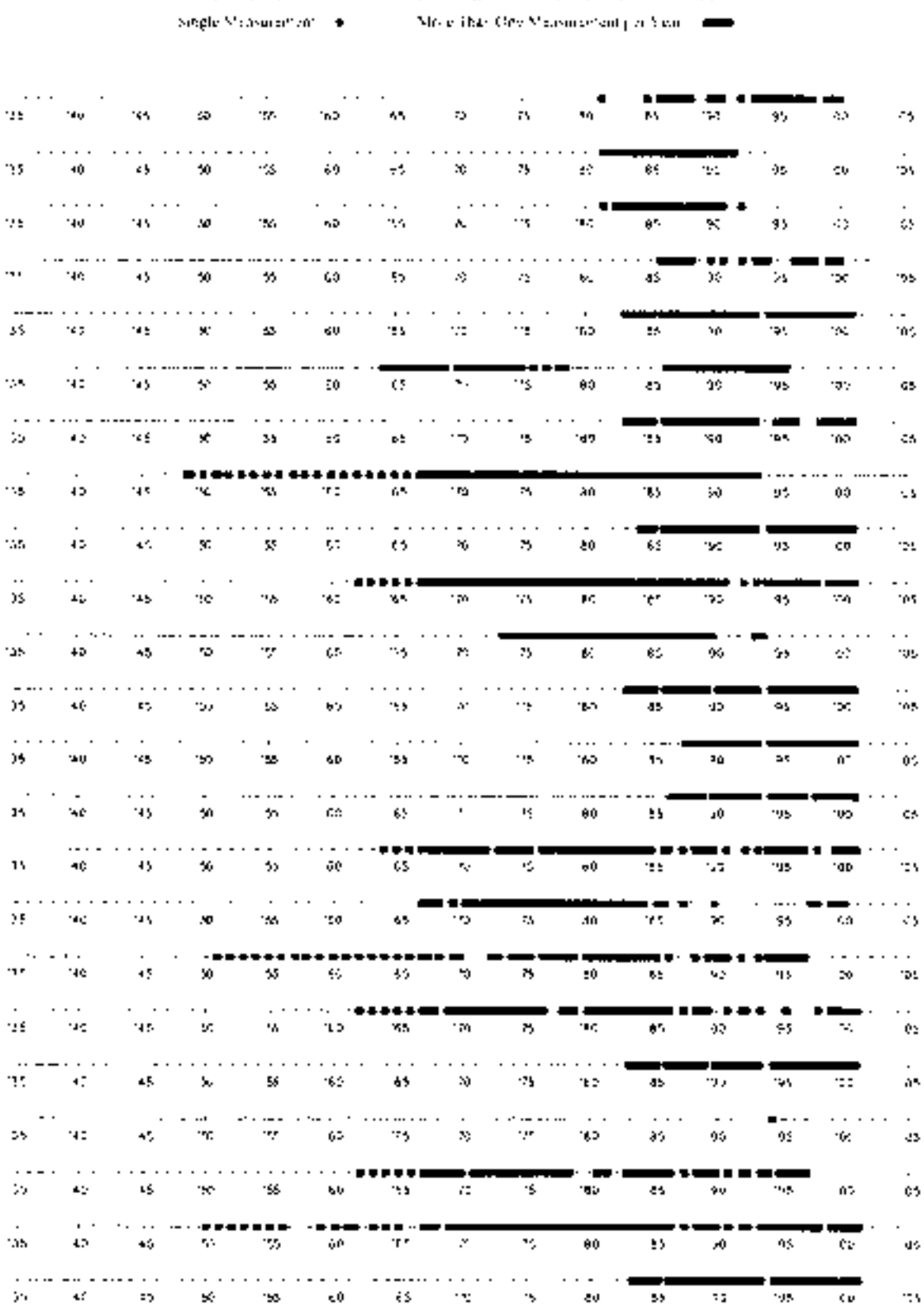
Santa Clara River Valley Groundwater Basin, East Subbasin



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Santa Clara River Valley Groundwater Basin, East Subbasin

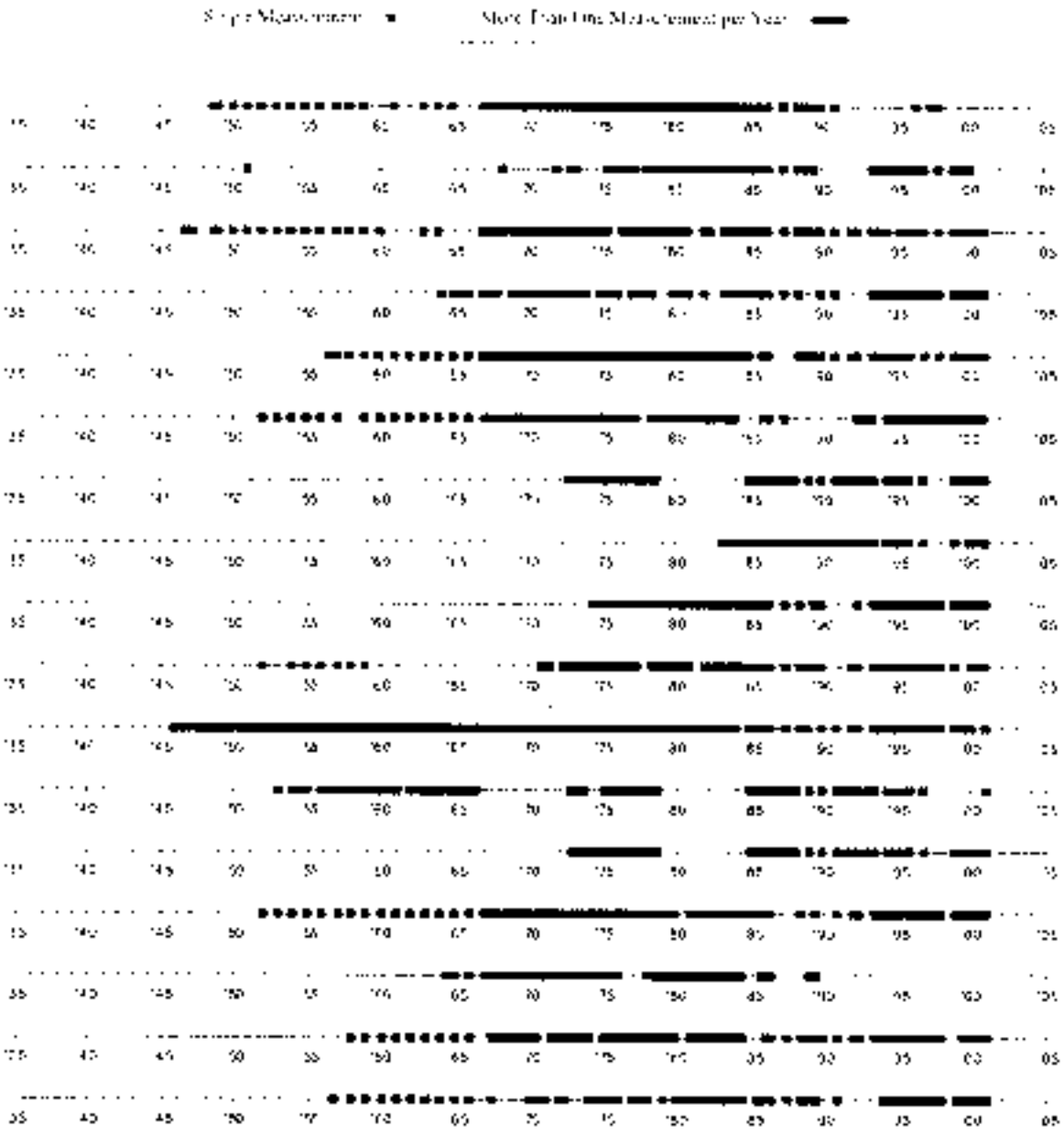


Table A2
Dates of Historic Water Level Measurements in Singles Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

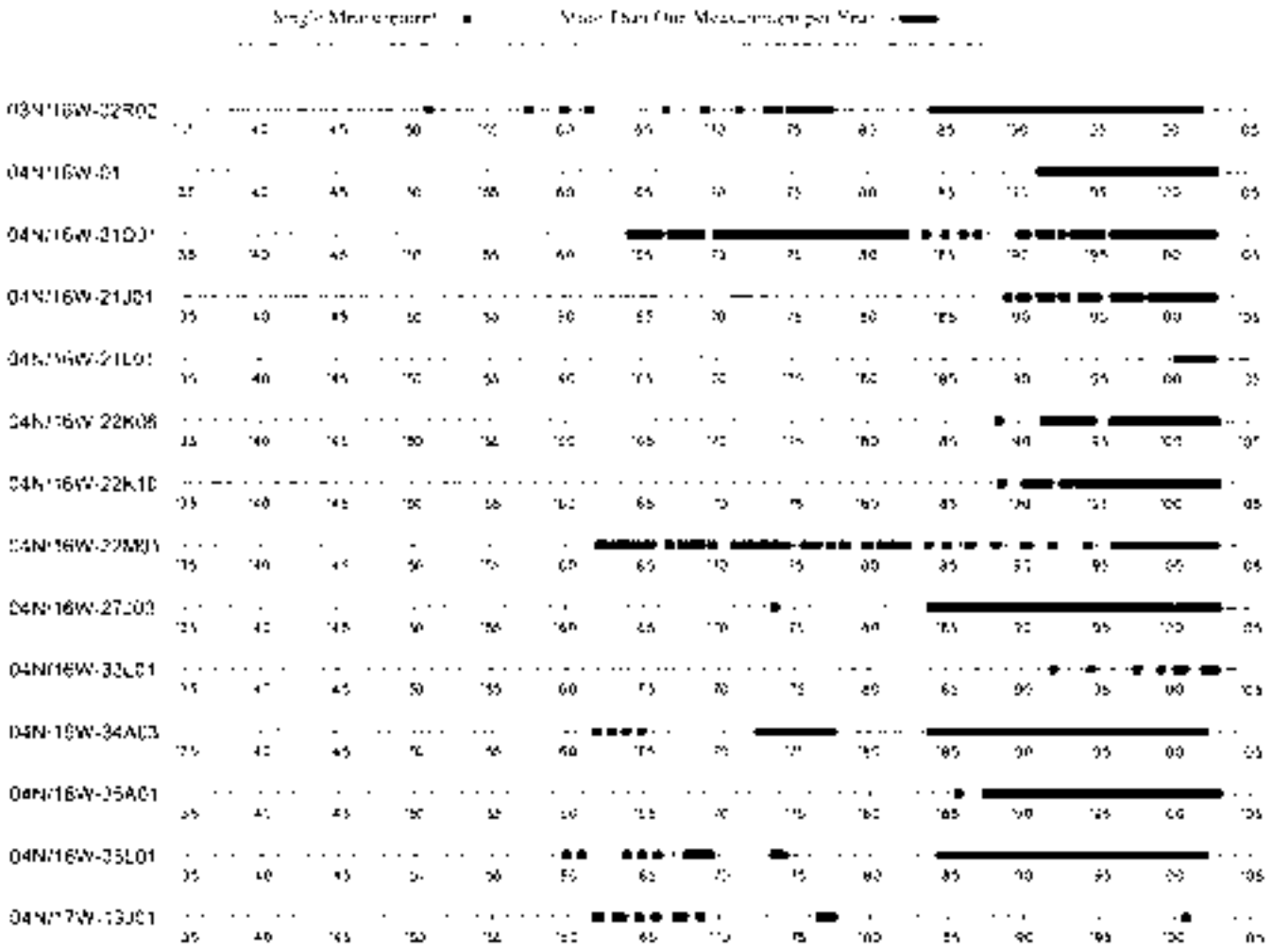


Table A3

Dates of Historic Water Quality Measurements (TDS) in Alluvial Wells

Santa Clara River Valley Groundwater Basin, East Subbasin

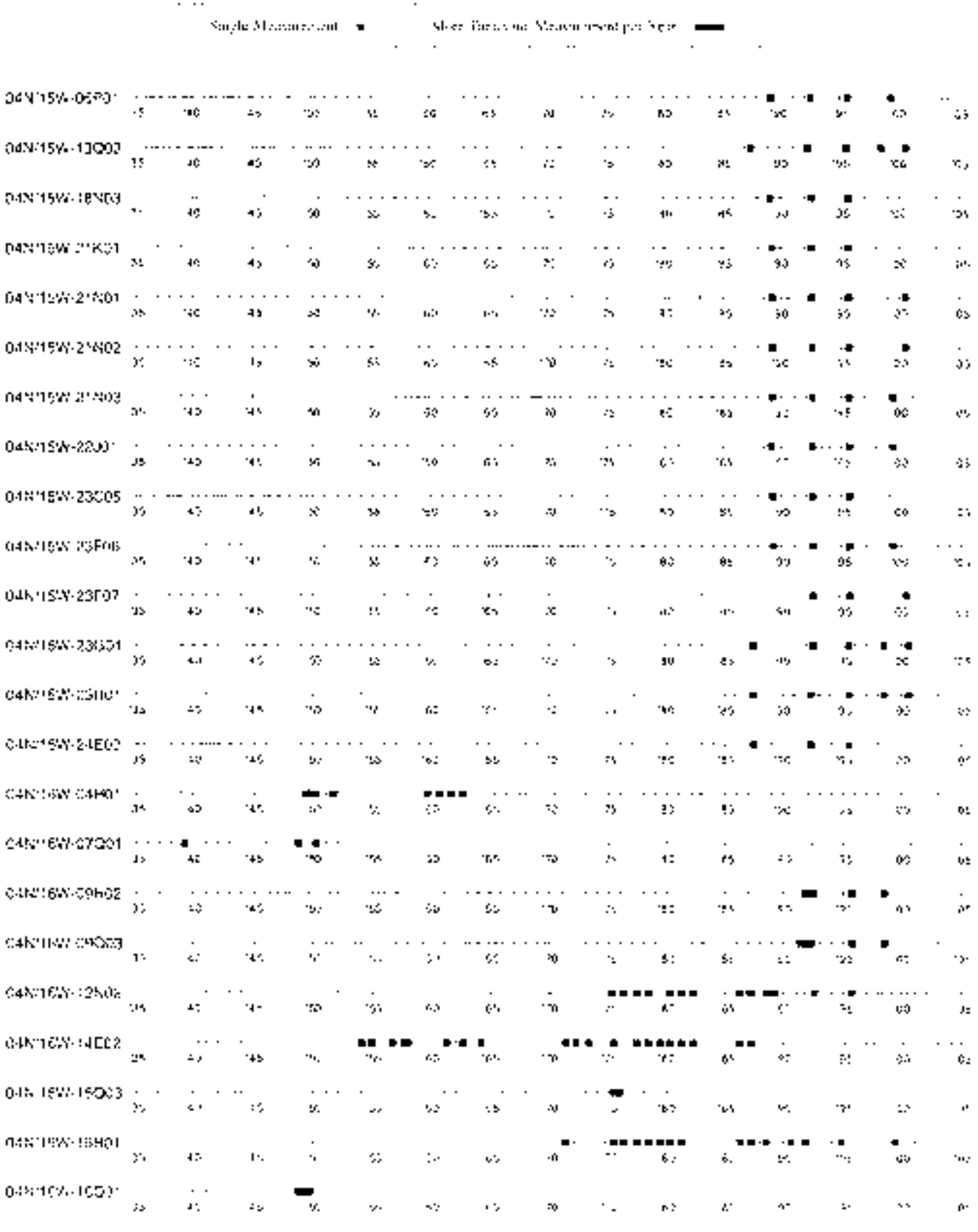
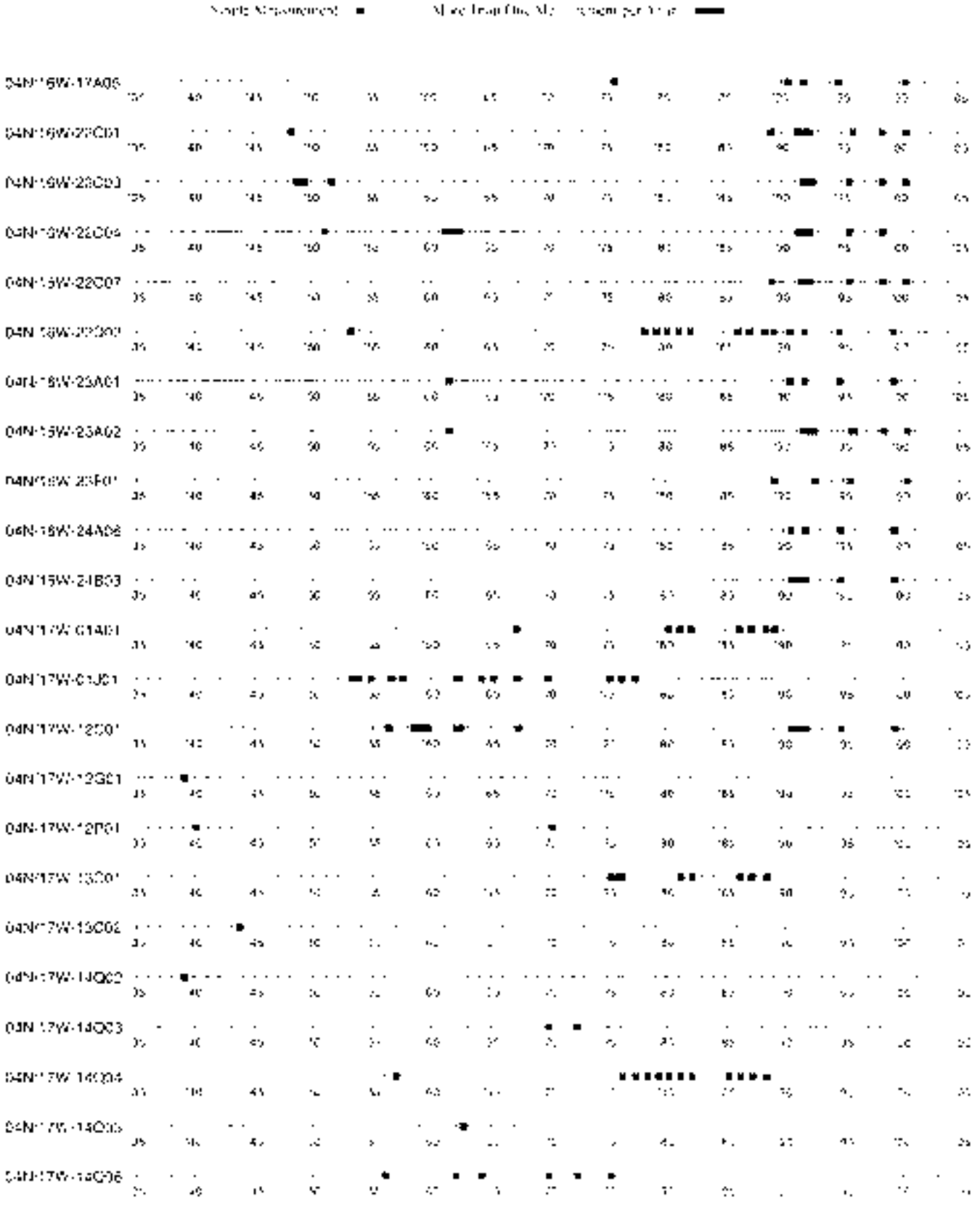


Table A3 Continued
Dates of Historic Water Quality Measurements (TDS) in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin



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Dates of Historic Water Quality Measurements (TDS) in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

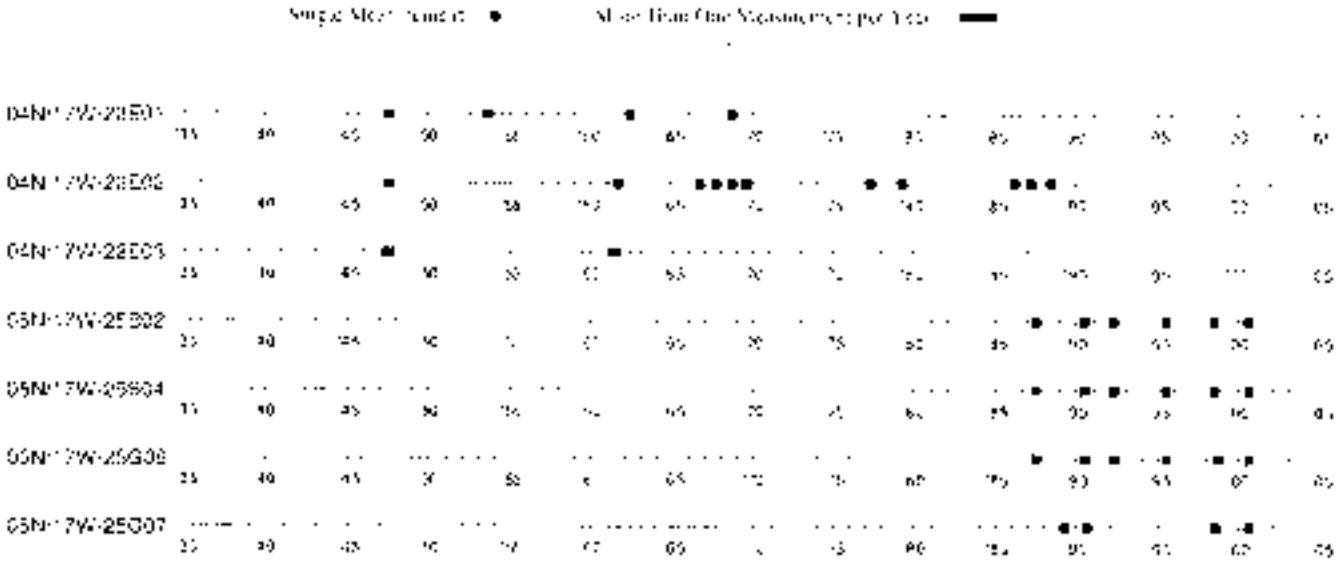
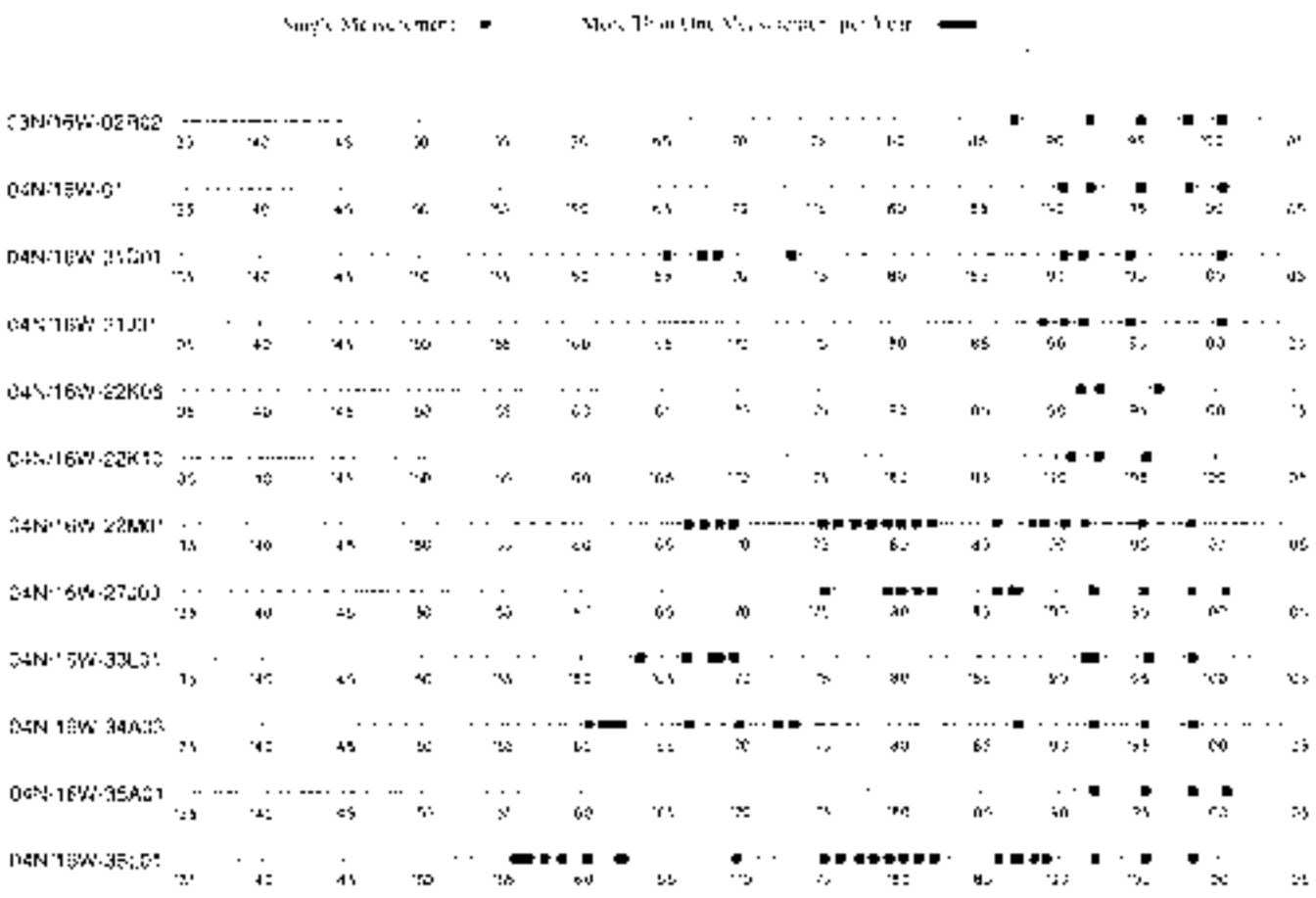


Table A4
Dates of Historic Water Quality Measurements (TDS) in Stagtes Wells
Santa Clara River Valley Groundwater Basin, East Subbasin



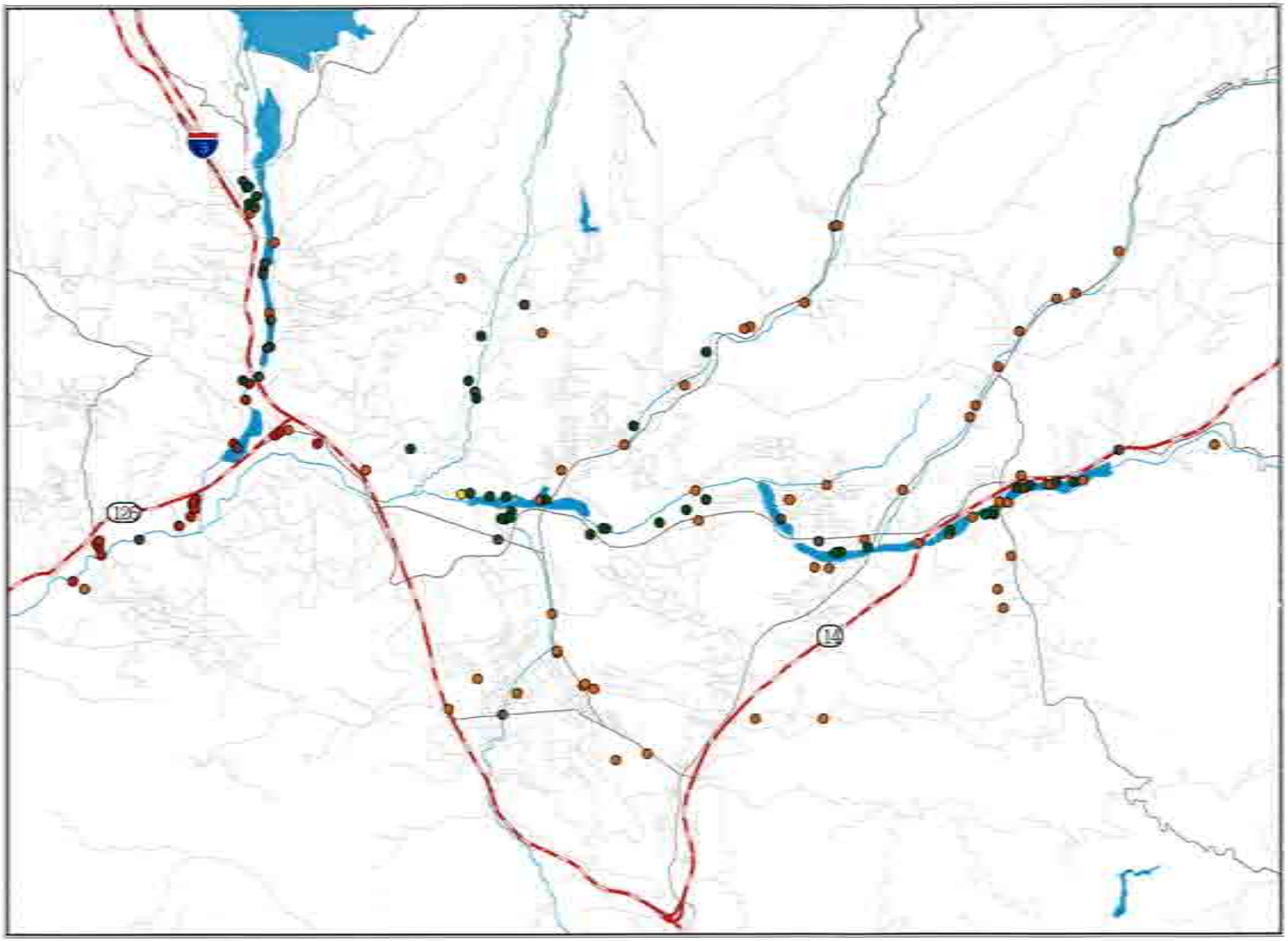


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Figure A1
Frequency of Water Level Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

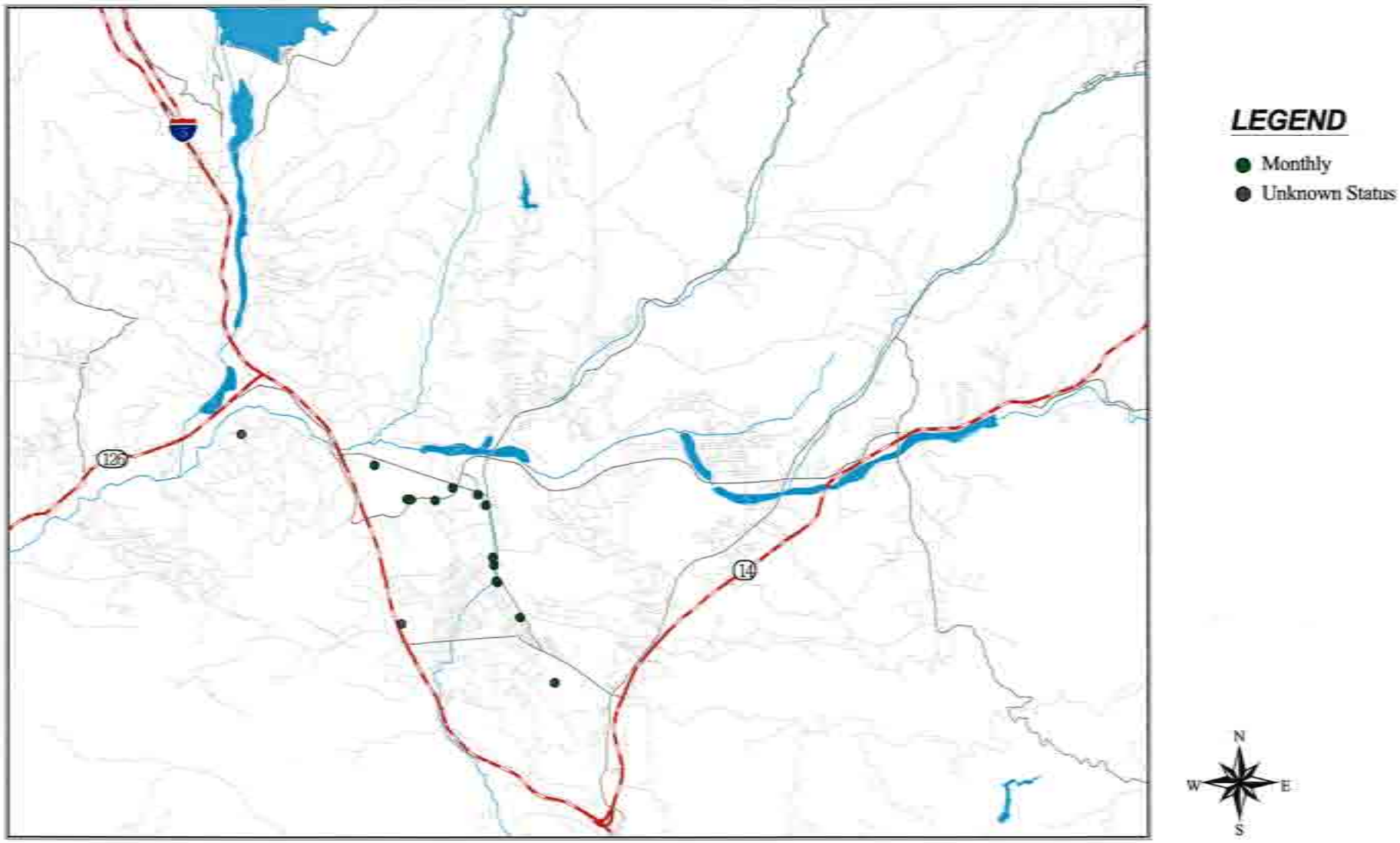

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Figure A2
Frequency of Water Level Measurements in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

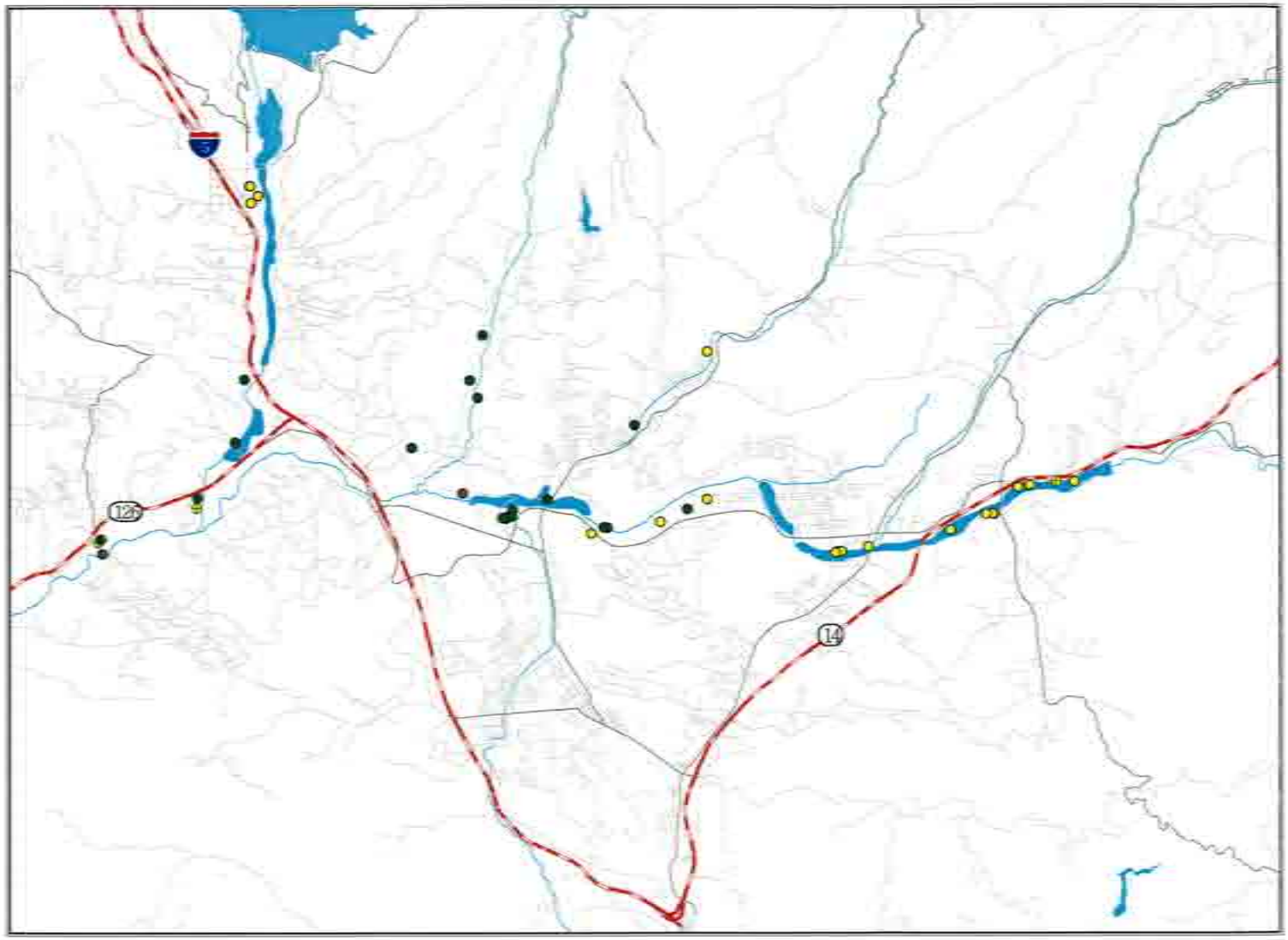

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Figure A3
Frequency of Water Quality Measurements in Alluvial Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

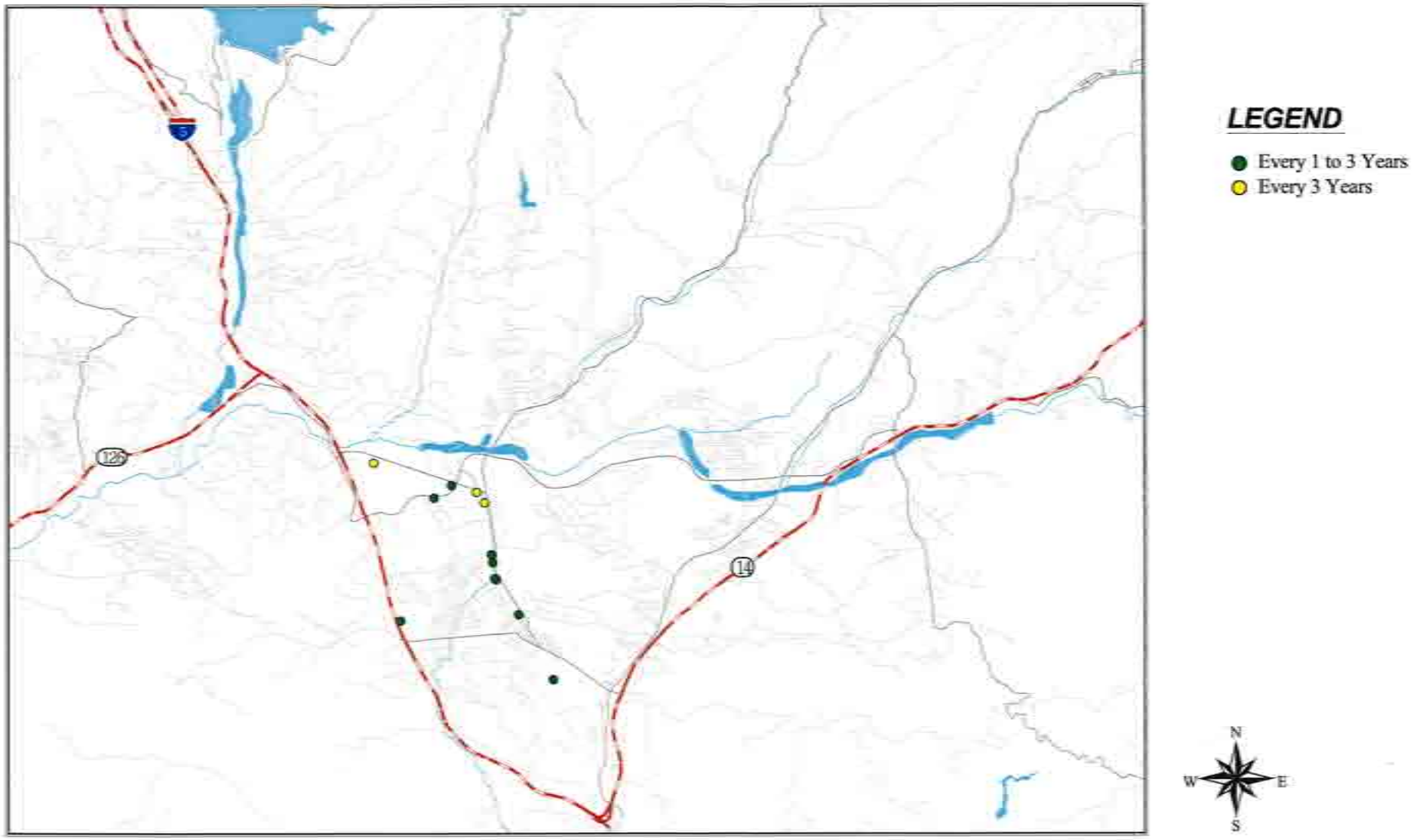

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Figure A4
Frequency of Water Quality Measurements in Saugus Wells
Santa Clara River Valley Groundwater Basin, East Subbasin

Appendix II

Groundwater Management Plan
Public Comments

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
UWCD #5	Under Primary Element 2 related to surface flows, in addition to SWP water contributing to the increased flow of the Santa Clara River, other considerations should be noted (hydrologic cycle, Alluvial pumping).	Primary Element 2	As noted above, discussion of groundwater related conditions is included in the Plan as a frame of reference for the Plan objectives and elements. Future interpretation and reporting will take such details as the impacts of the hydrologic cycle and Alluvial pumping into account.
Santa Clarita Organization for Planning and the Environment #1	Extensive pumping and lack of protection of recharge areas have resulted in almost complete elimination of surface flows and summer ponding necessary to wildlife as well as causing water level drops in wells that have resulted in water quality and availability problems for small users.	Section III (Groundwater Levels and Storage) and (Groundwater Quality) and Primary Elements 1, 2 and 3	See responses to SCOPE Comments 5, 6 and 9, Sand Canyon Comments 1 and 7, and Sierra Club Comment 5 regarding pumping within basin yield, avoidance of overdraft, preservation of recharge areas, and consideration of riparian conditions.
SCOPE #2	Concern that environmental organizations, small well owners, City of Santa Clarita, LA County, and others were not included on the Advisory Board.	Water Code Appendix § 103-15.1(e)(2)	CLWA legal counsel has confirmed that CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council. LA County was represented by LA Co. WWD #36 and LA County Sheriff's Department.
SCOPE #3	The GWMP should include a timeline for completion of the plan components.	AB 3030[2] and AB 134[3]	AB 3030 and AB 134 do not require the inclusion of a timeline.
SCOPE #4	The GWMP is lacking in the review of land use plans and coordination with land use agencies. Land use issues should be given higher priority. This may include a wellhead protection plan.	Water Code § 10753.8(t), Primary Element 9 and Secondary Element 2	Primary Element 9 and Secondary Element 2 have been expanded to further address general preservation of recharge areas and appropriate review of land use plans to protect against potential groundwater contamination.
SCOPE #5	GWMP should address maintaining tributaries in a natural state to enhance water recharge and quality.	This is not explicitly required by AB 3030 but does relate to Secondary Element 2	Secondary Element 2 has been expanded to address preservation of in-channel recharge areas in both the Santa Clara River and its tributaries.

[2] Stats. 1992, Ch. 947.
[3] Stats. 2001, Ch. 929.

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PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[5]	RESPONSE
SCOPE #6	GWMP should find ways to increase water recharge. Water agencies should also coordinate to prevent paving of permeable recharge areas.	This is not explicitly required by AB 3030 but relates to Primary Elements 3, 4 and 5 and Secondary Element 2	Potentially increasing groundwater recharge will be part of Primary Elements 3, 4 and 5. Prevention of paving permeable recharge areas is included in the expanded Secondary Element 2.
SCOPE #7	Number One Goal should not be "Development of Local Groundwater for Water Supply" because groundwater has many other important uses (recreational, biological, etc…)	This is not required by AB 3030 or AB 1314. See Section II of GWMP	The text of Section II, Management Objectives (Goals) for the Basin does not indicate a preference of any one objective over the others. The listing is not intended to indicate that any objective will not be attempted, all objectives are intended to be achieved
SCOPE #8	Agricultural water usage in the GWMP is overestimated with the perennial yield (40,000 afy) estimate higher than that in a Richard Slade report, less agricultural runoff water is available for recharge today	Section IV (Existing and Projected Water Supplies)	Reported historical agricultural pumping is consistent with all available records. A perennial yield of 60,000 afy is not included or implied in the GWMP. Rather, estimated ranges of 30,000 to 40,000 afy, depending on hydrologic conditions, are included as expected yield from the Alluvium. That range is consistent with historical reports, and with observations of actual Alluvial aquifer response to pumping in that range for at least the last 50 years
SCOPE #9	Disappearance of year round Santa Clara River flow is indication of overdraft. "There are numerous records and observations by long-time residents indicating that surface flow usually occurred year round."	Section III (Areas of Concern and Identified Problems). Water Code § 10753.8(c).	Disappearance of year round stream flow does not necessarily indicate groundwater overdraft. In fact, stream flow west of Bouquet Canyon is now perennial. Part of implementing Primary Element 1 will be to obtain the "numerous records" of year round stream flow that are noted to have actually occurred.
SCOPE #10	GWMP should disclose the reduction in production capability because of perchlorate contamination.	Primary Element 8, § 10753.8(j).	The GWMP notes the inactivation of wells that have been impacted by perchlorate contamination
Sand Canyon Area Well Owners Assoc. #1	Groundwater is extensively pumped and recharge areas are not adequately protected. water level in four wells has dropped from 12 ft in 1997 to 93 ft currently.	This relates to Primary Elements 1 and 3, and Secondary Element 2	The noted groundwater level fluctuations are consistent with those described in Section III and illustrated in Figure 3-2 for the Sand Canyon area. Section III also describes and illustrates the historical recovery from such declines. Avoidance of overdraft, i.e. continuous lowering of water levels, and protection of recharge areas are included in Primary Element 3 and Secondary Element 2, respectively.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sand Canyon #2	Advisory board lacks representation by rural well owners.	Water Code Appendix § 103-15.1(e)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council
Sand Canyon #3	GWMP should include timelines for completing its phases.	AB 3030 and AB 134.	Timelines are not required by AB 3030 or AB 134.
Sand Canyon #4	GWMP is lacking in its review of land use plans and coordination with land use agencies.	Water Code §10753.8(l)	See response to SCOPE Comment 3 above
Sand Canyon #5	Perennial yield estimates for the Santa Clara River are higher than that provided in a Richard Slade report. Agricultural runoff is no longer a factor; agricultural usage was not metered historically, and former recharge areas have been paved	Section IV (Existing and Projected Water Supplies)	See response to SCOPE Comment 8 above.
Sand Canyon #6	Santa Clara River should not be defined in terms of percolating groundwater. GWMP should clarify relationship between river and Saugus formation	Section III	The GWMP is not an appropriate document in which to define the legal classification of groundwater, whether in the Alluvium or the Saugus Formation; consequently, there is no expression in the GWMP to describe the legal classification of groundwater in the basin. The entire focus of the GWMP is management of groundwater toward long-term preservation of both the quantity and quality of the resource
Sand Canyon #7	GWMP's assertions against existence of overdraft or other undesirable conditions are incorrect since water levels in wells have reached historic lows. In addition, riparian conditions on the Santa Clara River and tributaries show signs of water deprivation	Section III (Areas of Concern and Identified Problems)	See response to Sand Canyon Comment 1. Further, intermittent fluctuations reaching the equivalent of historic low levels is not overdraft. Primary Elements 1 and 3 are included to monitor groundwater levels throughout the basin, and to operate in an ongoing manner to avoid overdraft. Finally, the statement that riparian conditions show signs of water deprivation is non-specific as to location and is otherwise unsubstantiated. Primary Elements 1 and 2 are included in the Plan to quantify the existence and extent of such conditions, if they occur; Primary Element 3 is included to avoid overdraft-related conditions of the type noted

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PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sand Canyon #8	GWMP should include reports regarding water contamination from Robinson Ranch. City of Santa Clarita had stipulated that water quality adjacent to the golf course be monitored with results published in a report	Primary Element 1	See response to UWCD Comment 1 regarding extent of detail regarding occurrence of groundwater as framework for understanding the objectives and elements of the GWMP. As regards this comment, there is no documented groundwater contamination from Robinson Ranch, including that golf course. Required reports on Robinson Ranch have not shown any contamination as alleged in this comment. Monitoring in accordance with Primary Element 1 is intended to detect any groundwater contamination of the nature alleged in this comment.
Friends of the Santa Clara River #1	Disappointed that GWMP's primary goal is "Development of Local Groundwater for Water Supply" because other objectives should include protection of groundwater resources	AB 3030 and AB 134. Section II of GWMP	See response to SCOPE Comment 7 above regarding lack of priority for all management objectives, and lack of "primary" status for "Development of Local Groundwater for Water Supply".
Friends #2	GWMP should emphasize that paving of streams reduces recharge and should be avoided. Buffer zones around streams should be discussed.	This is not explicitly required by AB 3030 but relates to Primary Elements 1, 4 and 5 and Secondary Element 2	See response to SCOPE Comments 4, 5 and 6. Further, given the importance of in-channel recharge to the yield of the Alluvium, a priority in implementation of the Plan can logically be expected to be avoidance of paving stream channels.
Friends #3	Advisory Board should include representatives from environmental groups and county agencies.	Water Code Appendix § 103-15.1(c)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council.
Santa Clarita Sierra Club Group #1	GWMP should include timelines for completion of components.	AB 3030 and AB 134.	Timelines are not required by AB 3030 or AB 134

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sierra Club #2	GWMP does not account for loss of groundwater from perchlorate contamination. "The numbers do not adequately represent the real water supply."	Primary Element 8; Water Code §10753.8(j)	See response to SCOPE Comment 10 regarding the inactivation of wells impacted by perchlorate contamination. The inactivation of certain wells impacts pumping capacity until the wells can be reactivated, with treatment if necessary, or replaced. However, perchlorate contamination does not reduce the available yield of the aquifer system, hence, the numbers included in the GWMP accurately reflect the current state of water supply.
Sierra Club #3	Loss of groundwater due to development and pavement is not considered. GWMP must address coordination of land use with water necessities.	This is not explicitly required by AB 3030 but relates to Primary Elements 3, 4 and 5 and Secondary Element 2.	See responses to SCOPE Comments 4 and 6. Further, there has been no "loss" of groundwater due to development or pavement; groundwater conditions remain as generally described in Section III, with nearly constant water levels to the west and repetitive fluctuations to the east (see response to Sand Canyon Comment 1).
Sierra Club #4	Drought planning is inadequate as it fails to take account of loss of primary water sources and reclaimed water.	Primary Element 1, 4, 5 and 7	Drought planning is embedded in the GWMP in that the Plan is intended to result in groundwater management that ensures adequacy of groundwater supplies through both wet and dry (drought) hydrologic cycles. While "drought planning", per se, relates more specifically to overall water supply planning, of which groundwater is only one component, this Plan is intended to manage groundwater in such a way that it will be a reliable component of overall water supply through dry periods without being overdrafted on a long-term basis, e.g. through wet/normal periods that follow dry periods. Primary Elements 3, 4, 5 and 7 in the Plan relate to drought planning as well as parts of groundwater management through long-term fluctuations in hydrologic conditions.
Sierra Club #5	GWMP does not adequately discuss maintaining river and tributary habitats. Sierra Club supports a citizen monitoring program for water quality.	This is not explicitly required by AB 3030 but does relate to Secondary Element 7	See response to SCOPE Comment 5 and Friends Comment 2.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Sierra Club #6	CLWA should involve the public and other government and private entities in its water supply planning.	Water Code Appendix § 103-15.2(e)(2)	CLWA complied with the requirements of AB 134 regarding the composition of the Advisory Council.
Ed & Joan Dunn #1	Concern because CLWA did not hold more public meetings before release of draft. Concern whether CLWA has regularly met with Advisory Board.	Water Code § 10753 et seq.	CLWA has complied with all requirements thus far regarding public meetings and gone beyond that legally required.
Dunn #2	Doubt regarding replenishment of water in the Alluvial Aquifer.	Primary Elements 3, 4 and 5	Fundamentally, as discussed in the Plan, the long-term objectives for the basin include utilizing groundwater for water supply while not overdrafting the basin. As also discussed in the Plan, historically, in the western part of the basin there has been sufficient water for recharge to maintain an essentially full basin throughout both wet and dry hydrologic periods. Part of the reference to "sustain recharge" relates to that historical condition. Whether or not additional artificial recharge will be implemented in other parts of the basin, and what water sources might be used for such recharge, are to be addressed via implementation of the Plan, particularly Primary Elements 3, 4 and 5.
Dunn #3	Doubt over Richard Slade's assertion as to Alluvial Aquifer capacity	This challenges evidence which the GWMP cites	The analysis and determination of the storage capacity of the Alluvium has been exhaustively described in Slade's reports. The comment conveys no specific aspect of its "question"; the commentors are referred to Slade's reports, which address the storage calculations in proper technical detail.
Dunn #4	GWMP should state that SWP water was interrupted for 6 months in 1991. Newspaper clipping is provided for this point.	Primary Elements 3, 4 and 5	Primary Elements 3, 4 and 5 are included in the GWMP to ensure the maximum reliability of local groundwater in order to endure any future drought-related impacts on SWP deliveries, such as occurred in 1991.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #5	Statement in GWMP that no wells exceeded DHS action level for perchlorate is false. Newspaper clippings provided.	Section III (Groundwater Quality)	The Plan has been revised to reflect that, while there remains no primary or secondary drinking water standard for perchlorate, and although only some of the detected concentrations of perchlorate in the Saugus wells exceeded the Action Level established by the State Department of Health Services at that time (18 ug/l), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service since then.
Dunn #6	Statement that perchlorate contamination has not reduced groundwater capacity is misleading	Primary Element 8	See response to SCOPE Comment 10 and Sierra Club Comment 2
Dunn #7	The Urban Water Management Plan should not be referred to because it is under legal attack.	While it has been challenged, the UWMP is still a valid document	While it has been challenged, the UWMP is still a valid document and represents the current plan for urban water supply through its 20 year planning horizon. The Kern County Superior Court in February 2005 ruled completely in favor of the water suppliers in their defense of the UWMP litigation. The remaining petitioners have appealed.
Dunn #8	The Saugus Formation does NOT underlie the entire CLWA service area	Section I (Santa Clara River Valley Groundwater Basin)	The text of the Plan has been revised to reflect that the Saugus Formation underlies much of the CLWA service area
Dunn #9	GWMP should state CLWA's inability to transport additional SWP to Santa Clarita Valley	Section IV (Existing and Projected Water Supplies)	CLWA does not have an inability to transport additional SWP water to the Santa Clarita Valley. Fundamentally, the comment is erroneous since the State conveys SWP water to CLWA's diversion points from Castaic Lake; from there CLWA has sufficient treatment and conveyance capacity for its current water demands, and is in the process of designing additional treatment plant capacity to treat and distribute additional water to accommodate projected increased demand.

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PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #10	CLWA's recycled water program is for private business only, not public agencies.	Primary Element 7	The recycled water program has no restrictions against use by public agencies. As described in Primary Element 7, the integration of recycled water to meet some non-potable demand is expected to decrease overall demand for potable water by up to 17,000 afy. As public agencies develop capabilities to utilize recycled water for non-potable uses, they are expected to reduce potable water demands by integrating recycled water into their overall water delivery systems. Initially, recycled water service to a specific user or area frees up potable water supplies for other users or areas, thus enhancing the reliability of the overall water supply of the Valley.
Dunn #11	Groundwater production from both the Alluvium and Saugus Formation is overstated	Section IV (Existing and Projected Water Supplies)	The comment is unsubstantiated and includes no support in the form of records or other data to validate it. The historical use of groundwater reported in the Plan is based on a combination of metered pumping and indirect estimation of pumping based on metered power consumption and pump performance testing. There is no basis for claiming that reported groundwater production is "overstated".
Dunn #12	CLWA should develop an emergency plan.	Primary Elements 3, 4 and 5	Development of an emergency plan, presumably an emergency water supply plan, is beyond the scope of a GWMP. However, Primary Elements 3, 4 and 5 are intended to further develop both a regular and a dry year/emergency component of water supply from local groundwater.
Dunn #13	Claim depicting SWP water received in 1991 is erroneous. Newspaper clipping provided	Figure 4-1	The final 1991 M&I allocation was 30% (October 1991). CLWA's M&I entitlement at that time was 41,500 af. The total amount made available to CLWA by DWR was 13,050 af. Since by October, CLWA and the retail purveyors had already instituted emergency operations, the entire amount was not used.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Dunn #14	Claim that CLWA meetings with retail water purveyors, the City, and UWCD have not occurred.	Primary Element 9	The Commentors' lack of knowledge of such meetings does not mean they have not occurred. Appropriate documentation of such meetings, including presentation materials, discussion topics, and resultant work assignments, are maintained by meeting participants.
Dunn #15	Secret meetings and secret reports related to Primary Element 10 should not be included as part of the GWMP.	Primary Element 10	The preparation of the annual Water Reports does not indicate that any secret meetings have taken place. Previous Water Reports have been prepared, and future Water Reports are envisioned to be prepared with few, if any, meetings of any type; both public and private meetings have been convened to present and discuss the findings of the various Water Reports, and such meetings are intended to occur in the future for the same purpose.
Dunn #16	CLWA should provide an accounting of water conserved.	N/A	Providing an accounting of water conserved is beyond the scope of the GWMP. More water sales are occurring through time due to increasing demand in the Valley. Water conservation measures result in water savings even though demand is increasing.
Diane Trautman (City Planning Commissioner) #1	What percentage of water demand will be drawn from local groundwater?	Primary Element 5	In terms of groundwater management planning, projected urban water demand (the 106,000 afy projected urban demand in 2020) does not represent total valley-wide demand; total projected demand is 113,100 afy, including both urban and agricultural. In that light, on an average basis, local groundwater is expected to be utilized to meet about 40 percent of total water demand.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #2	Will pumping of the Alluvial Aquifer reduce recharge of the Saugus Formation and reduce water that can be produced from the Saugus Formation during dry periods?	Primary Elements 5, 6 and 9	No. Since the Saugus Formation is recharged over a much larger area, beyond the spatial extent of the Alluvium, there is a limited relationship between Alluvial pumping and recharge to the Saugus Formation. The fundamental tenet of the GWMP is to utilize groundwater for water supply within its sustainable yield (see the Management Objectives, or Goals, for the Basin, GWMP Section II; see also the various GWMP Elements intended to achieve those objectives, GWMP Section V). In that light, it is expected and intended to operate in such a way that recharge to the Saugus Formation will not be "reduced" by pumping from the Alluvial Aquifer and that groundwater will be available in varying amounts, as needed depending on weather year-types, within the sustainable yields of the respective aquifers (or without overdrafting them).
Trautman #3	Does CLWA have sufficient data regarding the Alluvial Aquifer and Saugus Formation, if not, how will it obtain such data?	Section II and Primary Element 1.	The reference to "useful amount of groundwater quality data" in the GWMP includes both Alluvial and Saugus data. However, due to the historically greater development and use of groundwater from the Alluvium (number and distribution of wells, volume of pumping), and due to the historically smaller development and use of the Saugus Formation (fewer wells, smaller geographical distribution of wells, smaller pumpage), there is comparatively limited ability to examine relationships among pumping, recharge, and quality in the Saugus Formation. CLWA and the other purveyors intend to expand the overall knowledge of the Saugus Formation as that resource is further explored and developed (number of wells, additional sampling as new wells are added, etc.). All that data will be included in ongoing implementation of GWMP Primary Element 1, Monitoring of Groundwater Levels, Quality and Production.
Trautman #4	The 2002 Water Report indicates that "there are limited Saugus (Formation) water level data." Does CLWA plan to collect more comprehensive data on the Saugus Formation?	Section II and Primary Element 1	The "limited nature of Saugus water level data" as a result of the same smaller extent of historical Saugus development described in the preceding answer. Acquisition of additional data on the Saugus Formation is planned as also described in the preceding answer.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #5	Is CLWA sharing detailed information with the City of Santa Clarita regarding contamination risks in relation to existing closed wells?	Primary Element 9	All publicly available information regarding the investigation of perchlorate contamination, its extent, its impact on water supply, and plans for cleanup, control of migration, etc. is available to the City. Representatives of CLWA and the purveyors meet routinely with City representatives to review the status of perchlorate cleanup and remediation activities. CLWA and the impacted water purveyors will continue to pursue control and cleanup of perchlorate contamination in order to restore impacted groundwater pumping capacity and to ensure the long term quantity and quality of groundwater in accordance with the GWMP. As a practical matter, there are no surface contamination risks relating to perchlorate that would affect land use development adjacent to the impacted wells.
Trautman #6	Where is the Stadium Well located?	Section IV (Groundwater Quality)	The Stadium Well is located on the south side of the Santa Clara River, approximately two miles upstream (east) of its confluence with the South Fork tributary, or about 4,000 feet east of the Bouquet Canyon Road crossing of the Santa Clara River.
Trautman #7	Why isn't conservation a primary element (instead of secondary) since it may reduce water demand by 10%?	Secondary Element 1	The assignment of "primary" or "secondary" status to any GWMP element is discretionary and certainly not absolute. Secondary status is not intended to indicate that any element of the GWMP will not be implemented; all elements are intended to be implemented. Final status of all GWMP elements will be reviewed by the Advisory Council and the CLWA Board.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #8	How is CLWA delivering recycled water?	Primary Element 7	Recycled water is being delivered to the TPC golf course, the first customer of the system, via the dedicated, recycled water distribution system, which is also capable of delivering water to other non-potable water users, and which will be expanded in accordance with the Draft Recycled Water Master Plan. The costs and time frame for expanding recycled water distribution and use are included in the Draft Recycled Water Master Plan which is complementary to, but beyond the scope of the Groundwater Management Plan. The intent is to develop 17,000 afy of recycled water use by 2020. The capital cost of the complete system is estimated to be $68 million, and will be funded through CLWA's connection fee program.
Trautman #9	How is recycled water reprocessed?	Primary Element 7	Recycled water is not "reprocessed" at points of use such as the TPC golf course. In general, recycled water is highly treated (tertiary treated) waste water. In the case of the Santa Clarita Valley, treatment already occurs at the Valencia Reclamation Plant operated by the Sanitation Districts of Los Angeles County. The treated water, ready for non-potable use, is distributed from the plant site in a dedicated transmission pipeline system to end users such as the TPC. Pesticide and fertilizer uses, as part of cultural practices at end-user locations such as golf courses, are discretionary actions of the respective end users of recycled water.
Trautman #10	What is the average per capita water usage?	N/A	Most water agencies no longer use "per capita" water use as a standard because it is not an accurate representation of actual per person water use, mainly due to the effects of landscape and commercial/industrial water use. (It is also expressed in "gallons per day," rather than "acre-feet per year," since it refers to individual water usage.) In general, for the South Coast hydrologic region of California, water use is approximately 200 gallons per person per day (DWR Bulletin 160-98). Per capita use for the Santa Clarita Valley is slightly higher due to landscape irrigation demands caused by local climatic conditions.

PARTY	COMMENT	APPLICABLE GWMP SECTION/ COMPLIANCE[1]	RESPONSE
Trautman #21	The Semitropic Water Bank Transfer is not mentioned in discussion of the Supplemental (SWP) Surface Water on page 21. Is that because it is a relatively short-term water supply? Are any of the other water transfers – Kern Water Bank, Kern Delta Water, North Las Posas Water Bank – as listed on GWMP p. 2-16, of limited duration? And if the Semitropic Water Bank Transfer is short term, how can it be included in the 305,000 – 306,000 afy need projected for the next 20 years? When will take its place?	Section IV (Existing and Projected Supplies)	The SWP is referred to as "supplemental" water because that is the original purpose of the SWP to serve as a supply that would "supplement" local supplies (whether groundwater or local surface water or both). The specific amounts referred to in the GWMP are from the contractual terms between CLWA and the California Department of Water Resources. The water banked in the Semitropic Water Storage Program during 2002 is a short-term, dry period supply. The program has a term of ten years (i.e., the water must be returned to CLWA for use in its service area within that time period). Thus it is not included as a supply for long-term needs. However, the other programs listed in the GWMP (most of which, by the way, are not water "transfers," but are instead groundwater banking programs) are long-term sources of supply. CLWA is in the process of designing and implementing a Long-Term Reliability Plan to begin bringing such long-term programs on line as a means to store water available in wet years, for use in later dry years. CEQA analysis, with its accompanying public comment opportunities, will be part of the long term reliability program approval process.
Trautman #12	What specific efforts will be made to manage salinity?	Primary Element 6	Primary Element 6 – Long Term Salinity Management is included in the GWMP for the reasons presented in the text discussion of that element. The element recognizes the need to plan for salinity management but also recognizes that, to the present, there has been no extraordinary trend of salinity increase. Hence, there are no specific efforts currently in place to "manage" salinity. It is envisioned that specific efforts will be developed over time in response to implementation of the GWMP and, in particular, its Primary Element 6. CLWA is participating in efforts by the Sanitation Districts of Los Angeles County to address the Los Angeles Regional Water Quality Control Board's proposed TMDL standard for chloride in the Santa Clara River. This effort is separate from and beyond the scope of the Groundwater Management Plan.

UNITED WATER CONSERVATION DISTRICT

"Conserving Water Since 1927"

August 7, 2003

Dan Masnada
Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350

Re Response on Draft Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Sub-basin

Thank you for giving us the opportunity to review and comment on your *Draft Groundwater Management Plan, Santa Clara River Valley Groundwater Basin, East Sub-basin*. United Water considers this plan as one piece of a broader effort at groundwater management that is being accomplished as part of the Memorandum of Understanding between United Water and water purveyors in the Santa Clarita area. We offer some specific comments and suggestions for your consideration.

Comments include:

Figure 3-2. The vertical and horizontal scales associated with the hydrographs are very difficult to read. The T4N R17W, Section 22 well, in the western arm of the Alluvial Aquifer does not show data from approximately 1983 through 1997. In previous reports and analyses, the NLF #C9 well was used for this area. This well depicted variable groundwater levels for the period from the mid-1980s to the early 1990s. Because this is the discharge area of the Alluvial Aquifer to the Santa Clara River, we need to understand the response of the system to the onset of agricultural pumping in this area in the mid-1980s. The T4N R17W, Section 22 well does not possess the data needed to show that response.

Page 15. The comment near the top of the page that "*over the last 35 years, groundwater quality in the Saugus has remained generally constant*" would be more supportable if it was accompanied by a groundwater quality map similar to Figure 3-5, with a few groundwater quality time-series specific to the Saugus Formation.

Figure 5-3. The average daily mean streamflow data appears to be shifted one year on the histogram graph. As an example to show the error, the histograms suggest that there were high flow years in 1968 and 1997. The high flow years were actually 1969 and 1998.

UNITED WATER CONSERVATION DISTRICT

Page 27. Local Groundwater. The planned production of 30,000 to 40,000 acre-feet per year from the Alluvial Aquifer and 7,500 to 15,000 acre-feet per year from the Saugus Formation, along with 11,000 to 30,000 acre-feet per year from the Saugus in dry years has yet to be implemented. The current development of a regional transient groundwater flow model for the East Sub-basin is for the expressed purpose of evaluating the potential impacts to the basin and surface water outflow into Ventura County, of this increased pumping. Irrespective of the modeling results, only real groundwater and surface water data can verify the influence of significantly increased pumping within the sub-basin; and

Page 29. Primary Element 2 – Monitoring and Management of Surface Water Flows and Quality. While imported SWP water no doubt contributes to the observed increased flow in the Santa Clara River at the Ventura County line, there exist additional explanations for a portion of the increased flow. Other considerations include:

1. Influence of the hydrologic cycle. The cumulative departure for precipitation was declining during the 1950s and first half of the 1960s. The cumulative departure improved significantly during the period of 1978 through 1985; and
2. The amount of Alluvial Aquifer pumping may influence flow at the Ventura County line. During the latter half of the 1960's and through the 1970s, groundwater pumping of the Alluvial Aquifer declined by 30%. Pumping during the 1980s was 30% lower than during the 1950s and early 1960s.

In this particular case, it would be very difficult to differentiate between the influence on streamflow from changes to groundwater pumping and the hydrologic changes.

If you have any questions about United Water's comments, please contact Steve Bachman at (805) 525-4431.

Sincerely,

Dana L. Wisehart

Dana L. Wisehart
General Manager

cc: BRRF
Lowell Preston, Ph.D., Ventura County Water Resources Division

SCOPE

Santa Clarita Organization for Planning and the Environment

TO PROMOTE, PROTECT AND PRESERVE THE ENVIRONMENT, ECOLOGY AND QUALITY OF LIFE IN THE SANTA CLARITA VALLEY

POST OFFICE BOX 1182, SANTA CLARITA, CA 91380

8-6-03

Castaic Lake Water Agency
27234 Bouquet Cyn Rd.
Santa Clarita, Ca. 91350
Faxed to 661 297 1611 Hard copy to follow via regular mail

Re: Comments on Ground Water Management Plan

Dear Sirs

Thank-you for the opportunity to comment on your plan. We are pleased that your agency has begun a ground water management plan in response to the community's concerns over the excessive use of ground water. This extensive pumping and lack of protection of re-charge areas has resulted in almost complete elimination of surface flows and summer ponding necessary to wildlife as well as causing water level drops in wells that have resulted in water quality and availability problems for small users.

General Areas of Concern

We regret that environmental organizations, small well owners, the City of Santa Clarita, the County of Los Angeles (watershed and flood control divisions), Regional Water Quality Control and other members of the community interested in water issues in our valley were not included on your advisory board. We believe that inclusion of these groups early on would have helped resolved some of the issues with your plan at an earlier stage. Including only the water companies, Newhall Land and Robinson Ranch effectively excluded many of the groups and individuals that have voiced strong concerns over your present actions. The water agencies have consistently excluded these groups from all water planning, including water supply reports and the Urban Water Management Plan process. We strongly suggest that a more inclusive committee be formed to include representatives of the environmental community and rural well owners who are now being affected by overdraft of the Santa Clara River.

We also note that there are no timelines for completion of any of the components of the plan. Without such timelines, it would seem that there is little real intention or commitment to follow through on the various parts of the plan.

The Land Use/Wellhead Protection Component of the Groundwater Management Plan

Perhaps the most significant outcome of a ground water management plan in the Santa Clarita Valley would be implementation of the portion of Section 10753 which requires review of land use plans and coordination with land use agencies. Your plan assigns this area to

"Secondary element 2", an indication that you do not intend to pay much attention to this important component.

The coordination of land use and water planning has been sadly lacking in the Santa Clarita Valley. A simple wellhead protection plan would help decision makers understand the potentially polluting impacts of certain land uses such as gas stations, auto repair shops, etc and how they could negatively affect our water supply. Instead, these uses are routinely permitted next to water supply wells.

Paving over of prime re-charge areas is allowed without a word of protest from the water agencies, even though such loss of recharge capacity will severely affect water availability. Recreational uses should be encouraged in recharge areas that will accommodate and perhaps even enhance water re-charge and thus increase water availability.

Newhall County Water District began a well head protection program and educational presentations with its ground water management plan in the mid 90's, but efforts to both educate the planners and protect re-charge and water supply wells have been stalled by the strong developer involvement with water agency decisions. This involvement has precluded advocacy of long term decisions that would protect water availability and water quality in favor of short term profits for development companies.

The ground water management plan should stress the importance of avoiding the concreting of tributaries when approving new land uses and require adequate set back from natural water courses to allow these blue line streams to remain in a natural state. This will enhance water re-charge (and thus, ensure water availability). It will also aid water quality because riparian vegetation absorbs many pollutants before they can enter the ground water system.

It is an indication of the myopic view of the water agencies that this plan states its number one goal to be "Development of Local Groundwater for Water Supply". There are many other uses of ground water and surface water which are important to the community. These include recreational and aesthetic values, biological value and the quality of the water supply. More pumping will result in diminution of all these other aspects of our ground water resource and ignore the strong protests and demands for their protection which are already being heard from many voices in the community.

Monitoring of Ground Water and Surface to Establish Safe Yield

Agricultural Water Usage is Overestimated

In its presentation, Luhdorff and Scalmanini revise the previous perennial yield estimate of the Santa Clara River by Richard Slade (perennial yield 32,600 AF, Hydrology of the Alluvial Sediments of the Santa Clara River, 1988, page 109) to approximately 40,000 AF. This revision is based in part on an average agricultural usage from the 1940s to the 1960s. We believe that these calculations are incorrect for three reasons.

1. No inclusion of recharge from agricultural run off was included in the usage calculations as was included in previous reports. Agricultural run-off was a substantial source of re-charge to the river that no longer exists, therefore not as much water is available for extraction.

2. Agricultural withdrawal was not metered, so water usage is merely an estimate based on crops and weather. It appears that estimates of withdrawals may have been over-stated.
3. Agricultural lands provided a source of recharge during wet years. Urbanization has paved over most of this area, so recharge is no longer occurring. This will reduce that amount of recharge to the river alluvium and thus reduce the amount available for extraction. (Slade, 1988, Hydrological Investigation of the Perennial Yield of the Alluvial Aquifer, page 88)

These evaluation errors have caused the water companies to believe that they can withdraw a higher amount of water than can actually occur without causing impacts to public trust matters and small well users.

Monitoring and Managing Surface Water Flows

Visual Historical Evidence has been ignored

There are numerous records and observations by long-time residents indicating that surface flow usually occurred year round. Ponding that harbored fish and amphibians (many of which are listed as threatened or endangered) in areas that did not support year round flow has also been attested to by local residents. The disappearance of year-round flows and ponding is an indication of overdraft of the alluvial system. The impacts to riparian life and water quality are substantial. A goal of returning or replacing these summer surface waters should be incorporated in your plan. Such replacement may help to avoid potential future litigation brought to enforce the Endangered Species Act.

Water Quality Monitoring

Water Pollution

We appreciate that the water agencies have finally admitted that 5 municipal wells are closed and that there is a concern that the pollution plume is moving in a westerly direction (Plan at page 32). It is very regrettable that these facts were not disclosed to decision makers over the past several years and, further, were even denied by representatives of the water agencies.

However, we believe it is imperative that this plan additionally include a disclosure of the current reduction in production capability due to pollution of the Saugus and alluvial aquifer by ammonium perchlorate. Continued pumping may extend the pollution plume and increase clean-up costs. It is important that the extent of the problem be honestly outlined for the public so that alternative remedies may be developed and discussed. Failure to disclose the extent of the pollution problem and its real impact may lead to serious water quality problems if the Saugus aquifer is relied upon for drought supply.

Conclusion

We submit the following recommendations:

1. We encourage CLWA to re-form its advisory committee to be inclusive of the community and other local agencies.

2. We suggest that the goals of the plan be re-ordered to place land use issues in a position of significance, and include recommendations from other agencies, organizations and individuals that might enhance water availability and water quality.
3. A time line must be established, financial commitment discussed, and responsibility assigned so that the water management goals will actually be attained.

Sincerely,

Pat Salcisbury

Cc: City of Santa Clarita
County of Los Angeles
Regional Water Quality Control Board
Local Newspapers

Sand Canyon Area Well Owners Association
c/o 27363 Sand Canyon Road
Santa Clarita, CA 91387-3632

August 8, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

RE. Groundwater Management Plan ("AB 3030 Plan")

Gentlemen:

This letter is in response to your letter of June 16, 2003 which solicited comments about the above plan to ensure that the general public has had the opportunity to provide input on this local effort to manage our community's groundwater resources.

We are pleased to respond to your request for public participation. As well using residents of the Sand Canyon area who are affected by ground water use and plans for future use of it, we feel that our interests are very much at stake in determining how our river and ground water is to be used.

Our first and foremost concerns are that both river and ground water is being extensively pumped and that recharge areas are not being adequately protected. Surface flows and summer ponds have virtually vanished from our vicinity. In 1997, the water level in four wells adjacent to Sand Canyon Creek stood at twelve feet. As of last month, those same wells' water level now stands at ninety-three feet.

Other general concerns include the lack of representation on your advisory board by rural well owners. While water companies and the Robinson Ranch Golf Course have their own interests in how our community's water resources are used, many small well users have an equally valid interest in seeing that our area's water resources are managed in an equitable fashion that ensures no entity's use will result in the deprivation of others.

Also, none of we Sand Canyon area small well users have been consulted during the creation of water supply reports or the Urban Water Management Plan, despite the fact we are being affected by an increasingly serious overdraft of the Santa Clara River. Including members of our group in a groundwater management committee will bring important stakeholders to the planning process. We have important data to present.

It is disappointing to note that the ground water management plan specifies no timelines or dates for executing and completing its phases. We question whether there is sincere intent to carry out the plan given the lack of work plan.

On a broader scale, we are deeply concerned about the plan's land use and wellhead protection sections. Section 10753 calls for a review of land us plans and coordination with land use agencies, as stipulated in secondary element 2 of the plan. A critically important aspect of effective ground water management, such coordination has not taken place to any meaningful extent in the Santa Clarita Valley, and more specifically, in the Sand Canyon area. We have noted with dismay that vital recharge areas have been built upon and paved over with no comment from any water agencies, despite an obvious impact on water availability for all water users, particularly small well holders.

While intelligently planned development is meant to result in well designed, livable communities where all inhabitants are assured of fair access to resources, we note that ongoing strong developer involvement with water agency decisions has led to the potential compromise of water availability and quality in exchange for near term profits for developers and increased tax revenues for local governments.

In the draft plan's sections that deal with ground water monitoring to establish a safe yield, we believe that estimates of agricultural water consumption are not accurate. In Richard Slade's 1988 perennial yield estimate of the Santa Clara River, he stated on page 109 that it was approximately 32,000 acre-feet. Yet Lahdroff and Scalmanini raise this estimate to 40,000 acre feet. They base their calculations on data measured for agricultural operations between the 1940's and 1960's.

Since our membership includes individuals who have farmed a large parcel in the Sand Canyon area from 1951, we feel qualified to comment on the above figures.

First, agricultural usage during the reference years was never metered. Usage during this period is estimated based on available crop reports (when they were recorded) and available weather data. A reading of withdrawal estimates raises a suspicion that they are overstated.

Second, the upward revision of Slade does not include agricultural runoff. Since agriculture in our area has virtually disappeared, it is no longer a contributing factor to aquifer recharge. Yet earlier estimates included agricultural runoff, a significant source of recharge.

Third, land in our area that previously was planted in both irrigated and dry land crops has now been paved over. During rainy years, farm fields were an important component of recharge, since rain soaked into them. Slade specifically mentions this reduction of extractable water on page 88 of his 1988 report.

Flawed calculations like these have caused water companies and other institutional users to think that they can extract more water than they can and should without adversely affecting small well users.

Primary element number two gives the appearance of an attempt to establish a commingled inter relationship between the Saugus Formation and the Santa Clara River. With a clearly defined bed and banks, the Santa Clara River has historically behaved as a river, and despite severe depletion from over pumping, still exhibits the dynamics of a river during episodes of precipitation. With our members holding rights of diversion from the State Water Resources Board, we strongly feel that any attempt to define the river in terms of percolating groundwater defies logic and the laws of physics.

Also, in the "Existing and Projected Water Supplies" section, the draft report states that "...it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that have historically been pumped, 30,000 to 40,000 afy from the Alluvium..."

As stated above, Slade's 1988 report clearly and unequivocally sets the upper pumping limit of the Santa Clara flow at 32,000 afy. By relying on generous overstatements and exaggerated potentials, a plan will go forward that will have serious negative impacts for small well users in the Sand Canyon area.

In primary element three, Determination of Basin Yield and Avoidance of Overdraft, we are concerned with the second paragraph's first sentence that states " ...there has not been any widespread, steady degradation of groundwater conditions that might be indicative of overdraft..."

Again in Primary Element 4, the second sentence asserts..."Both ranges of numbers are consistent with recent historical pumping that has not resulted in any indication of overdraft or other undesirable conditions." And in Primary Element 5, the third sentence further posits that ..."Groundwater pumping has remained within a range that has not caused any evidence of overdraft, or associated undesirable impacts..."

It is the direct and incontrovertible evidence of water levels in our own wells that presents us with a clear contradiction to this assertion. Based on members' records that cover a fifty-year span, the current water levels in our wells have reached an unprecedented low. We are left with inescapable evidence that large users pumping from the Santa Clara River have contributed to a cone of depression that is negatively affecting our small wells.

In addition, riparian conditions along the tributaries and main channel of the Santa Clara River reflect highly stressed, water deprived environments. In areas away from river feeder creeks, some heritage California Coastal Oaks (Quercus Agrifolia) have begun showing signs of water deprivation.

In a related matter, the proposed plan calls for identification of potential sources of contamination to assure water quality. When Robinson Ranch Golf Course was granted permission to open and operate, the city stipulated that water quality adjacent to and on the golf course be monitored and that regular reports about it be published. These reports have not been included in the draft plan, despite the fact that Robinson Ranch is a participant on the advisory committee for this draft plan. Pesticide, insecticide, fertilizer, and other volatile organic compounds are all possible runoff and plume contaminants that may be leaching from the golf course.

As members of your advisory committee, we would be glad to share with others the data from five decades of small well usage. We believe that recent developments, specifically in our area, have seriously lowered both the alluvial water levels to historic levels.

While modeling, projection, and prediction can yield abstract theories, we small well users must live with the consequences of miscalculation, however unintentional or inadvertent.

Small well holders are franchised, integral, entitled members of the water using community, and as such, must be included in the planning process associated with any groundwater management plan that is to be implemented in the Santa Clarita Valley.

Primary element nine specifies a MOU (Memorandum of Understanding) executed between the United Water Conservation District in Ventura County as an example of..."a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive (sic) plan..." While we laud all attempts to widen the base of data and participation in the planning process for water resources, we are disappointed that as stakeholders in the Eastern Sub basin of the Santa Clara River Valley, our interests are not being represented on the advisory committee that has been created to direct the groundwater management plan.

We ask to be included in the planning committee that is helping to shape the future of water use in our community.

Respectfully,

The Sand Canyon Area Well Owners Association
Robert and Jane Fleck
Eugene and Marylou Ruddell
Richard and Leslie Christensen
Shawn Clement
Joan Waldman

Friends of the Santa Clara River

[illegible] • (661) 296-4523

August 7, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350

Board of Directors

[illegible]

Affiliated Organizations

[illegible]

Re: Groundwater Management Plan

Dear Sirs,

Friends of the Santa Clara River submits the following comments on the June 2003 Draft Groundwater Management Plan (Plan).

We are disappointed and dismayed that the Plan sets as its primary goal the "Development of Local Groundwater for Water Supply". While providing adequate water supplies is an important objective, it would seem to us that the primary goal should be the long-term protection of local groundwater resources, including groundwater quality. Groundwater resources provide many benefits to the community, including those related to the biological and environmental health of the river corridor. Long-term protection, if implemented, should curtail the over-pumping of local aquifers which is currently occurring.

We are also concerned that water agencies, in general, have failed to weigh-in on the paving over of recharge areas in the Santa Clarita Valley. Loss of recharge could have very substantial impacts on future water availability. The Plan should emphasize that concreting of ephemeral tributary streams reduces recharge, and thus should be avoided. Adequate setbacks, or buffer zones, around major streams should be stressed - an item that is rarely adequately addressed in development projects.

The Plan advisory board is too narrowly constituted. The Regional Water Quality Control Board should be represented, as should environmental groups and county agencies working on watershed protection.

Thank you for the opportunity to comment.

Sincerely,

Ron Bottorff

Ron Bottorff, Chair

Attention: CLWA Directors August 8, 2003
RE: Comments on Ground Water Management Plan

FAX: (661) 297-1611

From: Henry Schultz
Phone: (661) 284-5613 or (805) 447-2863 (work) or FAX at (805) 480-1333
Email: hschultz@amgen.com henry50@pacbell.net
Three pages total

There follow 2 pages of comments on the water plan. If there are any questions I can be contacted at the above locations.

Henry Schultz
Chair, Santa Clarita Sierra Club Group

S 7 03

Castaic Lake Water Agency
27234 Bouquet Canyon Rd
Santa Clarita, CA 91350
FAX 661-297-1611

RE Ground Water Management Plan Comments

Dear Directors,

We appreciate the chance to comment on the ground water management plan. This plan has been a long time in the making. We hope that your response to concerned public input will make it a viable document. A few comments follow.

1. Based on the (too) long history of this plan, it is essential to include deadlines (with penalties for failure) for completion of the various components of the plan. Otherwise our water will just slip away.

2. There is no accounting for loss of groundwater from pollution such as perchlorates. As soon as the magnitude of the problem has been adequately determined, a realistic plan can then be implemented. As it stands right now, the numbers do not adequately represent the real water supply.

3. Loss of groundwater due to loss of percolation due to extensive development, which paves over permeable soil, is not considered. It is a continuous and cumulative impact on the water supply. More generally, the water plan must address coordination of land use with water necessities such as the preservation of water percolation basins and similar amenities.

4. Drought planning is inadequate in the plan. For example, if a water treatment plant is built then a certain number of acre ft of water can be reclaimed. Current planning would say that this is real water, which can be counted on. In a drought, not only do you lose primary water sources, but also the correspondine amount of reclaimed water, a double hit which must be accounted for in any realistic water plan.

5. The Sierra Club strongly supports an active river-monitoring program so that potential and existing water quality issues can be addressed in a timely manner. This must be an integral part of the plan. In lieu of the water agency producing reliable data, a citizen-monitoring program will have to be undertaken to assure the quality of our water.

6. The plan does not adequately discuss maintaining river and tributary habitats such as the biological unhealthy zones created from the Rio Vista Plant's outflow into the Santa Clara River. While there are green plants growing in the area, UCLA researchers have shown that it is barren of many insects which would normally be present in such an environment. This engenders a ripple effect in the biota.

7. Just as the City of Santa Clarita involves the public and other government and private agencies in its long range planning, CLWA should do the same with its water planning. People in the Santa Clarita Valley are just beginning to realize the importance and the fragility of their water supply. The time to start RMA planning is now.

Thanks for your kind attention.

Henry Schultz
Chair, Santa Clarita Sierra Club Group
21827 Parvin Dr
Santa Clarita, CA 91350
Henry50@pacbell.net
661-284-5513

Ed & Joan Dunn
15414 Rhododendron Dr
Canyon Country, CA 91387
August 8, 2003

Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

RE: Groundwater Management Plan ; AB 3030

Dear Sirs:

We are pleased to have the opportunity to comment on your draft AB 3030 Plan. Enclosed please find copies of individual pages of this plan and associated comments for these pages.

We are disappointed that the writing of this plan appears to be following the same path of the UWMP. We are also displeased there has not been an attempt to hold more public meetings prior to this draft release. As required in AB 134, when has the agency met regularly with the advisory council to consult on this plan? What was the frequency of the meetings and how many were there?

We are quite interested in an AB 3030 Plan and would appreciated this draft be made into an honest and truthful document, allowing it to go ahead on a timely schedule without challenges and delays.

Respectfully submitted,

Ed and Joan Dunn

Enclosures: 3 Exhibits, 16 draft groundwater pages and 16 associated comment pages

Top of page:
Basin objective "manage groundwater levels and discharge to the Santa Clara River, at the west end of the basin"?
Wording should include "the entire basin".

Bottom paragraph, last sentence.
The plan is replenishing the aquifer with WITH sufficient water"

and effects, e.g. chronic water level decline, loss of groundwater storage, onset of land subsidence, groundwater quality degradation, a corresponding basin objective is to manage groundwater levels and associated groundwater discharge to the Santa Clara River at the west end of the basin, and thus not adversely impact surface and groundwater discharges to the downstream basin(s).

3. Preservation of groundwater quality for beneficial use in the basin, and for beneficial use of surface water and groundwater discharges from the basin. Included in this management goal will be the active characterization and solution of any groundwater contamination problems, through cooperation with responsible parties or through independent action if timely action by responsible parties is not forthcoming and the preceding management objectives are thereby impacted or constrained.

4. Preservation of interrelated surface water resources. Included in this management goal will be the maintenance of appropriate surface water flows and non-degradation of surface water quality as a result of managing groundwater conditions to meet the other management goals for the basin.

Quantitatively, the preceding goals translate into general preservation of groundwater levels and quality in the Alluvial aquifer system consistent with the last 30 years, including fluctuations through seasonal demands and local hydrologic variations (wet and dry periods). As discussed in more detail in the next chapter, the hydrogeologic setting in the area has resulted in smaller Alluvial groundwater level fluctuations toward the western half of the basin (generally west of Bouquet Canyon), and larger fluctuations to the east. However, largely due in part to the importation of supplemental surface water over the last 20 years, and the integrated or conjunctive use of that supplemental water with local groundwater, there has been no chronic decline in groundwater levels or storage. A continuation of such basin conditions, possibly complemented by management actions to decrease the historical water level fluctuations in the eastern part of the basin, will accomplish the second basin objective, continued avoidance of overdraft as has been the ongoing historical condition in the basin, while continuing to utilize local groundwater to meet part of projected water requirements, the latter being the first management objective for the basin. Corresponding management actions to sustain recharge and net overdraft groundwater storage will accomplish the third basin objective by replenishing the aquifer system with sufficient water to sustain what has been generally consistent quality of groundwater on a long-term basis.

We question Stokes 1986 and 2002 Report stating the Alluvium has the capacity of 240,000 acre feet.

III. Groundwater Basin Conditions

Occurrence of Groundwater

Groundwater in the Santa Clara River Valley East groundwater subbasin occurs in two aquifer systems, the Alluvium associated with the Santa Clara River and its tributaries, and the Saugus Formation. There are also some scattered outcrops of Terrace deposits in the basin that likely have the capacity to contain limited amounts of groundwater; however, since these deposits are located in limited areas that are situated at elevations above the regional water table and are also of limited thickness, they are of no practical significance as aquifers and have consequently not been developed for water supply.

The Alluvial aquifer system, of Quaternary to Holocene (Recent) geologic age, consists primarily of stream channel and flood plain deposits of the Santa Clara River and its tributaries. The Alluvium is deepest along the center of the present river channel, with a maximum thickness of about 200 feet near the area known as Saugus. It thins toward the flanks of the adjoining hills and toward the eastern and western boundaries of the basin and, at the tributaries, becomes a mere veneer in their upper reaches. The spatial extent of the Alluvium throughout the basin is illustrated in Figure 3-1.

The Alluvium is the most permeable of the local aquifer units. Based on well yields and aquifer testing, transmissivity values in the range of 50,000 to 500,000 gallons per day per foot (gpd ft) have been reported for the Alluvium, with the higher values where the Alluvium is thickest in the center of the valley and generally west of Bouquet Canyon (Slade 1986 & 2002). The amount of groundwater in storage can vary considerably because of the effects of recharge, discharge, and pumping from the aquifer. The maximum storage capacity of the Alluvium has been estimated to be about 240,000 acre-feet (af) (Slade, 1986 & 2002).

The Saugus Formation, of Pliocene to Pleistocene geologic age, has traditionally been divided into two stratigraphic units, the lowermost, geologically older Sunshine Ranch member, which is of mixed marine to terrestrial (non-marine) origin; and the overlying, of upper, portion of the Formation which is entirely terrestrial in origin. The Sunshine Ranch Member of the Saugus Formation has a maximum thickness of about 3,000 to 3,500 feet in the central part of the valley,

Top, bottom of first paragraph
The plan states "the most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions".

It should be stated that the SWP water was INTERRUPTED for approximately 6 months. See Feb. 27,1991 Daily News newspaper article " Santa Clarita will turn to wells as state water supplies dry up" . As stated in the article, the SWP water processing plant was shut down. Exhibit A.

"Officials say state's water delivery system inadequate". See Exhibit B

Since 1980, total pumpage from the Saugus Formation has ranged between about 3,850 afy and nearly 15,000 afy, average pumpage over that period has been about 6,900 afy. The great majority of pumpage from the Saugus is for municipal supply (nearly 6,700 afy, or 92 percent, on average). For comparison, although historical Saugus pumping records prior to 1980 are limited, there appears to have been essentially no pumping from the Saugus prior to 1960 (on the order of about 100 af in most years, beginning in 1948), and some increased pumping for agricultural water supply beginning in about 1962 (about 900 af). The largest amount of agricultural pumping from the Saugus was during the mid-1960's, when annual Saugus pumpage was about 3,000 af. Agricultural pumping from the Saugus declined to near zero by the late 1970's, but has been generally in the 500 to 1,000 afy range since 1982. There was no Saugus pumpage for municipal supply in the early 1960's; limited data suggests that municipal pumping from the Saugus began in the 1970's, and reached nearly 5,000 afy by 1980-81. The most significant period of Saugus pumpage was 1991 through 1994, when pumpage ranged from 10,600 afy to nearly 15,000 afy and averaged over 12,000 afy, during which time SWP water deliveries were reduced at the end of extended drought conditions.

Groundwater Monitoring Network and Program

There is no formal groundwater monitoring network of wells for groundwater level measurements and/or groundwater quality sampling in the basin. Consequently, one component of this Plan is to formalize both a network of wells for groundwater monitoring and a program for water level measurements, water quality sampling, and other pertinent groundwater data collection (Primary Plan Element 2). Despite the lack of an existing formal groundwater monitoring network and program, however, there is a significant amount of historical groundwater data, some of which dates back into the 1940's, on which to base reasonable assessments of groundwater conditions in the basin. For example, groundwater level measurements have been made over varying periods of record in a total of 154 wells, mostly alluvial wells, throughout the basin. Similarly, groundwater quality data, consisting of varying numbers of constituents analyzed, are available from some wells, but a much smaller number than is the case for groundwater level data. These data, along with direct measurements or indirect estimates of pumpage, primarily from high capacity municipal and agricultural wells, allow for analysis of groundwater basin conditions, as discussed in this Plan, and also provide the bases on which a groundwater model can be developed (Primary Plan Element 3) and on which various management criteria such as operational yield, baseline groundwater quality, etc. can be determined (Primary Plan Elements 3 to etc.).

Middle paragraph.
"Exceedence of action level of perchlorate".
Newhall County Water District perchlorate level was 19 micro-grams per liter and Santa Clarita Water Co. was 24 or more micro-grams per liter.
The statement that more two wells; exceeded 18 micro-grams per liter is false. See Exhibit C

higher quality (low TDS) water and dry periods have resulted in the notable declines in water levels described above, with a corresponding increase in TDS (and individual component constituents) in the deeper parts of the Alluvium.

Due to a much more limited number of wells and the limited spatial extent of groundwater development in the Saugus Formation, long-term Saugus groundwater quality data are not sufficiently extensive to permit any sort of basin-wide analysis or assessment of pumping-related impacts on quality. Based on the most complete historical record, over the last 35 years, however, groundwater quality in the Saugus has remained generally constant, and the Saugus Formation is, on a groundwater quality basis, a viable agricultural and municipal water supply.

The most notable groundwater quality issue in the basin centers around the detection and impact of perchlorate on several Saugus wells and one Alluvial well in the central part of the basin near the location of the former Whittaker Bermite facility, which is immediately southeast of the confluence of the main Santa Clara River and its South Fork tributary. In 1997, routine water quality sampling detected the presence of perchlorate in four municipal wells completed in the Saugus Formation (CLWA Santa Clarita Water Division Saugus Wells 1 and 2, Newhall County Water District Well 21, and Valencia Water Company Well 157). While there remains no primary or secondary drinking water standard for perchlorate, and although the detected concentrations of perchlorate in the Saugus wells did not exceed the Action Level established by the State Department of Health Services at that time (18 ug/), all those wells were inactivated by their respective owners after detection of perchlorate; those wells remain out of municipal water supply service to date.

More recently, in late 2002, routine water quality sampling of Alluvial wells detected perchlorate in one of them (CLWA Santa Clarita Water Division Stadium Well) at a concentration which slightly exceeds the current Action Level (4 ug/). This well has also been voluntarily inactivated, and thus remains removed from municipal water supply service.

This Plan, notably through Primary Plan Elements 1, 6 and 8, is intended to incorporate both short-term and long-term groundwater quality considerations in the management of the groundwater basin in order to formalize groundwater quality monitoring and assessment, to investigate and correct groundwater contamination problems, and to preserve or improve groundwater quality for ongoing water supply as well as for avoiding adverse water quality impacts on interconnected surface waters.

Paragraph #2.
The statement of this paragraph is misleading. The correction should show "lack of service wells significantly reduced groundwater capacity for existing groundwater supplies, so much so, that a substantial increase of state water use, has been initiated".

Areas of Concern and Identified Problems

A number of concerns have been expressed about groundwater conditions in the basin. While not all of the expressed concerns have been substantiated, they are listed and briefly discussed here, and they are addressed in the management objectives for the basin, intended to be achieved via implementation of the various primary and secondary elements in this Plan.

The most notable concern in the basin, at least at present, is the impact of perchlorate contamination on a number of municipal water supply wells, thus affecting the available pumping capacity from some municipal wells. While perchlorate impacts on a few wells do not preclude the ability to pump groundwater in accordance with existing water supply plans, activities to characterize the contamination, and ultimately to control it and treat it, have been initiated in order to return the impacted wells' pumping capacity to water supply service. Primary Element 8 is included in this Plan to formalize the addressing of groundwater contamination issues in the basin.

Concern has also been expressed that groundwater development in the basin will adversely impact the quantity and/or quality of surface flows leaving the basin via the Santa Clara River. Such concern extends to the potential impact on groundwater in the next downstream basin, the Piru Basin in Ventura County. While there are no established provisions regarding surface flows out of the Santa Clara River Valley East subbasin, Primary Element 3 is included in this Plan to formally address the monitoring and management of surface water flows and quality within, and flowing out of, the basin. Some work is already ongoing related to this area of concern via a Memorandum of Understanding (MOU) among CLWA, other purveyors within CLWA's service area, and United Water Conservation District, which manages surface water and groundwater in the downstream basins on the Santa Clara River in Ventura County. That cooperative effort, which is incorporated into this Plan via Primary Element 9, includes integration of databases, development of a numerical groundwater flow model, and interpretation and reporting on surface water and groundwater conditions.

A third expressed concern in the basin, although never substantiated, is that groundwater is already overdrafted. Associated with that expressed concern is a related issue that reliance on overdrafted groundwater results in an overstated water supply in the basin. As discussed earlier in this Section, long-term groundwater levels, storage, and quality all indicate a lack of overdraft. As also discussed above, the importation of supplemental surface water over the last 22 years,

Plan, page #19 Dunn, page 7

References to the Urban Water Management Plan (UWMP).
The UWMP of 2000 contains incorrect information and is under legal attacks for corrections. The UWMP does not address the total interruption of the state water supply in the event of drought, earthquake, or Delta problems. It is suggested that the UWMP not be utilized or referred to until its contents have been corrected to reflect accurate and truthful information.

32,000 afy. The history and trend of municipal groundwater use in the basin are illustrated in Figure 4-1.

As noted above, until 1980, all water supply in the basin was from local groundwater. Imported surface water was first available from the State Water Project (SWP) in 1980, when a total of 1,125 af were imported into the basin. Since then, importations of SWP water have increased in two separate steady trends, interrupted by a notable decrease at the end of, and following, the 1987-1992 drought period: a steady increase beginning in 1980, to about 21,600 afy in each of 1989 and 1990, followed by a substantial decrease, to less than 8,000 af in 1991, and then a steady increase back to about 21,000 afy in 1997 and 1998, followed by further increases to about 35,000 af in 2001. The history and trends in importation of SWP water to the basin are illustrated in Figure 4-2, which also illustrates the historical trends in groundwater pumping and total water use in the basin since the importation of SWP water.

In the context of this groundwater management plan, the historical utilization of imported SWP water to augment local groundwater represents the initiation of conjunctive use of surface water and groundwater supplies, a groundwater management principle which is intended to be continued via adoption of Primary Element 5 of this plan.

Projected Water Requirements

Detailed projections of municipal water requirements were most recently completed as part of the Urban Water Management Plan prepared by CLWA and the municipal water purveyors (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) in 2000. Those projections, which are forecast for a 20 year period, also recognize an ongoing but decreasing agricultural water demand over the same period, from about 15,000 afy in 2005 to about 7,000 afy by 2020. The municipal water demand projections in the Urban Water Management Plan were derived from utilization and interpretation of multiple projection methods, including Per-Capita Water-Use applied to population projections; extrapolation of number of service connections (using two different projection techniques, an average rate and an accelerated rate projection) applied to the rate of service connection additions since 1990; and land use projections combined with unit water use factors on multiple land use categories (urban, including residential, commercial, industrial and recreational; irrigated agricultural; and vacant and open space). The water demand projections in the Urban Water Management Plan also considered weather effects (variations due to hot-dry years vs. cool-wet years) and conservation

References to the Urban Water Management Plan (UWMP)
The UWMP of 2010 contains incorrect information and is under legal attack for correction. The UWMP does not address the total interruption of the state water supply in the event of drought, earthquake, or Delta problems. It is suggested that the UWMP not be utilized or referred to until its contents have been corrected to reflect accurate and truthful information.

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Top
"Local Groundwater" The statement is made: "That for all practical purposes the Saugus Aquifer underlies the entire CLWA service area". That statement is absolutely false! It does not!
Please correct.

Bottom paragraph:
Supplemental (SWP) Surface Water

CLWA's SWP Water Entitlement
The CLWA, indeed, has purchased water in addition to the original Table A entitlement, but cannot obtain contractual agreement to transport the additional water to the Santa Clarita Valley

water and possibly some water supply derived from water transfers and desalination outside the basin.

Local Groundwater - Local groundwater has historically been developed from the two aquifers that comprise the groundwater basin, the Alluvium that underlies the Santa Clara River and its tributaries, and the Saugus Formation that underlies, for all practical purposes, the entire CLWA service area. Those two aquifers, and the groundwater basin they comprise, are the focus of this groundwater management plan. Based on historical experience and observation of groundwater conditions, it is currently expected that ongoing utilization of local groundwater will continue to be in amounts that are generally comparable to what has historically been pumped, 30,000 to 40,000 afy from the Alluvium and 7,500 to 15,000 afy from the Saugus Formation. It is also expected that there is some additional development potential in the Saugus Formation, in the range of 10,000 to 20,000 af which might be intermittently extracted during one or more dry years when supplemental imported water might be reduced. Ultimately, it is expected that local groundwater will continue to be a component of water supply, at appropriate production levels in both aquifers, in the basin. The intent of this groundwater management plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, i.e. avoidance of overdraft (Primary Plan Element 3), no degradation of quality (Primary Plan Element 6), no adverse impacts to surface waters (Primary Plan Element 2), all via continuation of conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Primary Plan Element 5) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Primary Plan Elements 1 and 2).

Supplemental (SWP) Surface Water - CLWA has a contractual Table A amount of 95,200 af of water from the SWP. CLWA's original contract, signed in 1963, was for 23,000 af, that Table A amount was later increased to 41,500 af. In 1988, CLWA purchased a Table A amount of 12,700 af from Devil's Den Water District, and it acquired another Table A amount of 41,000 af in 1995 from Kern County Water Agency and its member district, the Wheeler Ridge-Maricopa Water Storage District. There is ongoing CEQA-related litigation over the most recent acquisition of the additional SWP Table A amount, the 41,000 af acquired from Kern County Water Agency and Wheeler Ridge-Maricopa WSD. However, there has been no invalidation of the completed agreement to transfer the 41,000 af Table A amount to CLWA, and current water supply planning includes that Table A amount as CLWA corrects the CEQA technicality by preparing a new EIR to address the environmental consequences of the transfer.

Tap:
Recycled Water

It should be noted CLWA's planned recycle water program is and has been for one private business only. No public agency is receiving or is planned to receive recycled water from CLWA.

Recycled Water - In 1993, CLWA prepared a draft Recycled Water System Master Plan that outlined a multi-phase program to integrate recycled water into the overall water supply system in the basin. Construction has begun on Phase I of that project, which will deliver approximately 1,700 afy, and deliveries are expected to begin in 2003. Overall, recycled water is expected to ultimately reclaim up to 17,000 afy of treated waste water suitable for irrigation use on golf courses, landscaping, and other non-potable uses.

Plan, page #25 Dunn, page 70

Top
Number 7 should read: Valley wide integration of recycled water.

Middle
Secondary (Potential Elements) Item #2 Change to: Involvement in land use planning per Water Code 10753.7 (f)

4. Development of Regular and Dry Year/Emergency Water Supply
5. Continuation of Conjunctive Use Operations
    - active and passive groundwater recharge
6. Long Term Salinity Management
7. Integration of Recycled Water
8. Identification and Mitigation of Soil and Groundwater Contamination
    - involvement with other local agencies in investigation, cleanup, and closure
9. Development and Continuation of Local, State and Federal Agency Relationships
10. Groundwater Management Reports

Secondary (Potential) Elements

1. Continuation of Public Education and Water Conservation Programs
2. Identification and Management of Recharge Areas and Wellhead Protection Areas
    - involvement in land use planning process
3. Identification of Well Construction Abandonment, and Destruction Policies
    - water quality protection
    - manage vertical distribution of pumpage
4. Provisions to Update the Groundwater Management Plan

Primary Element 1 - Monitoring of Groundwater Levels, Quality, and Production

Prior to 1980, all water supply in the Upper Santa Clara River Area was developed from local groundwater; since 1980, imported surface water has become an increasing component of overall water supply in the area, but groundwater continues to meet all agricultural water demand and a significant part of municipal water demand. As a result of the long term development and use of groundwater in the area, there is a fairly substantial amount of historical groundwater level data, and a useful amount of groundwater quality data, and groundwater pumping data that has been collected in the basin. All the available historical groundwater level, quality, and pumping data have been organized into a computerized data base for the Upper Santa Clara River Area. That data base, while separate, has been coordinated with an equivalent data base maintained by United Water Conservation District for the downstream basins on the Santa Clara River. The intent of database coordination has been to facilitate interpretation and reporting on groundwater and other water resources related issues by the respective agencies overlying the various basins along the River.

Bottom:
As stated earlier the UWMP is inaccurate and under legal attack and not certified by the courts.
Primary Element 4 – Development of Regular and Dry Year Emergency Water Supply

40,000 acre feet from the alluvium and 15,000 a f from the Sangers is optimistic.
We strongly suggest developing an emergency plan for an extended interruption of the state water project. How many times must we ask for such an obvious safeguard!

conditions (and associated fluctuations in recharge and pumping). Such fluctuations are typical of groundwater basin conditions in any conjunctive use setting, such as in this basin: groundwater is utilized from storage during dry years, or dry periods, and that storage is replenished during alternate wet years, or periods. The observation of these historical groundwater conditions, in combination with knowledge of pumpage from both the Alluvial and Saugus Aquifers, has led to current operational practices as well as general expectations regarding the approximate yield of the local groundwater system as discussed in this plan.

While historical operating experience, complemented by observed groundwater conditions, is an appropriate basis for generally planning for available groundwater supplies, it is possible and appropriate to more precisely analyze the basin to determine values or ranges of yield under varying hydrologic conditions, and to assess the impacts of various management actions that might be implemented in the basin. The MOU process described in Primary Element 9 of this Plan includes the development of a numerical groundwater flow model which is intended to be utilized for determination of the yield of the basin under existing land use and under existing groundwater and surface water development conditions. It is also expected to be used for implementation of this Plan Element in order to assess the yield of the basin under future land use conditions as well as future ranges of surface water importation, groundwater development, and recycled water use through varying hydrologic conditions, i.e. wet and dry periods that affect the availability of imported surface water.

The ultimate intent of this Plan Element is to develop an understanding and quantification of the yield of the basin, under varying hydrologic conditions and developing local cultural conditions, in order that groundwater development and use be managed in such a way to meet an appropriate fraction of total water demand while avoiding levels of groundwater use that would result in overdraft conditions. Thus, implementation of this Plan Element is essential to accomplishing the first and second management objectives (goals) for the basin.

Primary Element 4 - Development of Regular and Dry Year/Emergency Water Supply

The most recent updated Urban Water Management Plan (UWMP, December 2010) prepared by CLWA and the other purveyors in the basin (Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company) includes plans to develop 30,000 to 40,000 acre-feet per year (afy) from the Alluvial aquifer and 7,500 to 15,000 afy from the Saugus Formation in average normal years. Both ranges of numbers are consistent with recent historical pumping that

The SWP water received in 1991 is erroneous. The chart indicates 8,000 a.f. It is incorrect. CVWA only received 10% of its then allocation 54, 200 a.f. The 10% was received in January and the plant shut down in March. See Exhibit A. It should be noted that this is a state water project interruption for months, not a reduction.

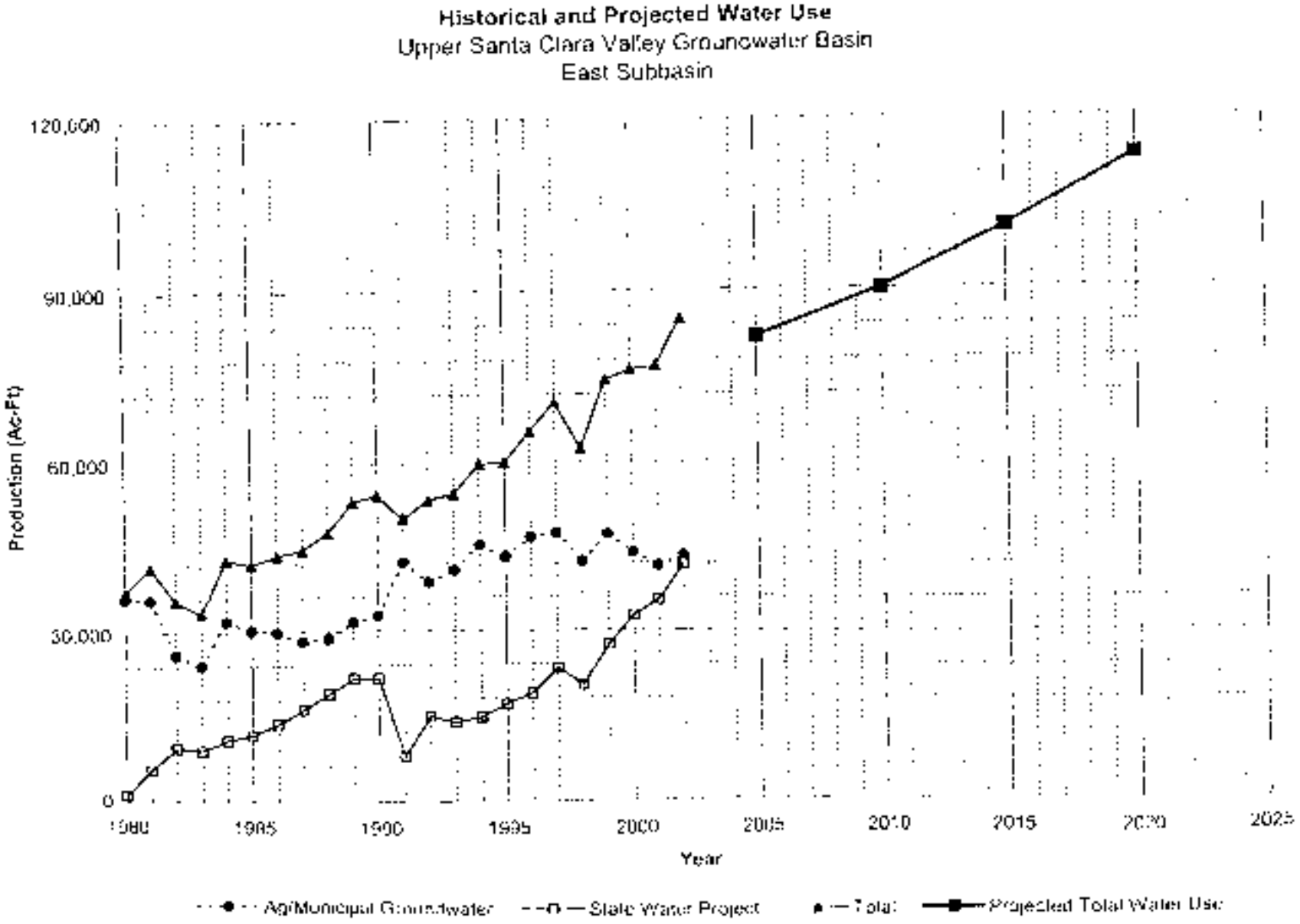

Historical and Projected Water Use
Upper Santa Clara Valley Groundwater Basin
East Subbasin
120,000
90,000
60,000
30,000
0
Production (Ac-Ft)
1980
1985
1990
1995
2000
2005
2010
2015
2020
2025
Year
Ag/Municipal Groundwater
State Water Project
Total
Projected Total Water Use

Figure 5-4

Plan. page #30 District page 13

Top paragraph:

There is no mention what the folks can do if groundwater cannot meet demand and the supplemental water is not there for an extended period of time. Please develop a plan to solve this most serious occurance.

Conjunctive use of local groundwater and imported surface water will continue to be a key element in meeting all the goals for the basin, most notably utilizing groundwater for water supply without overdrafting the basin. Historical experience with groundwater pumping and aquifer response to varying hydrologic conditions has shown that the groundwater basin can support notable variations in pumping during wet and dry periods, but it cannot support continuous pumping at rates high enough to meet total local water demands. Thus, utilization of imported surface water in conjunction with local groundwater will be essential to the management of groundwater for water supply without overdrafting that resource.

As part of conjunctively using surface water and groundwater, it is recognized that, particularly when the surface water supply is imported from the State Water Project, there will be variations in the amount of available surface water supply from year to year. Similarly, there are expected to be variations in local groundwater conditions as a function of local hydrologic conditions which affect, among other things, the natural recharge to the groundwater basin from year to year. In the case of this basin, local (Southern California) hydrology which affects local groundwater conditions may not necessarily be the same as the hydrology in a distant (Northern California) location that directly affects the availability of supplemental, imported surface water in any given year. Thus, conjunctive use management is challenging, but is notably important to ensure that the groundwater basin is maintained to meet a regular component of water supply and to also be able to meet a larger component of water supply during "dry periods" that affect supplemental surface water availability. Conjunctive use management is similarly important to ensure that local groundwater can be replenished, via reduced pumping and or as a result of wetter local hydrologic conditions, during periods of wet/normal surface water availability. In light of all the preceding, implementation of this Plan Element is essential to accomplishing all the management objectives (goals) for the basin.

Primary Element 6 - Long Term Salinity Management

In general, groundwater quality in the basin is such that groundwater supplies meet standards for beneficial use in the basin, most of which now is for municipal (domestic) use but some of which remains for agricultural and some other irrigation (non-domestic) use. There also have been no notable historical trends of groundwater quality degradation in the basin over time. However, a number of geologic and hydrologic factors suggest that observations and interpretation of groundwater quality warrant some focus to ensure long-term preservation of groundwater quality. Notable among those geologic and hydrologic factors are: 1) the largely "closed" geologic nature

Bottom of page:

It appears the entire paragraph is false. There is no knowledge of such meetings occurring.

Newhall County Water District, Los Angeles County Waterworks District No. 36, Valencia Water Company, and its own Santa Clarita Water Division. As such, CLWA has a historical and ongoing working relationship with all those local agencies, as well as with other local groundwater pumpers, to manage water supplies in order to effectively meet water demands within the available yields of imported surface water and local groundwater. In fact, the Advisory Council convened to assist in the preparation of this Plan is comprised representatives of all the local water purveyors and significant groundwater pumpers.

A local MOU process among CLWA, other purveyors within CLWA's service area, and United Water Conservation District in neighboring Ventura County is a classic illustration of a local agency relationship that has produced the beginnings of local groundwater management, now embodied in this comprehensive plan, most notably in Primary Elements 1 through 5. In 2001, out of a willingness to seek opportunities to work together and develop programs that mutually benefit the region as well as their individual communities, those agencies prepared and executed a Memorandum of Understanding (the MOU) that initiated a collaborative and integrated approach to several of the aspects of water resource management that are now included in this Plan. United WCD manages surface water and groundwater resources in seven groundwater basins, all located in Ventura County, downstream of the East Subbasin of the Santa Clara River Valley that is the focus of this Plan. United is thus a logical partner in the cooperation of management efforts to accomplish the objectives (goals) for this basin, particularly as they relate to preservation of surface water resources that flow through the respective basins. As a result of that MOU, the cooperating agencies have integrated their database management efforts (part of Primary Elements 1 and 2 of this Plan), have initiated the development of a numerical groundwater flow model (for utilization in Primary Elements 3, 4 and 5 of this Plan), and are continuing to prepare reports on the status of basin conditions, as well as on geologic and hydrologic aspects of the overall stream-aquifer system.

A local extension of the interaction among CLWA, the retail water purveyors, and United is an ongoing working relationship with the City of Santa Clarita. CLWA and the municipal purveyors meet regularly with City staff and also present water supply conditions via study sessions with the City Council on a regular basis. It is expected that the implementation of this Plan will result in the availability of a broader range of information transfer with the City relative to the existing and future water supply to its residents.

This Primary Element is included in this Plan to formalize the historical local and state agency

Middle:

Primary Element 10-Groundwater Management Reports
These secretly created reports contain erroneous numbers to overstate supply and understate demand. The creators meet secretly, allow no public participation or oversight and meet without authority or sanction from any public agency. The meetings are held secretly and without benefit of the Brown Act. Since these reports are created with no public oversight, do not appear to have credibility, and usually are not signed by anyone, they should not be included as part of an AB3030 groundwater management plan. It is time to form an official joint powers authority between the purveyors and other participating parties

working relationships as part of comprehensively managing local groundwater, in concert with imported surface water and local recycled water, to accomplish all the management objectives (goals) for the basin.

Primary Element 10 - Groundwater Management Reports

As briefly described in the Introduction of this Plan, local groundwater management planning already includes, among several other activities, analysis of groundwater conditions and preparation of annual reports on groundwater and all other aspects of water resources and water supplies in the Santa Clara River Valley East ground water basin. In addition, recently formalized cooperative work with neighboring United Water Conservation District includes both regular reporting on the status of groundwater conditions and specific reporting on geologic and hydrologic aspects of the overall stream-aquifer system. For example, documentation of the numerical groundwater modeling work currently in progress is expected to be the first of the latter reports in the next year.

Beginning in 1998, CLWA and the retail water purveyors in the basin have prepared a series of annual reports, known locally as the Water Report, to describe all aspects of water supply and water resource conditions in the basin. That report provides current information to local City and County land use agencies, and to other interested parties, about current water requirements, use of groundwater and treated imported surface water to meet those water requirements, groundwater conditions (pumping, groundwater levels and quality, etc.), local surface water conditions, the status of imported surface water supplies including details of delivered SWP water in the reported year as well as an up-to-date summary of available imported SWP water for the next year, a short-term projection of water requirements in the next year, and other appropriate details about water requirements and supplies such as, for example, the status of introducing recycled water as a component of non-potable water supply.

In light of the frequency and comprehensive nature of the annual Water Reports, and also in light of the planned preparation of more detailed technical reports on various aspects of the basin as appropriate, the continued preparation of those reports will serve as regular and complete reporting on all aspects of this groundwater management plan.

(Not much info on this page – CLWA constantly preaches conservation but continually sells more and more water. CLWA should provide the public with an accounting of the water CLWA is conserving.

Secondary Element 1 - Continuation of Public Education and Water Conservation Programs

CLWA has provided water conservation and public education programs that will continue and expand as a complement to and an element of this groundwater management plan. The expansion of water conservation will largely stem from CLWA's having signed the "Memorandum of Understanding Regarding Water Conservation in California" (Urban MOU) in 2002, which made CLWA a wholesaler member of the California Urban Water Conservation Council. CLWA has thus committed to implementation of cost-effective water conservation measures known as Best Management Practices (BMPs) that are included in the Urban MOU and are intended to reduce California's long-term urban water demands. The BMPs have been incorporated into the water demand management measures section of the Urban Water Management Planning Act.

Water conservation and related public education measures have generally been developed in California to achieve the following goals:

meet legal mandates
- reduce average annual potable water demands
- reduce sewer flows
- reduce water demands during peak seasons
meet drought restrictions.

As a wholesaler of imported surface water CLWA has implemented the following BMPs for several years prior to signing the MOU:

distribution system water audits, leak detection and repair
public information
school education
- wholesale agency assistance ?
- conservation pricing ?
conservation coordinator. ?

Top:

(Not much truth here either.) Mostly deception. The UWMP doesn't exist for the reasons mentioned earlier. The UWMP must not be considered here.

As a signatory to the MOU, CLWA's water conservation and public education program will expand to include the following BMPs found to be locally cost-effective, as detailed in the 2000 Urban Water Management Plan for CLWA and the Santa Clarita Valley retail purveyors.

- water survey programs for single-family residential and multi-family residential programs
- residential plumbing retrofits
  metering with commodity rates for all new connections and retrofit of existing connections
- large landscape conservation programs and incentives
- high-efficiency washing machine rebate programs (when also provided by local energy providers or wastewater utilities)
- conservation programs for commercial, industrial, and institutional accounts
- wholesale agency programs to financially or otherwise support water conservation efforts by retailers (this measure will be expanded)
  residential ultra-low-flow toilet replacement program.

This Primary Element, while identical to independent CLWA efforts in water conservation and public education, is incorporated in this Plan to complement other Plan elements, and to move toward accomplishment of all management objectives (goals) for the groundwater basin.

Secondary Element 2 - Identification and Management of Recharge Areas and Wellhead Protection Areas

The 1986 Amendments to the federal Safe Drinking Water Act (SDWA) established a new Wellhead Protection Program (WPP) to protect groundwater that supplies drinking water wells for public water systems. Each state was required to prepare a WPP and submit it to the USEPA by June 19, 1989. However, California did not develop an active state-wide Wellhead Protection Program at that time. Subsequently, in 1996, reauthorization of the SDWA established a related program called the Source Water Assessment Program. In 1999, the California Department of Health Services (DHS) Division of Drinking Water and Environmental Management developed its Drinking Water Source Assessment Program (DWSAP), and EPA approved it. The overall objective of the DWSAP is to ensure that the quality of drinking water sources is protected.

As discussed in Section 3 of this Plan, the potential groundwater management plan component

EXHIBIT A

Suppliers driven into the ground

Drought forces area to rely on well water

2-27-91

By Kimberly Heinrichs
Daily News Staff Writer

SANTA CLARITA — The state is expected to stop water deliveries March 15 in the Santa Clarita Valley, forcing the area to rely on ground water as California's worst drought on record continues, officials said Tuesday.

The Castaic Lake Water Agency, which treats, stores and distributes state water to local purveyors, will close its plant after the last of the imported water arrives, agency General Manager Robert Sagehorn said.

Related story:
■ Conservation law gets OK. Page 4

"For all substantial purposes we're shutting the plant down on March 15," he said, adding, "No one's going to go bone dry over this."

Local water suppliers still will pump water from the Santa Clarita Valley's extensive network of wells, he said.

The state Department of Water Resources told Sagehorn on Saturday that the expected cut of 50 percent of the agency's water supply has been increased to 90 percent as the drought continues its fifth year. The agency will have received 10 percent of this year's water allocation by the middle of March, Sagehorn said.

Of the four purveyors receiving state water from the Castaic Lake agency, only the Los Angeles County Waterworks District No. 36 -- which serves Val Verde

See WATER / Pg. 2

Santa Clarita will turn to wells as state water supplies dry up

2-27-91 DN.

WATER / From Page 1

and Hasley Canyon -- does not have a ground-water supply.

The county agency has drilled a well about 1,000 feet northwest of the intersection of Hasley Canyon and Del Valle roads that it had planned on using in about a year after building a 250,000-gallon storage tank, Assistant Deputy Director Gary Hartley said. However, with the new cutback, the county is hurriedly seeking permission from several property owners to run a temporary pipeline from that well to customers, Hartley said.

County officials hope to have the pipeline operating in about six weeks, he said. Meanwhile, the county is working on agreements with the three other purveyors in the valley — the public Newhall County Water District and the private Valencia Water Co. and Santa Clarita Water Co., Hartley said.

If the county cannot set aside enough well water from the other purveyors, there is a chance the state would send emergency supplies through the Castaic agency, he said.

While the city considers a law that would restrict wasteful practices in the hopes of achieving a 25 percent reduction in water use, Hartley said that county water officials are drafting a conservation proposal that would require different levels of participation in different areas. Because of the severity of the water cuts in the Val Verde and Hasley Canyon areas, he said he would expect a 20 percent to 30 percent mandatory cutback in water use.

Although the plant near Castaic Lake will be closed, the agency most likely will lay off just a temporary maintenance worker, Sagehorn said. The worker was hired when one of the two permanent maintenance workers was on medical leave and was kept on.

FOR FIG. 17 + FIG. 5-4

EXHIBIT [illegible]

Officials say state's water delivery system inadequate

By [illegible] Myers

MONTEREY, Calif. — [illegible] many years [illegible] of an inadequate water delivery system, representatives of the three main groups vying for the precious [illegible]

The 5-year-old drought that [illegible] were drastically cut only magnified the problem this year, said representatives of the urban, agriculture and wildlife interests.

"The biggest problem we have is that the reliability of the water supply is grossly inadequate," said Tim Quinn, conservation director for the urban Metropolitan Water District of Southern California. "The way the system works now, people can't count on a steady water supply because the water delivery system just doesn't work like it should."

Quinn's comments came at the annual spring conference of the California Association of Water Agencies, which attracted more than 2,000 of the state's top water officials.

Stephen Hall, representing agriculture, and Charles Hansen, representing wildlife and the environment, agreed with Quinn that the State Water Project and the federal Central Valley Water Project can't satisfy competing water needs.

All three men [illegible] of what would happen if there weren't the [illegible] for water if the drought continues — the [illegible] of urban [illegible], farms with [illegible] will be [illegible] and wildlife will [illegible] with some species becoming extinct.

But beyond the [illegible] competition for scarce supplies, they said water officials must improve the delivery and storage system that essentially hasn't [illegible] for decades.

"We shouldn't have to continue to fight one another for resources," said Hall, executive director of the California Farm Water Coalition.

The Sacramento-San Joaquin Delta, the cornerstone of the delivery system, is a bottleneck even in non-drought years, Quinn and Hall said.

Part of the problem, according to Hansen, who [illegible] environmental consulting business, is the growing importance on protecting endangered and threatened species while making water transfers in the delta.

The [illegible] already [illegible] by state and federal wildlife officials as threatened and the delta smelt also is expected to win the U.S. Fish and Wildlife Service [illegible]

[illegible] when these fish [illegible] under wildlife protection, he said.

"We need to manage the [illegible] to provide adequate water throughout the year," Hansen said.

EXHIBIT C

A boost for toxic cleanup in state

Feds back state on perchlorate

By Heather MacDonald
Staff Writer 8-8-03 D.N.

SANTA CLARITA — The Department of Defense agreed Thursday to obey California's drinking water standards for perchlorate and not try to avoid paying for cleanup of the toxic rocket fuel byproduct.

The agreement, announced by U.S. Sen. Barbara Boxer and Pentagon officials during a visit to a contaminated site in Rialto, could help speed the cleanup of the defunct Bermite explosives factory in the center of Santa Clarita, and dozens of other polluted sites all over California, officials said.

"This is an important breakthrough," said Boxer, a California Democrat. "Defense Department activities have been a major source of perchlorate contamination in California. This kind of active cooperation will help us find and fix perchlorate problems throughout the state."

The agreement also appeared to put to rest concerns expressed by Santa Clarita leaders that legislation introduced by President George W. Bush would exempt some defense contractors from having to pay for environmental cleanups in the name of military readiness.

The Newhall County Water District Board of Directors was afraid the language of the bill could be used to let Whittaker Corp., which operated the site until 1987 and has recently begun studying the best ways to clean up the pollution, off the hook.

"The well-being of millions of Californians depends on this agreement," Boxer said.

More than 7 million Californians drink water with at least traces of perchlorate, which can damage the thyroid gland and be risky for pregnant women, whose fetuses can be affected, according to the U.S. Environmental Protection Agency.

A provisional standard set by the EPA recommends that drinking water have no more than 1 part per billion of perchlorate. The old standard considered water with 32 parts per billion of perchlorate safe.

Although the EPA is not expected to set a final standard

See WATER / Page 2

Help on the way for toxic cleanups

8-8-03 D.N.

WATER / From Page 1

until at least 2008, Boxer has called for the agency to act next year because of the threat perchlorate poses to California residents.

Five wells in Santa Clarita have been shut down because of high levels of perchlorate, with tests showing as much as 40 parts per billion of the toxin in the water, officials said. The wells draw on the Saugus Aquifer, which serves as a backup water supply for the Santa Clarita Valley in times of drought.

State officials believe the pollution is coming from the Bermite property near the Santa Clarita Metrolink Station on Soledad Canyon Road. From World War II to the end of the Cold War, several companies manufactured and tested munitions and explosives for the U.S. military on the 996-acre site.

While the California Department of Health Services requires that wells with more than 4 parts per billion of perchlorate be shut down, the state Office of Environmental Health Hazard Assessment has found that water with as much as 6 parts per billion is safe to drink.

Heather MacDonald, (661) 257-5257
heather.macdonald@scnewspapers.com

FOR PG. 15

-----Original Message-----
From: Diane Trautman [mailto:dianetrautman@comcast.net]
Sent: Friday, August 08, 2003 2:41 PM
To: Dan Masnada
Cc: Marsha McLean; Vince Bertani
Subject: Draft Groundwater Management Plan

TO: Dan Masnada

RE: Draft Groundwater Management Plan

Following are my questions and comments related to the Agency's Draft Groundwater Management Plan:

1. What percentage of the 106,000 afy (needed over the next 20 years) will be drawn from local groundwater sources? Does the Agency expect to maintain roughly the same 60% SWP/40% local groundwater mix in most years?

2. If the Saugus Formation absorbs recharge much more slowly than the Alluvial Aquifer, won't pumping of the Alluvial Aquifer at the high end of the scale over a sustained period of time reduce recharge of the Formation and reduce the amount of potable water that can be drawn from the Formation in dry periods?

3. Both this report (p. 15) and the 2002 Water Report (p. 19) state that the Agency does not have sufficient groundwater quality data on the Saugus Formation to perform an analysis of "pumping related inpacts on quality." On page 25 of this report under Primary Element 1, the Agency states that it has "a useful amount of groundwater quality data." Is the latter in reference only to the Alluvial and not the Saugus? And if the Agency does not have sufficient data on quality of water from the Saugus Formation, how does the agency propose to collect that data to ensure quality in order to maintain the current pumpage level and to increase the yield as proposed on page 21?

4. Looking back at the 2002 Water Report, the Agency indicates (on page 19) that "there are limited Saugus (Formation) water level data." Does the Agency plan to collect more comprehensive data on the Saugus Formation general groundwater stability to determine reliability of projected yields and "artificial groundwater recharge" (p. 27) capacity?

5. Regarding Secondary Element 2,the Agency states: "The results of the DWSAPs can be used as a planning tool to guide land use development in the vicinity of water sources." Is the Agency currently sharing more recent, detailed information with the City regarding contamination risks in relation to the existing closed wells?

6. Where is the SCWC Stadium Well located?

7. Why is "Continuation of Public Education and Water Conservation listed as a Secondary (Potential) Element" when increased conservation savings are projected to reduce water demand by 10%? Shouldn't conservation be one of the primary elements of water management?

8. How is the Agency delivering recycled water to the TPC? Is it being run through a parallel piping system? Is so, what is the estimated cost and time frame for constructing such a system to carry the estimated 17,000afy? And how does the Agency propose to pay for this system?

9. How is the recycled water in locations, such as the golf course, reprocessed to remove pesticides and fertilizers?

10. What is the current average per capita water usage in afy?

11. The Semitropic Water Bank/Transfer is not mentioned in discussion of the Supplemental (SWP) Surface Water on page 21. Is that because it is a relatively short-term water supply? Are any of the other water transfers – Kern Water Bank, Kern Delta Water, North Las Posas Water Bank – as listed on UWMP p. 2-16, of limited duration? And if the Semitropic Water Bank Transfer is short term, how can it be included in the 105,000-106,000 afy need projected for the next 20 years? What will take its place?

12. What specific efforts will be made to manage salinity?

Thank you for giving me an opportunity to respond.

Diane Trautman

Responses to Trautman

1. In terms of groundwater management planning, projected urban water demand (the 106,000 afy projected urban demand in 2020) does not represent total valley-wide demand; total projected demand is 113,100 afy, including both urban and agricultural. In that light, on an average basis, local ground water is expected to be utilized to meet about 40 percent of total water demand.

   In regards to maintaining "roughly the same 60% SWP 40% local groundwater mix in most years", please refer to page 20 of the draft GWMP for a more complete response to your question. For example, about 54 percent of water demand in 2001 was supplied by local groundwater, and about 46 percent was supplied by imported SWP water. Also please refer to Table II-5 in the 2002 Santa Clarita Valley Water Report, which displays the build up of SWP water use through time, and the relative percentages of groundwater and SWP water used in a given year. As noted above, it is expected that, over time, again on an average basis, the annual amount of local groundwater pumping will not appreciably change but its fraction of total water supply will decrease. Conversely, over time, and once again on an average basis, both the annual volume of imported SWP water and its fraction of total water supply will increase.

2. No. Since the Saugus Formation is recharged over a much larger area, beyond the spatial extent of the Alluvium. There is a limited relationship between Alluvial pumping and recharge to the Saugus Formation.

   The fundamental tenet of the GWMP is to utilize groundwater for water supply within its sustainable yield (see the Management Objectives, or Goals, for the Basin, GWMP Section II; see also the various GWMP Elements intended to achieve those objectives, GWMP Section V). In that light, it is expected and intended to operate in such a way that recharge to the Saugus Formation will not be "reduced" by pumping from the Alluvial Aquifer and that groundwater will be available in varying amounts, as needed depending on weather year-types, within the sustainable yields of the respective aquifers (i.e. without overdrafting them).

3. The reference to "useful amount of groundwater quality data" in the GWMP includes both Alluvial and Saugus data. However, due to the historically greater development and use of groundwater from the Alluvium (number and distribution of wells, volume of pumping), and due to the historically smaller development and use of the Saugus Formation (fewer wells, smaller geographical distribution of wells, smaller pumpage), there is a comparatively limited ability to examine relationships among pumping, recharge, and quality in the Saugus. CLWA and the other purveyors intend to expand the overall knowledge of the Saugus Formation as that resource is further explored and

developed (number of wells, additional sampling as new wells are added, etc.) All that data will be included in ongoing implementation of GWMP Primary Element 1, Monitoring of Groundwater Levels, Quality, and Production.

4. The "limited nature of Saugus water level data" is a result of the same smaller extent of historical Saugus development described in the preceding answer. Acquisition of additional data on the Saugus Formation is planned as also described in the preceding answer.

5. All publicly available information regarding the investigation of perchlorate contamination, its extent, its impact on water supply, and plans for cleanup, control of migration, etc. is available to the City. Representatives of CLWA and the purveyors meet routinely with City representatives to review the status of perchlorate cleanup and remediation activities. CLWA and the impacted water purveyors will continue to pursue control and cleanup of perchlorate contamination in order to restore impacted groundwater pumping capacity and to ensure the long-term quantity and quality of groundwater in accordance with the GWMP. As a practical matter, there are no surface contamination risks relating to perchlorate that would affect land use development adjacent to the wells.

6. The stadium well is located on the south side of the Santa Clara River, approximately two miles upstream (east) of its confluence with the South Fork tributary, or about 4,000 feet east of the Bouquet Canyon Road crossing of the Santa Clara River.

7. The assignment of "primary" or "secondary" status to any GWMP element is discretionary and certainly not absolute. Secondary status is not intended to indicate that any element of the GWMP will not be implemented; all elements are intended to be implemented. Final status of all GWMP elements will be reviewed by the Advisory Council and decided by the CLWA Board.

8. Recycled water is being delivered to the TPC via the dedicated, recycled water distribution system, which is also capable of delivering water to other non-potable water users, and which will be expanded in accordance with the Draft Recycled Water Master Plan. The costs and time frame for expanding recycled water distribution and use are included in the Draft Recycled Water Master Plan, which is complementary to, but beyond the scope of the Groundwater Management Plan. The intent is to develop the 17,000 AFY of use by 2020. The capital cost of the complete system is estimated to be $68 million, and will be funded through CLWA's connection fee program.

9. Recycled water is not "reprocessed" at points of use such as the TPC golf course. In general, recycled water is highly treated (tertiary treated) waste water. In the case of the Santa Clarita Valley, treatment already occurs at the Valencia Reclamation Plant operated by the Sanitation Districts of Los Angeles County. The treated water, ready for non-potable use, is distributed from the plant site in a dedicated transmission pipeline system to end users such as the TPC. Pesticide and fertilizer uses, as part of cultural practices at end-user locations such as golf courses, are discretionary actions of the respective end users of recycled water.

10. Most water agencies no longer use "per capita" water use as a standard because it is not an accurate representation of actual per person water use, mainly due to the effects of landscape and commercial/industrial water use. (It is also expressed in "gallons per day," rather than "acre-feet per year, since it refers to individual water usage.") In general for the South Coast hydrologic region of California, water use is approximately 200 gallons per person per day (DWR Bulletin 160-98). Per capita use for the Santa Clarita Valley is slightly higher than this due to landscape irrigation demands caused by local climate conditions.

11. The SWP is referred to as "supplemental" water because that is the original purpose of the SWP: to serve as a supply that would "supplement" local supplies (whether groundwater or local surface water or both). The specific amounts referred to in the GWMP are from the contractual terms between CLWA and the California Department of Water Resources.

    The water banked in the Semitropic Water Storage Program during 2002 is a short-term, dry period supply. The program has a term of ten years (i.e., the water must be returned to CLWA for use in its service area within that time period). Thus it is not included as a supply for long-term needs. However, the other programs listed in the UWMP (most of which, by the way, are not water "transfers," but are instead groundwater banking programs) are long-term sources of supply. As of this writing, the Agency is in the process of designing and implementing a Long-Term Reliability Plan to begin bringing such long-term programs on line as a means to store water available in wet years, for use in later dry years. CEQA analysis, with its accompanying public comment opportunities, will be part of the long-term reliability program approval process.

12. Primary Element 6 – Long Term Salinity Management is included in the GWMP for the reasons presented in the text discussion of that element. The element recognizes the need to plan for salinity management but also recognizes that, to the present, there has been no extraordinary trend of salinity increase. Hence, there are no specific efforts currently in place to "manage" salinity. It is envisioned that specific efforts will be developed over

time in response to implementation of the GWMP and, in particular, its Primary Element 6

CLWA is participating in efforts by the Sanitation Districts of Los Angeles County to address the Los Angeles Regional Water Quality Control Board's proposed TMDL standard for chloride in the Santa Clara River. This effort is separate from and beyond the scope of the Groundwater Management Plan.

Additional Comments

Ed and Joan Dunn
15414 Rhododendron Dr.
Canyon Country, CA 91387
November 25, 2003

Castaic Lake Water Agency
President Peter Kavoumas and Board of Directors
27234 Bouquet Canyon Road
Santa Clarita, CA 91350-2173

Re: Groundwater Management Plan (AB 3030) Nov. 2003 Draft

Dear President Kavoumas and Directors:

We would like to comment on some statements of your new draft plan. On page 38 there is a bullet - Conservation pricing. Since we have never seen any conservation pricing locally, this should be explained or removed. We seriously question this being presently implemented.

On page 41, we ask why you are stating that only the eastern portion of the alluvium has experienced historical fluctuations in groundwater levels. How can there be constant groundwater levels in the western portion of the basin, when the western basin is supposed to receive its re-charge primarily from the eastern portion of the river? You imply that tributaries in the Bouquet Canyon area are the source of water in that area. We believe you are avoiding the real source of water to the area. That source appears to be the large amount of effluent from Sanitation District #26, and is maintaining the water level. Why is this not explained?

As usual, there is no explanation for a total extended interrupt of the state wholesale water system or the CLWA facilities!

We are disappointed that of the numerous comments of August 8, 2003 that we supplied, only a few were considered. We spent our time and efforts to supply comments and suggestions to make the water plan a good plan. So much for that!

Sincerely,

Ed and Joan Dunn

November 25, 2003

Mary Lou Cotton
Water Resources Manager
CLWA
via fax only

Subject: November 25, 2003 Groundwater Management Plan Protest Hearing

I will not be attending the protest hearing this evening, but I do have three comments on the information you provided to me.

First, I commented previously on the proposed network of monitoring wells and the public availability of data. The monitoring wells in figures 5-1 and 5-2 appear to cover a wide range of the valley. However, the text on p. 27 states the network will be mostly as illustrated in figures 5-1 and 5-2, but possibly expanded. I hope the final network is extensive and covers all areas of the valley. Further expansion of the network would add valuable data points and should be encouraged.

I did not see any indication of whether the collected monitoring data would be publicly available. I have heard comments from others that some well data is not being released to the public even upon request. I think that concerned citizens and groups should be allowed access to the monitoring database.

Second, I have one new comment on the wording on page 34 regarding perchlorate cleanup. The last paragraph states "The proposed pumping would be combined with approved wellhead treatment to render the treated water suitable for municipal supply." This may be a wording issue, but my understanding is that wellhead treatment is not always approved or allowed by the permitting agencies. This wording implies that wellhead treatment is already an approved scenario. While it may be determined that treatment followed by re-injection of non-potable usage makes more sense, I think it would be more accurate to not specify the final treatment scenario until the plume characterization is complete and the pilot studies are finished and accepted.

Finally, the plan is clearly an overview that will have to be expanded upon with supporting policies and target dates. Some commenters requested more information on goals in the groundwater plan. While the agency does not add implementation strategies and target dates to the plan, they should be prepared, separately updated annually, and made available to the public upon request.

I understand the time for commenting may have past, but if you are able to address these comments on the final draft, I would be appreciated.

Sincerely,

Maria Gutzeit
24463 Shadeland Dr
Newhall, CA 91321

Final Report

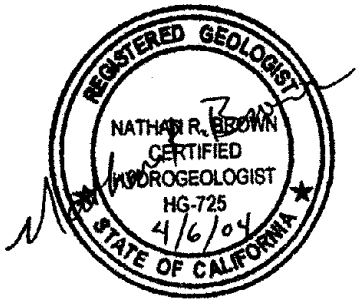
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Development and Calibration

Prepared for

Upper Basin Water Purveyors:

Castaic Lake Water Agency (CLWA)
Newhall County Water District
Santa Clarita Water Division of CLWA
Valencia Water District



April 2004

CH2MHILL

Executive Summary

The water purveyors in the Santa Clarita Valley of Southern California have constructed a regional-scale numerical groundwater flow model of the valley. The model, which is called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. Figure ES-1 shows the study area, including the Regional Model's boundaries. Figure ES-2 shows the extent of the watershed that the valley occupies, and shows the sub-watersheds that drain into the study area covered by the Regional Model.

The Regional Model has been developed as part of the work scope contained in a Memorandum of Understanding (MOU) that was entered into in August 2001 by the Upper Basin Water Purveyors in the Santa Clarita Valley and the United Water Conservation District in Ventura County. This report documents the construction and calibration of the Regional Model, including presenting the conceptual hydrogeologic model on which the Regional Model is based.

ES.1 Model Development Objectives and Approach

The Regional Model is intended to become an evolving tool for managing the local groundwater resource. Specific objectives that are identified for the model are:

a. To be able to evaluate the long-term sustainability (yield) of the two aquifer systems that are present in the valley, the Alluvial Aquifer and the Saugus Formation, under a range of existing and potential future water resource management conditions

b. To be able to evaluate artificial recharge to increase the long-term sustainability of the aquifer system, particularly in conjunction with the availability of imported surface water supplies

c. To evaluate the influences of future water management plans and alternatives on groundwater conditions within the valley and on the flows of water into the downstream basins in Ventura County

d. To facilitate general management of water quantity and water quality issues

The approach to developing the Regional Model included the following steps:

1. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system

2. Creating a variety of data sets to conduct steady-state and transient calibrations

3. Constructing the Regional Model using the MicroFEM® finite-element groundwater flow code, and also using the available database and geographic information system (GIS) for the Santa Clarita Valley

4. Calibrating the Regional Model
5. Performing sensitivity tests on the Regional Model

ES.2 Hydrogeology of the Santa Clarita Valley

Section 2 of the report describes the hydrogeology of the Santa Clarita Valley, including the geologic system; groundwater occurrence; groundwater recharge and discharge mechanisms; the relationship of surface hydrology to the valley's groundwater resources; historical trends in the valley's hydrology; the role of the State Water Project (SWP) in the valley's water resources and water supply; and key findings from prior studies conducted in the valley. This section of the report focuses particularly on information of specific relevance to development of the Regional Model. Figure ES-3 is a schematic representation of the regional-scale geology and hydrologic cycle in the Santa Clarita Valley. Figure ES-4 is a geologic map.

ES.2.1 Geology

The geology of the valley is defined in part by the non-water-bearing bedrock that underlies and surrounds the valley's aquifer systems. This bedrock forms a bowl-shaped aquifer system, which is thickest at the center of the valley and progressively thins outwards towards the margins of the valley. The deeper of the two aquifer systems is contained in the Saugus Formation, which consists of lenticular and interfingered beds of poorly- to well-consolidated sandstone, conglomerate, and siltstone that are at least 7,500 feet thick in the deepest part of the basin. The most productive portion of the Saugus Formation is thought to be the area southwest of the San Gabriel Fault. The deeper and older portion of the Saugus Formation, the Sunshine Ranch Member, was deposited in a marine environment and consists of fine-grained, low-permeability siltstone and sandstone that preclude development of municipal water supplies. Evidence from geophysical logs also indicates that the groundwater in much of the Sunshine Ranch Member may be somewhat brackish in quality.

Overlying the Saugus Formation is the Alluvial Aquifer, which consists of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable amounts of cobbles and boulders. In general, alluvium in the main river valley ranges from medium-grained sand to sandy gravel and cobbles. Due to its unconsolidated to poorly consolidated condition, and its lack of cementation, the alluvium has relatively high permeability and porosity.

ES.2.2 Groundwater Recharge

Average annual rainfall in the Santa Clarita Valley is approximately 18 inches per year, and higher (up to 30 inches per year or more) in the surrounding mountains. Natural groundwater recharge occurs from direct precipitation and from stormwater flowing in the Santa Clara River and its tributaries. Each of these streams have their headwaters in areas lying upstream of the Alluvial Aquifer and Saugus Formation. Consequently, stormwater that is generated in these upstream watersheds flows into the valley and is an important source of groundwater recharge. Because the climate is semi-arid, rainfall and stormwater runoff occur primarily between November and March and can vary considerably in

magnitude from year to year. The direct precipitation in the valley and the recharge of stormwater generated in upstream watersheds together provide approximately 94 percent of the total groundwater recharge to the valley's groundwater resources. Irrigation on agricultural and urban lands represents another 4 percent, and underflow beneath Castaic Dam into the adjoining Alluvial Aquifer is estimated to represent approximately 2 percent of the total basinwide groundwater recharge.

ES.2.3 Groundwater Discharge

Groundwater discharge from the Alluvial Aquifer occurs primarily as discharge to the Santa Clara River and evapotranspiration (ET) by the riparian vegetation growing along the river corridor. The Alluvial Aquifer also discharges as subsurface outflow into the Piru Basin at Blue Cut, which is located just downstream of the Los Angeles-Ventura County line. Groundwater pumping occurs from both the Alluvial Aquifer and the Saugus Formation, and Saugus Formation groundwater also discharges to the Alluvial Aquifer.

ES.2.4 Aquifer Physical Properties

Specific capacity data from Alluvial Aquifer production wells indicates that the horizontal hydraulic conductivity is approximately 300 to 700 feet per day, and possibly higher, along the Santa Clara River. In the tributaries, the horizontal hydraulic conductivity is approximately 100 to 600 feet per day. The horizontal hydraulic conductivity in the Saugus Formation has been estimated to be approximately 6.5 feet per day, based on pumping and injection tests conducted on production wells with long screen intervals.

ES.2.5 Basin Hydrology

Long-term records of groundwater elevations and pumping exist for the Alluvial Aquifer throughout the valley. These records indicate that groundwater elevations can fluctuate significantly from year to year in the eastern part of the valley, in response to patterns of droughts and above-normal rainfall. In the western part of the valley, groundwater levels are stable, as this is the regional groundwater discharge area. Despite the variations in groundwater elevations in the eastern valley and the variations in pumping throughout the valley during the past five decades, groundwater elevations in the Alluvial Aquifer have shown no permanent long-term declines. In addition, the availability of SWP water has allowed the valley to become increasingly urbanized, and the resulting gradual increase in urbanization and SWP water imports have resulted in a gradual increase in flows in the Santa Clara River.

Similar conditions are seen in the Saugus Formation. From the late 1980s through the early to mid-1990s, groundwater elevations declined in response to drought conditions and increased pumping. However, starting in the mid-1990s, Saugus groundwater elevations increased notably as pumping decreased and rainfall increased. As with the Alluvial Aquifer, the Saugus Formation showed groundwater elevation recovery to levels seen prior to the drought.

ES.2.6 Water Supply

The Santa Clarita Valley obtains its water supply from local groundwater sources and from SWP water that is delivered to the Castaic Lake Water Agency by the California Department

of Water Resources (DWR) via the California Aqueduct. Water use includes municipal and agricultural uses.

Before 1970, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during the 1950s and early 1960s ranged from 35,000 to 44,000 acre-feet per year (AF/yr). Pumping from the Alluvial Aquifer dropped gradually from 40,000 AF/yr in 1967 to less than 30,000 AF/yr by 1983, and did not rise above 30,000 AF/yr until 1993. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. In response to statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available. The water management practices of the purveyors call for maximizing the use of Alluvial Aquifer and SWP water. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. Consequently, since 1995, Saugus pumping has ranged between approximately 4,000 and 8,500 AF/yr.

The Castaic Lake Water Agency (CLWA) has a contract amount of SWP Table A water of 95,200 AF/yr. Modeling by DWR has indicated that actual SWP water imports, based on the current CLWA Table A contract amount, will be 66,300 AF/yr in wet years, 56,800 AF/yr in average years, and 37,900 AF/yr in multiple dry years. The occurrences of drought years in the SWP system is based on the hydrology of Northern California, and hence only occasionally coincides with the occurrence of drought locally. In addition to the above entitlements, DWR occasionally releases flood flows into Castaic Creek from Castaic Dam. These flows averaged 15,700 AF/yr during the 24-year period of water years 1977 through 2000. However, no flood flows were stored or delivered in five of those years, and the median flow was 2,800 AF/yr (only 18 percent of the average flow).

ES.3 Model Construction

The Regional Model was constructed using the three-dimensional finite-element groundwater modeling software called MicroFEM® (Hemker and de Boer, 2003). The Regional Model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. The model area largely coincides with the Santa Clara River Valley East Groundwater Subbasin, extending from the Lang stream gage at the eastern end of the valley to the County Line gage area in the west. The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. The upper model layer simulates the Alluvial Aquifer, or the upper portion of the Saugus Formation wherever the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and the Sunshine Ranch Member.

The boundary conditions in the model consist of specified flux boundaries for precipitation; irrigation; recharge from ephemeral streams; pumping; and underflow from beneath Castaic Dam. Head-dependent flux boundaries are used in the perennial reach of the Santa Clara River, and to model any residual drainage of groundwater that might occur in the

ephemeral reach under high water table conditions. A head-dependent flux boundary is also used for ET. A constant-head boundary was used in the Alluvial Aquifer at the downgradient (western) end of the valley, at the County Line gage.

Groundwater recharge rates were estimated using precipitation records; streamflow records; watershed maps; topographic maps; and aerial photography. These recharge rates were calculated using a detailed Surface Water Routing Model that was written specifically for the construction and calibration of the Regional Model. Pumping rates and pumping depths were defined from groundwater pumping and well construction records.

ES.4 Model Calibration Process

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation. The steady-state calibration was performed for calendar years 1980 through 1985, and the transient calibration was performed for calendar years 1980 through 1999. The goals of the calibration process were generally to match groundwater flow directions, groundwater gradients, and groundwater elevations that were measured throughout the 20-year simulation period at wells across the valley. Figures ES-5 and ES-6 show the locations of wells that were used to evaluate calibration in the Alluvial Aquifer and the Saugus Formation, respectively. The figures also show how each aquifer was subdivided into zones to facilitate parameter selection and model calibration. An additional calibration goal was to match the patterns of total flow in the Santa Clara River and estimated groundwater discharge rates to the river. Model variables were adjusted in a manner that sought to honor independent estimates of parameter values while resulting in the best possible calibration.

ES.5 Model Calibration and Sensitivity

The Regional Model meets most of the qualitative and quantitative goals that were established for the calibration process. For the steady-state model, statistical goals for the head residuals, which are equal to the modeled minus measured groundwater elevations, were easily met for the Alluvial Aquifer and adequately met for the Saugus Formation. For the transient model, trends in groundwater elevations were generally well matched. However, during the mid- and late 1990s, the model tended to simulate too much decline in Alluvial Aquifer groundwater elevations in the eastern-most portion of the valley and water level fluctuations that were too variable in Castaic Creek. Groundwater discharges to the river were simulated well for both the steady-state and transient models.

The groundwater budget for the 20-year transient calibration period showed that recharge from precipitation and streamflows varied considerably from year to year, ranging from less than 15,000 AF/yr in the driest years to as much as 270,000 AF/yr in the wettest years (see Figure ES-7). In contrast, total groundwater discharges were less variable, ranging from approximately 61,000 AF/yr at the end of the late 1980s/early 1990s drought to 116,000 AF/yr during 1998 (see Figure ES-8). This variability in groundwater discharge did not follow the year-to-year pumping patterns, but instead was caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlated well with groundwater recharge patterns. During the 20-year transient

calibration period, changes in the volume of groundwater stored in the combined Alluvial-Saugus aquifer system varied primarily according to year-to-year variations in regional rainfall. No long-term decline in groundwater storage was observed in the field or simulated by the model (see Figure ES-9) during this period. As Section 2.6.2 of this report will discuss, available data dating back to the 1950s also show that no long-term water level declines have occurred in the valley, despite past periods of significant pumping (particularly during the 1950s) and drought cycles.

Sensitivity analyses were performed to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the Regional Model. Variables that were tested were the hydraulic properties (horizontal and vertical hydraulic conductivities and storage coefficients) for the Alluvial Aquifer and the Saugus Formation; the riverbed leakage terms for the Santa Clara River and Castaic Creek; and the ET parameters. The sensitivity analysis indicated that the model is calibrated well and that it is sensitive to the choices of horizontal hydraulic conductivity in both aquifers and vertical hydraulic conductivity in the Saugus Formation. The Regional Model was also sensitive to the riverbed leakage terms in both groundwater recharge and groundwater discharge areas. However, the model was insensitive to the choice of ET parameters.

The process of calibrating the Regional Model to a 20-year period of groundwater elevation and streamflow data has resulted in a model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary attributes of the model's calibration that makes this tool appropriate for its intended uses are:

a. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased SWP water imports (from outside the valley), and associated changes in land use and water use

b. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property)

c. Its use of an integrated model of the watershed, the Surface Water Routing Model, to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system

The calibration process has resulted in a Regional Model that closely simulates, on a monthly basis, total flows in the river and estimated volumes of groundwater discharging to the river. The calibration process has also resulted in a Regional Model that closely simulates the short-term and long-term time-varying trends in groundwater elevations throughout the valley, which is necessary for evaluating groundwater management strategies. The close calibration of the groundwater elevation trends and absolute groundwater elevations in both the Alluvial Aquifer and the Saugus Formation near the Whittaker-Bermite property also renders the Regional Model suitable for particle-tracking analyses, to support the design of a long-term pumping and groundwater treatment plan that will restore impaired water supplies while also preventing contamination in unimpacted portions of the aquifer.

ES.6 Model Use and Recommendations

The Regional Model is generally well-calibrated and therefore can be applied to meet the objectives for which it was developed. Nonetheless, because no model is perfect, it should be used with care, and all model results should be examined by qualified and experienced hydrogeologists and water resource managers. It is recommended that future applications of the model include sensitivity analyses on key variables and that the Regional Model and the Surface Water Routing Model be updated as water use conditions change in the future. Additionally, data gathering efforts should continue or resume, to facilitate updates of the Regional Model. In particular, controlled pumping tests should be conducted to provide quantitative estimates of aquifer properties at the locations of new Saugus Formation wells and streamflow monitoring should resume at the Lang gage, in order to better understand the magnitudes and timing of Santa Clara River flows into the valley.

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Figures

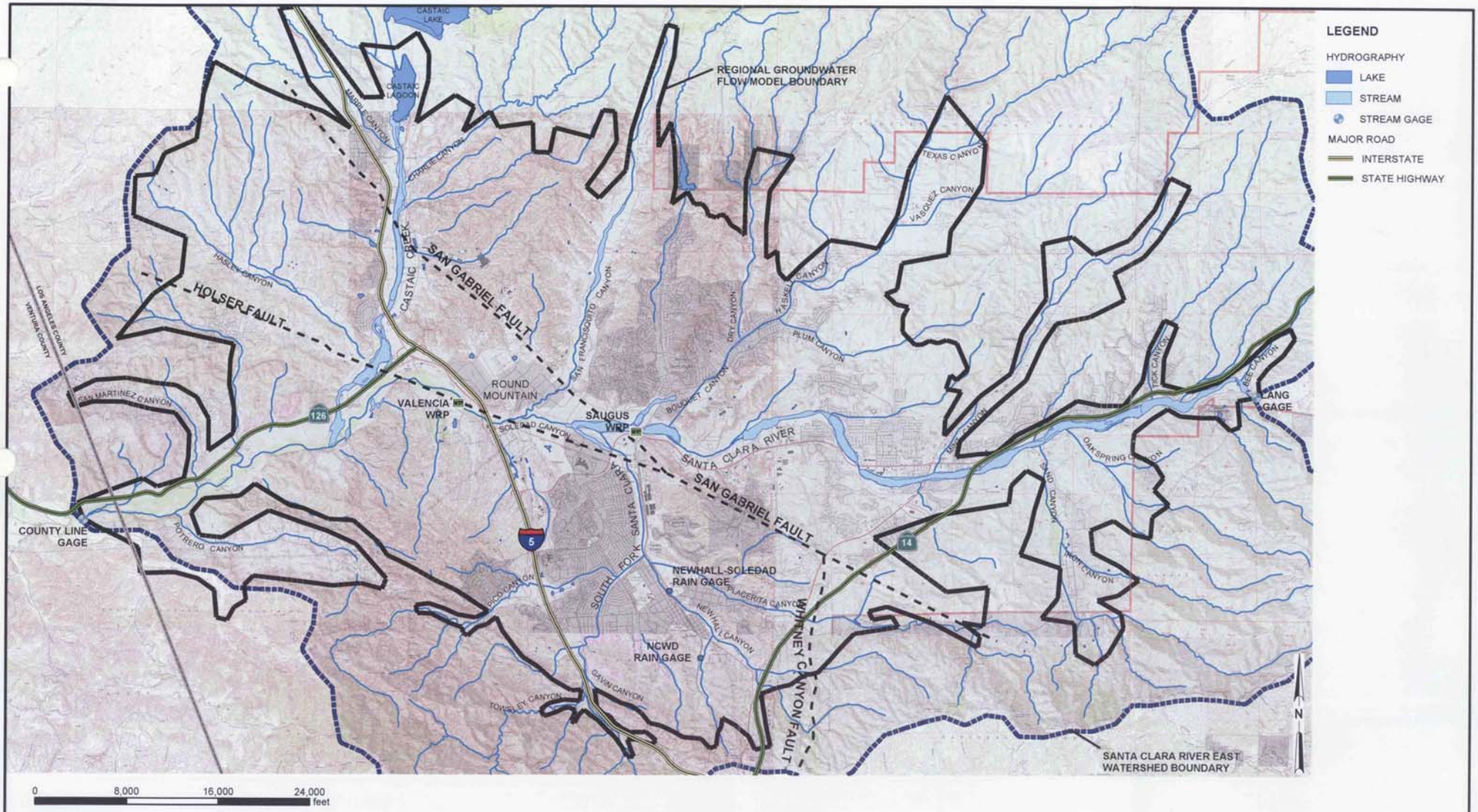

FIGURE ES-1
MAP OF STUDY AREA
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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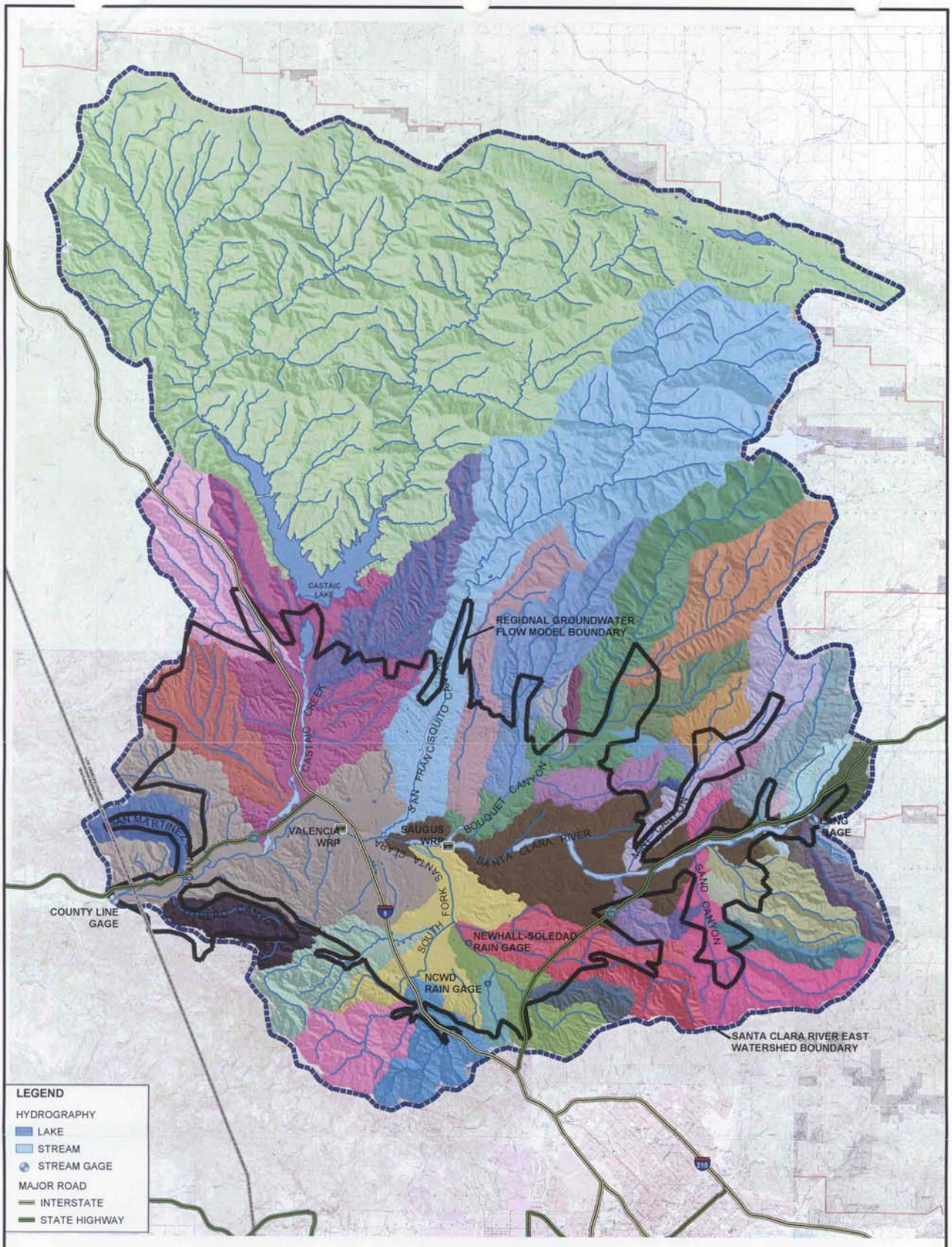

FIGURE ES-2
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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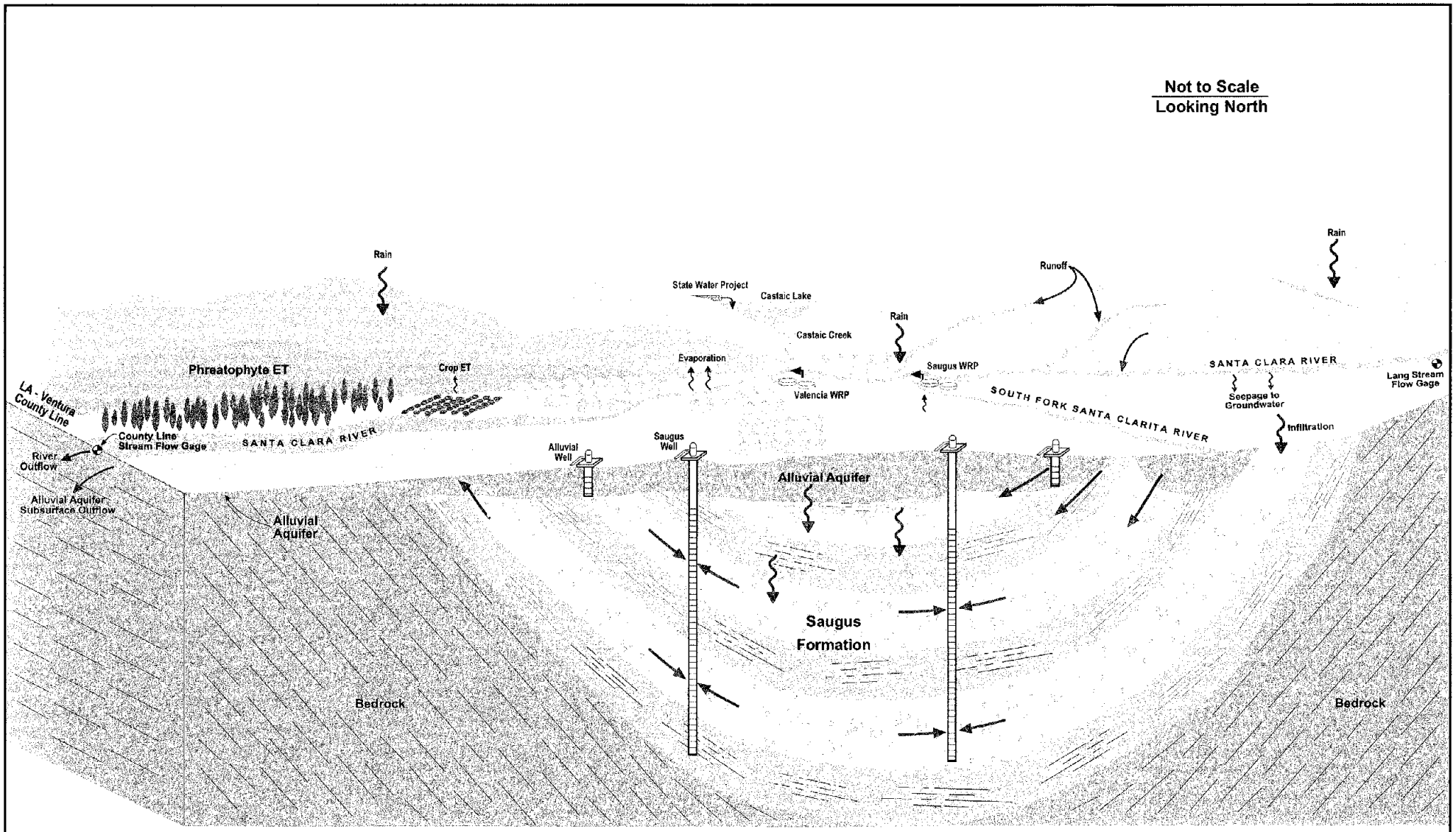

FIGURE ES-3
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REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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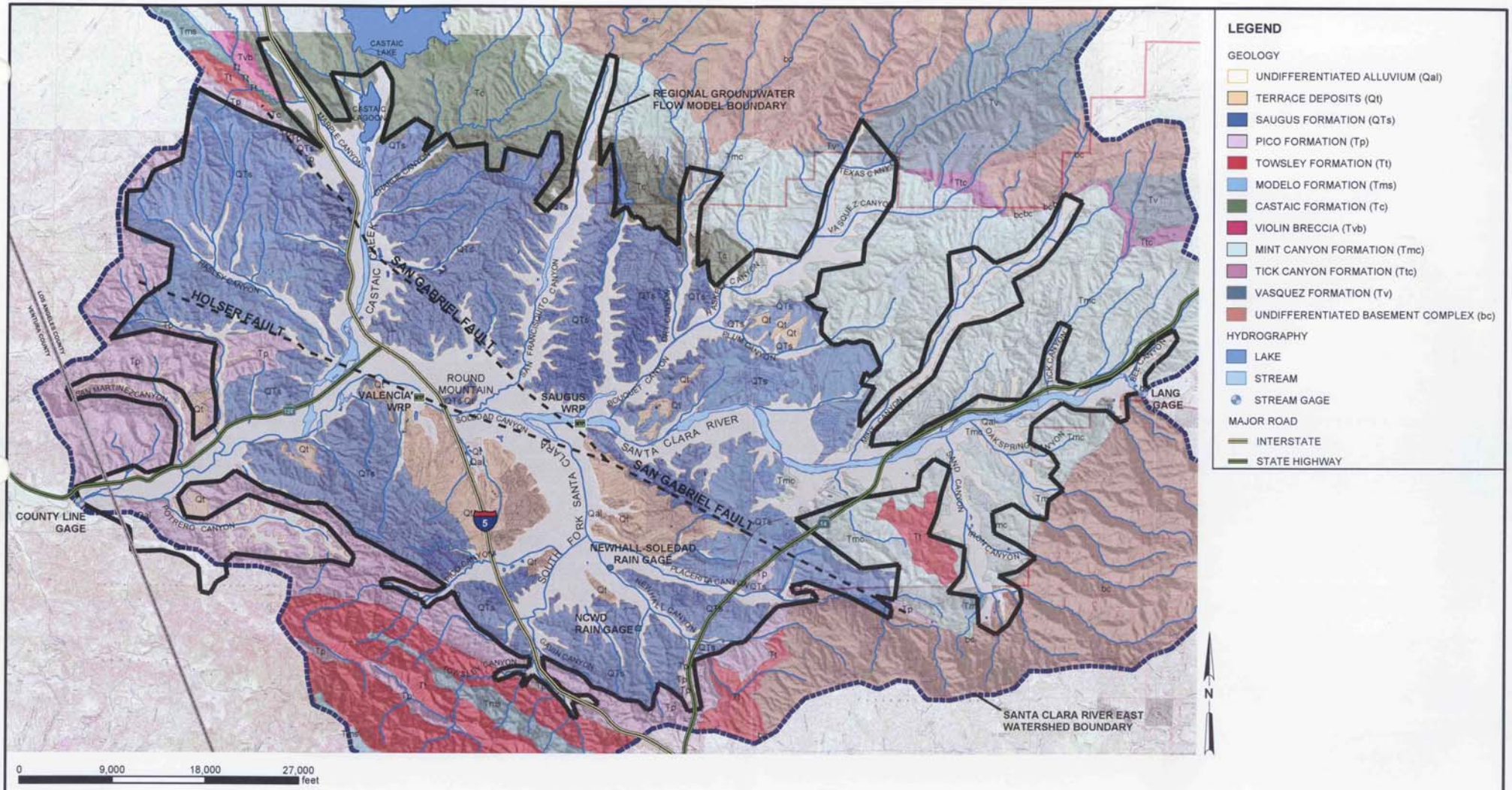

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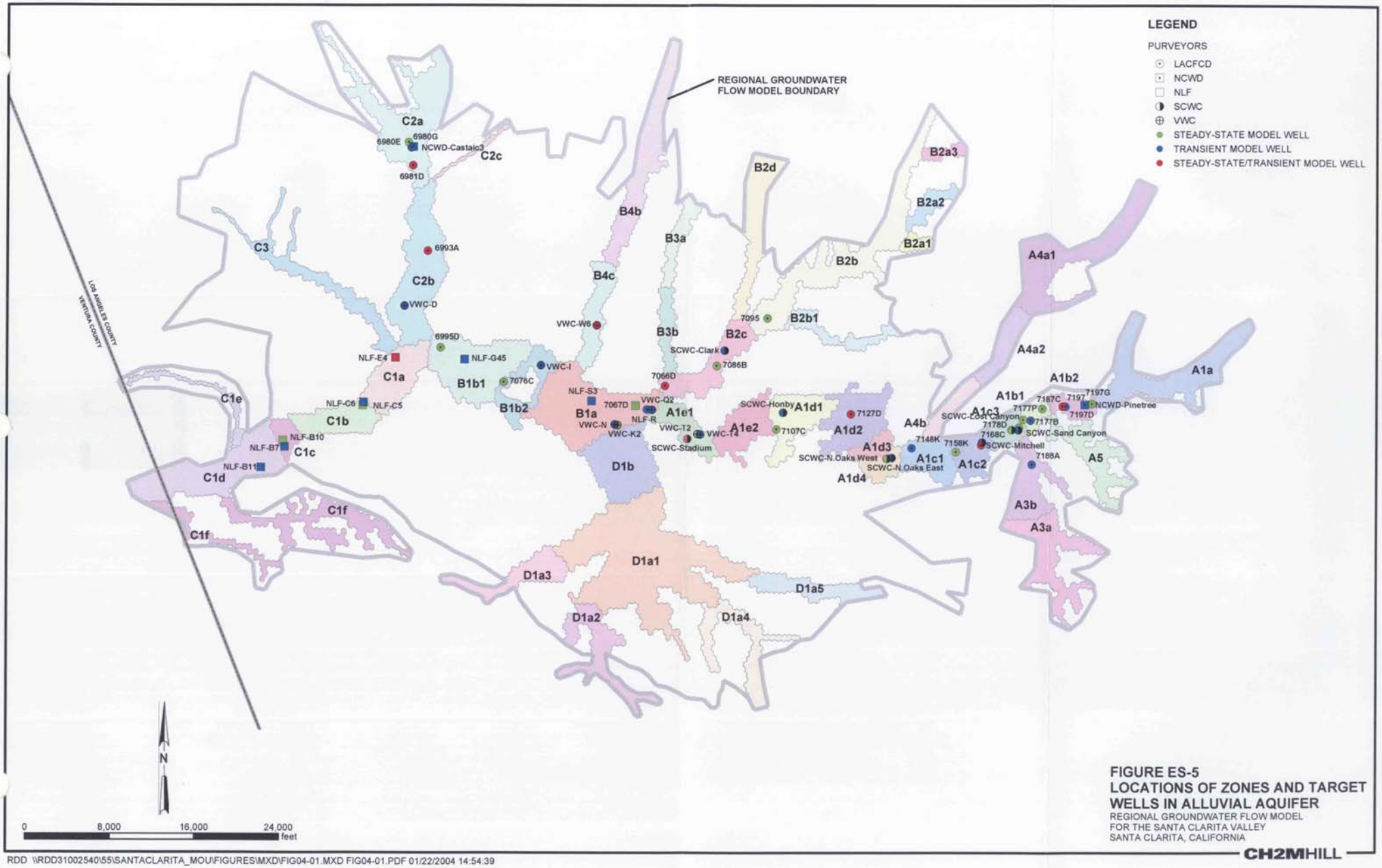

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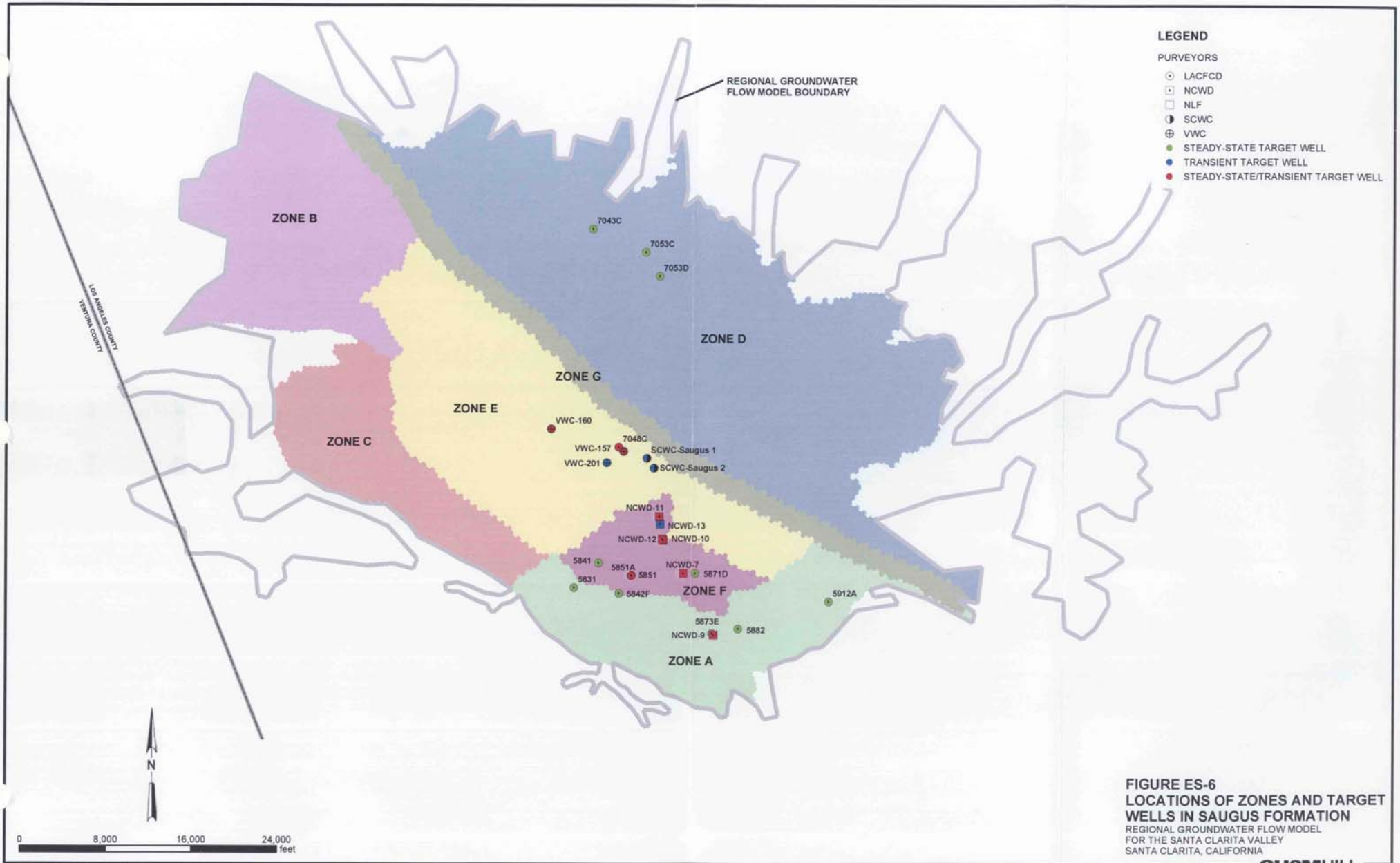

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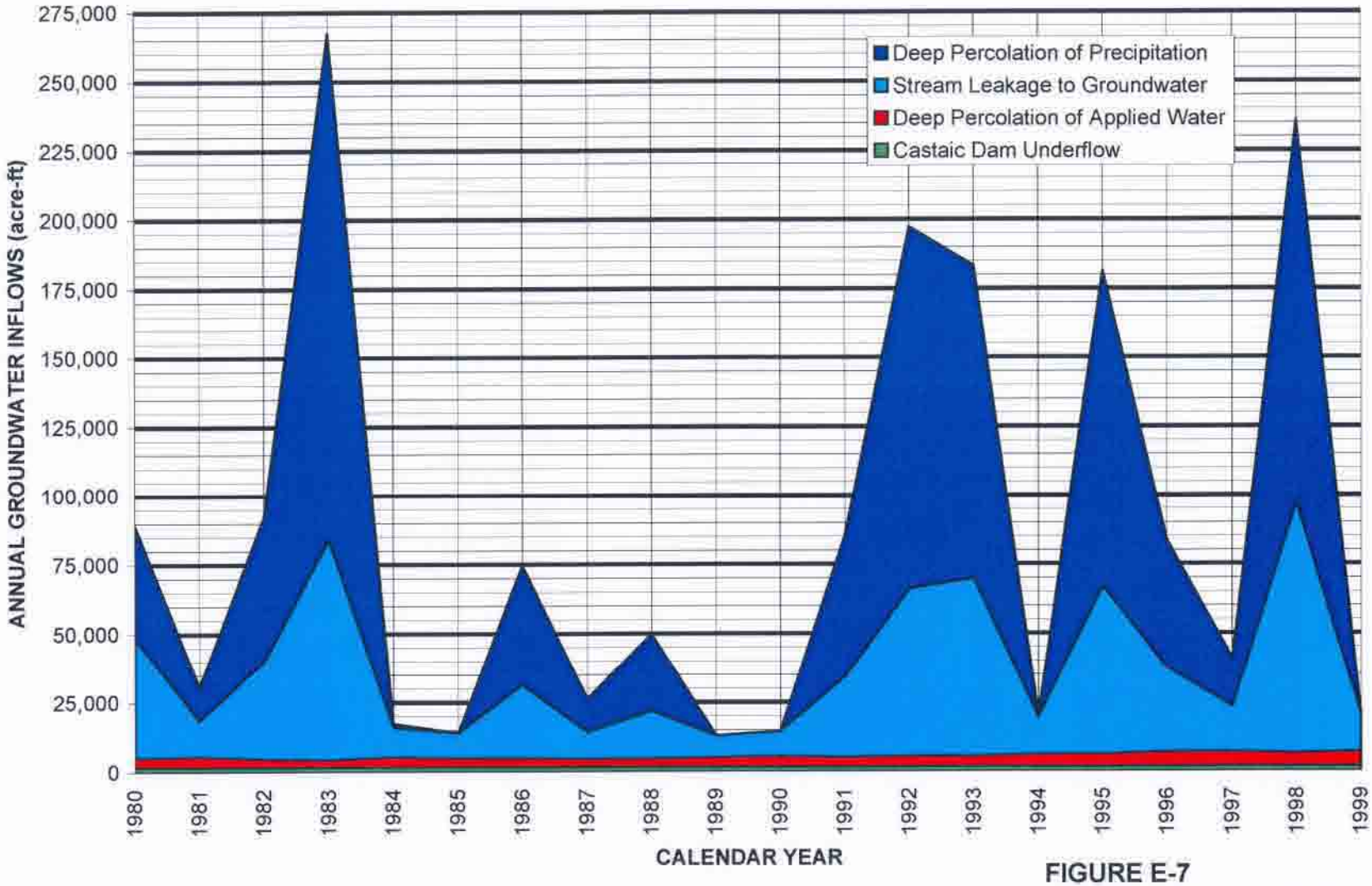

FIGURE E-7
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SANTA CLARITA, CALIFORNIA

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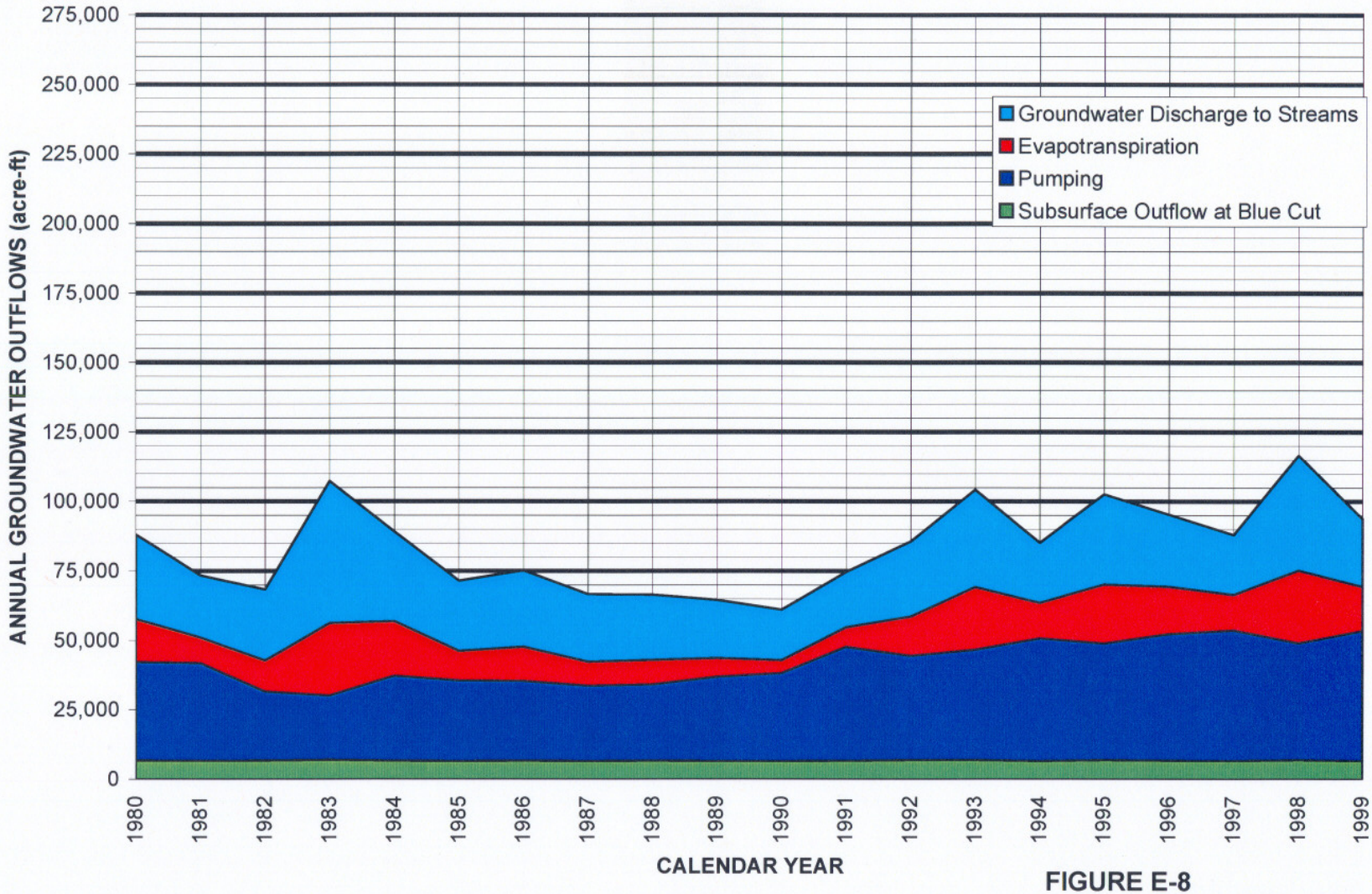

FIGURE E-8
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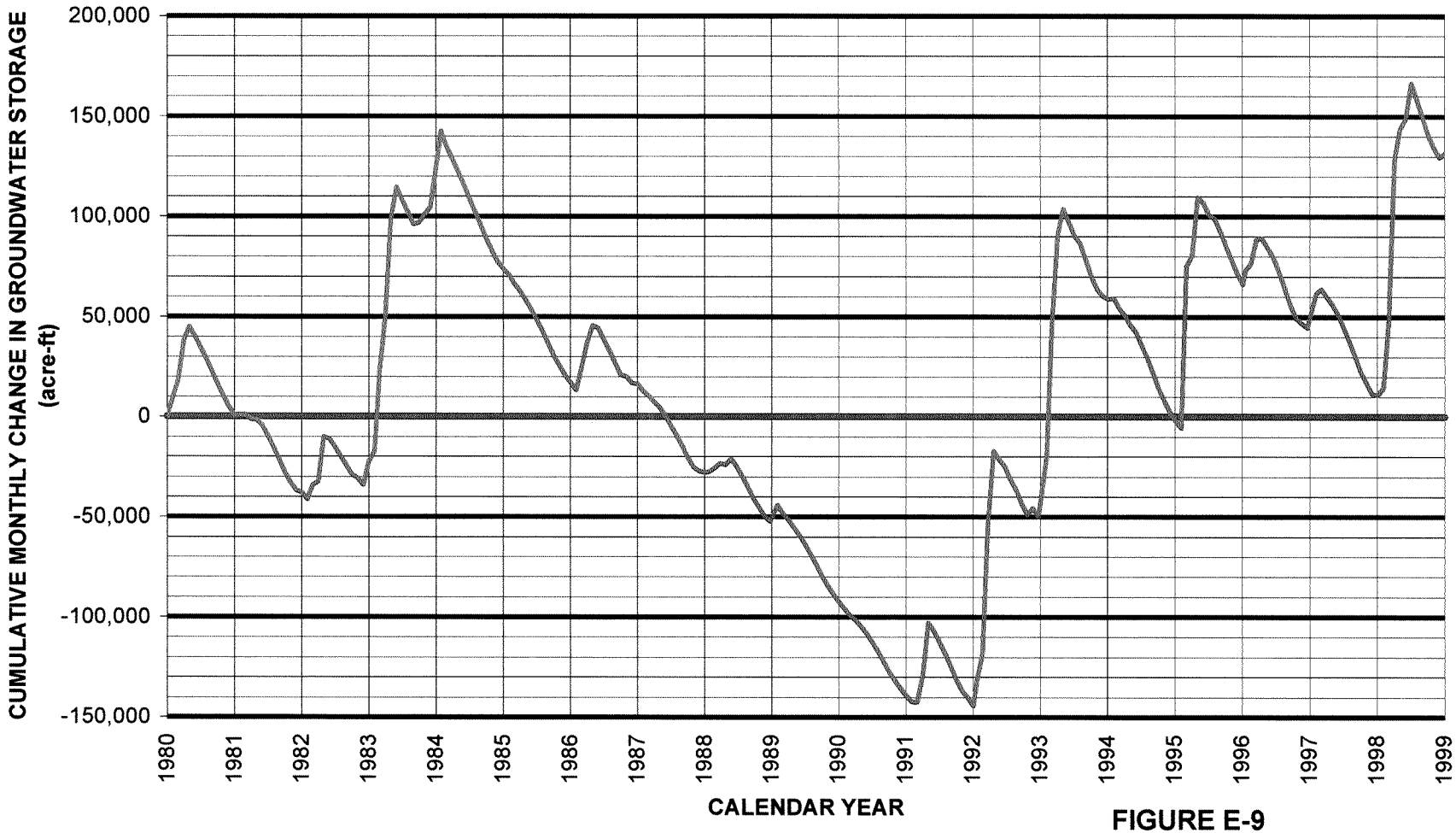

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AF	acre-feet
AF/yr	acre-feet per year
ASR	aquifer storage and recovery
bgs	below ground surface
cfs	cubic feet per second
CLWA	Castaic Lake Water Agency
cm/sec	centimeters per second
county line	Los Angeles-Ventura County line
Downstream Water Users	Los Angeles County Waterworks District, Newhall Land & Farming Company, Newhall County Water District, and United Water Conservation District
DWR	California Department of Water Resources
ET	evapotranspiration
ft/day	feet per day
ft^2/day	square feet per day
ft/yr	feet per year
GIS	geographic information system
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
gpm/ft	gallons per minute per foot
GPS	global positioning system
I-5	Interstate 5
in/yr	inches per year
K	hydraulic conductivity
Kh	horizontal hydraulic conductivity
Kv	vertical hydraulic conductivity
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District

LACWWD	Los Angeles County Waterworks District
LADPW	Los Angeles County Department of Public Works
MOU	Memorandum of Understanding
NCDC	National Climate Data Center
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
Purveyors	Upper Basin Water Purveyors
R	vertical anisotropy ratio (Kh:Kv)
RCS	Richard C. Slade and Associates, LLC
Regional Model	Santa Clarita Valley Groundwater Model
residual	residual error
RMS	root-mean-square
SCWC	Santa Clarita Water Company
SWP	State Water Project
SWRM	Surface Water Routing Model
Sy	aquifer specific yield
T	transmissivity
UWCD	United Water Conservation District
USGS	U.S. Geological Survey
VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WRP	water reclamation plant
WY	water year

SECTION 1

Introduction

This report describes the development of a regional groundwater flow model for the Santa Clarita Valley, located in northwestern Los Angeles County, California. The model, called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. It has been developed for the water purveyors in the valley as a tool for the analysis of groundwater management options in the context of future water demands and water supply conditions in the valley. Figure 1-1 is a map showing the study area.

1.1 Model Use Objectives

The Regional Model has been developed as part of the work scope contained in a Memorandum of Understanding (MOU) that was entered into in August 2001 by the water purveyors in the Santa Clarita Valley (the Purveyors) and the United Water Conservation District (UWCD), located downstream in Ventura County. The MOU, which is contained in Appendix A, is a commitment by the Purveyors to expand the analysis of groundwater conditions such that the adequacy of the local water supply is well understood and questions about surface water and groundwater resources can be more readily addressed. The MOU contained a number of technical components, including the development and calibration of a regional-scale groundwater flow model and the preparation of technical reports on topics such as groundwater model development. This report and the model described herein reflect the accomplishment of two of the MOU technical components.

The Regional Model is intended to become a tool for managing the local groundwater resource, including the relationship of surface water to groundwater in the valley. The model has been designed to be an evolving tool that will analyze groundwater development, natural and artificial recharge (particularly in conjunction with the availability of imported surface water supplies), and the resultant impacts of these activities on groundwater conditions within the valley and on the flows of water into the downstream basins in Ventura County. As discussed in the MOU, one use will be to evaluate the long-term sustainability, or operational yield, of the shallow Alluvial Aquifer and the deeper groundwater resources that are present in the underlying Saugus Formation. Specifically, this assessment will look at basin operations over a multi-year wet/dry cycle, with operational yield defined as a basin operating plan that allows continued pumping from these aquifers while assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. The parties to the MOU agreed to use the Regional Model for this assessment because (1) data show no long-term lowering of the water table or degradation of water quality has occurred during the 50 to 60 years of historical groundwater development in the valley, and (2) current planning places future pumping of the Alluvial Aquifer in the same range as historical pumping. At this time, the primary question of interest to the MOU parties is the effect of pumping the Saugus Formation during short-term dry periods at rates that are higher than have been historically pumped from that formation. An additional

planned application of the model will be to evaluate the restoration of pumping capacity that has been impacted by perchlorate contamination in the vicinity of the Whittaker-Bermite property in the central part of the valley.

Based on these objectives, the MOU specified that a model would be constructed that covers the entire area within the Santa Clarita Valley where Alluvial and Saugus groundwater resources are present, and that the model should be subjected to a transient calibration.

1.2 Model Development

The approach to developing the model included:

a. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system.

b. Creating a variety of data sets to conduct steady-state and transient calibrations.

c. Constructing the groundwater flow model using the MicroFEM® finite-element groundwater flow code, and also using the available database and geographic information system (GIS) for the Santa Clarita Valley.

d. Calibrating the flow model.

e. Performing sensitivity tests on the flow model.

This project was conducted for the parties to the MOU, who are the United Water Conservation District (UCWD) in Ventura County and the Upper Basin Water Purveyors, the water providers in the Santa Clarita Valley. The Upper Basin Water Purveyors consist of four retail purveyors of municipal water and the Castaic Lake Water Agency (CLWA), which has a contract with the State of California to obtain water from the State Water Project (SWP), and which furnishes SWP water to the four retail purveyors. The four retail purveyors are Los Angeles County Waterworks District (LACWWD) No. 36, the Newhall County Water District (NCWD), Santa Clarita Water Company (SCWC, a division of CLWA), and the Valencia Water Company (VWC).

1.3 Previous Studies

There are several previous studies of the groundwater system in the Santa Clarita Valley that were used to help develop the conceptual and numerical models of the hydrogeologic system. These studies include reports on the regional geology and hydrogeology, and a previous modeling analysis of the feasibility of constructing an aquifer storage and recovery (ASR) system. These studies are listed below and are described in more detail in Section 2.7 of this report.

a. *Hydrogeologic Investigation: Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clarita River Valley of Los Angeles County, California* (Richard C. Slade and Associates, LLC [RCS], 1986). This report was the first comprehensive study of the geology and hydrology of the Alluvial Aquifer.

b. *Hydrogeologic Assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, California* (RCS, 1988). This report was the first comprehensive study of the geology and hydrology of the Saugus Formation.

c. *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001). This report documented the results of ASR field tests in the Saugus Formation that evaluated the feasibility of injecting water into, and recovering water from, deep Saugus Formation wells.

d. *2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems* (RCS, 2002). This report was a summary and update of the 1986 and 1988 RCS reports.

e. *Newhall Ranch ASR Impact Evaluation* (CH2M HILL, 2001). This document evaluated the longer-term basinwide influences that would occur for an ASR program that was proposed as part of the water supply for the planned Newhall Ranch community.

f. *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002). This document updated the ASR impact evaluation, including analyzing the effects of all aspects of the Newhall Ranch community (not just ASR) on the valley's water resources.

1.4 Report Organization

The remainder of this report is organized as follows:

Section 2 describes the hydrogeology of the Santa Clarita Valley, including the geologic system; groundwater occurrence; groundwater recharge and discharge mechanisms; the relationship of surface hydrology to the valley's groundwater resources; historical trends in the valley's hydrology; the role of the SWP on the valley's water resources and water supply; and key findings from prior studies conducted in the valley. This section of the report (along with Appendix B) focuses on information of specific relevance to development of the regional flow model.

Section 3 discusses the construction of the model, including the modeling software; the grid design; the layer-by-layer representation of the aquifers; the boundary conditions; the estimation of groundwater recharge rates; and the assignment of pumping rates in the model. Appendix C describes the design, operation, and data for a surface water routing model that was developed to provide the Regional Model with recharge rates from urban irrigation, agricultural irrigation, direct precipitation, streamflows entering the model domain, and discharges from water reclamation plants (WRP).

Section 4 describes the calibration conditions; the calibration goals; the model variables that were adjusted during calibration; the calibration procedure; and the measured (target) data that were used to evaluate calibration quality.

Section 5 presents quantitative and semi-quantitative evaluations of the calibration results, with a focus on the assessment of the model's calibration quality compared with the calibration goals presented in Section 4. Section 5 then concludes with a sensitivity analysis that further evaluates calibration quality and demonstrates the sensitivity of simulated groundwater elevations and water budget terms to changes in model parameter values.

Section 6 summarizes the applicability of the model for use in managing local groundwater resources, including the key attributes of the model and recommendations for further data collection and future model updates.

Section 7 is the reference list.

Figures

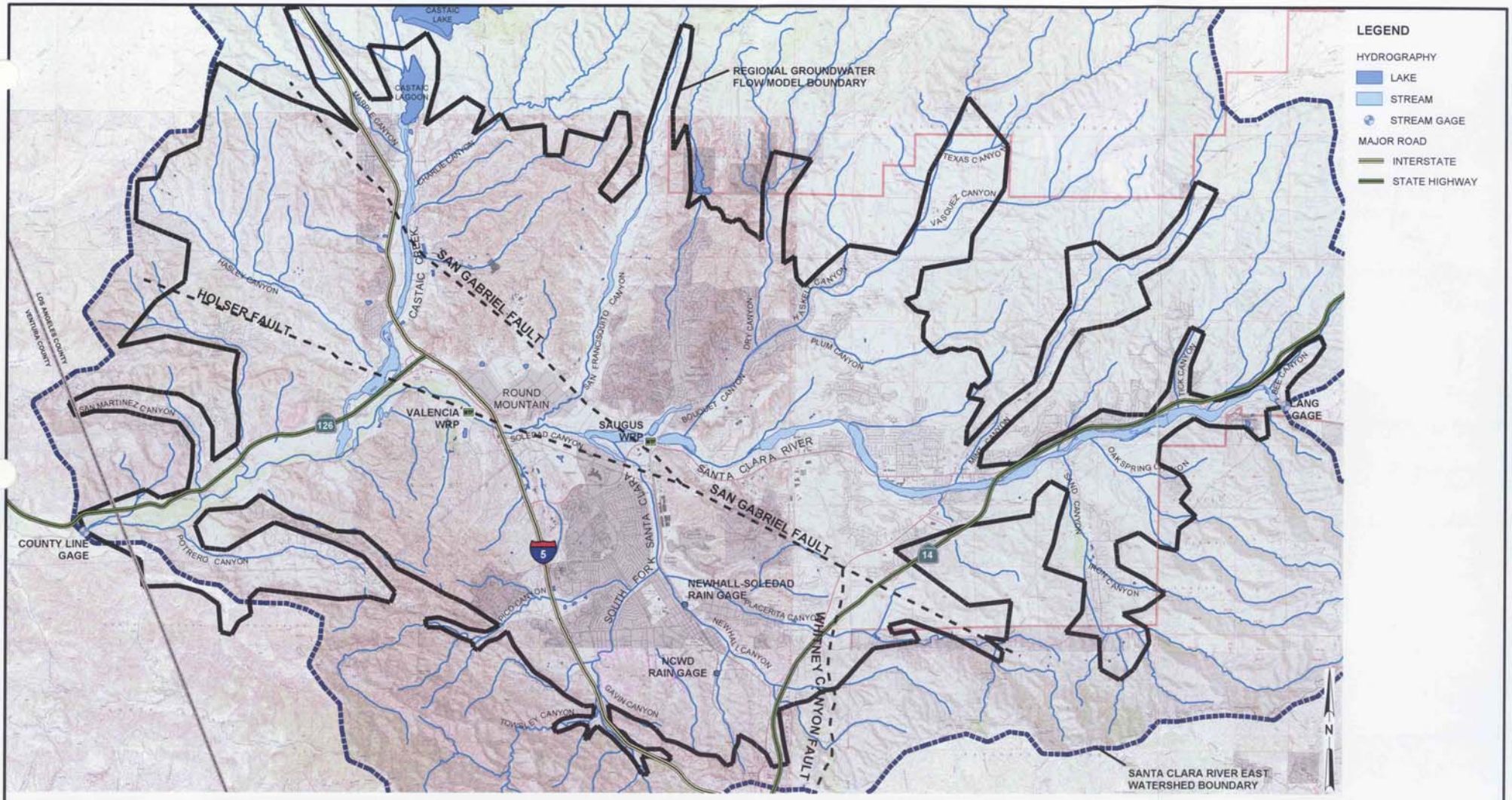

FIGURE 1-1
MAP OF STUDY AREA
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 2

Hydrogeology of the Santa Clarita Valley

The geology and hydrogeology of the Santa Clarita Valley are described in this section, which is derived primarily from the reports described in Section 1.3 and Section 2.7. Figure 2-1 is a schematic representation of the regional scale geology and hydrologic cycle in the Santa Clarita Valley. As shown on Figure 2-1, the two aquifer systems in the Santa Clarita Valley are the Alluvial Aquifer and the Saugus Formation. Groundwater is exchanged between these two units. Additionally, the aquifer systems are affected by direct rainfall; streamflows in the Santa Clara River and its tributaries; evapotranspiration (ET) by riparian vegetation along portions of the river; and human influences which consist of pumping, agricultural and urban irrigation, discharge of treated water into the Santa Clara River from two water reclamation plants, and occasional releases of water into Castaic Creek from Castaic Lake and Castaic Lagoon.

Figure 2-2 shows the location of the Santa Clarita Valley groundwater basin. This groundwater basin is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley East Groundwater Subbasin and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Figure 2-3 is a map of the Santa Clarita Valley, showing the locations of production wells completed in the Alluvial Aquifer and Saugus Formation.

2.1 Setting

The study area comprises the relatively flat-lying Santa Clarita Valley and portions of the surrounding hills and mountains. The study area extends from approximately the Los Angeles-Ventura County line (county line) on the west to the community of Lang on the east, and from the southern end of Castaic Lake on the north to the intersection of the Golden State Freeway (Interstate 5 [I-5]) and the Antelope Valley Freeway (State Highway 14) on the south. The mountains that surround the Santa Clarita Valley include the Santa Susana and San Gabriel Mountains to the south and the Sierra Pelona and Leibre-Sawmill Mountains to the north. Elevations range from approximately 800 feet on the valley floor to approximately 6,500 feet in the San Gabriel Mountains. The headwaters of the Santa Clara River are at an elevation of approximately 3,200 feet at the topographic divide separating the Upper Santa Clara River Hydrologic Area from the Mojave Desert.

The largest community in the study area is the City of Santa Clarita, which was formed in 1987 through the amalgamation of the communities of Newhall, Valencia, Saugus, and Canyon Country. Other smaller unincorporated communities in the study area include Stevenson Ranch and Val Verde in the west, Castaic in the northwest, and Lang in the east. The population of the City of Santa Clarita was estimated to be approximately 151,260 in the 2000 U.S. Census. In 2001, the Southern California Association of Governments estimated the population of the surrounding unincorporated Santa Clarita Valley at 48,237. Hence, the total current population of the Santa Clarita Valley is approximately 200,000 (RCS, 2002).

Prior to the 1960s, the predominant land use in the Santa Clarita Valley was agricultural, with much of the valley undeveloped. Urbanization began gradually in the 1960s, with a rapid increase beginning in the late 1970s and early 1980s and continuing to the present. Accompanying the rapid population increase has been a gradual change in valley land use patterns, from largely agricultural to urban and suburban developments. Nevertheless, a considerable portion of the hills and low mountains bordering the main river valley remain in a natural, undeveloped condition (RCS, 2002).

2.2 Climate

The study area has a semi-arid Mediterranean-type climate, characterized by long, dry summers and relatively short, wet winters. Temperatures in the Santa Clarita Valley range from a minimum of 20 degrees Fahrenheit (°F) to 30°F in the winter to a maximum of approximately 100 to 110°F during the summer. Mean monthly temperatures range between approximately 48°F in the winter and 77°F in the summer.

Rainfall data have been recorded since 1883 at the Newhall-Soledad gage (Station No. FC32CE), located at the Los Angeles County Department of Public Works (LADPW) Newhall-Soledad Division Headquarters office, on San Fernando Road in the community of Newhall. The average rainfall at this gage was 17.95 inches from 1883 through 2000 and 17.84 inches from 1950 through 2000.[1] A second rain gage is located approximately 1.3 miles to the south, at the NCWD office. Figure 2-4 shows the annual rainfall at the Newhall-Soledad and NCWD gages for calendar years 1950 through 2000. As shown in the figure, annual rainfall is highly variable from year to year. During this period, the highest calendar-year rainfall was 42.17 inches in 1978 at the Newhall-Soledad gage, and 48.33 inches in 1983 at the NCWD gage. The lowest amount of annual rainfall from 1950 through 2000 was 4.15 inches in 1972 at the Newhall-Soledad gage, and 8.47 inches in 1989 at the NCWD gage. Average annual rainfall from 1979 through 2000 was 18.67 inches at the Newhall-Soledad gage and 22.88 inches at the NCWD gage. Rainfall at the NCWD gage is usually greater than at the Newhall-Soledad gage, because the NCWD gage is located closer to the hills that form the southern boundary of the watershed and receive a greater amount of orographic precipitation.

Rainfall is not only variable on an annual basis, but is also highly seasonal. Approximately 80 percent of the annual precipitation in the Santa Clarita Valley falls between November and March. Most of the precipitation comes from winter storms that last only a few days and are separated by relatively long periods of clear weather.

As shown by the difference in rainfall values between the Newhall-Soledad and NCWD rain gages, rainfall varies across the basin according to elevation differences and the locations of surrounding mountain ranges. Figure 2-5 shows lines of equal precipitation (rainfall isohyets), based on long-term mean annual precipitation data compiled from the U.S. Geological Survey (USGS), DWR, and California Division of Mines maps and data. The source maps consist primarily of U.S. Weather Service data for approximately 800 precipitation stations, but in the Los Angeles and San Francisco Bay areas the

[1] Annual rainfall values for the Newhall-Soledad gage are based on monthly records reported by the National Climate Data Center (NCDC) and LADPW.

U.S. Weather Service data have been supplemented by county and local agency precipitation data. The precipitation isohyets shown on Figure 2-5 display the average annual rainfall during the period from 1900 through 1960. (See the internet site http://gis.ca.gov/meta.epl?oid=286 for more information.)

2.3 Geology

Figure 2-6 presents a geologic map of the Santa Clarita Valley, as reported by RCS (2002). The geologic units shown on the map include water-bearing sediments and non-water-bearing bedrock.

The Santa Clarita Valley is underlain and bounded by non-water-bearing bedrock units that are Miocene, Oligocene, and pre-Tertiary in geologic age. These units yield little water and are not considered viable for groundwater development.

Where the bedrock units are not exposed at the ground surface, they are overlain by younger geologic units. The Pliocene-age to Pleistocene-age Saugus Formation (map symbol, QTs) overlies the bedrock in much of the basin. At the far western and eastern ends of the basin, and in the upper reaches of some of the canyons, the Saugus Formation is absent and the bedrock units are overlain by a blanket of unconsolidated alluvium of Quaternary geologic age (map symbol, Qal). Where present, the alluvium overlies the Saugus Formation within much of the Santa Clarita Valley. In some areas where the alluvium is absent, the Saugus Formation is overlain by scattered outcrops of Quaternary-age Terrace deposits (map symbol, Qt). Groundwater is present in much of the alluvium and the Saugus Formation. However, the terrace deposits do not contain significant water resources because they are typically situated at elevations above the regional water table.

2.3.1 Non-Water-Bearing Bedrock

Underlying the water-bearing sediments in the Santa Clarita Valley are a series of consolidated, older, cemented sedimentary and crystalline rocks of Tertiary geologic age or older. For the most part, the sedimentary rocks are exposed along the flanks of the hills and mountains that border the Santa Clarita Valley, while the geologically older crystalline metamorphic and igneous rocks crop out in the upper watershed areas of the Sierra Pelona and San Gabriel Mountains.

Geologically older sedimentary rocks underlie the base of the Saugus Formation and are exposed in the hills beyond the exterior boundary line for the mapped surface limits of the Saugus Formation. The older rocks lying immediately below the Saugus Formation are: (1) the Pico Formation, composed of siltstone and shale, which underlies the Saugus Formation in the region southwest of the San Gabriel fault; and (2) the Castaic Formation and the Mint Canyon Formation, mainly siltstone and shale, which underlie the Saugus Formation in areas northeast of the San Gabriel fault. These sedimentary rock formations are generally fine grained, have low permeability, and do not yield substantial quantities of water to wells. In the project area, these rocks are considered barriers to groundwater flow.

2.3.2 Water-Bearing Sediments

Water-bearing sediments in the Santa Clarita Valley consist of:

a. Alluvial and valley fill deposits that underlie the Santa Clara River and its tributaries

b. Partially consolidated, older sediments of the Saugus Formation, including the Sunshine Ranch Member, that underlie the alluvium and are also exposed in the hillsides surrounding the main portion of the valley

2.3.2.1 Alluvium

The alluvial sediments are composed of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable amounts of cobbles and boulders. In general, alluvium in the main river valley ranges from medium-grained sand to sandy gravel and cobbles. Drillers' logs indicate the presence of discrete sand zones and discrete gravel zones in many areas of the alluvium. Due to its unconsolidated to poorly consolidated condition, and its lack of cementation, the alluvium has relatively high permeability and porosity.

The alluvial sediments lie within and along the course of the Santa Clara River and its main tributaries. The maximum thickness of the alluvium varies along the Santa Clara River, but generally is considered to be 200 feet. Typically, the alluvium tends to be thickest near the central portion of the river, and thins or pinches out near the flanks of the adjoining hills.

The alluvium overlies the Saugus Formation in much of the valley. However, in the eastern part of Soledad Canyon, the Saugus Formation is absent, and instead the alluvium overlies Miocene-age terrestrial sediments of the Tick Canyon and Mint Canyon Formations. In the upper reaches of some tributaries to the Santa Clara River, the alluvium overlies these or other Miocene-age sediments, such as the Pico and Castaic Formations. At the west end of the valley, the alluvium overlies the Pico Formation.

2.3.2.2 Saugus Formation

The Saugus Formation is present throughout the main portion of the Santa Clarita Valley and extends to the surrounding foothills. The Saugus Formation contains lenticular and interfingered beds of poorly- to well-consolidated sandstone, conglomerate, and siltstone that are at least 7,500 feet thick in the deepest part of the basin. These terrestrial sediments were deposited in stream channels, floodplains, and alluvial fans by the ancestral drainage system in the valley. The coarser-grained materials in the Saugus Formation were deposited in the main channels of the ancestral drainage system, and the locations of these channels changed throughout the approximately 3-million-year period of deposition of the Saugus Formation. Recent interpretations of geophysical electric log data indicate that the coarse-grained channel deposits (the primary water-bearing strata) are thicker and more numerous in some areas than in other locations in the valley. Although the Saugus Formation displays a considerable amount of lateral variability in lithology and grain size, some thicker stratigraphic packages can be traced through portions of the valley, primarily on the west (downthrown) side of the San Gabriel Fault (RCS, 2002).

The deeper and older portion of the Saugus Formation, the Sunshine Ranch Member, was deposited in a marine environment and consists of fine-grained, low-permeability siltstone and sandstone. The Sunshine Ranch Member has a maximum thickness of approximately 3,500 feet in the central part of the valley. It is present at or very close to ground surface at the margins of the valley. Geophysical (electric) logging indicates that the groundwater in

much of the Sunshine Ranch Member may be somewhat brackish in quality and is not useful for municipal water supply purposes.

2.3.3 Geologic Structure

Faulting and folding of the rocks in the region have caused the sedimentary rocks, including the Saugus Formation, to form a bowl-shaped structure. The Saugus Formation and the underlying bedrock dip generally toward the center of the "bowl" from all locations along the bottom (basal) contact of the Saugus Formation.

Dominating the geologic structure in the valley is the southeast-northwest-trending San Gabriel fault. The fault is a northeast-dipping reverse fault. The vertical displacement of the Saugus Formation on each side of the fault varies along the length of the fault and ranges from 100 feet to 2,600 feet within the valley (RCS, 1988). The Saugus Formation is thickest south of the fault, and this is the area where all significant Saugus production wells are located. North of the San Gabriel fault, the Saugus Formation is older, thinner, and finer grained than south of the fault. Little groundwater development has occurred north of the San Gabriel Fault.

A spur from this fault, referred to as the Holser fault, trends west through the valley. Cross sections prepared by RCS (1988, 2002) show that marker beds are offset by approximately 100 to 200 feet across the Holser Fault, which is substantially less than the offset across the San Gabriel Fault. Another spur fault called the Whitney Canyon fault extends south from the San Gabriel Fault in the southeastern corner of the valley.

2.4 Groundwater Occurrence, Recharge, and Discharge

Groundwater is present in the alluvium under generally unconfined conditions. Saugus Formation groundwater is thought to be present under unconfined conditions in the shallowest water-bearing zones where the Alluvial Aquifer is absent, and under semi-confined and confined conditions at greater depths. Figure 2-1 is a schematic cross-sectional representation of the groundwater flow patterns in the Santa Clarita Valley, including the predominant recharge and discharge mechanisms for the two aquifer systems. These are discussed in detail below.

2.4.1 Alluvium

Natural sources of recharge to the alluvium include deep percolation (infiltration) of direct precipitation within the valley; percolation of stream runoff flowing into the valley along the Santa Clara River and its tributaries; subsurface inflow from the adjoining (upgradient) portions of the Alluvial Aquifer to the north and east of the valley; and discharge of groundwater from the Saugus Formation to the Alluvial Aquifer, primarily on the west side of the Santa Clarita Valley.

Manmade sources of recharge to the Alluvial Aquifer include infiltration of irrigation water; infiltration of stormwater runoff from urban areas; infiltration of surface flow and underflow from Castaic Dam within the Castaic Creek area; infiltration of water released by the Los Angeles Department of Water and Power from its reservoir facilities in upper San Francisquito Canyon and upper Bouquet Canyon; and infiltration of water reclamation

plant (WRP) discharges to the Santa Clara River from two Los Angeles County Sanitation District (LACSD) WRPs in the valley (Plant No. 26 near Bouquet Canyon and Plant No. 32 near Valencia).

Groundwater discharge is significant in the western portion of the Alluvial Aquifer, where it occurs primarily as discharge to the Santa Clara River and ET by the riparian vegetation growing along the river corridor. Groundwater discharge from the west end of the basin also occurs as subsurface outflow through the Alluvial Aquifer to the downstream Piru Basin. Other groundwater discharge mechanisms in the Santa Clarita Valley are pumping for agricultural and municipal uses and seepage to underlying permeable portions of the Saugus Formation, particularly in the eastern portion of the basin.

According to RCS (1986), groundwater present within the Alluvial Aquifer flows from east to west roughly coincident with the direction of surface water flow. Figure 2-7 displays a groundwater elevation contour map for the Alluvial Aquifer, using water level data collected during the spring of 2000.

RCS (2002) estimated that the amount of groundwater in storage in the Alluvial Aquifer has historically fluctuated between approximately 100,000 and 200,000 acre-feet. Table 2-1 summarizes the well-by-well historical annual groundwater pumping from the Alluvial Aquifer from 1980 through 2000. Historical groundwater production rates during this period averaged 29,700 acre-feet per year (AF/yr) and ranged from approximately 20,300 to 43,500 AF/yr. As discussed later in Section 2.6.2, these pumping rates are at or below pumping rates during the 1950s and 1960s, when groundwater was used primarily for agricultural purposes.

2.4.2 Saugus Formation

The Saugus Formation is recharged by two principal sources: (1) infiltration of precipitation in the exposed portions of the Saugus in the highlands surrounding the valley, and (2) seepage from the Alluvial Aquifer along the Santa Clara River and its tributaries, particularly in the eastern and central portions of the Santa Clarita Valley. Minor recharge may also occur in limited areas through irrigation seepage, where the land overlying the Saugus is cultivated. In the eastern part of the Santa Clarita Valley, the Saugus Formation is underlain by older rocks of the Castaic Formation and Mint Canyon Formation, which surround the bowl-shaped Saugus structure. Little, if any, groundwater exchange occurs between these formations and the Saugus Formation.

Discharge from the Saugus Formation occurs in part as groundwater pumping from wells as deep as 2,000 feet. Discharge from the Saugus Formation also occurs at the west end of the valley, west of the I-5 bridge, where Saugus groundwater is thought to discharge to the Alluvial Aquifer. The older and relatively impermeable rocks of the Pico Formation, that underlie and form the western boundary of the Saugus Formation, form a barrier to groundwater flow and force Saugus groundwater to discharge upwards into the Alluvial Aquifer in the area extending between two miles and six miles upstream of the county line (refer to Figure 2-1). The Saugus is not present at Blue Cut, which is approximately three miles downstream of the Saugus/Pico Formation contact and approximately one mile downstream of the county line.

Because the Saugus Formation and underlying bedrock units tilt downward from the edges of the valley to the center of the valley, the permeable sand layers within the Saugus Formation near the margins of the valley are thought to be oriented so that they are in direct connection with the overlying Alluvial Aquifer. Consequently, recharge to the Saugus Formation from the Alluvial Aquifer is thought to be greatest in these areas, particularly on the east side of the valley. Also, discharge from the Saugus Formation to the Alluvial Aquifer is thought to be enhanced where permeable sand layers of the Saugus are contacting the Alluvial Aquifer on the western end of the valley where the Saugus Formation discharges.

The available water level data, which are concentrated in localized areas, indicate that the direction of groundwater flow in the Saugus is toward the center of the valley from the highlands. The data indicate that Saugus groundwater flows toward the western end of the Santa Clara Valley where it discharges naturally into the Alluvial Aquifer. Figure 2-8 displays a groundwater elevation contour map for the Saugus Formation, using water level data collected during the fall of 2000 (RCS, 2002).

Although few wells have been drilled into the Saugus Formation at or north/northeast of the San Gabriel fault, there is evidence of limited Saugus groundwater flow across the fault. Data that suggest this limited hydraulic connection between the two fault blocks are as follows:

a. Geologic and geophysical logging of former exploratory oil wells indicates that the Saugus Formation is much thinner north of the San Gabriel Fault than south of it (see geologic cross section E-E′ in RCS, 1988). Preliminary interpretations of recent geologic and geophysical logging at multi-port monitoring wells on the Whittaker-Bermite property also suggest the Sunshine Ranch Member is present at much shallower depths on the upthrown fault block, north/northeast of the fault, than on the downthrown block, south/southwest of the fault. Together, these data indicate that the older and fine-grained Sunshine Ranch Member of the Saugus Formation predominates in the area north of the fault.

b. Water level monitoring on the Whittaker-Bermite property shows groundwater elevations in multi-port monitoring well MP-3, on the upthrown side of the fault, are approximately 100 to 150 feet higher than in the other multi-port wells, which are on the downthrown side of the fault. Additionally, the three monitoring wells on the downthrown side (MP-1, MP-2, and MP-4) that have been monitored since January 2003, show responses to seasonal pumping of nearby water supply wells, whereas the monitoring well on the upthrown side (MP-3) shows no such response. (See Figure 2-3 for the locations of these wells, and Figure 2-9 for plots of groundwater elevations over time at each of these wells.)

In contrast, recent drilling, well construction, and pump testing work has indicated that the Holser Fault does not act as a barrier to groundwater flow. In early 2003, well MP-5 was installed in the Saugus Formation, located just north of the fault. This is a multi-port monitoring well that measures water levels at four discrete depths as great as 965 feet in the Saugus Formation. During March 2004, a deep Saugus production well south of the Holser Fault (VWC-205, located 4,700 feet away) was pumped for 72 hours under controlled conditions that included allowing no pumping to occur from other Saugus wells in the area.

The test was performed in part to evaluate the Holser Fault's hydraulic influence in the Saugus Formation. During pumping at VWC-205, measurable drawdown was observed at the two deepest ports at MP-5, which are situated at depths (795 feet and 965 feet) that correspond with the depths of the upper portion of the screen of VWC-205. Water level recovery monitoring conducted when VWC-205 was shut down showed rising water levels in these same two ports at MP-5. These observations are consistent with previous indications that the Holser Fault is not a significant barrier to groundwater flow in the Saugus Formation.

RCS (2002) estimated that the amount of groundwater in storage in the freshwater-portion of the Saugus Formation is approximately 1.65 million acre-feet. Historical groundwater production rates since 1980 have ranged from approximately 3,000 to nearly 15,000 AF/yr. Table 2-2 summarizes the well-by-well historical annual groundwater pumping from the Saugus Formation from 1980 through 2000.

2.5 Aquifer Physical Properties

2.5.1 Alluvium

Available groundwater elevation data and aquifer test data from Alluvial wells indicate that the Alluvial Aquifer is unconfined (i.e., is under water table conditions). Transmissivity values range from 4,700 square feet per day (ft^2/day), or 35,000 gallons per day (gpd) per foot (gpd/ft) to over 100,000 ft^2/day, or 750,000 gpd/ft. Specific yield values range from approximately 0.09 to 0.16 (RCS, 1986, 2002).

The transmissivity values are estimated (indirectly calculated) from pumping plant efficiency (specific capacity) tests conducted on a number of alluvial water wells over the years by the Southern California Edison Company. The transmissivity estimates that are calculated from these tests vary widely over short distances, and in some cases they vary substantially over time at individual wells. This is because the drawdown data that are collected during these tests are solely from the pumping wells themselves. Consequently, the use of water level drawdown data from pumping wells may provide transmissivity estimates that are strongly influenced (potentially biased low) by the condition of the well's screen or perforations and the gravel pack, particularly in the case of older wells. Nonetheless, these estimates can be useful for identifying substantial spatial variations in aquifer permeability if one selects the highest transmissivity values that are calculated for each given well (those values least impacted by well structure or well-related issues). Table 2-3 summarizes the results of the interpretations of the specific capacity data. Appendix B contains detailed tables of the testing data and the calculations of transmissivity and hydraulic conductivity, along with a comparison of these values to parameter values used in the regional model.

2.5.2 Saugus Formation

Available aquifer test data from Saugus wells located near the center of the valley where the Saugus is thickest indicate that the Saugus is semi-confined to confined (under pressure). In areas where the Saugus crops out, the uppermost saturated zones are partially unconfined because the permeable beds are folded upwards. In the highlands, the Saugus beds are

exposed at the ground surface, and in the valley the Saugus beds are in contact with the Alluvial Aquifer.

Transmissivity values range from approximately 400 to 25,000 ft^2/day (3,000 to 180,000 gpd/ft), but are typically between 5,500 and 11,000 ft^2/day (40,000 and 80,000 gpd/ft). Storativity values are on the order of 10^{-3} to 10^{-4}. These aquifer parameter values have been estimated from well performance tests and from the Saugus Formation ASR study conducted in 2000 (RCS, 2001, 2002). Table 2-4 summarizes this parameter data.

The ASR study consisted of a three-phase field test:

a. Phase 1: Injection of approximately 24 million gallons of treated drinking water into well VWC-205 at three injection rates (500, 800, and 1,100 gallons per minute [gpm]). Injection at each rate was performed for 7 days, for a total injection period of 21 days.

b. Phase 2: Recovery of 33 million gallons of water by pumping well VWC-205 at an average rate of 2,300 gpm for a period of 10 days. This pumping began 13 days after injection had ended.

c. Phase 3: Pumping 35 million gallons of water from nearby well VWC-201 at an average rate of 2,400 gpm for a period of 10 days. This pumping began 24 days after pumping had stopped at well VWC-205.

Water levels were monitored in nearby non-pumping Saugus Formation wells, including a Saugus monitoring well located 35 feet from well VWC-205, and in a newly installed Alluvial Aquifer monitoring well located 40 feet from well VWC-201. Monitoring began 22 days prior to Phase 1 and continued 3 days beyond the completion of Phase 3. Testing and monitoring details are provided in the report titled *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001). The ASR test indicated that it is hydrogeologically feasible to inject and recover significant volumes of water from a well completed in the Saugus Formation. The data also indicated that there was no measurable effect on water levels at the alluvial monitoring well during the monitoring period.

The ASR testing data also indicated that wells VWC-201 and VWC-205 have specific capacities between 10 and 20 gpm per foot (gpm/ft), which is intermediate in value between those of nearby wells. NCWD's wells to the south have specific capacities ranging from approximately 2 to 10 gpm/ft. To the north, wells that are owned by VWC and SCWC show specific capacities ranging from approximately 25 to 50 gpm/ft. Although these data suggest the possible existence of slightly more permeable zones in the center of the basin than along the southern edge, the apparent difference may also be caused by differences in well construction and well efficiency. Analyses of the ASR test data, including numerical model calibration runs, indicate that the bulk permeability of the Saugus Formation at wells VWC-201 and VWC-205 is approximately 6.5 feet per day (ft/day) (CH2M HILL, 2001).

2.6 General Hydrology and Hydrologic Cycle

The major sources of surface water in the Santa Clarita Valley include precipitation, return flows of urban and agricultural irrigation water, and treatment plant discharges to the Santa Clara River from two WRPs which were built in 1962 and 1967. Another significant source

of surface water is the increased importing of SWP water, which is stored in Castaic Lake and Castaic Lagoon, then treated and delivered by CLWA to the retail water purveyors in the Santa Clarita Valley. In some years, DWR releases flood flows from Castaic Dam/ Lagoon into Castaic Creek during the winter or spring months. Further details regarding the operation of the SWP system and its effect on the valley's hydrology and water supply are provided in Section 2.6.3 below.

Before 1970, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during the 1950s and early 1960s ranged from 35,000 to 44,000 AF/yr. Pumping from the Alluvial Aquifer dropped gradually from 40,000 AF/yr in 1967 to less than 30,000 AF/yr by 1983, and did not rise above 30,000 AF/yr until 1993. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. In response to statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available. The water management practices of the purveyors call for maximizing the use of Alluvial Aquifer and SWP water. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. Consequently, since 1995, Saugus pumping has ranged between approximately 4,000 and 8,500 AF/yr.

The remainder of this section describes the hydrology of the Santa Clarita Valley, historical hydrologic trends, and the operation of the SWP system and its influence on local hydrology and water supplies.

2.6.1 Basin Hydrology

The natural surface water features in the basin are the Santa Clara River and the tributaries that flow into it from canyons lying north and south of the river (Figure 2-10). Flows in the tributary canyons, and in the reach of the Santa Clara River that lies upstream of San Francisquito Canyon, are ephemeral, or intermittent. In these ephemeral streams, flow is limited to short-term runoff periods during storm events. The reach of the Santa Clara River west of San Francisquito Canyon is a perennially flowing river that obtains its flow from natural discharge of Alluvial Aquifer groundwater and from discharge of treated water from two WRPs. The other significant surface water feature is Castaic Lake, an SWP reservoir that lies at the north end of Castaic Creek in the northwestern portion of the valley. Like other tributaries to the Santa Clara River, the flows in Castaic Creek are ephemeral.

Figure 2-1 is a schematic diagram showing the hydrologic cycle for the Santa Clarita Valley. Table 2-5 lists the components of the hydrologic cycle for the basin. The components are classified in the table as one or more of the following:

a. Surface water recharge
b. Surface water discharge

c. Groundwater recharge
d. Groundwater discharge

These four elements of the hydrologic cycle have an important influence on the availability of surface water and groundwater resources in the basin. Time-series plots were constructed to show the relative magnitudes and trends of the various components of the hydrologic cycle in recent years. The time-series plots also illustrate the interrelationships of the hydrologic system components and their relationships to trends in groundwater levels in the Alluvial Aquifer and the Saugus Formation. The time-series analyses are discussed below.

2.6.2 Historical Hydrologic Trends

Long-term water level data have been collected over the years at purveyor-owned wells in the City of Santa Clarita and along the South Fork Santa Clara River. The data have been collected in pumping wells, and the hydrographs of these wells are steep at certain times, suggesting that some water levels are influenced by pumping at the well. Nonetheless, the data show some general trends over time and are useful for assessing general relationships between groundwater elevation trends and changes in groundwater recharge and pumping over time. Following are discussions of the observed hydrologic trends in the basin during the 50-year period from 1950 through 1999, as well as a comparison of hydrologic trends locally and in the SWP system.

2.6.2.1 Historical Trends in Rainfall

Figure 2-11 shows the annual precipitation along with the cumulative departure from the average annual precipitation since 1950. Cumulative departure refers to the cumulative amount of rainfall that is greater than or less than the long-term average rainfall. The slope of the cumulative departure plot shows the temporal trends in rainfall over successive years. The figure shows the following trends in precipitation within the Santa Clarita Valley:

a. 1950 through 1964: Dry conditions except for single wet years in 1952, 1957, 1958, and 1962 (a nearly continual decrease in cumulative departure values)

b. 1965 through 1970: Wet conditions (increase in cumulative departure values)

c. 1971 through 1977: Average to dry conditions (flat or declining cumulative departure values)

d. 1978 through 1983: Wet conditions (increase in cumulative departure values)

e. 1984 through 1991: Dry conditions (decrease in cumulative departure values)

f. 1992 through 1999: Highly variable conditions from year to year, but overall increase in cumulative departure values

2.6.2.2 Historical Trends in Alluvial Groundwater Elevations

Figure 2-12 shows trends in groundwater elevations in two Alluvial Aquifer wells located near the mouth of the South Fork Santa Clara River (VWC-N and NLF-S) and two Alluvial Aquifer wells near the western end of the basin (NLF-C5 and NLF-C7). The figure also shows trends in the following other components of the hydrologic cycle:

a. Precipitation at the Newhall-Soledad rain gage (plotted as the cumulative departure from the average precipitation)

b. Annual pumping volumes from the Alluvial Aquifer and the Saugus Formation

c. Total discharges from the WRPs to the Santa Clara River

d. Measured flow volume in the Santa Clara River during the lowest flow month of each year

Observations from Figure 2-12 are as follows:

a. Alluvial Aquifer groundwater elevations show greater variability over time within the basin interior (wells VWC-N and NLF-S) than near the basin outlet (wells NLF-C5 and NLF-C7). The range in water levels during the 50-year period of record is approximately 100 feet at the interior wells but only 20 to 30 feet in the two wells near the basin outlet.

b. The effect of reduced pumping from the Alluvial Aquifer from 1967 through 1989 was to minimize seasonal fluctuations in Alluvial Aquifer water levels near the aquifer's regional discharge zone at the western end of the valley. In this area, fluctuations in Alluvial pumping over time affected Alluvial groundwater elevations only seasonally; year-to-year variations in groundwater elevations were small. This indicates that water levels in this area are controlled less by pumping than by the discharge of Alluvial Aquifer groundwater to the Santa Clara River in the area downstream of I-5.

c. As with the western portion of the Alluvial Aquifer, the central portion of the Alluvial Aquifer has not shown long-term water level declines. During the 1950s and early 1960s, total pumping from the Alluvial Aquifer ranged between 35,000 AF/yr and 44,000 AF/yr during all but one year, and long-term (year-to-year) groundwater elevations were relatively stable (see the hydrographs for wells VWC-N, and NLF-S). When pumping from the Alluvial Aquifer decreased beginning in 1967, Alluvial groundwater elevations in this area quickly rose and have been relatively stable since about 1970, despite an increase in Alluvial Aquifer pumping during the 1990s. The hydrographs indicate that after an extended drought and high rates of pumping, Alluvial Aquifer groundwater elevations recover very quickly when normal or above normal rainfall patterns return.

d. The seasonal low flow in the Santa Clara River at the County Line gage has shown a long-term increase since the mid-1970s and, to some degree, during the late 1960s. The figure shows that this increase in flow coincides with increases in the annual discharges of treated water to the Santa Clara River from the two WRPs. Although Alluvial Aquifer pumping increased during the 1980s and 1990s, the seasonal low river flow did not show a long-term decrease during this period. The increases in WRP and Santa Clara River flows and the fluctuations in Alluvial Aquifer pumping have not caused long-term changes in Alluvial Aquifer groundwater elevations at the two wells near the basin outlet.

2.6.2.3 Historical Trends in Saugus Groundwater Elevations

Figures 2-13 and 2-14 compare groundwater elevation trends in the Saugus near the Santa Clara River, below the mouth of the South Fork Santa Clara River, with the same hydrologic

components displayed on Figure 2-12. Figure 2-13 shows this information for the period 1950 through 1999, and Figure 2-14 shows this information during the 1990s, when groundwater levels rose in the Saugus Formation. Figures 2-15 and 2-16 show the same information, but for groundwater elevations at Saugus Formation wells located farther away from the Santa Clara River, along the tributary valley containing the South Fork Santa Clara River.

In examining the four Saugus figures, it is difficult to distinguish between the influences of precipitation and pumping trends on changes in Saugus water levels. Although a slight rise in water levels may have occurred at VWC-157 and VWC-160 during the late 1960s and early 1970s, it appears to follow the trends in Saugus pumping volumes more closely than the precipitation trends. The data at VWC-157 also suggest that a succession of above-normal precipitation years (e.g., 1978 through 1983) or a year of precipitation that is substantially above normal (e.g., 1983) may have some influence on Saugus water levels. However, the data are limited, and the periods of increased precipitation tend to coincide with periods of decreased pumping, making it difficult to identify the effect of precipitation or pumping on Saugus water levels.

Another observation is that the rise in Saugus water levels in the late 1960s and early 1970s occurred despite an increase in annual pumping volumes from the Alluvial Aquifer. This indicates that Saugus water levels are controlled by precipitation and/or Saugus pumping trends, and not by Alluvial pumping trends.

2.6.2.4 Comparison of Historical Trends in Alluvial and Saugus Groundwater Elevations

Figure 2-17 compares groundwater elevations at Alluvial and Saugus wells located near each other along the Santa Clara River, just below the mouth of the South Fork Santa Clara River. At this location, the trends in Alluvial groundwater elevations show no clear relationship with the trends in Saugus groundwater elevations. A moderate overall increase in groundwater elevations is observed in both the Alluvial Aquifer and the Saugus Formation during the late 1960s. However, this similarity in the water level trends may be a coincidence arising from reduced pumping in both aquifers. During the early 1970s, water levels in Saugus well VWC-157 decreased while water levels in the nearby Alluvial Aquifer well (VWC-N) generally increased. During the 1990s, the Alluvial Aquifer groundwater elevations at well VWC-N were generally stable despite (1) increased basinwide alluvial pumping and (2) a sharp decrease, then increase, in Saugus groundwater elevations, which correlated with the trends in Saugus pumping. In summary, although there may be a relationship between Alluvial and Saugus groundwater elevations near the margins of the Santa Clara Valley, where folding of Saugus beds has brought permeable zones in contact with the alluvium, Figure 2-17 indicates that there is general independence between the Alluvial and Saugus water level trends at this location, which is near the center of the bowl-shaped Saugus Formation structure discussed in Section 2.3.3.

2.6.2.5 Historical Trends in Santa Clara River Baseflow

Hydrograph separation techniques were applied to the daily streamflow data for the County Line gage to estimate historical groundwater discharges (baseflow) to the Santa Clara River within the Santa Clarita Valley. The hydrograph separation was performed for calendar years 1953 through 1999 using the following five steps:

1. For each day, the average daily flow at the County Line gage in cubic feet per second (cfs) was converted to acre-feet of volumetric flow for the day.

2. The daily flows from Castaic Dam and at the Castaic Creek South gage (located near the mouth of Castaic Creek) were subtracted from the flow at the County Line gage. These data reflect surface water flow from tributaries. Data from the Castaic Creek South gage were used through June 1977. Beginning in July 1977, operational data for Castaic Lagoon, presented in annual reports by DWR, were used to estimate surface flow contributions from Castaic Creek.

3. The discharges of treated effluent from WRPs owned by LACSD were subtracted. This was performed for calendar years 1975 and later, as 1975 was the first year that such records were available.

4. The resulting day-to-day trends in streamflows were scrutinized for days when notably elevated flows occurred suddenly. These days were assumed to be dominated by storm flow. In some cases, the elevated flows lasted for only 2 to 5 days. In other cases, flows remained elevated for several days but showed steady declines, indicating that only the beginning of the elevated-flow period was dominated by surface runoff.

5. On all other days, storm flow was considered to be minimal or zero, and the flow values calculated for days not dominated by storm flow were assumed to represent river base-flow (that is, groundwater discharge to the river). For each month, an average flow was calculated for these non-storm days. The average flow was then converted to a total flow for the month, and the monthly flow volumes were summed to come up with the total flow for each year.

Table 2-6 presents the annual calculations from the hydrograph separation analysis. Table 2-7 presents summary statistics for the entire 47-year period that was analyzed, as well as for shorter time frames. Tables 2-8 and 2-9 show dry-year, normal-year, and wet-year statistics for the entire period of record and the shorter time frames. The shorter time frames are:

a. Calendar years 1953 through 1965, which were years of primarily agricultural water use prior to urbanization and construction of WRPs. This 13-year period was also characterized by 5 years of below-normal rainfall.

b. Calendar years 1975 through 1999, which represent 25 years of significant urbanization, including SWP water importation and WRP operations. This 25-year period was characterized by 6 years of below-normal rainfall, though rainfall volumes in general were somewhat higher (19.4 inches per year [in/yr] average, versus 15.5 in/yr average for 1953 through 1965).

c. Calendar years 1953 through 1999, but excluding 8 years (1966 through 1974) when WRP discharges occurred but were not recorded.

The daily streamflow data and the hydrograph separation technique indicate the following:

a. Summary statistics in Table 2-7 for all types of rainfall years (dry, normal, and wet) show that average groundwater discharges to the river from 1953 through 1965 were approximately 2,500 AF/yr (3.5 cfs). Groundwater discharges to the river were typically

14,000 to 22,000 AF/yr (19 to 31 cfs) from 1975 through 1999 because of more rainfall, increasing urbanization, and increasing importation of water from outside the valley.

b. For normal rainfall years only, median and average groundwater discharges to the river were approximately 12,500 and 14,300 AF/yr (17 and 20 cfs), respectively, during 1975 through 1999 (Table 2-8); approximately 8,600 and 10,000 AF/yr (12 and 14 cfs), respectively, for the entire historical record (Table 2-9); and approximately 4,000 and 3,600 AF/yr (5.5 and 5.0 cfs), respectively, from 1953 through 1965 (Table 2-8).

c. For drought years only, Table 2-8 shows that groundwater discharges to the river ranged from 400 to 4,900 AF/yr (0.5 to 7 cfs) between 1953 and 1965, and from 5,200 to 14,500 AF/yr (7 to 20 cfs) between 1975 and 1999. Table 2-8 also shows that median and average groundwater discharges to the river during drought years were 600 and 1,700 AF/yr (1 and 2 cfs), respectively, from 1953 through 1965, and typically 9,600 and 10,200 AF/yr (13 and 14 cfs), respectively, from 1975 through 1999.

2.6.3 State Water Project Operations and Hydrology

The import of SWP water is an important aspect of the local hydrologic system, particularly for water supplies. Following is a summary of the SWP system's operations and history in the Santa Clarita Valley, the amount of SWP water available to the valley, and a comparison of the timing of wet-dry rainfall cycles in the SWP system and in the Santa Clarita Valley.

2.6.3.1 State Water Project Operations and History

SWP water is transported to the Santa Clarita Valley by the California Aqueduct and is stored in Castaic Lake prior to use. Castaic Lake is one of several facilities that store SWP water that is transported to Southern California by the California Aqueduct and other aqueducts. The designated uses of Castaic Lake are recreation and storage of SWP water intended for eventual municipal use.

The stored SWP water is delivered by CLWA, which was formed in 1962 to provide a supplemental supply of imported water to the retail water purveyors in the valley. CLWA treats this water at two facilities, the Earl Schmidt Filtration Plant and the Rio Vista Water Treatment Plant, then wholesales this water to each of the retail water purveyors through an extensive transmission pipeline system. The CLWA service area covers approximately 195 square miles (124,800 acres), including the City of Santa Clarita and the surrounding unincorporated communities.

In 1966, CLWA signed a contract with DWR that established a contract amount of 41,500 acre-feet of SWP water. CLWA subsequently purchased 12,700 AF/yr from a Kern County water district during the 1980s, and recently purchased an additional 41,000 AF/yr from a member agency of the Kern County Water Agency, for a current total of 95,200 AF/yr of Table A SWP water. From 1980, when SWP water was first imported into the Santa Clarita Valley, through 1999, the total amount of SWP water delivered to the CLWA service area was approximately 298,972 acre-feet.

The SWP water is combined with local groundwater to meet both residential and non-residential interior and exterior water demands. Ultimately, a substantial portion of the municipal water supply reaches the local existing WRPs in the valley. Historically, the

treated water has been discharged from these WRPs to the Santa Clara River, where it contributes significantly to the natural surface water and groundwater flows reaching Ventura County. As discussed previously, stream gage data at the county line (USGS Gage No. 11108500)[2] demonstrate an increase in annual flow since the import of SWP water and the operation of the WRPs began, even during dry years. This is expected to continue in the future because increased urbanization will increase CLWA water deliveries, which in turn will increase inflows and outflows at LACSD's two WRPs (LACSD, 1998; CH2M HILL, 2002). However, over time, a portion (up to 17,000 AF/yr) of the future increases in flows into the WRPs will become reclaimed water that is used for outdoor irrigation, rather than being discharged into the river.

2.6.3.2 State Water Project Water Availability

The current CLWA Table A contract amount of 95,200 AF/yr of SWP water is affected by a number of factors, including hydrologic conditions; the status of SWP facilities construction; environmental requirements; and evolving policies for water resources management in the San Francisco Bay and Sacramento Delta system, which help route SWP water. While several programs may improve the reliability of SWP water imports to Southern California, such as Interim Delta Improvements and future improvements called the Full Delta Fix and South of Delta Storage, water planning efforts in the Santa Clarita Valley have conservatively assumed that future SWP water supplies will be equal to the SWP supply available under existing conditions. (See the Urban Water Management Plan 2000 [S.A. Associates et al., 2000] for details.)

The DWR has created a model of the SWP system and its allocations. The results from the model, called the DWRSIM model, are used by water agencies in the Santa Clarita Valley as planning numbers for SWP deliveries. The planning numbers for annual SWP water imports to the Santa Clarita Valley, based on CLWA's current Table A contract amount, are as follows:

a. Average years = 56,800 AF/yr (59.7 percent of the 95,200 AF/yr Table A contract amount)

b. Wet years = 66,300 AF/yr (69.6 percent of the 95,200 AF/yr Table A contract amount)

c. Multiple dry years = 37,900 AF/yr (39.8 percent of the 95,200 AF/yr Table A contract amount)

d. Multiple critical years = 19,000 AF/yr (20.0 percent of the 95,200 AF/yr Table A contract amount)

The DWRSIM model also indicates that a dry year allocation occurs, on average, once every 10 years, and that 3 consecutive years of drought occur, on average, once every 20 years. A separate DWR study (Roos, 1992) also concluded that droughts in excess of 3 years are rare in Northern California. Consequently, because of the availability of storage in the SWP

[2] Until October 1996, this gage was located just downstream of the county line at Blue Cut, an area where the valley becomes substantially narrower in width and the river begins to bend toward the southern side of the valley. See Figure 1-1 for this location. This gage continued operation through October 21, 1996, at which time it was permanently taken out of service. A new gage (USGS Gage No. 11109000) was put into service beginning on October 1, 1996 approximately 2.5 miles downstream, near Piru Junction, at the Las Brisas Bridge.

system, DWR and the water agencies in the Santa Clarita Valley use the dry year allocation of 37,900 AF/yr to plan for single dry years, and also for droughts lasting up to 3 years.

2.6.3.3 Local and State Water Project Historical Hydrology

Table 2-10 compares the historical hydrologic pattern for the SWP system with the local basin hydrology since 1944. The SWP hydrologic pattern is affected by the hydrology of Northern and Central California and is specifically mentioned in the Sacramento Four Rivers Unimpaired Runoff Index in Volume 1 of *Bulletin 160-98: The California Water Plan Update* (DWR, 1998). This index provides a general indication of SWP water delivery patterns, though it only describes runoff into the SWP system and does not account for system storage and other factors that affect actual SWP deliveries. The local hydrologic pattern shown in Table 2-10 is based on the long-term rainfall record at the Newhall-Soledad rain gage. Table 2-10 shows the following:

a. Critically low runoff years occurred in the SWP system during the 2-year period 1976 through 1977; during 1988; during the 3-year period 1990 through 1992; and again during 1994.

b. The period 1980 through 1999 shows primarily extreme hydrologic conditions (wet, dry, or critical), with moderate hydrologic conditions occurring only twice, above-normal years in 1980 and 1993.

c. Hydrologic conditions in the SWP system are often different from local hydrologic conditions. Below-normal years in the SWP system often do not coincide with local droughts, and only some critical SWP years, 1990 and 1994, coincide with local drought. Likewise, historical SWP hydrology has varied considerably during years of local droughts.

The Regional Model was calibrated to time-varying hydrologic conditions for the historical time period 1980 through 1999 (see Section 4 for more details on Regional Model calibration). Table 2-11 compares SWP hydrology, SWP allocations, and local hydrology for the period 1980 through 1999. Based on the historical cycle and the goals listed above, the hydrologic cycle relating to the availability of SWP water during that period was as follows:

a. Years 1 through 5 (water years [WY] 1980 through 1984): normal or above-normal availability

b. Year 6 (WY 1985): 1-year drought (below-normal availability)

c. Years 7 through 10 (WYs 1986 through 1989): normal or above-normal availability

d. Years 11 through 13 (WYs 1990 through 1992): 3-year drought (below-normal availability)

e. Year 14 (WY 1993): normal or above-normal availability

f. Year 15 (WY 1994): 1-year drought (below-normal availability)

g. Years 16 through 20 (WYs 1995 through 1999): normal or above-normal availability

Although SWP hydrology was dry or critical during water years 1987 through 1989, the DWRSIM model indicates that the storage volume in the SWP would have provided normal water deliveries to the Santa Clarita Valley (S.A. Associates et al., 2000).

2.6.3.4 Availability of Castaic Creek Flood Flows

As provided through agreement with DWR, CLWA has access to approximately 4,700 acre-feet of storage in Castaic Lake. This water is stormwater that flows into Castaic Lake from its upstream watersheds. Prior to completion of Castaic Dam in 1972, the LACWWD, Newhall Land & Farming Company (NLF), NCWD, and UWCD, which together constitute the Downstream Water Users, had certain rights to the stormwater flowing in Castaic Creek. On October 24, 1978, DWR entered into agreements with the Downstream Water Users regarding their rights to this water. Under the terms of the agreement, DWR would release the first 100 cfs of inflow. At the time of the agreement, flows in excess of 100 cfs were believed to be wasted to the ocean. When the local inflow to Castaic Reservoir exceeds 100 cfs, the excess of 100 cfs inflow is retained in the reservoir. Until May 1 of each year, the Downstream Water Users can receive 75 percent of this retained water by paying specified storage charges. If the Downstream Water Users request this water, it is delivered by releasing water into Castaic Lagoon, and then Castaic Creek. These releases are called Castaic Creek Flood Flows. If the Downstream Water Users do not request this water on or before May 1, any retained water becomes the property of DWR.

The allocation of stored water among the Downstream Water Users is specified in a separate agreement. Under that agreement, UWCD receives 48 percent of the delivered flood flows, while the three Santa Clarita Valley entities, NLF, NCWD, and LACWWD, together receive 52 percent.

The Castaic Creek flood flows available to the group of four Downstream Water Users averaged 15,700 AF/yr during water years 1977 through 2000. (See Table 2-12.) However, the magnitudes of these flows varied greatly from year to year, as shown on Figure 2-18. No flood flows were stored or delivered in 5 of these years, and the median flow was 2,800 AF/yr (only 18 percent of the average flow). The highest flood flow was 67,400 AF/yr, in water year 1978, and the flood flow exceeded the average flow in only 7 of these 24 years. The Regional Model simulated these historical flows, as described in Appendix C.

2.7 Previous Studies

Several prior studies have been important in developing a general understanding of the valley's geology and hydrology and in developing and calibrating the Regional Model.

2.7.1 1986 Alluvial Aquifer Study

In 1986, RCS studied the alluvial sediments in the Santa Clarita Valley to estimate the amount of groundwater in storage and the amount of recharge that occurs over the long-term, and also to evaluate the feasibility of artificially recharging these sediments (RCS, 1986). This was the first published report detailing the hydrogeologic characteristics of the Alluvial Aquifer system, water well construction and testing information, and magnitudes and changes in groundwater elevation and groundwater quality. Prior studies in the Santa Clarita Valley focused on oil development, and therefore evaluated the regional geology

with an emphasis on the subsurface geologic conditions in the hills and mountains surrounding the valley.

The 1986 study identified 650 water wells that had been drilled in the valley up to that time, all but 22 of which were drilled in the alluvium to depths less than 250 feet. The study examined geologic logs, well testing (specific capacity) records, long-term water level data, and water quality records. The study concluded that the coarse-grained, permeable sediments comprising this aquifer system are subjected to seasonal and year-to-year variations in water levels and groundwater in storage due to highly variable rainfall and streamflow patterns. In addition to describing the hydrogeology of the Alluvial Aquifer, the study mapped and identified the watersheds contributing to streamflows in the Santa Clara River and its tributaries, and estimated the amount of runoff from these watersheds that is potentially available as recharge to the Alluvial Aquifer. The study also concluded that it would be feasible to artificially recharge portions of the Alluvial Aquifer using spreading basins, primarily along the Santa Clara River in the area east of the mouth of Bouquet Canyon.

2.7.2 1988 Saugus Aquifer Study

In 1988, RCS conducted a study of the Saugus Formation that was similar in scope to the 1986 study of the Alluvial Aquifer (RCS, 1988). The scope of work included conducting 24-hour, constant discharge aquifer tests in five different Saugus Formation wells, including monitoring water level recovery rates. Six regional geologic cross-sections were also constructed from geologic and geophysical logs that had been compiled prior to this study at water wells and numerous oil wells within and around the Santa Clarita Valley.

The study concluded that the Saugus Formation is discretely layered, with groundwater production occurring from discrete sand and gravel zones that exist throughout much of the total thickness of the formation. The study also concluded that it is hydrogeologically feasible to develop additional groundwater supplies from the Saugus Formation as long as wells are properly sited and constructed, and that the groundwater-yielding capability of the Saugus Formation is likely greater south of the San Gabriel fault than north of the fault.

2.7.3 2002 Aquifer Study Update

In 2002, RCS updated the 1986 and 1988 studies with more recent data and prepared a report for both the Alluvial and Saugus Formation aquifers (RCS, 2002). As part of this work, a GIS and digital database were constructed. Field activities conducted during the study included surveying water well locations and elevations using a global positioning system (GPS) survey and water level data collected at Alluvial and Saugus wells.

The report concluded that groundwater levels in the Alluvial Aquifer and Saugus Formation have fluctuated over time, but have shown no long-term progressive declines in the amount of groundwater storage that could be considered indicative of overdraft conditions. From the long-term pumping and water level data, the report concluded that the Alluvial Aquifer can be pumped at rates between 30,000 and 40,000 AF/yr over the long-term, and suggested that pumping be between 30,000 and 35,000 AF/yr during dry years. For the Saugus Formation, the study concluded that pumping can occur at rates between 7,500 and 15,000 AF/yr on a long-term basis, with short-term increases to as much as

35,000 AF/yr during the end of a multi-year drought period. These pumping rates for the Alluvial and Saugus aquifer systems were referred to in the 2002 study as the operational yields of both aquifers.[3]

2.7.4 Newhall Ranch ASR Impact Evaluation

The Newhall Ranch Company performed analyses of potential impacts resulting from development of the proposed Newhall Ranch Specific Plan, including implementation of an ASR program. Findings were documented in the following reports:

a. *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001).

b. *Newhall Ranch ASR Impact Evaluation* (CH2M HILL, 2001).

c. *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002).

The study consisted of the following work:

a. An ASR field test was conducted by RCS in the Saugus Formation at VWC-205 in July 2000. The objective of the test was to determine the feasibility of injecting water into the Saugus Formation and later extracting the stored water. Approximately 24 million gallons of treated drinking water were injected into the well at a rate of up to 1,100 gpm for 21 days (RCS, 2001). The stored water was then recovered at a rate of 2,300 gpm for 10 days. Water levels were monitored in nearby Saugus Formation wells and in a newly installed Alluvial Aquifer monitoring well. This test demonstrated that ASR is indeed feasible in the Saugus Formation. Also, there was no measurable effect on water levels during the injection or pumping phase at the Alluvial monitoring well.

b. A pumping test was conducted by RCS in the Saugus Formation at VWC-201 to further demonstrate the limited hydraulic connection between the Saugus Formation and the Alluvial Aquifer. Well VWC-201 was pumped at 2,400 gpm for 10 days and water levels were monitored at an Alluvial Aquifer well located less than 50 feet away. Again, no response to Saugus Formation pumping was discernible at the Alluvial monitoring well.

While the ASR field test demonstrated that ASR is feasible in the Saugus Formation and that there is limited effect on the Alluvial Aquifer, it was necessary to conduct additional

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[3] The concept of operational yield was described in the RCS report as follows (RCS, 2002):

"One of the disadvantages of utilizing perennial yield as a basis for managing the pumpage from an aquifer system is that it represents a long-term average value for annual yield. There is a potential for the perennial yield value to be interpreted as a "not-to-exceed" volume, with a related potential for pumping above the perennial yield value in any give year to be incorrectly interpreted as "overdraft." A recently advanced concept intended to deal with such misinterpretations is that of operational yield. Operational yield can be defined as a fluctuating value of pumpage that may be above or below the perennial (or average) yield in any given year, and that varies as a function of the availability of other water supplies. The basic intent of the operational yield value is that it should not exceed the perennial yield of the groundwater basin over multi-year wet and dry cycles."

"The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in wet/normal rainfall periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. In the Valley, historical groundwater data demonstrate that the alluvium has been, and continues to be, developed within its long-term sustainability (i.e., no continuous lowering of water levels, no notable trend toward degradation of groundwater quality, etc.)"

analysis to extrapolate the results of RCS's well field testing to a full-scale, long-term ASR operation. This additional analysis was designed to address the following questions:

a. Can 4,500 AF/yr of water be stored in the Saugus Formation for withdrawal during drought years?

b. Will storage of water in the Saugus Formation increase the rate of natural groundwater discharge to the Alluvial Aquifer and to the Santa Clara River, and, if so, by how much?

c. Will pumping Saugus Formation ASR wells during a drought period reduce groundwater elevations in the Alluvial Aquifer and, subsequently, flows in the Santa Clara River?

d. Will the ASR program result in water quality changes within the Saugus Formation, the Alluvial Aquifer, and the Santa Clara River?

e. Will the ASR program cause spreading of perchlorate that is present in the Saugus Formation?

To answer these questions, CH2M HILL prepared a numerical groundwater flow model of the western and central portions of the Santa Clarita Valley. The model simulated the groundwater flow in the Saugus Formation and the Alluvial Aquifer, accounting for the inflows and outflows to and from the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River under historical conditions. The model was also used to simulate the changes in the groundwater flow system that would arise from operation of the ASR system. Of particular interest was the model's simulation of changes in subsurface groundwater flow out of the valley and changes in groundwater discharge into the Santa Clara River that would arise from ASR operations under a historical climatic cycle (wet and dry hydrologic conditions) observed during the 1980s and 1990s. These two groundwater discharge mechanisms were evaluated in detail with the model to estimate the potential changes in flow to Ventura County from the ASR system. The western limit of the model was placed at the county line, and the eastern limit of the Saugus Formation was established as the eastern limit of the model domain.

The primary findings from the analysis were:

a. On the basis of the historical timing of drought years, the proposed ASR system would provide long-term benefits to the river and the groundwater system. ASR pumping cycles would cause small (less than 1 foot) declines during drought years, and long-term operation of the ASR system would not cause long-term groundwater elevation declines in the Alluvial Aquifer, where riparian habitat is present along the river.

b. The combined influence of the proposed ASR program and the other water resource attributes[4] of Newhall Ranch would result in an overall increase in river flows over the long term.

c. The continued increase in water supplies to meet the water demands arising from a combination of growth outside Newhall Ranch and development of the Newhall Ranch

[4] Direct discharges of treated effluent into the river from the Newhall Ranch WRP, and the redistribution of irrigation demands (rates and locations) associated with conversion of water use from agricultural to municipal demands.

project would further enhance the long-term flows to the river, compared with present conditions. The occurrence of increased annual river flows during drought and nondrought years alike, compared with present conditions, is consistent with historical records, showing that continued urbanization and associated importation of water from areas outside the valley would increase river flows gradually over time.

Tables

TABLE 2-1

Annual Groundwater Pumping from the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NCWD	Castaic1	244	257	253	189	251	274	295	450	520	478	444	561	515	458	496	401	385	535	166	426	118
	Castaic2	124	48	0	0	0	0	380	535	324	678	0	0	0	477	518	380	327	268	257	331	289
	Castaic3	0	108	136	172	240	301	0	0	324	0	660	532	488	0	0	0	0	0	0	0	0
	Castaic4	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	95	57	6	7
	Pinetree1	346	326	355	242	148	273	8	0	2	152	0	47	16	247	154	79	64	89	227	403	245
	Pinetree2	58	84	209	112	154	113	206	309	351	348	31	0	283	326	218	165	70	0	0	0	0
	Pinetree3	398	527	225	432	753	655	719	756	758	672	801	724	682	450	607	595	624	812	716	505	494
	Pinetree4	0	0	0	0	3	28	234	77	4	0	0	0	10	19	232	55	333	510	338	5	355
NLF	161	317	370	271	223	314	220	170	0	0	0	120	82	401	753	791	0	0	0	0	123	106
	B10	0	0	0	0	0	0	0	0	0	0	0	291	1,225	452	1,406	894	1,045	930	1,244	1,155	990
	B11	186	217	159	133	184	138	60	0	0	127	445	311	0	136	51	127	151	30	250	212	182
	B5	1,218	1,423	1,041	858	1,208	772	1,178	1,002	1,481	1,928	1,893	1,880	860	989	1,950	1,921	1,649	1,756	1,273	1,748	1,500
	B6	858	1,002	733	604	850	543	946	788	165	96	137	263	615	283	808	1,359	1,421	1,602	1,572	2,133	1,830
	B7	0	0	0	0	0	0	60	0	0	127	0	0	400	180	581	373	56	286	176	444	381
	C	723	845	618	510	717	575	660	387	418	557	338	226	756	1,024	417	1,324	715	1,126	598	716	614
	C3	196	229	168	138	195	140	254	63	130	71	134	48	197	259	582	333	397	355	378	619	531
	C4	260	304	222	183	258	196	137	25	30	7	213	225	166	12	108	150	293	483	609	819	703
	C5	459	536	392	323	455	359	328	191	198	154	147	250	428	414	394	472	676	894	628	685	588
	C6	203	237	174	143	201	166	161	103	117	77	59	123	0	0	0	360	229	226	128	154	132
	C7	575	671	491	405	570	354	195	192	318	337	339	220	427	279	625	778	582	779	779	1,167	1,001
	C8	0	0	0	0	0	0	0	0	0	0	0	0	126	254	166	199	458	432	179	236	202
	E	2,067	2,416	1,767	1,457	2,051	3,342	1,842	1,180	812	624	965	498	1,325	1,513	1,022	1,366	2,542	1,949	1,522	2,506	2,150
	E2	174	203	149	123	173	138	103	0	0	251	1,284	830	560	584	555	115	669	525	426	138	118
	E3	0	0	0	0	0	0	0	0	0	0	0	0	0	15	138	0	0	0	0	0	0
	E4	1,011	1,181	864	712	1,003	639	716	83	566	392	553	284	376	16	0	381	140	339	80	281	241
	E5	0	0	0	0	0	0	0	0	0	0	0	0	65	274	0	142	514	598	42	0	0
	E7	0	0	0	0	0	0	0	0	0	0	0	0	116	80	105	88	79	2	0	0	0
	E9	96	113	82	68	96	78	117	288	476	411	339	596	252	187	435	319	12	142	170	42	36
	G45	324	378	277	228	321	179	153	98	123	99	143	146	165	82	144	137	159	180	144	231	198
	Q	441	515	377	311	438	159	360	382	312	185	15	0	0	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	205	0	0	0	0	0	0	0	0	0	0	0	0	0
	R2	159	186	136	112	158	71	104	47	0	0	0	87	0	0	0	0	0	0	0	0	0
	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S2	293	342	250	206	290	95	0	958	0	0	503	0	0	0	0	0	0	0	0	276	237
	S3	655	765	560	461	649	327	124	0	0	0	29	37	52	99	87	109	97	55	10	3	0
	Topco 1	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0
	Topco 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	W4	303	354	259	213	300	138	60	1	0	300	157	252	1	0	36	5	128	29	20	3	3
	W5	553	646	472	389	548	191	315	205	308	192	0	175	0	0	0	0	0	0	0	21	18
	X3	260	304	222	183	258	508	244	314	497	308	412	215	350	135	205	222	8	108	22	112	96
SCWC	Clark	303	228	131	137	194	200	208	342	248	301	407	542	662	635	572	662	1,027	873	697	878	747
	Guida	1,058	795	457	477	677	698	221	569	158	530	676	801	978	895	942	744	1,252	1,479	1,274	1,556	853
	Honby	594	447	257	268	381	392	193	391	462	216	930	893	731	1,393	476	553	352	814	532	1,162	815
	Lost Canyon 2	1,083	814	468	489	693	714	765	923	787	588	601	404	465	692	669	773	678	792	757	946	708
	Lost Canyon 2A	0	0	0	0	0	0	0	0	0	0	293	832	1,284	1,080	1,383	1,230	1,370	1,055	973	890	998
	Methodist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mitchell	1,189	893	515	537	761	785	444	582	485	435	264	3	474	663	564	610	598	633	482	913	439
	N.Oaks Central	488	367	211	220	313	322	304	361	153	329	525	704	701	1,403	1,313	965	851	870	1,490	1,682	1,145
	N.Oaks East	601	451	260	271	385	396	863	972	776	914	454	194	588	1,233	1,473	1,295	900	1,033	1,407	695	1,483
	N.Oaks West	643	483	278	290	412	424	874	465	842	413	275	78	634	866	972	795	663	952	934	1,894	1,663
	Sand Canyon	721	542	312	325	461	477	514	466	498	1,115	458	49	661	918	781	842	1,211	1,533	1,622	1,629	1,317
	Sierra	2,780	2,089	1,202	1,255	1,780	1,834	856	220	459	730	772	719	1,050	1,413	1,433	1,092	1,034	597	814	1,158	640
	Stadium	0	0	0	0	0	0	167	291	211	214	328	374	60	825	418	656	509	637	444	338	721

TABLE 2-1

Annual Groundwater Pumping from the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
VWC	D	289	269	164	163	240	41	0	305	588	614	510	680	239	173	494	403	454	1,134	1,209	921	880
	I	214	200	122	121	177	181	95	0	91	132	73	108	1	0	1	0	0	0	0	0	0
	K2	0	0	0	0	0	0	0	0	0	0	0	982	1,134	1,708	2,089	1,155	1,305	1,076	1,489	1,420	861
	L2	9	8	5	5	7	91	0	0	0	0	0	838	526	996	1,236	818	961	308	190	532	494
	N	1,475	1,376	840	833	1,223	1,093	1,472	1,420	1,473	1,177	792	976	697	66	0	24	263	808	768	1,036	935
	N3	0	0	0	0	0	0	0	0	0	0	0	10	999	1,536	29	943	1,325	1,034	1,093	1,057	778
	N4	5	5	3	3	4	65	0	0	0	0	0	847	248	133	911	1,329	1,328	1,185	772	894	710
	Q2	440	411	251	248	367	461	838	893	512	1,483	1,398	1,783	335	548	1,348	1,126	1,385	1,462	1,655	1,288	1,387
	S6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515
	S7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111
	S8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79
	T2	621	580	354	351	515	704	894	913	1,007	1,030	643	662	379	0	3	280	733	837	941	726	984
	T4	160	150	91	91	133	54	167	0	0	0	0	163	687	3	1	975	1,258	804	523	892	625
	U3	1,476	1,378	841	834	1,225	1,278	1,033	638	323	823	1,254	1,199	369	1	2	765	987	851	560	702	1,126
	U4	1,306	1,220	744	738	1,084	665	668	606	696	567	551	584	42	3	2	7	742	789	529	828	1,073
	W6	0	0	0	0	0	0	0	146	145	0	0	217	260	204	224	365	615	493	355	416	445
	W9	0	0	0	0	0	0	0	0	0	0	11	902	699	444	507	508	1,077	915	627	1,111	1,176
WHR	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,229	1,376	772	1,104	1,204	1,352	760	614	1,229	1,131	1,010
	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	137	137	137	137	137	137	137	137	137	137	91	102	57	82	89	100	56	46	91	84	75
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	680	762	427	612	666	748	421	340	680	627	559
	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Pumping (NCWD)		1,170	1,350	1,178	1,147	1,549	1,644	1,842	2,127	2,283	2,367	1,936	1,864	1,994	1,977	2,225	1,675	1,803	2,309	1,761	1,676	1,508
Total Pumping (NLF)		11,331	13,237	9,684	7,983	11,237	9,328	8,287	6,512	5,951	6,243	8,225	7,039	8,938	8,020	10,606	11,174	12,020	12,826	10,250	13,824	11,857
Total Pumping (SCWC)		9,460	7,109	4,091	4,269	6,057	6,242	5,409	5,582	5,079	5,785	5,983	5,693	8,288	12,016	10,996	10,217	10,445	11,268	11,426	13,741	11,529
Total Pumping (VWC)		5,995	5,597	3,415	3,387	4,975	4,633	5,167	4,921	4,835	5,826	5,232	9,951	6,615	5,815	6,847	8,698	12,433	11,696	10,711	11,823	12,179
Total Pumping (WHR)		3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	2,000	2,240	1,256	1,798	1,959	2,200	1,237	1,000	2,000	1,842	1,644
Total Pumping (All Purveyors)		30,956	30,293	21,368	19,786	26,818	24,847	23,705	22,142	21,148	23,221	23,376	26,687	27,091	29,626	32,633	33,964	37,938	39,099	36,148	42,906	38,717
Total Pumping (Others)		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	932	953	890
Total Alluvial Aquifer Pumping		31,456	30,793	21,868	20,286	27,318	25,347	24,205	22,642	21,648	23,721	23,876	27,187	27,591	30,126	33,133	34,464	38,438	39,599	37,080	43,859	39,607

Notes:

N. = north

WHR = Wayside Honor Rancho, owned by LACWWD

All pumping volumes are listed in acre-feet.

Data source: Luhdorff and Scalmanini, Consulting Engineers. April 2003. *Santa Clarita Valley Water Report 2002.* Prepared for the Castaic Lake Water Agency, Los Angeles County Waterworks District #36, Newhall County Water District, and Valencia Water Company.

TABLE 2-2

Annual Groundwater Pumping from the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NCWD	7	404	396	350	348	355	384	271	260	332	242	242	274	180	268	321	364	332	288	280	172	0
	4	440	449	319	385	315	369	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9	0	0	0	0	119	227	115	138	1	0	5	1	1	0	4	1	1	0	1	0	0
	10	790	906	1,287	1,300	1,007	997	731	888	613	453	644	343	351	61	0	1	0	0	2	0	0
	11	729	870	716	754	1,159	1,278	2,209	2,371	1,265	1,280	1,252	1,034	428	730	614	522	353	81	14	0	0
	12	0	0	0	0	0	0	0	0	1,830	2,713	2,603	3,342	2,807	1,956	1,918	2,264	2,140	1,798	1,909	1,155	1,767
	13	0	0	0	0	0	0	0	0	0	0	0	0	1,393	2,053	2,248	1,623	2,045	3,001	2,351	1,295	419
NLF	156	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374
SCWC	Saugus1	0	0	0	0	0	0	0	0	31	0	0	1,690	437	1,226	1,333	0	410	451	0	0	0
	Saugus2	0	0	0	0	0	0	0	0	32	0	40	3,091	2,476	1,675	2,530	1,726	1,766	617	0	0	0
VWC	157	635	604	529	239	387	314	581	483	1,223	1,146	635	1,005	570	436	616	403	46	80	0	0	0
	159	0	0	0	0	0	0	0	0	0	0	3	63	65	74	147	68	3	0	0	0	0
	160	1,571	1,725	368	372	467	571	846	822	1,077	1,326	839	1,325	580	920	957	585	206	401	133	95	776
	201	0	0	0	0	0	0	0	0	0	57	2,039	2,249	1,170	752	845	530	71	35	16	11	172
	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59
Total Pumping (NCWD)		2363	2621	2672	2787	2955	3255	3548	3657	4041	4688	4746	4994	5160	5068	5103	4775	4871	5168	4557	2622	2186
Total Pumping (NLF)		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374
Total Pumping (SCWC)		0	0	0	0	0	0	0	0	63	0	40	4781	2913	2901	3863	1726	2176	1068	0	0	0
Total Pumping (VWC)		2206	2329	897	611	854	885	1427	1305	2300	2529	3516	4642	2385	2182	2565	1586	326	516	149	106	1007
Total Pumping (All Purveyors)		4,589	4,970	3,589	3,418	3,829	4,160	4,995	4,982	6,424	7,237	8,322	14,437	10,478	10,171	11,551	8,107	7,639	7,197	5,132	3,207	3,567
Total Pumping (Others)		0	0	501	434	620	555	490	579	504	522	539	480	446	439	474	453	547	548	423	509	513
Total Saugus Formation Pumping		4,589	4,970	4,090	3,852	4,449	4,715	5,485	5,561	6,928	7,759	8,861	14,917	10,924	10,610	12,025	8,560	8,186	7,745	5,555	3,716	4,080

Note:

All pumping volumes are listed in acre-feet.

Data source: Luhdorff and Scalmanini, 2003.

TABLE 2-3

Summary of Selected Tests and Estimated Parameter Values for the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Area	Well Owner-Name	Estimated T (ft^2/day)	Model T (ft^2/day)	Estimated K (ft/day)	Model K (ft/day)	Model Zone
West of I-5	NLF-B5	80,000 to 150,000	60,500	750 to 1,400	550	C1c
	NLF-B6	40,000 to 70,000	60,500	100 to 600	550	C1c
	NLF-C4	20,000 to 35,000	60,500	100 to 300	550	C1b
	NLF-E5	40,000 to 55,000	71,500	100 to 400	550	C1a
Between I-5	VWC-I	30,000 to 45,000	22,500	250 to 350	375	B1b2
and Soledad	VWC-K2	60,000 to 90,000	54,375	400 to 600	375	B1a
Canyon	VWC-N3	55,000 to 80,000	79,750	375 to 550	550	B1a
	VWC-N4	75,000 to 100,000	54,375	500 to 750	375	B1a
	VWC-Q2	35,000 to 50,000	79,750	250 to 350	550	B1a
	NLF-R2	50,000 to 105,000	22,050	600 to 1,200	245	B1a
	NLF-S	35,000 to 85,000	54,375	250 to 600	375	B1a
	NLF-S3	35,000 to 55,000	79,750	250 to 350	550	B1a
Lower Soledad	SCWC-Stadium	85,000 to 150,000	63,250	950 to 1,650	550	A1e1
Canyon	VWC-U3	90,000 to 170,000	63,250	800 to 1,500	550	A1e2
	VWC-U4	65,000 to 135,000	63,250	550 to 1,200	550	A1e2
	SCWC-Honby	30,000 to 50,000	49,500	300 to 550	550	A1d1
Upper Soledad	SCWC-N.Oaks West	35,000 to 55,000	49,500	400 to 600	550	A1d4
Canyon	SCWC-N.Oaks Central	85,000 to 120,000	49,500	900 to 1,350	550	A1d4
	SCWC-N.Oaks East	50,000 to 70,000	49,500	500 to 800	550	A1d4
	SCWC-Sierra	80,000 to 145,000	49,500	900 to 1,600	550	A1c1
	SCWC-Mitchell	40,000 to 60,000	49,500	450 to 650	550	A1c2
	SCWC-Sand Canyon	35,000 to 125,000	36,000	400 to 1,400	400	A1c3
	NCWD-Pinetree 3 and 4	30,000 to 50,000	31,500	300 to 550	350	A1b1
Castaic Valley	VWC-D	30,000 to 50,000	35,000	300 to 500	350	C2b
	NLF-E	60,000 to 90,000	35,000	600 to 900	350	C2b
	NLF-E2	45,000 to 100,000	35,000	450 to 1,000	350	C2b
	WHR Wellfield	40,000 to 75,000	35,000	400 to 750	350	C2a and C2b
Northern Canyons	NLF-W4	25,000 to 35,000	10,500	250 to 350	105	B4c
	VWC-W6	25,000 to 40,000	10,500	250 to 400	105	B4c
	SCWC-Guida	45,000 to 65,000	12,600	500 to 700	140	B2b
	SCWC-Clark	55,000 to 80,000	22,050	650 to 900	245	B2c

Note:

See Section 4.3.1 for a discussion of the model zones.

TABLE 2-4

Summary of Selected Tests and Estimated Parameter Values for the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Name	Date	Type of Test	Pumping or Injection Rates (gpm)	Length of Test (minutes)	Well Monitored	Specific Capacity (gpm/ft)[a]	T (gpd/ft)	T (ft^2/day)	Storativity	Model Zone
NCWD-7	03/04/1987	Drawdown	341	1,440	NCWD-7	3.1	26,400	3,530		F
NCWD-7	03/05/1987	Recovery		1,500	NCWD-7		23,300	3,110		F
NCWD-10	03/11/1987	Drawdown	364	1,440	NCWD-10	8.3	28,500	3,810		F
NCWD-10	03/11/1987	Drawdown	364	1,440	NCWD-12 (160 feet away)		57,700	7,710	9.10E-04	F
NCWD-10	03/11/1987	Recovery		1,480	NCWD-10		38,400	5,130		F
NCWD-10	03/11/1987	Recovery		1,490	NCWD-12 (160 feet away)		61,500	8,220	7.60E-04	F
NCWD-9	03/17/1987	Drawdown	256	1,460	NCWD-9	1.9	3,700	490		A
NCWD-9	03/17/1987	Recovery		1,500	NCWD-9		3,000	400		A
VWC-160	03/24/1987	Drawdown	2,562	720	VWC-160	49.8	163,000	21,790		E
VWC-160	03/24/1987	Recovery		850	VWC-160		182,000	24,330		E
VWC-205	07/01/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-205M (40 feet)	12.2	41,370	5,530	8.88E-04	E
VWC-205	07/02/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-201 (2,400 feet)		50,450	6,740	7.56E-04	E
VWC-205	07/03/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-157 (4,100 feet)		54,880	7,340	6.45E-04	E
VWC-205	08/01/2000	Pumping	2,273	12,960 / 14,440	VWC-205	18.7				E
VWC-205	08/01/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-205M (40 feet)	18.7	78,910	10,550	9.48E-04	E
VWC-205	08/02/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-201 (2,400 feet)		76,410	10,220	1.37E-03	E
VWC-205	08/03/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-157 (4,100 feet)		65,880	8,810	1.36E-03	E
VWC-201	10/01/2000	Pumping	2,439	14,440 / 2,880	VWC-201	30	65,100	8,700	5.75E-04	E
VWC -201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-157 (1,900 feet)		44,230	5,910	1.17E-03	E
VWC-201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-205M (2,360 feet)		57,210	7,650	8.49E-04	E
VWC-201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-205 (2,400 feet)		47,890	6,400	6.75E-04	E
SCWC-Saugus1	07/01/1988	Pumping	2,941	1,440	SCWC-Saugus1	30.2	69,300	9,260		E
SCWC-Saugus1	07/01/1988	Recovery	2,941	480	SCWC-Saugus1		59,700	7,980		E
SCWC-Saugus2	09/01/1988	Pumping	2,531	2,880	SCWC-Saugus2	24.1	53,500	7,150		E
SCWC-Saugus2	09/01/1988	Recovery	2,531	1,320	SCWC-Saugus2		55,700	7,450		E
SCWC-Saugus2	09/01/1988	Pumping	2,531	2,880	SCWC-Saugus1		71,500	9,560	3.60E-04	E
SCWC-Saugus3	09/01/1988	Recovery	2,531	1,320	SCWC-Saugus1		60,200	8,050		E

[a]gpm/ft of drawdown

Note:

See Section 4.3.1 for a discussion of the model zones.

Data source: RCS, 2002 (except model zones)

TABLE 2-5
Recharge and Discharge Components of the Hydrologic Cycle in the Upper Santa Clara River Basin
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Recharge	Discharge
Surface Water	
Direct runoff of precipitation	Evapotranspiration of precipitation
Precipitation runoff from upstream watershed areas	Santa Clara River flow to Ventura County
Castaic Lake/Lagoon releases into Castaic Creek	Streamflow seepage to the Alluvial Aquifer
WRP discharges into the Santa Clara River	Evapotranspiration of applied irrigation water
Groundwater seepage into the Santa Clara River	
Irrigation return flows (agricultural and urban)	
Groundwater	
Infiltration of precipitation	Pumping
Infiltration of outdoor applied water (agricultural and urban)	Evapotranspiration of Alluvial Aquifer groundwater by riparian vegetation
Alluvial Aquifer subsurface inflow (Castaic Dam)	Alluvial Aquifer subsurface outflow (western study area boundary)
Streamflow seepage to Alluvial aquifer	Groundwater seepage into the Santa Clara River

Notes:

The two sources of water for agricultural and municipal water uses in the basin are groundwater pumping and imported water from the SWP.

Because SWP water is stored in Castaic Lake, which is outside the limits of the Alluvial and Saugus aquifers, it is not considered to be a part of the valley's hydrologic cycle while it is still in storage. However, SWP water that is land-applied or that is discharged from a WRP qualifies as a component of the hydrologic cycle. In addition, subsurface groundwater flow occurs into the Santa Clarita Valley beneath Castaic Creek due to water seepage beneath Castaic Dam.

TABLE 2-6
Estimated Annual Groundwater Discharge to the Santa Clara River
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Total Gaged Flow at Mouth of Castaic Creek (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[a]	Local Rainfall Condition[b]
1953	0	4,986	4,943	0	4,943	4.88	Dry
1954	977	7,316	5,554	0	5,554	15.82	Normal
1955	134	4,795	4,122	0	4,122	13.91	Normal
1956	311	5,429	3,803	0	3,803	14.21	Normal
1957	559	4,782	2,410	0	2,410	22.85	Wet
1958	21,204	38,756	5,344	0	5,344	23.14	Wet
1959	473	3,277	2,206	0	2,206	9.81	Dry
1960	1	777	586	0	586	11.64	Dry
1961	79	804	410	0	410	8.82	Dry
1962	5,101	28,460	2,433	0	2,433	21.22	Wet
1963	32	1,884	1,058	0	1,058	12.79	Normal
1964	1	1,030	646	0	646	10.09	Dry
1965	3,702	35,614	996	0	996	32.28	Wet
1966	5,780	10,101	2,332	No data	---	14.57	Normal
1967	27,819	40,480	8,640	No data	---	23.23	Wet
1968	4,381	7,216	3,895	No data	---	6.90	Dry
1969	46,461	258,660	29,395	No data	---	32.42	Wet
1970	6,597	31,066	14,924	No data	---	23.19	Wet
1971	2,310	15,883	10,843	No data	---	13.75	Normal
1972	2,205	16,027	12,975	No data	---	4.15	Dry
1973	12,671	52,631	26,115	No data	---	19.79	Wet
1974	7,288	25,265	11,918	No data	---	18.04	Wet
1975	2,027	14,770	10,806	5,534	5,272	10.92	Dry
1976	156	10,162	9,754	6,095	3,659	14.02	Normal
1977	1,380	13,454	9,359	6,004	3,355	20.87	Wet
1978	35,378	129,187	60,955	6,982	53,973	42.17	Wet
1979	13,626	57,594	42,448	7,397	35,051	21.47	Wet
1980	16,785	95,211	57,593	7,372	50,221	27.00	Wet
1981	6,519	24,232	21,172	7,949	13,223	13.42	Normal
1982	9,102	36,488	32,531	8,436	24,095	20.20	Wet
1983	67,058	131,236	55,878	9,420	46,458	39.07	Wet
1984	13,787	39,279	35,215	9,512	25,703	12.86	Normal
1985	2,619	24,466	24,089	9,614	14,475	8.37	Dry
1986	4,945	48,024	31,327	10,822	20,505	18.02	Wet

TABLE 2-6
Estimated Annual Groundwater Discharge to the Santa Clara River
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Total Gaged Flow at Mouth of Castaic Creek (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[a]	Local Rainfall Condition[b]
1987	911	26,198	23,663	11,844	11,819	14.45	Normal
1988	2,415	36,611	24,934	12,363	12,571	16.92	Wet
1989	Unavailable	24,799	23,453	13,560	9,893	7.56	Dry
1990	0	23,472	21,772	14,006	7,766	6.98	Dry
1991	65	34,901	18,702	14,108	4,594	17.21	Wet
1992	4,450	68,577	23,601	15,703	7,898	32.03	Wet
1993	7,725	152,783	65,054	17,179	47,875	32.72	Wet
1994	Unavailable	32,039	31,239	16,946	14,293	10.27	Dry
1995	5,611	82,409	51,001	17,824	33,177	29.15	Wet
1996	5,632	47,930	36,366	16,831	19,535	15.88	Normal
1997	9,885	36,780	27,521	15,778	11,743	13.35	Normal
1998	47,803	205,139	81,744	17,695	64,049	30.73	Wet
1999	5,830	32,382	27,176	17,847	9,329	8.96	Dry

[a]Annual rainfall values are based on monthly records for this gage, as reported by NCDC and LADPW.

[b]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-7
Statistics on Annual Groundwater Discharge to the Santa Clara River, All Years
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	311	4,795	2,410	0	2,410	13.91
Average	2,506	10,608	2,655	0	2,655	15.50
Maximum	21,204	38,756	5,554	0	5,554	32.28
Statistics for 1975 through 1999						
Minimum	0	10,162	9,359	5,534	3,355	6.98
Median	5,632	36,611	27,521	11,844	14,293	16.92
Average	11,466	57,125	33,894	11,873	22,021	19.38
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	3,161	30,250	22,613	11,844	8,613	15.14
Average	8,230	41,211	23,207	11,873	15,396	18.05
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	4,450	28,460	18,702	11,844	8,613	15.82
Average	9,151	43,050	21,338	11,873	15,396	17.92
Maximum	67,058	258,660	81,744	17,847	64,049	42.17

TABLE 2-8
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1965 vs. 1975 through 1999
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 5 Dry Years during 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	1	1,030	646	0	646	9.81
Average	111	2,175	1,758	0	1,758	9.05
Maximum	473	4,986	4,943	0	4,943	11.64
Statistics for 4 Normal Years during 1953 through 1965						
Minimum	32	1,884	1,058	0	1,058	12.79
Median	222	5,112	3,963	0	3,963	14.06
Average	363	4,856	3,634	0	3,634	14.18
Maximum	977	7,316	5,554	0	5,554	15.82
Statistics for 4 Wet Years during 1953 through 1965						
Minimum	559	4,782	996	0	996	21.22
Median	4,402	32,037	2,421	0	2,421	23.00
Average	7,641	26,903	2,796	0	2,796	24.87
Maximum	21,204	38,756	5,344	0	5,344	32.28
Statistics for 6 Dry Years during 1975 through 1999						
Minimum	0	14,770	10,806	5,534	5,272	6.98
Median	2,323	24,633	23,771	13,783	9,611	8.67
Average	2,619	25,322	23,089	12,918	10,171	8.84
Maximum	5,830	32,382	31,239	17,847	14,475	10.92
Statistics for 6 Normal Years during 1975 through 1999						
Minimum	156	10,162	9,754	6,095	3,659	12.86
Median	6,076	31,489	25,592	10,678	12,521	13.72
Average	6,148	30,763	25,615	11,335	14,280	14.00
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 13 Wet Years during 1975 through 1999						
Minimum	65	13,454	9,359	6,004	3,355	16.92
Median	7,725	68,577	42,448	10,822	33,177	27.00
Average	16,642	83,970	42,702	11,639	31,063	26.74
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-9
Statistics on Annual Groundwater Discharge to the Santa Clara River, Including and Excluding 1966 through 1974
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 13 Dry Years during 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	473	14,770	10,806	13,783	5,272	8.82
Average	1,601	14,311	12,630	12,918	6,347	8.41
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 12 Normal Years during 1953 through 1999						
Minimum	0	7,316	2,433	6,004	2,433	13.35
Median	5,101	26,198	21,172	11,844	11,743	16.92
Average	5,238	27,883	16,963	10,788	8,671	17.10
Maximum	12,671	52,631	27,521	15,778	13,223	21.22
Statistics for 22 Wet Years during 1953 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	7,507	44,252	25,525	10,822	20,505	23.17
Average	15,807	73,060	29,877	11,639	24,412	25.62
Maximum	67,058	258,660	81,744	17,824	64,049	42.17
Statistics for 11 Dry Years during 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	79	14,770	10,806	13,783	5,272	8.96
Average	1,226	14,800	13,393	12,918	6,347	8.94
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 10 Normal Years during 1953 through 1965 and 1975 through 1999						
Minimum	32	1,884	1,058	6,095	1,058	12.79
Median	944	17,197	15,463	10,678	8,649	13.97
Average	3,834	20,400	16,823	11,335	10,022	14.07
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 17 Wet Years during 1953 through 1965 and 1975 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	5,611	48,024	31,327	10,822	20,505	23.14
Average	14,524	70,543	33,312	11,639	24,412	26.30
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-10
Historical Hydrology in Northern California and the Santa Clarita Valley
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Northern California Hydrology[a]	Local Hydrology[b]
1944	Dry	Wet
1945	Below Normal	Normal
1946	Below Normal	Wet
1947	Dry	Dry
1948	Below Normal	Dry
1949	Dry	Dry
1950	Below Normal	Dry
1951	Above Normal	Normal
1952	Wet	Wet
1953	Wet	Dry
1954	Above Normal	Normal
1955	Dry	Normal
1956	Wet	Normal
1957	Above Normal	Wet
1958	Wet	Wet
1959	Below Normal	Dry
1960	Dry	Dry
1961	Dry	Dry
1962	Below Normal	Wet
1963	Wet	Normal
1964	Dry	Dry
1965	Wet	Wet
1966	Below Normal	Normal
1967	Wet	Wet
1968	Below Normal	Dry
1969	Wet	Wet
1970	Wet	Wet
1971	Wet	Normal
1972	Below Normal	Dry
1973	Above Normal	Wet
1974	Wet	Wet
1975	Wet	Dry
1976	Critical	Normal
1977	Critical	Wet
1978	Above Normal	Wet
1979	Below Normal	Wet

TABLE 2-10
Historical Hydrology in Northern California and the Santa Clarita Valley
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Northern California Hydrology[a]	Local Hydrology[b]
1980	Above Normal	Wet
1981	Dry	Normal
1982	Wet	Wet
1983	Wet	Wet
1984	Wet	Normal
1985	Dry	Dry
1986	Wet	Wet
1987	Dry	Normal
1988	Critical	Wet
1989	Dry	Dry
1990	Critical	Dry
1991	Critical	Wet
1992	Critical	Wet
1993	Above Normal	Wet
1994	Critical	Dry
1995	Wet	Wet
1996	Wet	Normal
1997	Wet	Normal
1998	Wet	Wet
1999	Wet	Dry

[a]Defined by water year, using the Sacramento Four Rivers Index (Figure 3-4 in Bulletin 160-98; DWR, 1998): wet = wettest; critical = driest.

[b]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-11
Historical State Water Project Allocations and Local Hydrology, 1980 through 1999
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	SWP Hydrology[a]	SWP Allocations[b]	Local Hydrology[c]
1980	Above Normal	100%	Wet
1981	Dry	100%	Normal
1982	Wet	100%	Wet
1983	Wet	100%	Wet
1984	Wet	100%	Normal
1985	Dry	100%	Dry
1986	Wet	100%	Wet
1987	Dry	85%	Normal
1988	Critical	100%	Wet
1989	Dry	100%	Dry
1990	Critical	100%	Dry
1991	Critical	30%	Wet
1992	Critical	45%	Wet
1993	Above Normal	85%	Wet
1994	Critical	50%	Dry
1995	Wet	80%	Wet
1996	Wet	100%	Normal
1997	Wet	100%	Normal
1998	Wet	100%	Wet
1999	Wet	100%	Dry

[a]Defined by water year, using the Sacramento Four Rivers Index (Figure 3-4 in Bulletin 160-98; DWR, 1998): wet = wettest; critical = driest. SWP = State Water Project.

[b]Contractor demands, and therefore requests for water, have been increasing through the time period shown. Water allocations in the earlier part of the time period reflect that 100% of contractor requests were met. Those requests were for amounts of water less than the full SWP contract (i.e., Table A) amounts totaling 4.1 million acre-feet. In recent years, SWP contractors have been requesting nearly all of the 4.1 million acre-foot Table A amount contained in the 29 SWP contracts.

[c]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-12

Castaic Creek Flood Flows

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Water Year[a]	Natural Inflows	Flood Flows 10/1 - 4/30	Late Flood Flows[b] 5/1 - 9/30	Total Flood Flows	Net Flood Flows[c]	Flood Flow Shares				Total NLF/LACWWD/ NCWD Flood Flows
						UWCD 48%	NLF 44.867%	LACWWD 4.471%	NCWD 2.662%	
1977	752	0	0	0	0	0	0	0	0	0
1978	92,780	89,592	325	89,917	67,438	32,370	30,257	3,015	1,795	35,068
1979	31,440	19,641	0	19,641	14,731	7,071	6,609	659	392	7,660
1980	54,158	47,625	101	47,726	35,794	17,181	16,060	1,600	953	18,613
1981	6,186	628	0	628	471	226	211	21	13	245
1982	8,930	3,544	0	3,544	2,658	1,276	1,193	119	71	1,382
1983	78,010	74,287	3,020	77,307	57,981	27,831	26,014	2,592	1,543	30,150
1984	10,582	2,106	0	2,106	1,580	758	709	71	42	822
1985	3,361	0	0	0	0	0	0	0	0	0
1986	20,005	13,867	0	13,867	10,400	4,992	4,666	465	277	5,408
1987	1,212	0	0	0	0	0	0	0	0	0
1988	4,401	807	0	807	605	290	272	27	16	315
1989	919	0	0	0	0	0	0	0	0	0
1990	540	0	0	0	0	0	0	0	0	0
1991	6,719	4,375	0	4,375	3,281	1,575	1,472	147	87	1,706
1992	29,409	22,631	0	22,631	16,973	8,147	7,615	759	452	8,826
1993	81,264	77,722	0	77,722	58,291	27,980	26,154	2,606	1,552	30,312
1994	6,424	502	0	502	377	181	169	17	10	196
1995	57,914	53,363	0	53,363	40,022	19,211	17,957	1,789	1,065	20,812
1996	7,105	1,654	0	1,654	1,241	596	557	55	33	645
1997	9,028	3,918	0	3,918	2,938	1,410	1,318	131	78	1,528
1998	68,846	66,597	11,639	78,236	58,677	28,165	26,327	2,623	1,562	30,512
1999	7,793	238	0	238	179	86	80	8	5	93
2000	7,212	4,118	0	4,118	3,088	1,482	1,386	138	82	1,606
Totals	**594,990**	**487,215**	**15,085**	**502,300**	**376,725**	**180,828**	**169,025**	**16,843**	**10,028**	**195,897**
Average	**24,791**	**20,301**	**629**	**20,929**	**15,697**	**7,535**	**7,043**	**702**	**418**	**8,162**
Median	**8,362**	**3,731**	**0**	**3,731**	**2,798**	**1,343**	**1,255**	**125**	**74**	**1,455**

[a]A water year is from October 1 to September 30, but the flood flow water is generally available only from October 1 through April 30.

[b]Late flood flows are from May 1 through September 30.

[c]Net flood flows are 75% of total flood flows.

Note:

All flows are listed in acre-feet.

Figures

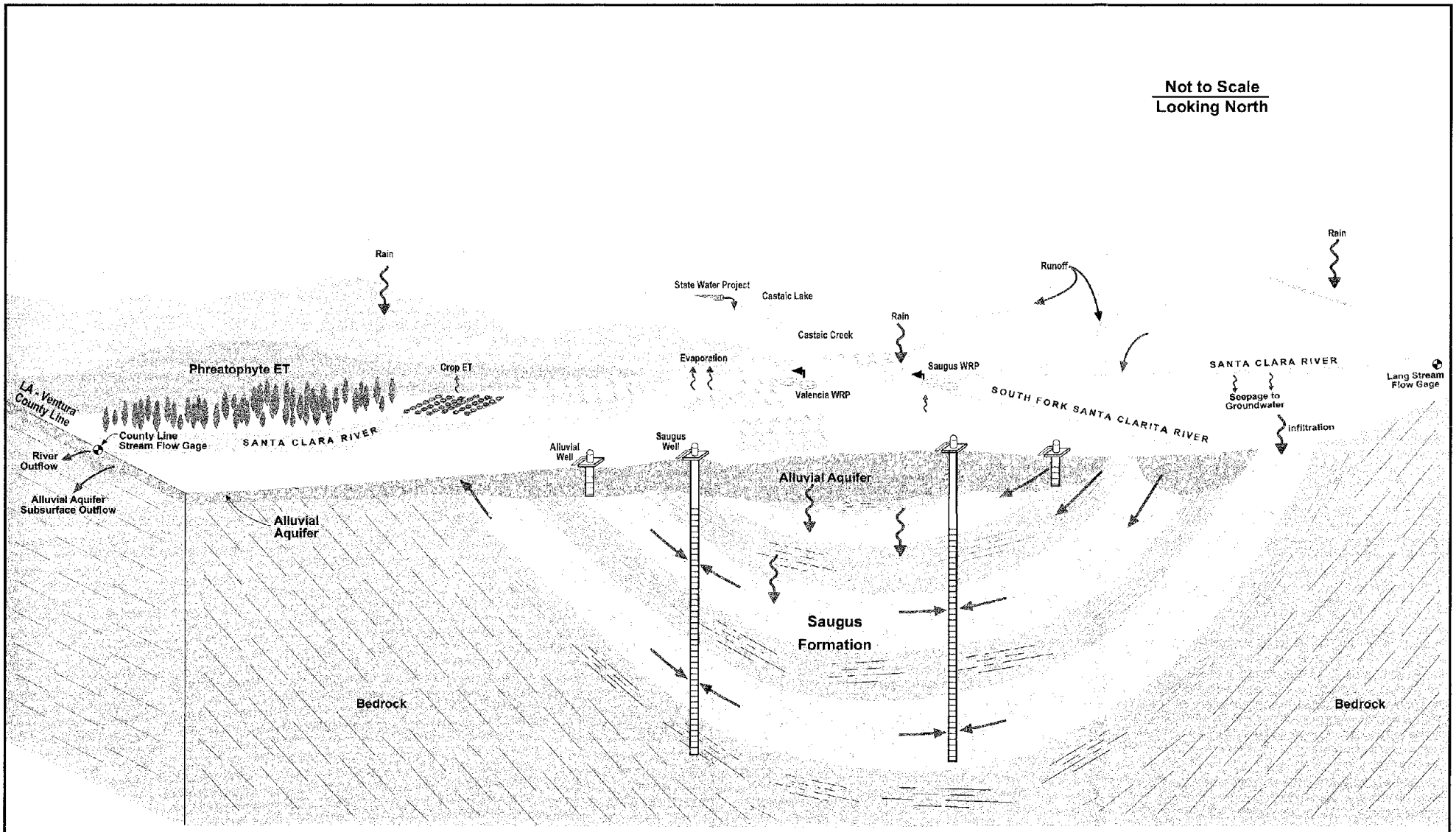

FIGURE 2-1
SANTA CLARITA VALLEY HYDROLOGY
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

E012004006RDD_01 (1/20/04)

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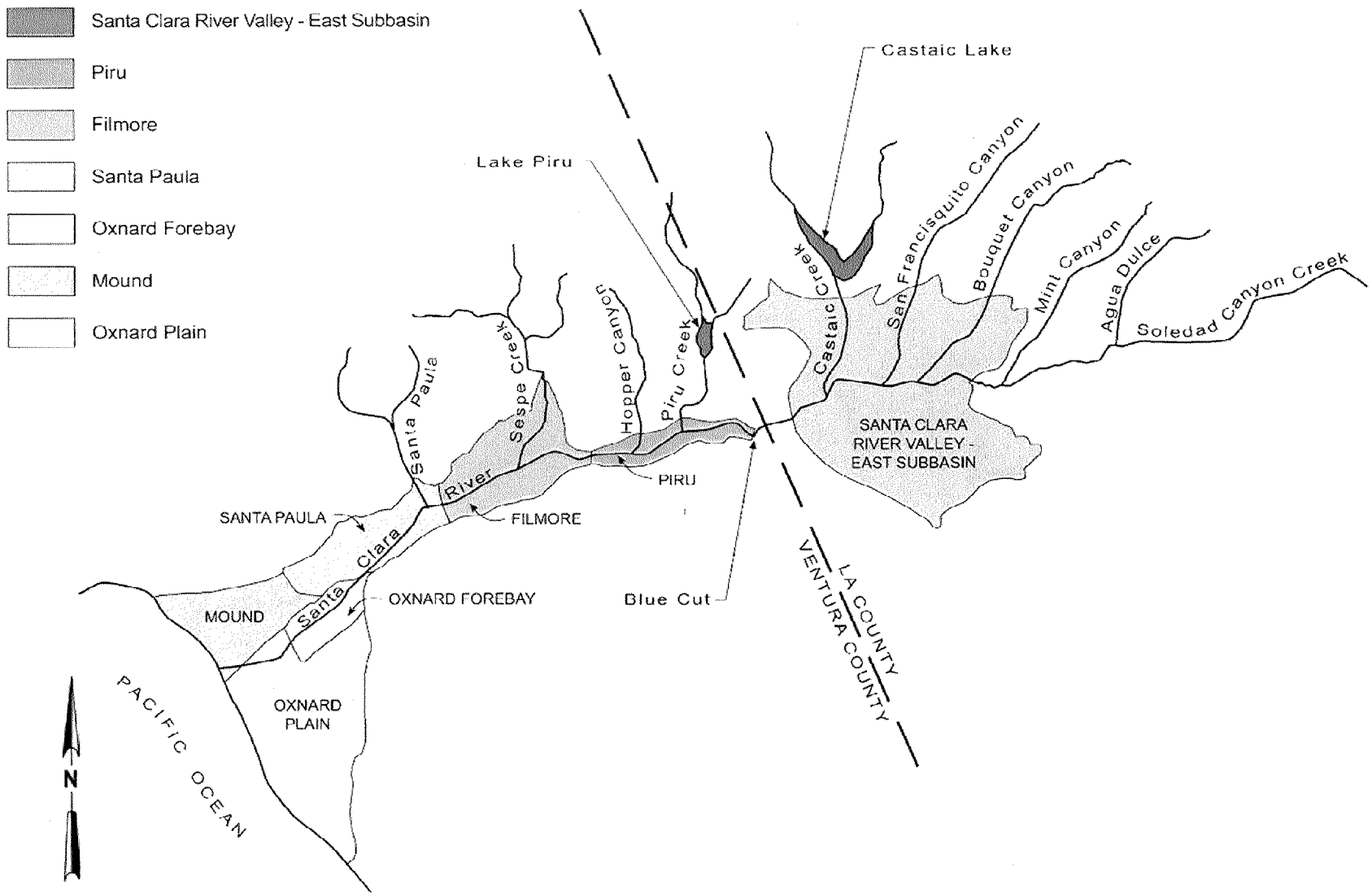

FIGURE 2-2
GROUNDWATER BASINS IN THE SANTA CLARA RIVER DRAINAGE
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-001.FH9

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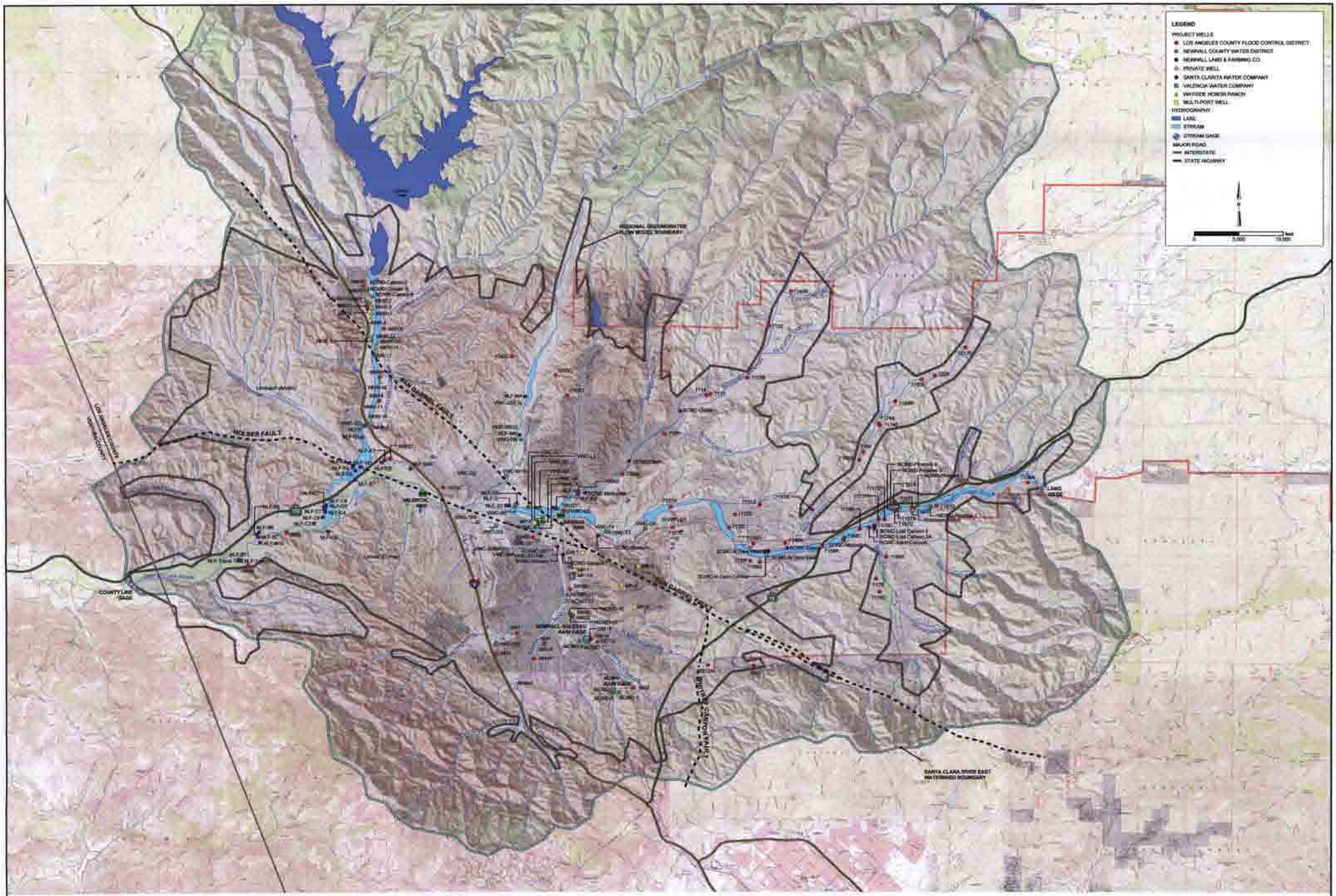

FIGURE 2-3
WELL LOCATIONS AND FEATURES MAP
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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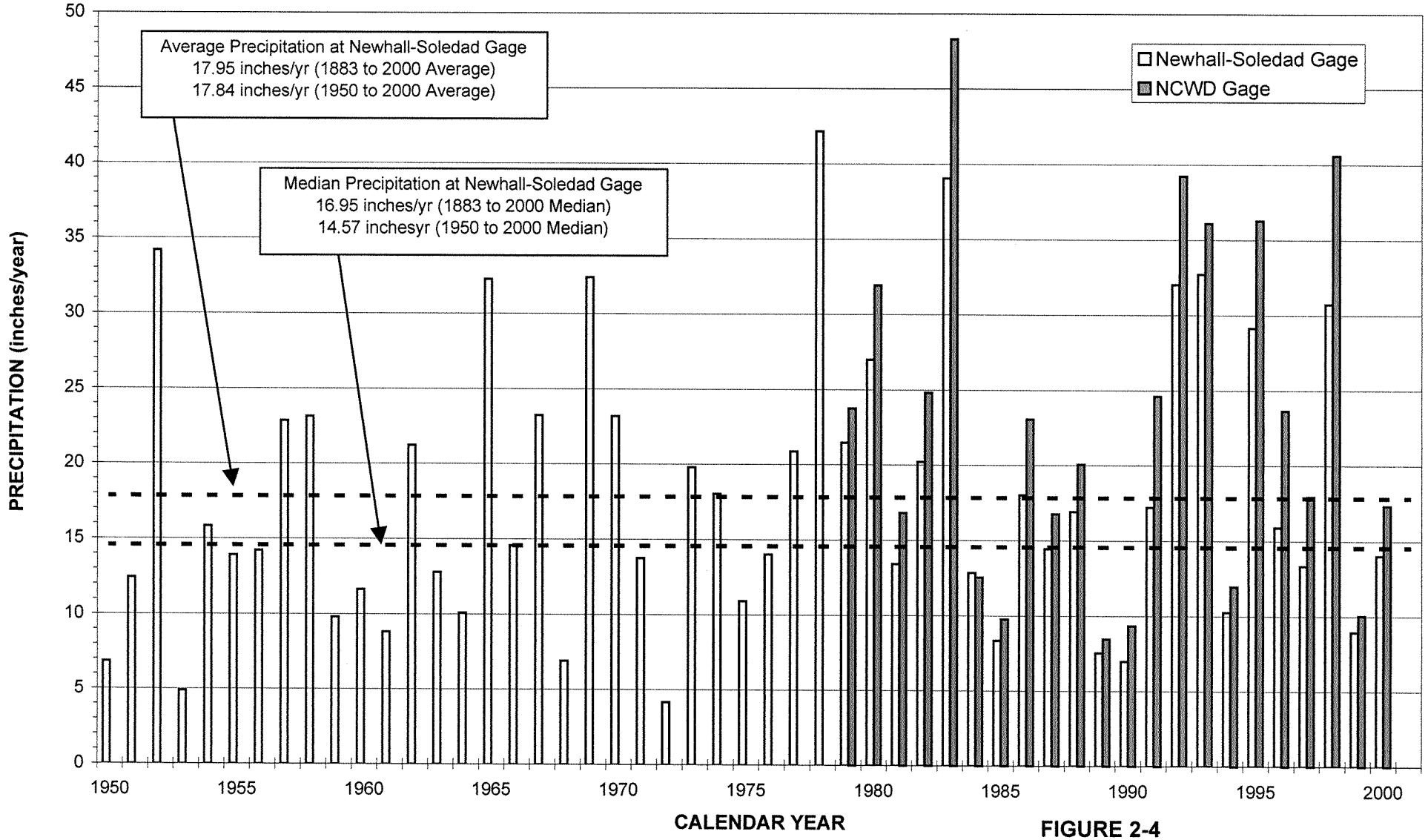

FIGURE 2-4
ANNUAL PRECIPITATION AT THE NEWHALL-SOLEDAD AND NCWD RAIN GAGES SINCE 1950
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-401.xls\Fig 2-4

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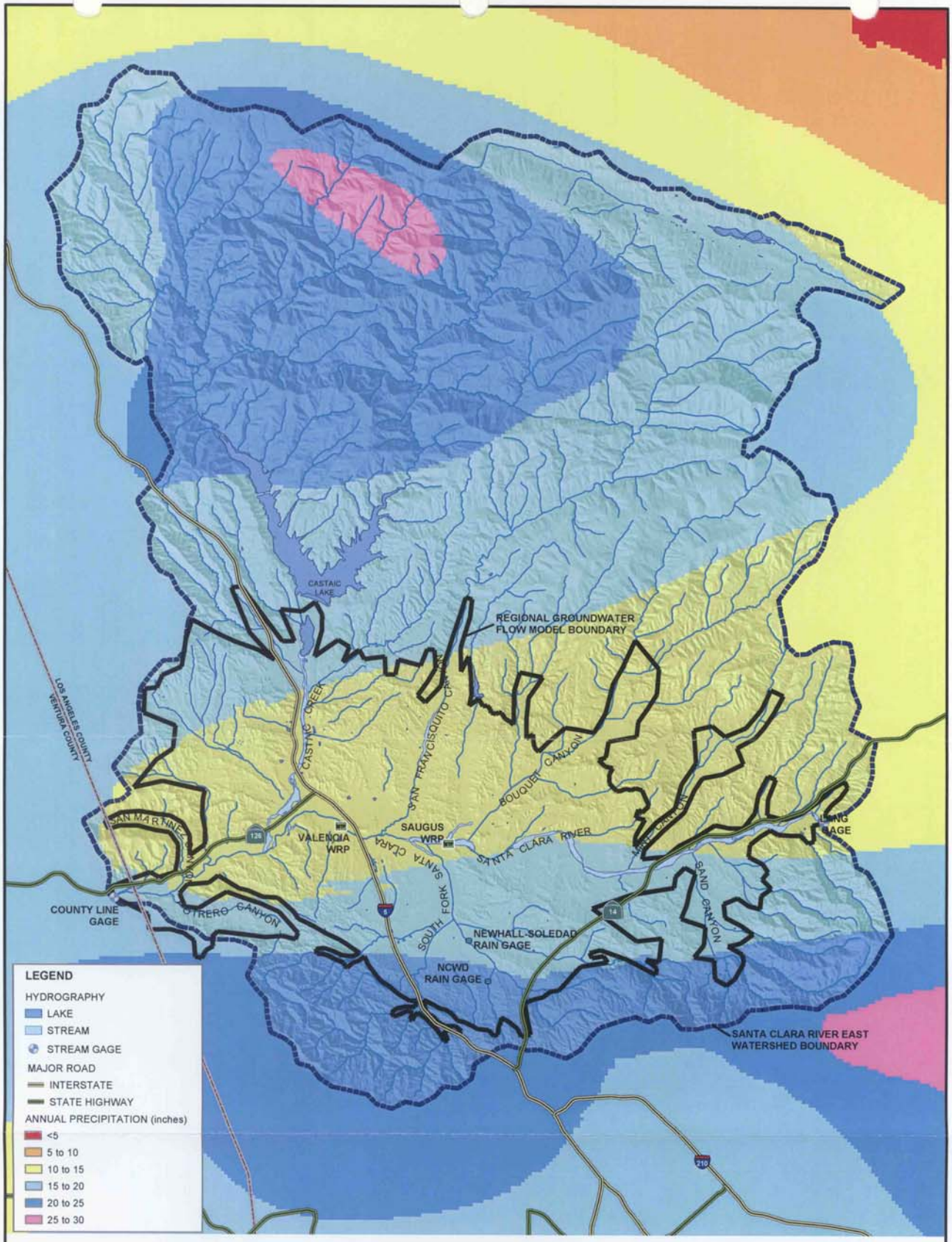

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

FIGURE 2-5
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0205.MXD FIG0205.PDF

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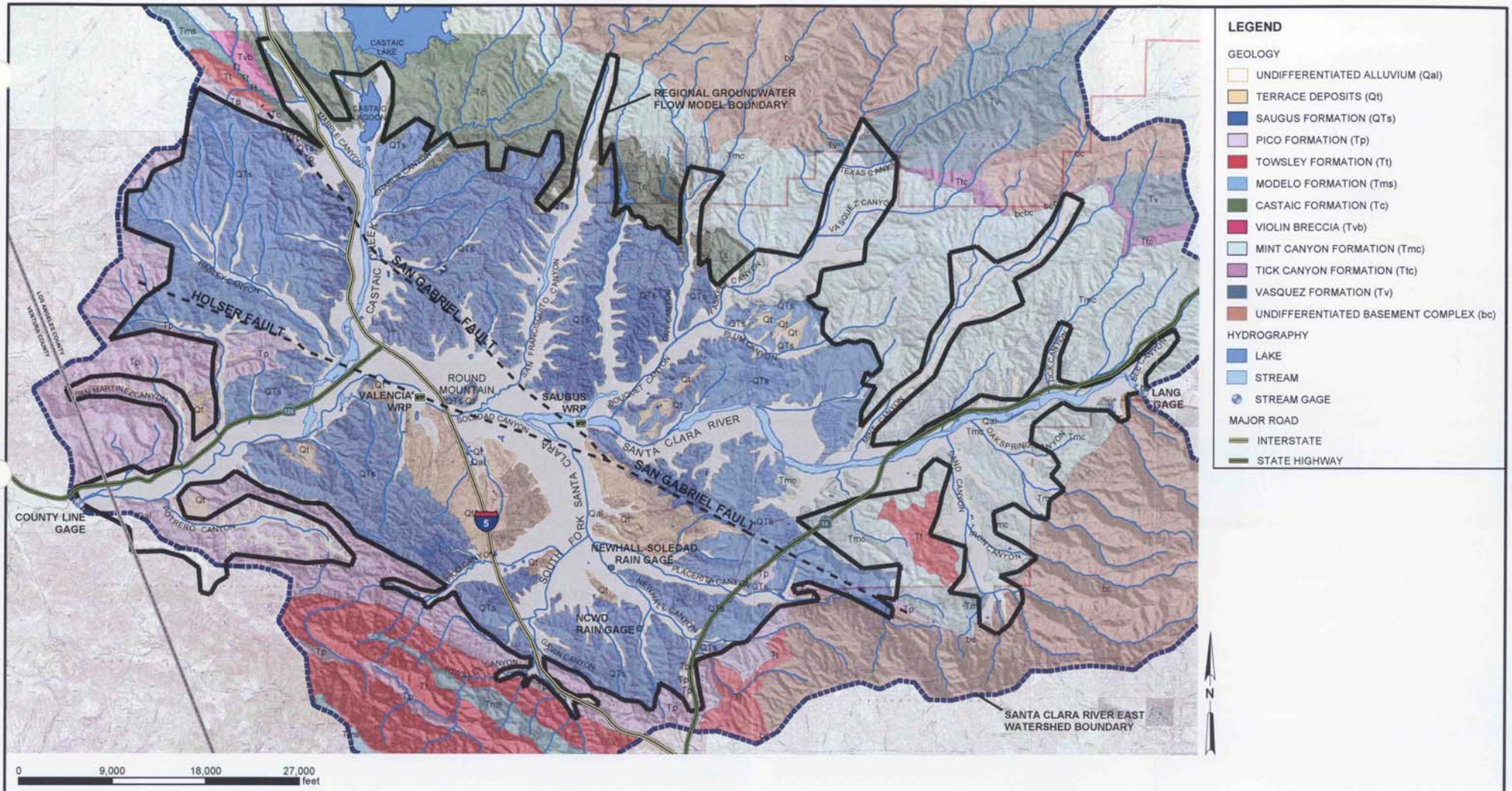
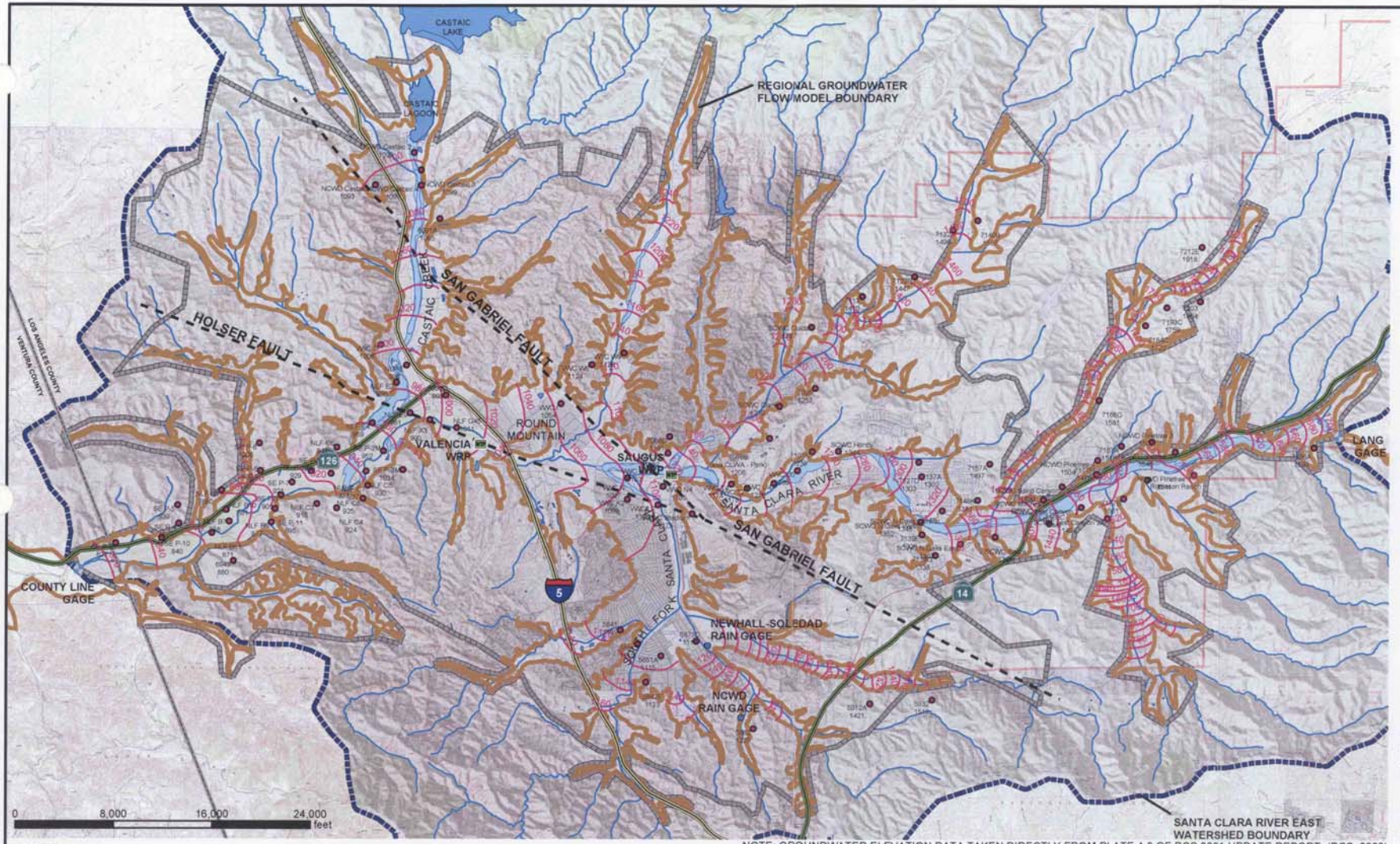


FIGURE 2-6
BASIN GEOLOGIC MAP
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\RDD31002540\SANTACLARITA\MXD\FIG0206.MXD FIG02-06.PDF 04/04/2004 17:54:36



NOTE: GROUNDWATER ELEVATION DATA TAKEN DIRECTLY FROM PLATE 4-3 OF RCS 2001 UPDATE REPORT. (RCS, 2002)

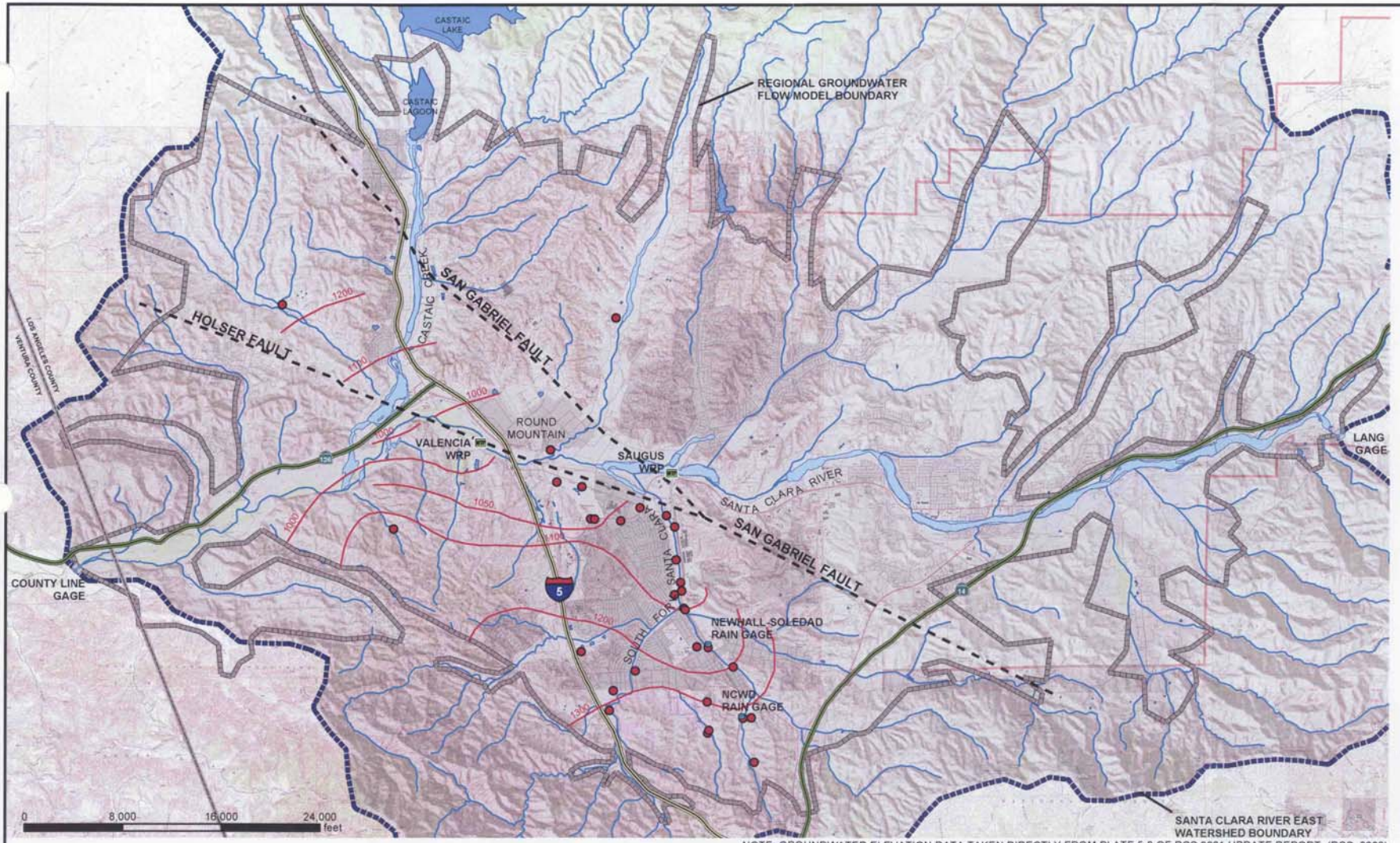
LEGEND

- CONTOUR OF SPRING 2000 GROUNDWATER ELEVATION (feet MSL)
- SPRING 2000 GROUNDWATER ELEVATION (feet MSL)
- EXTENT OF ALLUVIUM
- LAKE
- STREAM

FIGURE 2-7
GROUNDWATER ELEVATION CONTOUR MAP FOR THE ALLUVIUM – SPRING 2000
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0207.MXD FIG02-07.PDF 02/02/2004 12:27:27



NOTE: GROUNDWATER ELEVATION DATA TAKEN DIRECTLY FROM PLATE 5-3 OF RCS 2001 UPDATE REPORT. (RCS, 2002)

LEGEND

- SAUGUS WELLS
- CONTOUR OF FALL 2000 GR0UNDWATER ELEVATION (feet MSL)
- LAKE
- STREAM

FIGURE 2-8
GROUNDWATER ELEVATION CONTOUR MAP FOR THE SAUGUS – FALL 2000
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0208.MXD FIG02-08.PDF 02/04/2004 10:57:48

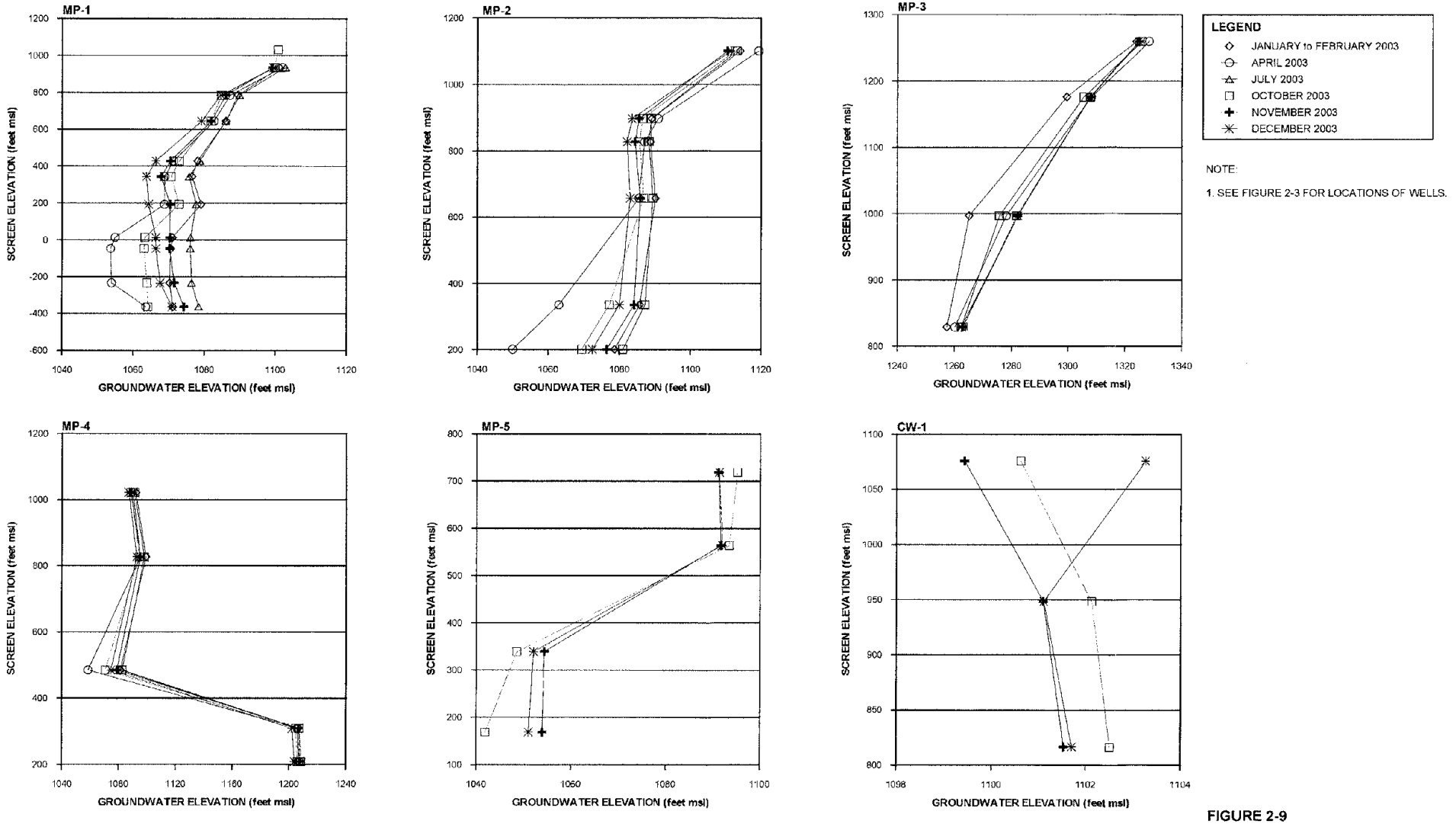


FIGURE 2-9
GROUNDWATER ELEVATIONS IN MULTI-PORT SAUGUS FORMATION MONITORING WELLS JANUARY 2003 THROUGH DECEMBER 2003
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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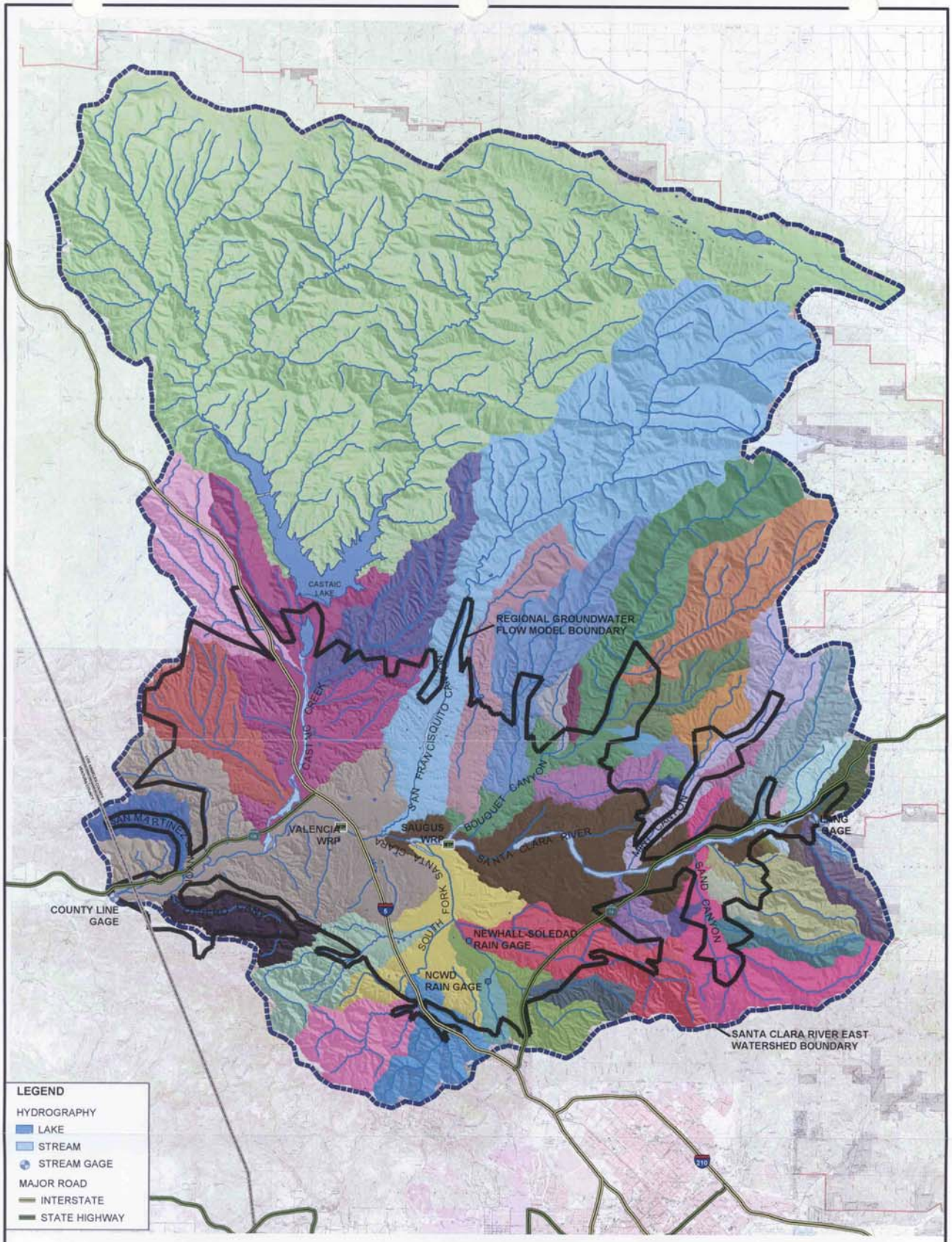


FIGURE 2-10
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

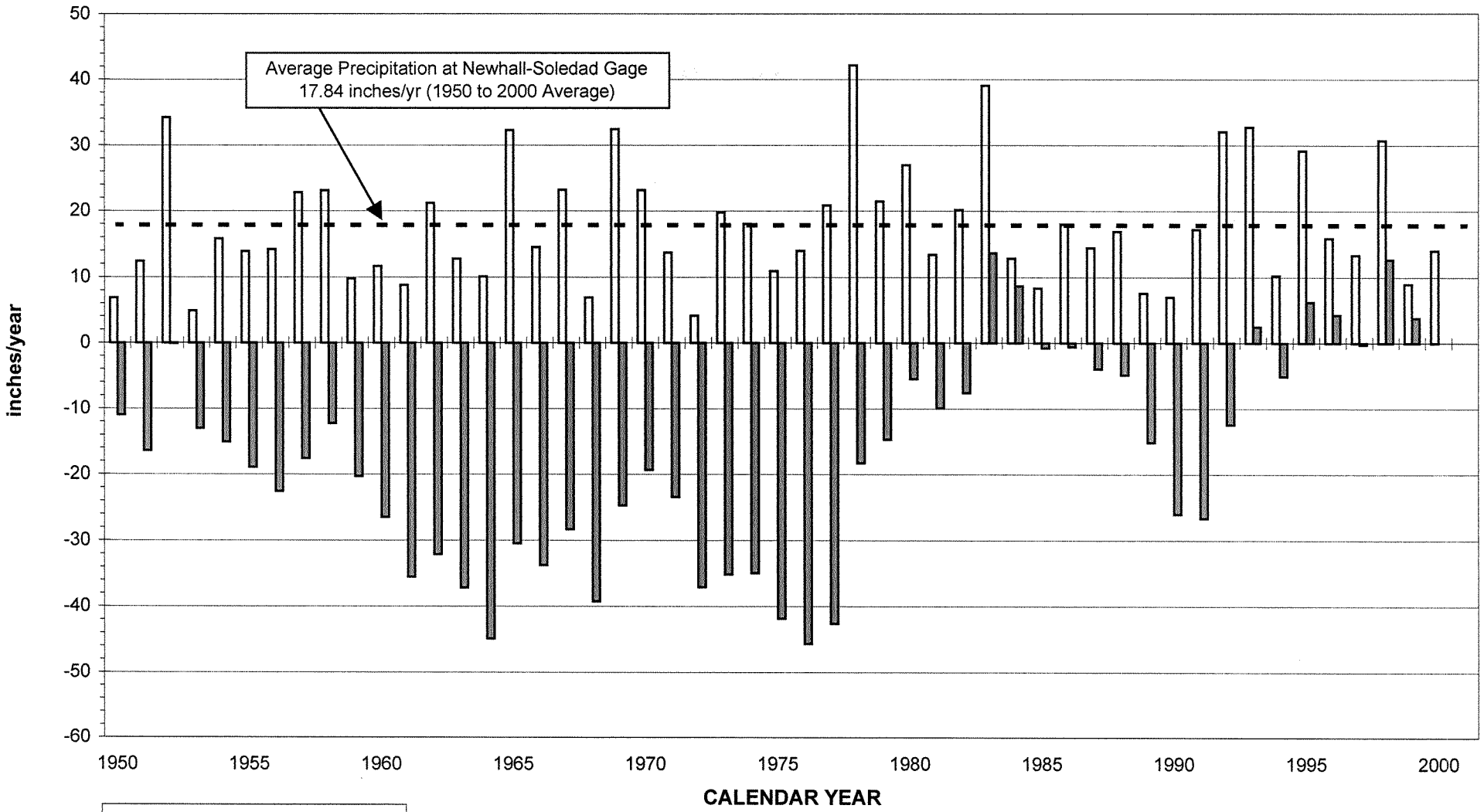
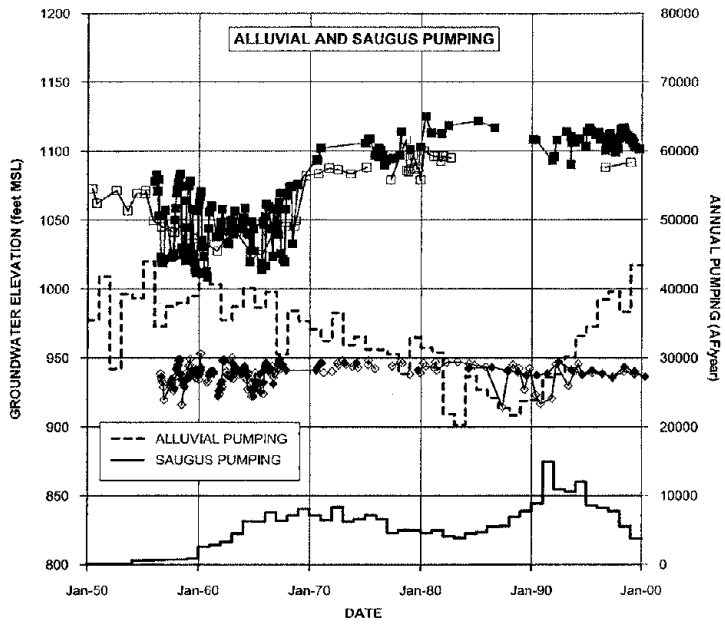
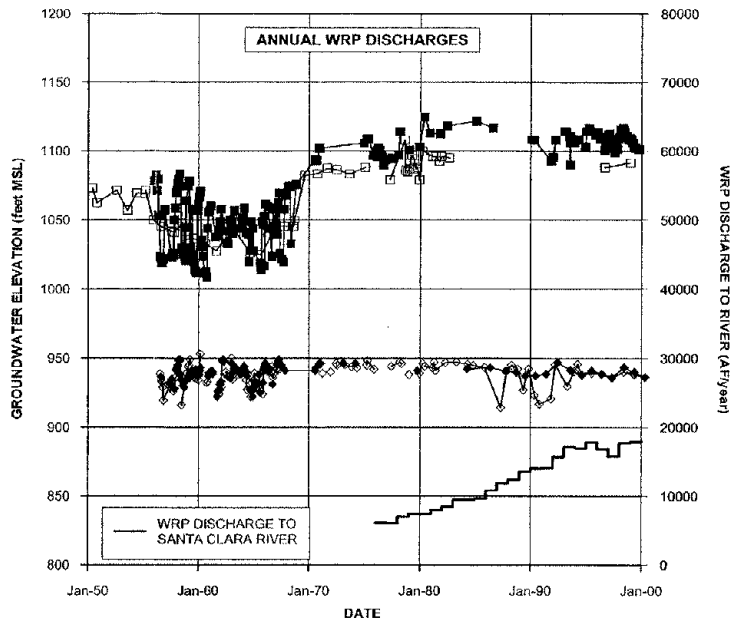


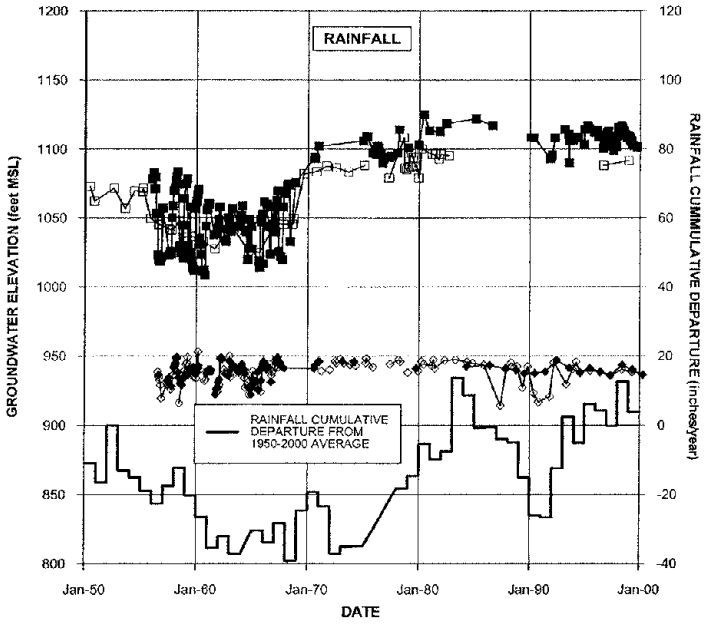
FIGURE 2-11
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 TO 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE SINCE 1950
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

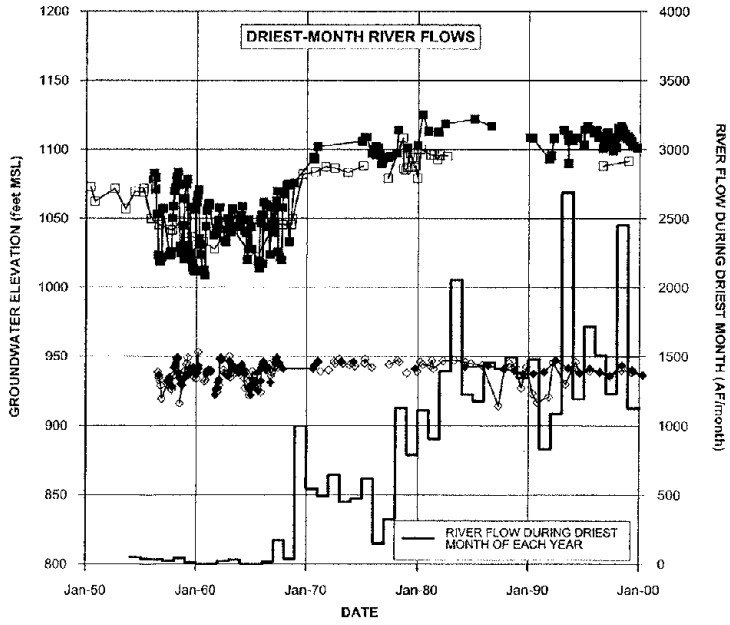
CH2MHILL

178973-401.xls\Fig 2-11









LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N
- ELEVATION OF GROUNDWATER IN NLF-S
- ELEVATION OF GROUNDWATER IN NLF-C5
- ELEVATION OF GROUNDWATER IN NLF-C7

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-12
ALLUVIAL GROUNDWATER ELEVATIONS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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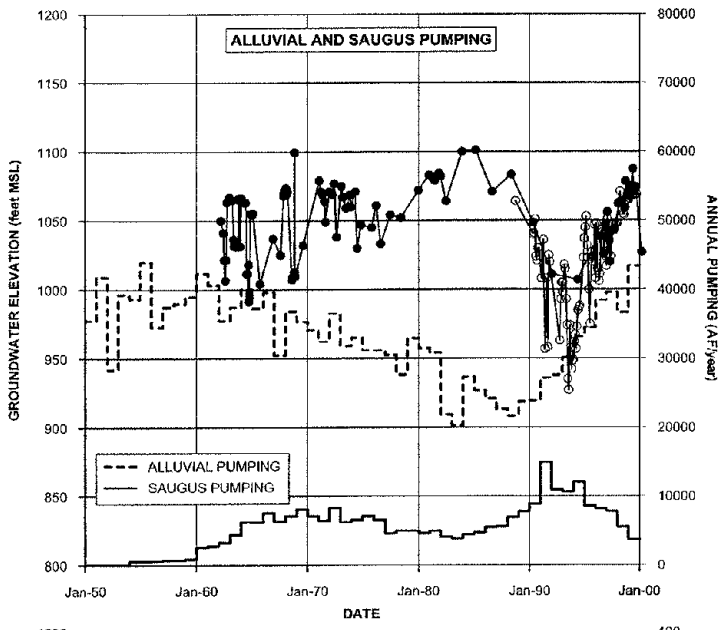

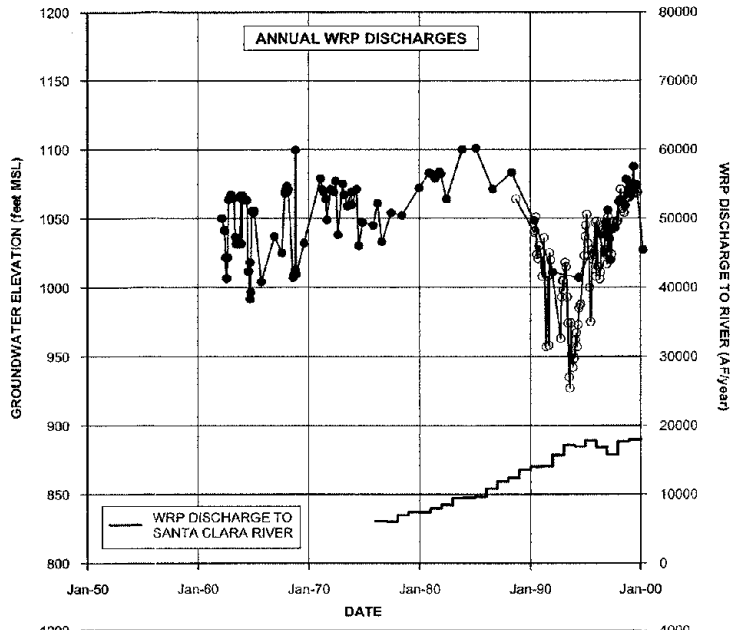

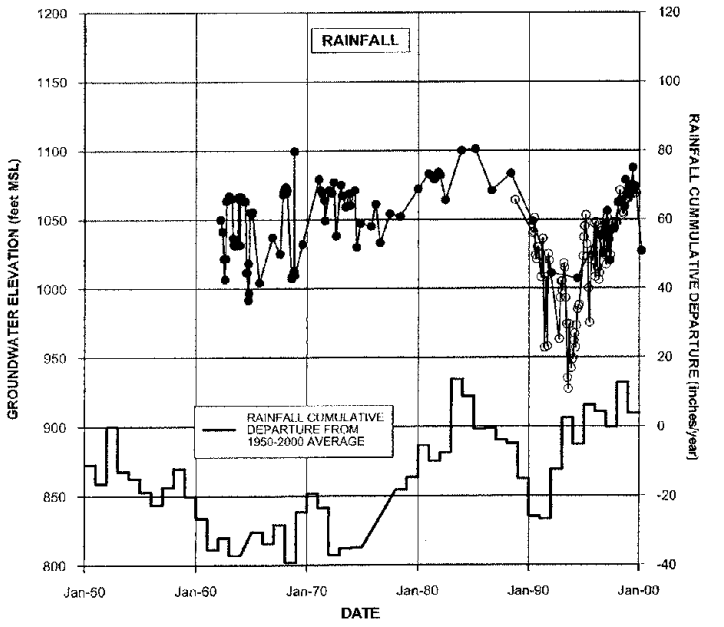

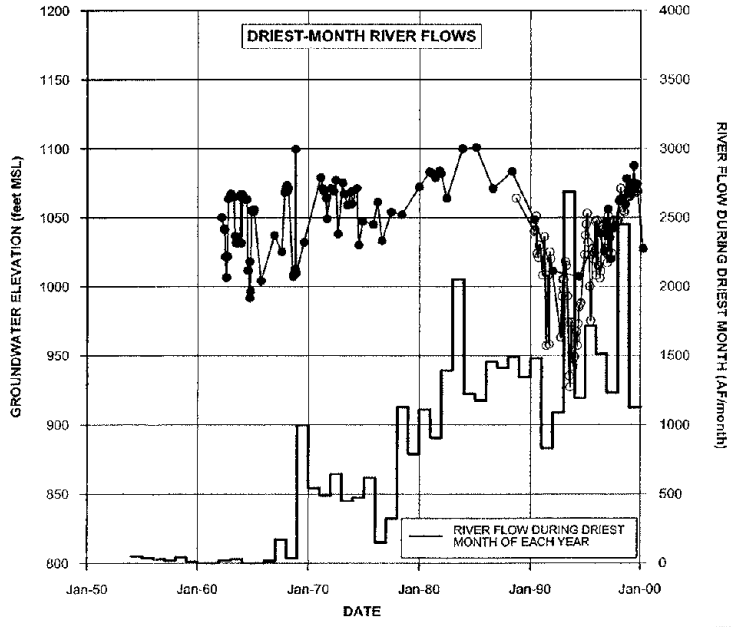

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157
- ELEVATION OF GROUNDWATER IN SCWC SAUGUS 2

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-13
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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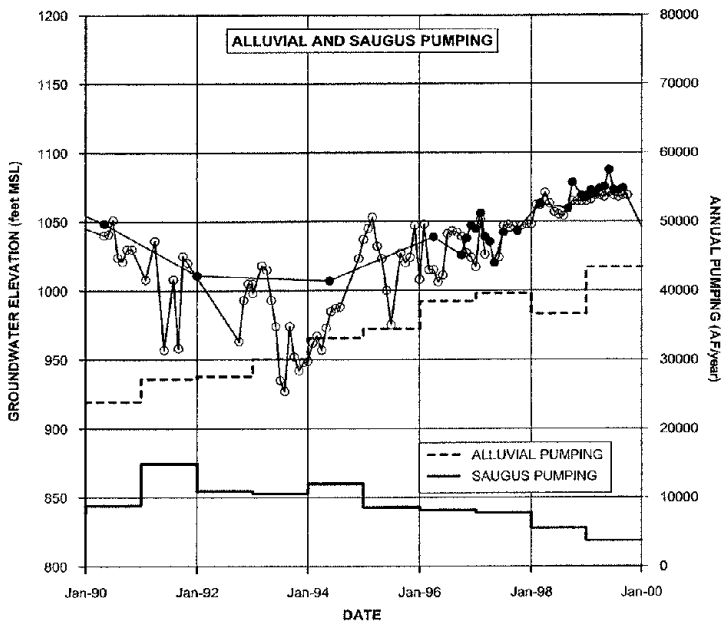

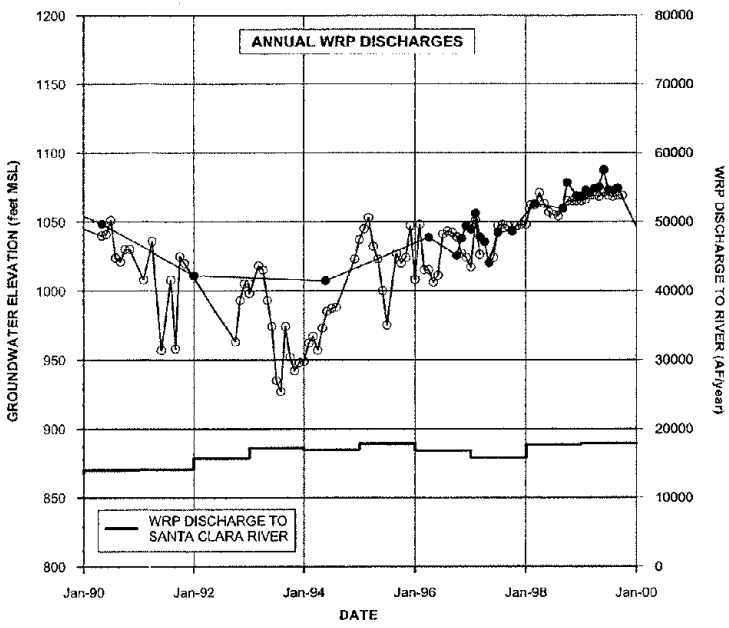

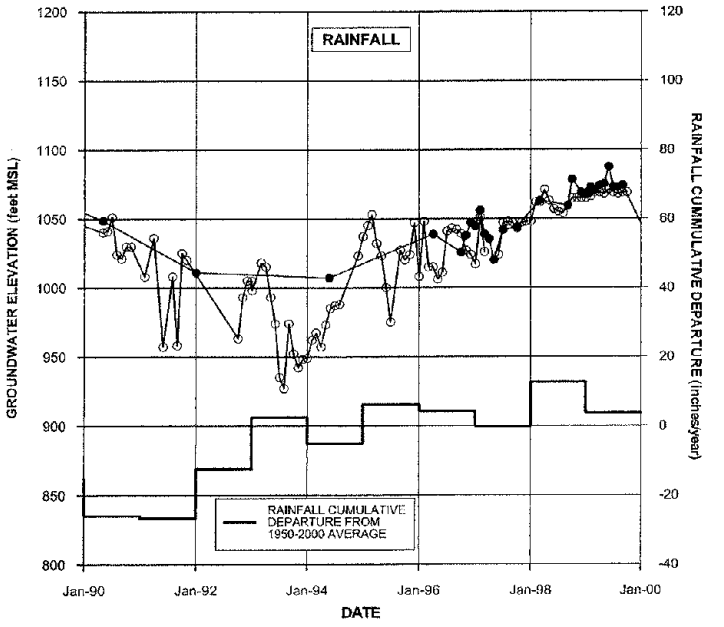

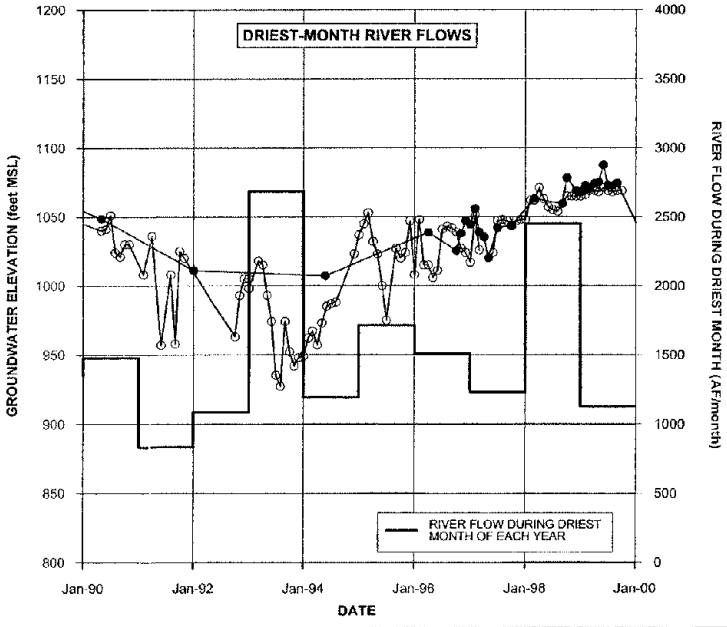

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157
- ELEVATION OF GROUNDWATER IN SCWC SAUGUS 2

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-14
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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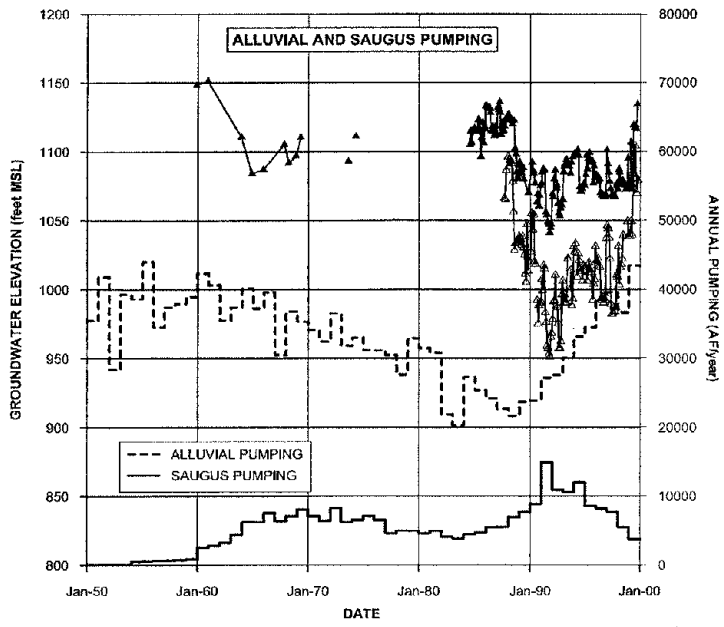
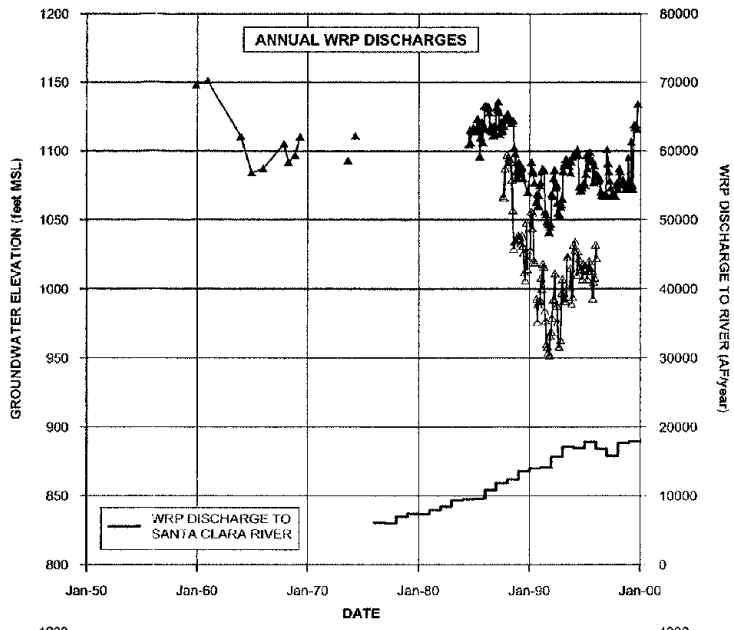
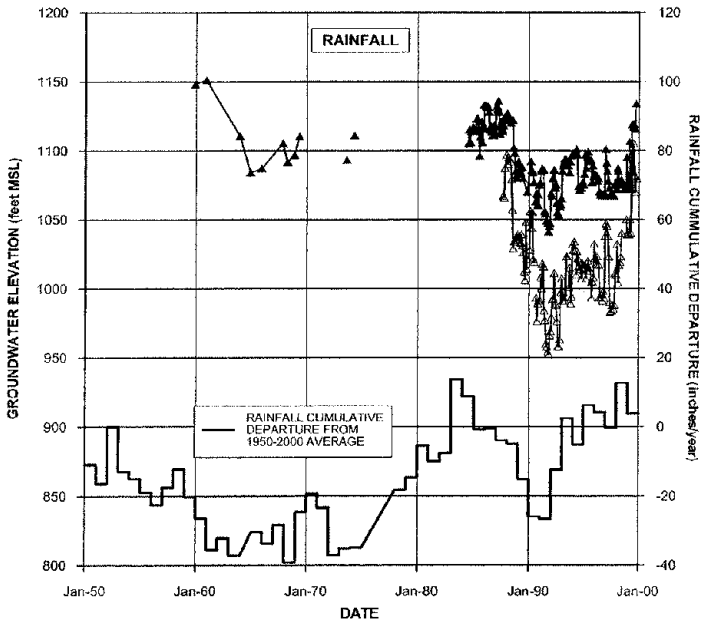
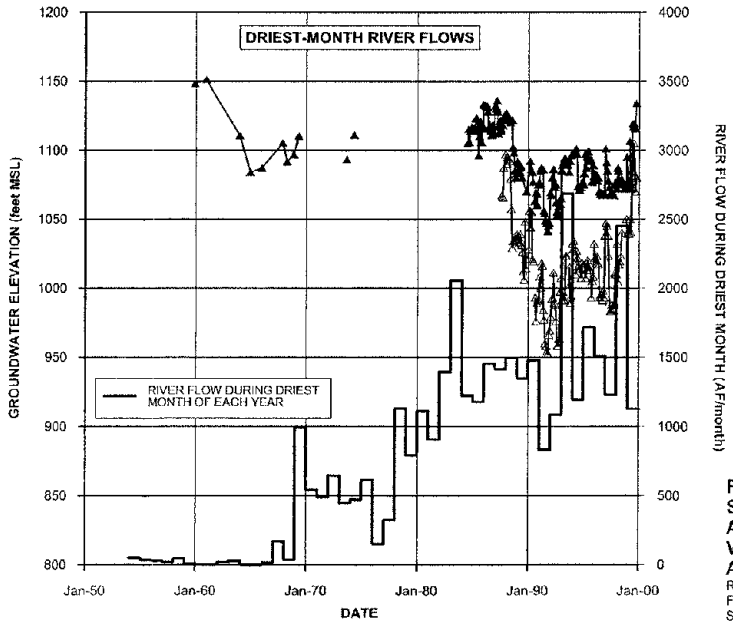








LEGEND

- ELEVATION OF GROUNDWATER IN NCWD-7
- ELEVATION OF GROUNDWATER IN NCWD-12

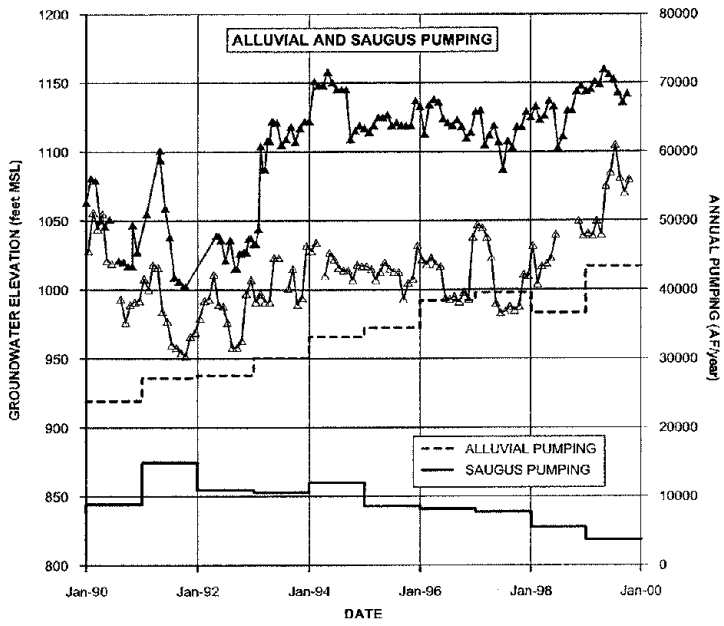
NOTES:

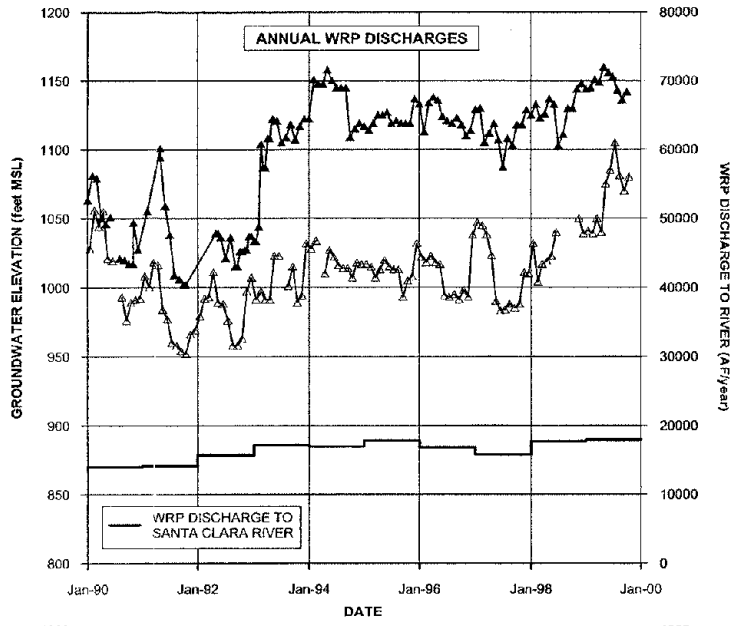
1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

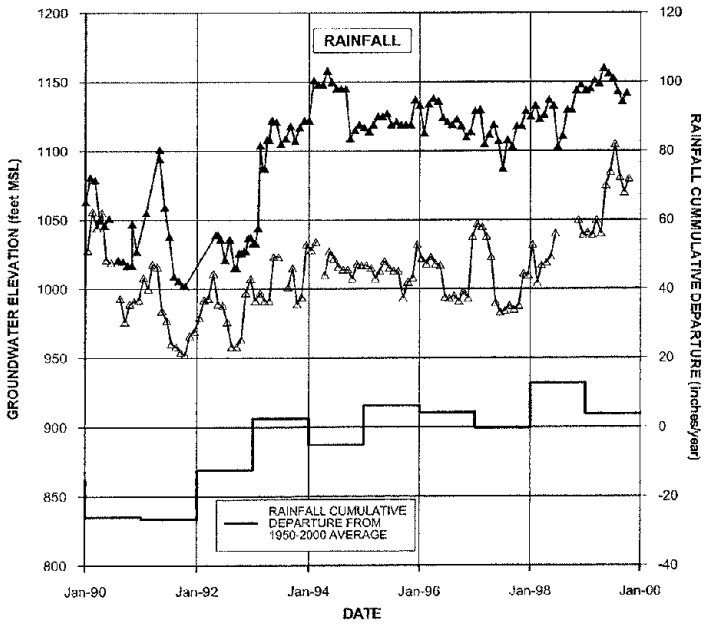
FIGURE 2-15
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

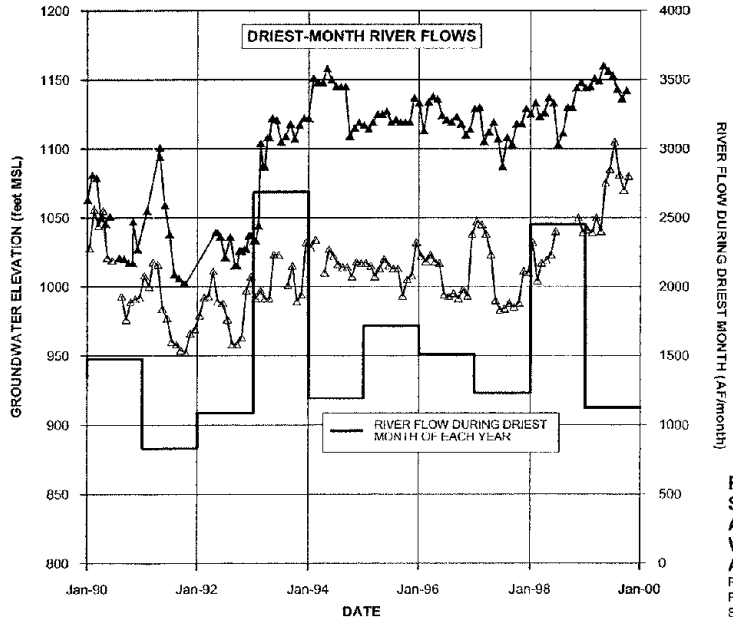
CH2MHILL

178973-304.GRF









LEGEND

- ELEVATION OF GROUNDWATER IN NCW-10
- ELEVATION OF GROUNDWATER IN NCW-12

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-16
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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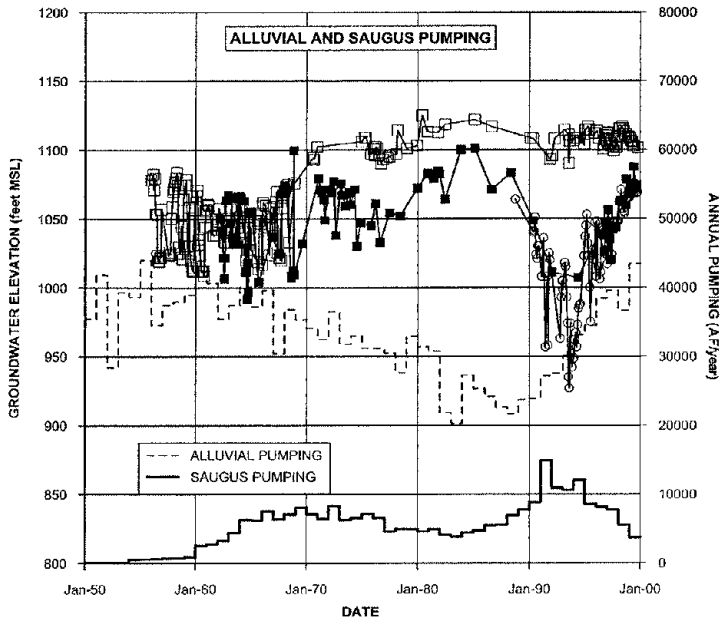

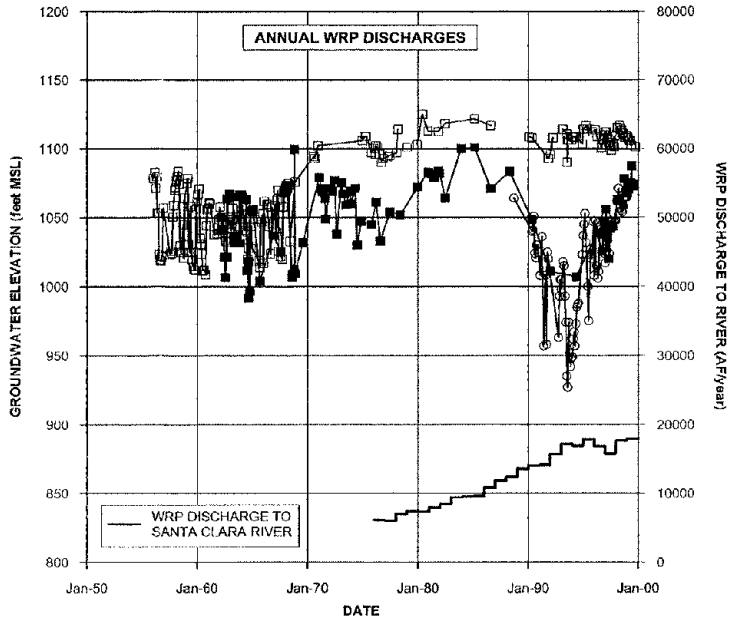

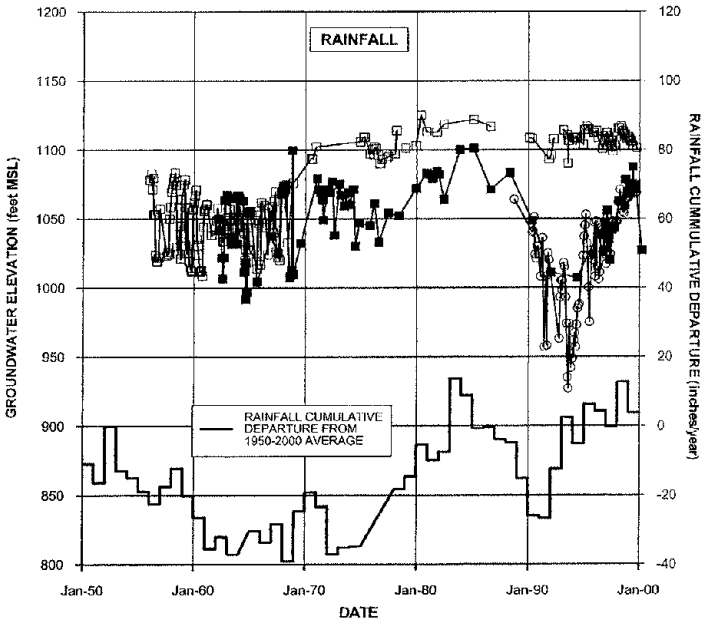

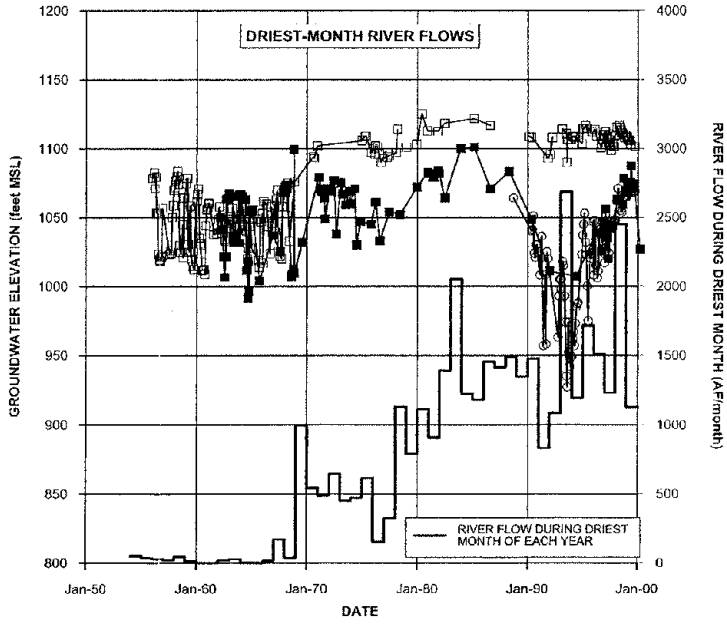

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N (ALLUVIUM)
- ELEVATION OF GROUNDWATER IN NVWC-157 (SAUGUS)
- ELEVATION OF GROUNDWATER IN SWC SAUGUS 2 (SAUGUS)

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-17
GROUNDWATER ELEVATIONS IN ADJACENT ALLUVIAL AND SAUGUS WELLS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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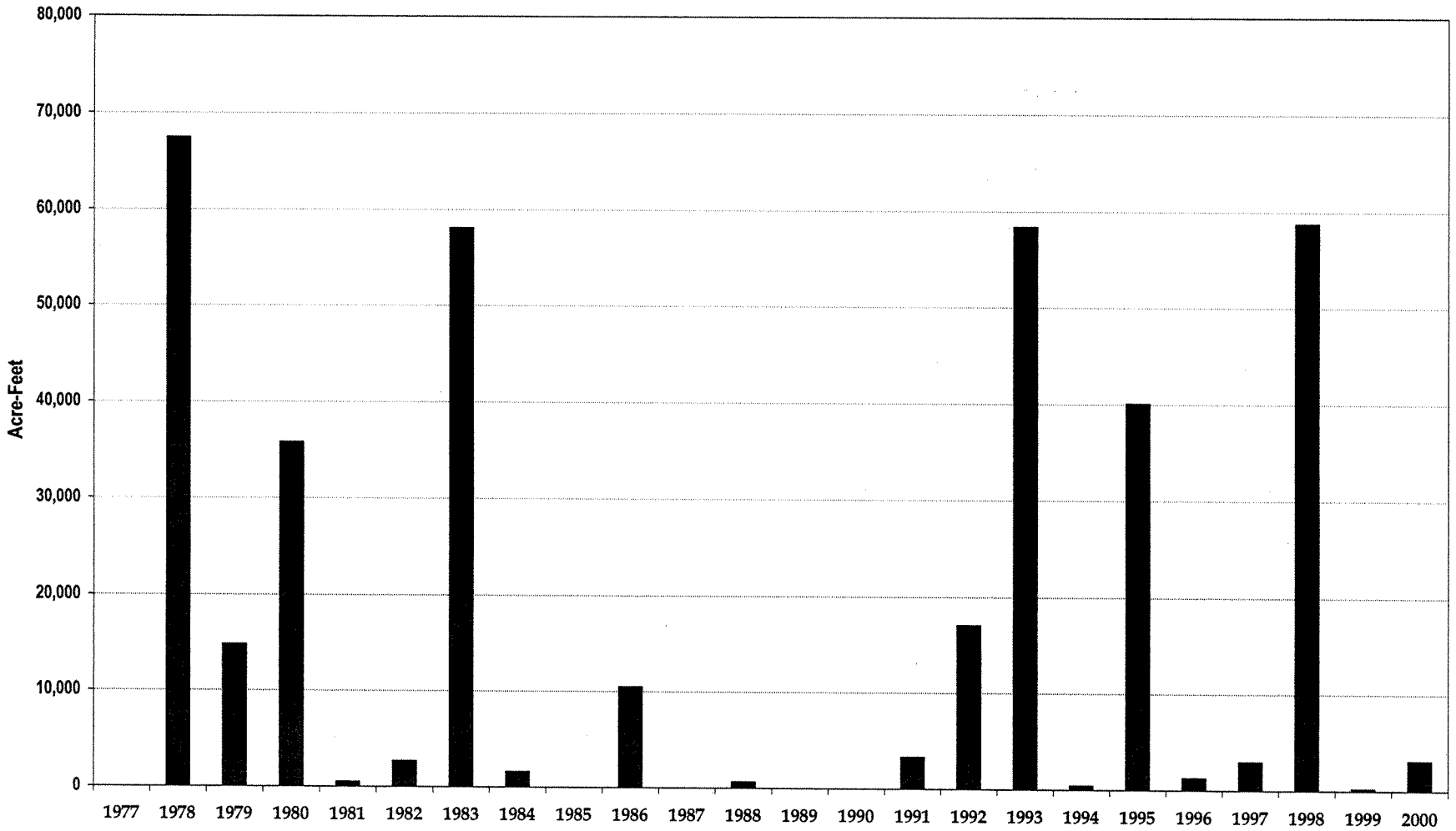

This chart shows the potential Flood Flows available during water years 1977 through 2000. Water Year 1977 is defined as October 1, 1976 through September 30, but the water is generally available only from October 1 through April 30.

FIGURE 2-18
NET CASTAIC CREEK FLOOD FLOWS AVAILABLE TO DOWNSTREAM USERS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 3

Model Construction

The Regional Model is a three-dimensional numerical model of groundwater flow in the Alluvial Aquifer and the Saugus Formation. The model simulates changes in groundwater flow and storage during the recent 20-year period from 1980 through 1999. This section of the report presents the overall approach to the construction of the Regional Model including the model software; model domain; grid design; layering scheme; boundary conditions; designation of subareas within the model domain; and the process for estimating the magnitudes of groundwater recharge and pumping terms required by the model.

3.1 Modeling Software

The Regional Model was constructed using the three-dimensional finite-element groundwater modeling software called MicroFEM® (Hemker and de Boer, 2003). MicroFEM® operates in a Windows™ environment and can be used to solve groundwater flow problems for unconfined, semi-confined, or confined aquifer systems. This software simulates steady-state or transient flow conditions in up to a 20-layer aquifer system; the finite-element mesh may contain as many as 50,000 nodes in each model layer. The software contains several different methods for simulating groundwater/surface water interactions. MicroFEM® is based on software developed in the Netherlands during the 1980s for use in evaluating the effects of groundwater pumping in areas with complicated meandering rivers. Further details regarding this software's design, capabilities, and functionality can be found on the Internet at www.microfem.com and in two reviews of the software by Diodato (1997, 2000).

3.2 Extent of the Model Domain

A finite-element mesh was designed that covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. The model area largely coincides with the Santa Clara River Valley East Groundwater Subbasin, extending from the Lang stream gage at the eastern end of the valley to the County Line gage area in the west. The northern and southern edges of the model domain are defined by the geologic contacts mapped by RCS (2002) for the Alluvial Aquifer and the Saugus Formation. Figure 2-10 shows the model domain, along with its location relative to the upstream watersheds that contribute runoff into the model study area.

3.3 Model Grid

Figure 3-1 shows the spacing of the individual nodes that comprise the grid. The mesh contains 17,103 nodes in each model layer. The nodes are connected by segments, forming 32,496 triangular elements. Calculations of all flow components (recharge and discharge),

groundwater storage, and groundwater elevations are performed by the model for each node and segment.

The nodes are 500 feet apart in the majority of the modeled area. However, a finer node spacing (150 feet) was used along the Santa Clara River and its tributaries to allow a more exact simulation of surface water/groundwater exchanges. Additionally, specific nodes were placed within this regional grid at the locations of production and monitoring wells.

3.4 Layering

The groundwater system was represented in the Regional Model with seven layers. The layer representation is summarized schematically on Figure 3-2. The Alluvial Aquifer, where present, was modeled with a single layer, and the Saugus Formation was modeled with multiple layers to its total depth, which was defined as the base of the Sunshine Ranch Member of the Saugus Formation. Figures 3-3 through 3-9 show the assigned thicknesses in model layers 1 through 7. Figure 3-10 shows the total modeled saturated thickness of the Saugus Formation. Figures 3-11 through 3-17 show the elevations of the base of each model layer. Figure 3-18 shows the model layering in three cross-sectional views. Further details regarding model layering are presented below.

3.4.1 Alluvial Aquifer Layer

In 2002, RCS compiled and geographically grouped hydrogeologic data from Alluvial Aquifer wells to estimate the aquifer's saturated thickness during various historical periods. The saturated thickness was defined from the average base elevation of the aquifer and the water level elevations measured during the fall of 1985 and the spring of 2000, then typical saturated thicknesses for geographic subareas were defined. The spatial distribution of the Alluvial Aquifer's typical saturated thickness is shown on Figure 3-3. Along the Santa Clara River, the typical saturated thickness ranges between 110 and 130 feet west of I-5; is less than 100 feet near Round Mountain; ranges between 100 and 150 feet between Round Mountain and Soledad Canyon; and ranges between 80 and 90 feet in Soledad Canyon. The typical saturated thickness ranges between 80 and 100 feet in the Castaic Creek Valley and in the lower reach of Bouquet Canyon. Other tributary canyons to the Santa Clara River have typical saturated thicknesses of 60 feet or less, and the saturated thickness decreases significantly in the upstream direction within each canyon, particularly along the South Fork Santa Clara River, where all production wells are constructed in the Saugus Formation, rather than the alluvium (RCS, 2002).

3.4.2 Saugus Formation Layers

The Saugus Formation was simulated using 500-foot-thick model layers through the freshwater-bearing deposits, which are present in the basin at depths up to 2,500 feet (RCS, 1988, 2002). The model layers were specified at each node by importing digitized contours of the total thickness of the Saugus Formation's freshwater-bearing deposits (Plate 5 in RCS, 1988). Figure 3-4 is a contour fill map showing the total thickness of the Saugus Formation's freshwater-bearing deposits that was programmed into the model. As shown in the individual thickness maps for each model layer, the Saugus is present in the

model at progressively fewer nodes with depth, due to the bowl-shaped structure of the unit and the underlying bedrock.

3.5 Boundary Conditions

The boundary conditions used in the Regional Model were the following:

a. **Specified flux for precipitation within the model grid.** Deep percolation of precipitation was simulated using the precipitation top-system package contained in MicroFEM®.

b. **Specified flux for irrigation.** Deep percolation of agricultural irrigation and urban irrigation in developed areas was simulated using the precipitation top-system package contained in MicroFEM®.

c. **Specified flux and head-dependent flux along ephemeral streams.** With respect to groundwater discharges to streams, the Santa Clara River was modeled as an ephemeral, predominantly losing stream at and upstream of the mouth of San Francisquito Canyon, and as a perennial, predominantly gaining stream downstream of San Francisquito Canyon. Although flows in the river are currently perennial below the mouth of Bouquet Canyon, because of discharges from the Saugus WRP, the river was perennial only below the mouth of San Francisquito Canyon in the 1960s, prior to WRP operations. The tributaries to the Santa Clara River were modeled as ephemeral streams, using the precipitation top-system package to specify stream leakage to groundwater. Aerial photos and historical observations indicate that under high water table conditions, groundwater can locally discharge into Castaic Creek and the ephemeral reach of the Santa Clara River wherever Alluvial groundwater levels rise above the riverbed elevation. Consequently, the drain package in MicroFEM® was used in these streams to allow drainage of any groundwater that was calculated to be above the riverbed elevation at each river node.

d. **Specified flux and head-dependent flux along perennial Santa Clara River.** In the perennial reach of the Santa Clara River, the river was modeled using the wadi top-system package contained in MicroFEM®. The wadi package allows groundwater to discharge to the river whenever groundwater elevations are higher than the specified river stage. When groundwater levels are below the river stage, the river recharges the Alluvial Aquifer. The rate of recharge is proportional to the difference between the river stage elevation and the model-calculated groundwater elevation. However, once the groundwater elevation drops below the streambed sediments, the rate of leakage from the stream is constant (i.e., does not vary as the groundwater elevation fluctuates). For the Regional Model, each node along the perennial reach of the Santa Clara River was assigned a river stage 1 foot higher than the mapped bed elevation of the river. The riverbed permeability, or conductance, which helps control the model-calculated groundwater/surface water exchange rates, was adjusted during model calibration by calibrating to streamflow data collected at the county line. (See Section 4.3 for further details on the use of the streamflow data during model calibration.)

e. **Specified flux for pumping.** Pumping rates and locations for wells completed in the Alluvial Aquifer and the Saugus Formation were directly imported into the Regional

Model from the Upper Santa Clara River Groundwater Basin database. Further information on how pumping was specified in the model is contained in Section 3.7.

f. **Specified flux at upgradient Alluvial Aquifer boundaries.** Where there is Alluvial groundwater flow into the study area from beneath Castaic Dam, the magnitude of the specified flux was adjusted during the model calibration process, using groundwater elevations and gradients published by RCS (1986 and 2002).

g. **Specified groundwater elevation in the Alluvial Aquifer at the county line.** The groundwater elevation (805 feet) was obtained from water level contour maps for the Alluvial Aquifer prepared by RCS (1986, 2002). (See Figure 2-7 for groundwater elevation contours during Spring 2000, as mapped by RCS [2002].)

h. **Head-dependent flux for evapotranspiration.** ET from the water table by riparian vegetation was simulated using the evaporation top-system package contained in MicroFEM®. This package requires specification of the maximum rooting depth for the riparian vegetation, the maximum potential ET rate, and the ground surface elevation.

i. **No-flow.** In general, the outermost line of nodes that form the model boundary and the bottom of the model are no-flow boundaries. The exceptions are the western model boundary (specified head) and the specified-flux nodes representing underflow into the Alluvial Aquifer from beneath Castaic Dam. Also, all nodes on the model boundary are assigned specified fluxes due to precipitation and, in some cases, ephemeral streamflow.

3.6 Estimation of Groundwater Recharge Rates

The groundwater recharge rates required by the model were derived from the following information sources:

a. Precipitation records

b. Watershed maps and topographic maps

c. Aerial photography (to identify vegetation patterns and areas of agricultural and urban irrigation)

Groundwater recharge was defined on a month-to-month basis for the transient calibration process. Groundwater recharge rates were assigned at all model nodes using the GIS for the valley and a Surface Water Routing Model (SWRM), which was written specifically for the Regional Model using the Visual Basic Editor within Microsoft® Excel 97. For each month during the transient calibration period, the SWRM estimated the following:

a. The amount of water potentially available to recharge the aquifer, which consisted of:

   1. Infiltration of direct precipitation within the model grid area
   2. Infiltration of urban irrigation water
   3. Infiltration of agricultural irrigation water
   4. The amount of stormwater yielded by upstream watersheds in each tributary to the Santa Clara River
   5. The amount of water entering the valley in the Santa Clara River at the Lang gage

6. The amount of water released into Castaic Creek by DWR
7. The locations and volumes of flow discharged into the Santa Clara River from the two LACSD WRPs

b. The amount of water in each stream that actually infiltrates to the aquifer, based on an assigned streambed leakage rate at each model node

c. The amount of water in each stream that does not infiltrate and therefore remains as surface water in the Santa Clara River at the west end of the valley, at the County Line gage

During model calibration, the SWRM was used to adjust the streambed conductance terms for Castaic Creek and the ephemeral reach of the Santa Clara River. These adjustments were made by examining the differences between measured and modeled groundwater elevations at wells located in the valleys where these ephemeral streams are present. In addition, the streambed conductance terms were allowed to vary from month to month because the conductance implicitly incorporates the streambed area, which is large during high river flows and smaller during low-flow periods.

A detailed discussion of the SWRM's design, operations, and input data is contained in Appendix C.

3.7 Assignment of Pumping Rates

Pumping rates were assigned in the Regional Model using the following information:

a. Water use records maintained by the Purveyors and other agencies in the valley. These records were available in the form of AF/yr of water use at each well.

b. Estimates of monthly water demand for urban water use and agricultural water use.

c. Well construction records, which were needed to determine which model layers at each individual well should be assigned pumping.

Tables 2-1 and 2-2 summarize annual pumping rates at each well and for each year during the transient model calibration period. All production wells in the Alluvial Aquifer were assigned pumping rates in model layer 1. For each production well completed in the Saugus Formation, the pumping assignments in each model layer were based on the total pumping rate, the percentage of the model layer in which the well was open, and the thickness and hydraulic conductivity of each model layer. Table 3-1 summarizes this information and shows the percentage of the total well yield that was derived from each model layer.

Table 3-2 summarizes the monthly distribution of the annual pumping volumes. Separate distributions were used for agricultural demands, which are exclusively for outdoor uses, and for urban demands, which are for both indoor and outdoor uses. The monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining monthly flow records for the two LACSD WRPs and monthly demand distributions recorded by VWC during the past several years.

Tables

TABLE 3-1

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-7	3	520	974	454	2	908	100.0
NCWD-8	2	342	970	158	10	1,580	62.7
NCWD-8	3	342	970	470	2	940	37.3
NCWD-9	2	311	674	189	0.03371	6.37	59.4
NCWD-9	3	311	674	174	0.025	4.35	40.6
NCWD-10	3	780	1,544	220	2	440	28.8
NCWD-10	4	780	1,544	500	2	1,000	65.4
NCWD-10	5	780	1,544	44	2	88	5.8
NCWD-11	2	200	1,075	300	10	3,000	72.3
NCWD-11	3	200	1,075	500	2	1,000	24.1
NCWD-11	4	200	1,075	75	2	150	3.6
NCWD-12	2	485	1,280	15	10	150	8.8
NCWD-12	3	485	1,280	500	2	1,000	58.5
NCWD-12	4	485	1,280	280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
NCWD-13	3	420	750	250	2	500	38.5
NLF-156	2	320	1,800	180	10	1,800	21.8
NLF-156	3	320	1,800	500	6.5	3,250	39.4
NLF-156	4	320	1,800	500	4	2,000	24.2
NLF-156	5	320	1,800	300	4	1,200	14.5
SCWC-Saugus1	2	490	1,620	10	10	100	1.8
SCWC-Saugus1	3	490	1,620	500	6.5	3,250	59.9
SCWC-Saugus1	4	490	1,620	500	4	2,000	36.8
SCWC-Saugus1	5	490	1,620	20	4	80	1.5
SCWC-Saugus2	2	490	1,591	10	10	100	1.8
SCWC-Saugus2	3	490	1,591	500	6.5	3,250	56.9
SCWC-Saugus2	4	490	1,591	500	4	2,000	35.0
SCWC-Saugus2	5	490	1,591	91	4	364	6.4
VWC-157	3	586	2,008	414	6.5	2,691	40.2
VWC-157	4	586	2,008	500	4	2,000	29.9
VWC-157	5	586	2,008	500	4	2,000	29.9
VWC-159	3	662	1,900	338	0.025	8.45	27.3
VWC-159	4	662	1,900	500	0.025	12.5	40.4
VWC-159	5	662	1,900	400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.5
VWC-160	4	950	2,000	500	4	2,000	46.2
VWC-160	5	950	2,000	500	4	2,000	46.2

TABLE 3-1

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
VWC-201	3	540	1,670	460	6.5	2,990	52.7
VWC-201	4	540	1,670	500	4	2,000	35.3
VWC-201	5	540	1,670	170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
VWC-205	4	820	1,930	500	4	2,000	40.9
VWC-205	5	820	1,930	430	4	1,720	35.2

TABLE 3-2

Allocation of Pumping by Month for Agricultural and Urban Production Wells

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Month	% of Annual Water Use, Agricultural	% of Annual Water Use, Urban	% of May through October Water Use, Urban
January	3.8	5.2	
February	5.1	3.7	
March	6.6	5.2	
April	9.1	6.6	
May	10.6	8.7	13.2
June	11.4	10.4	15.8
July	14.1	13.0	19.7
August	12.9	13.6	20.6
September	10.2	10.9	16.5
October	7.5	9.3	14.1
November	5.0	7.1	
December	3.8	6.3	
Total	**100.0**	**100.0**	**100.0**

Figures

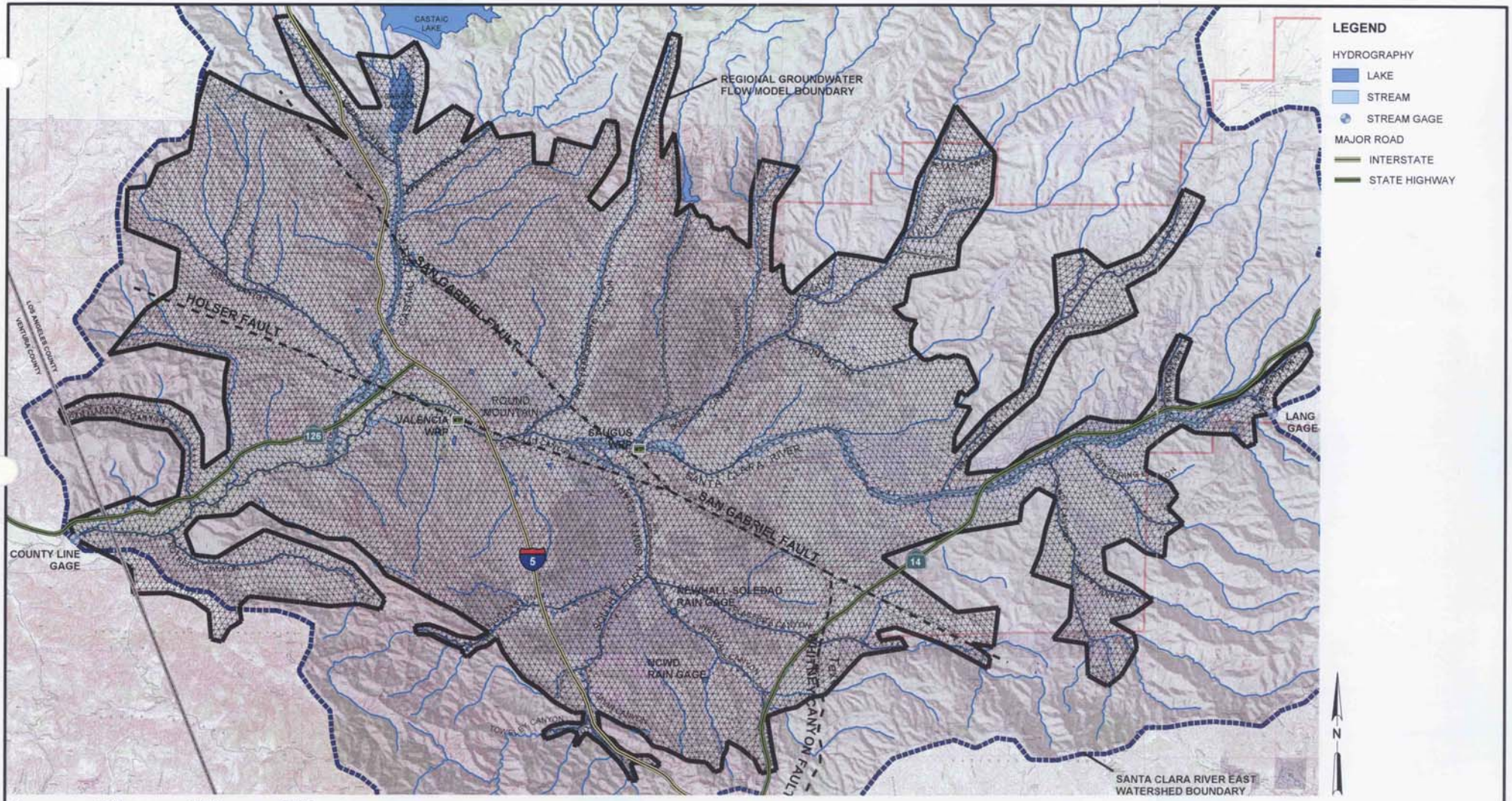

FIGURE 3-1
MODEL GRID
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0301.MXD FIG03-01.PDF 02/03/2004 09:40:41

	Stratigraphy		Model Layer	Thickness (feet)
Saugus	Alluvium	Saugus	1	500
Saugus	Saugus	Saugus	2	
Saugus	Saugus	Saugus	3	500
Saugus	Saugus	Saugus	4	500
Saugus	Saugus	Saugus	5	500
Saugus	Saugus	Saugus	6	500
Sunshine	Sunshine	Sunshine	7	Variable

FIGURE 3-2
SHEMATIC DIAGRAM OF THE MODEL'S REPRESENTATION OF STRATIGRAPHY IN THE MIDDLE OF THE BASIN
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

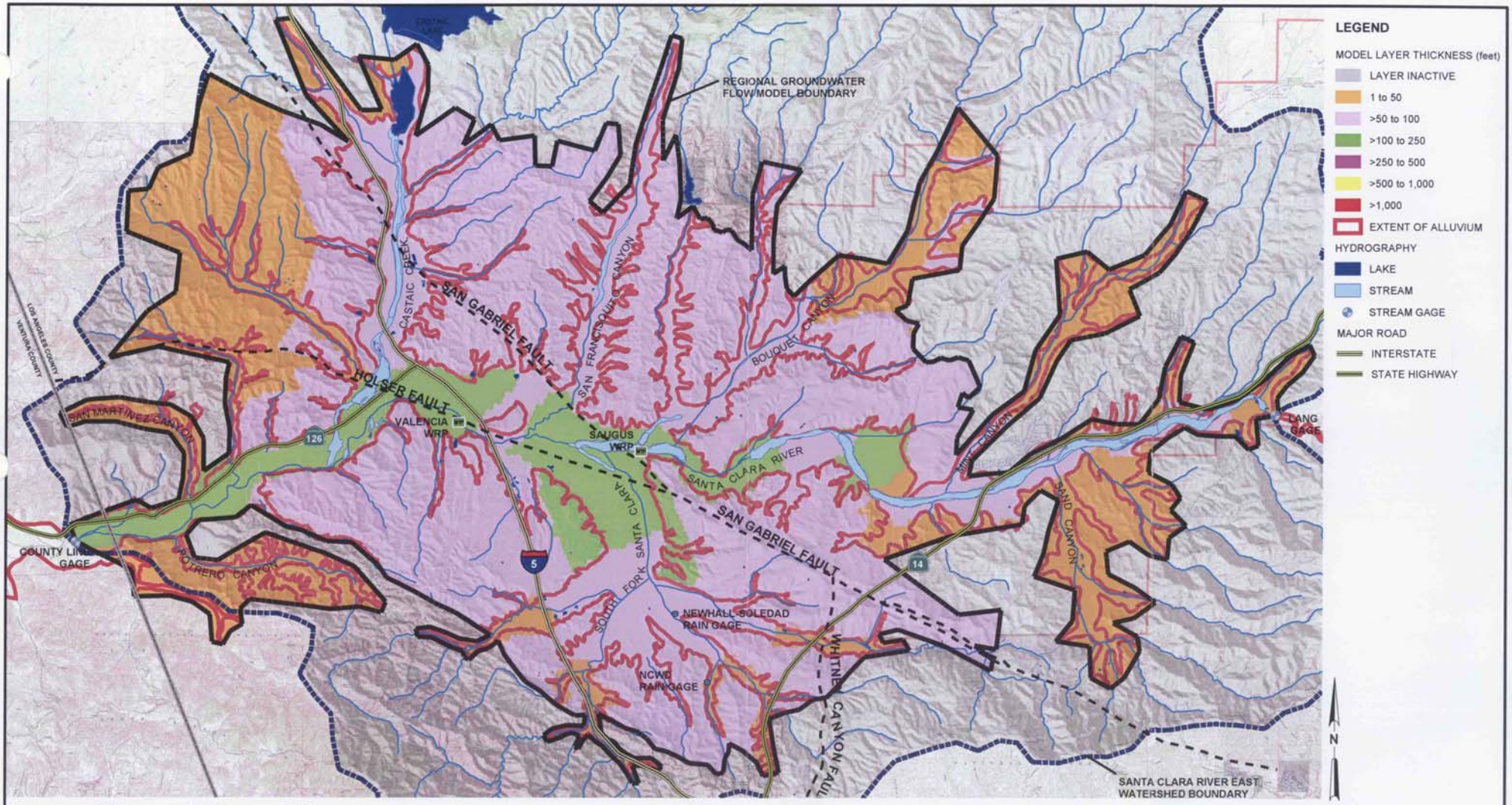

FIGURE 3-3
THICKNESS OF MODEL LAYER 1
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG020.MXD FIG03-03.PDF 02/02/2004 13:01:44

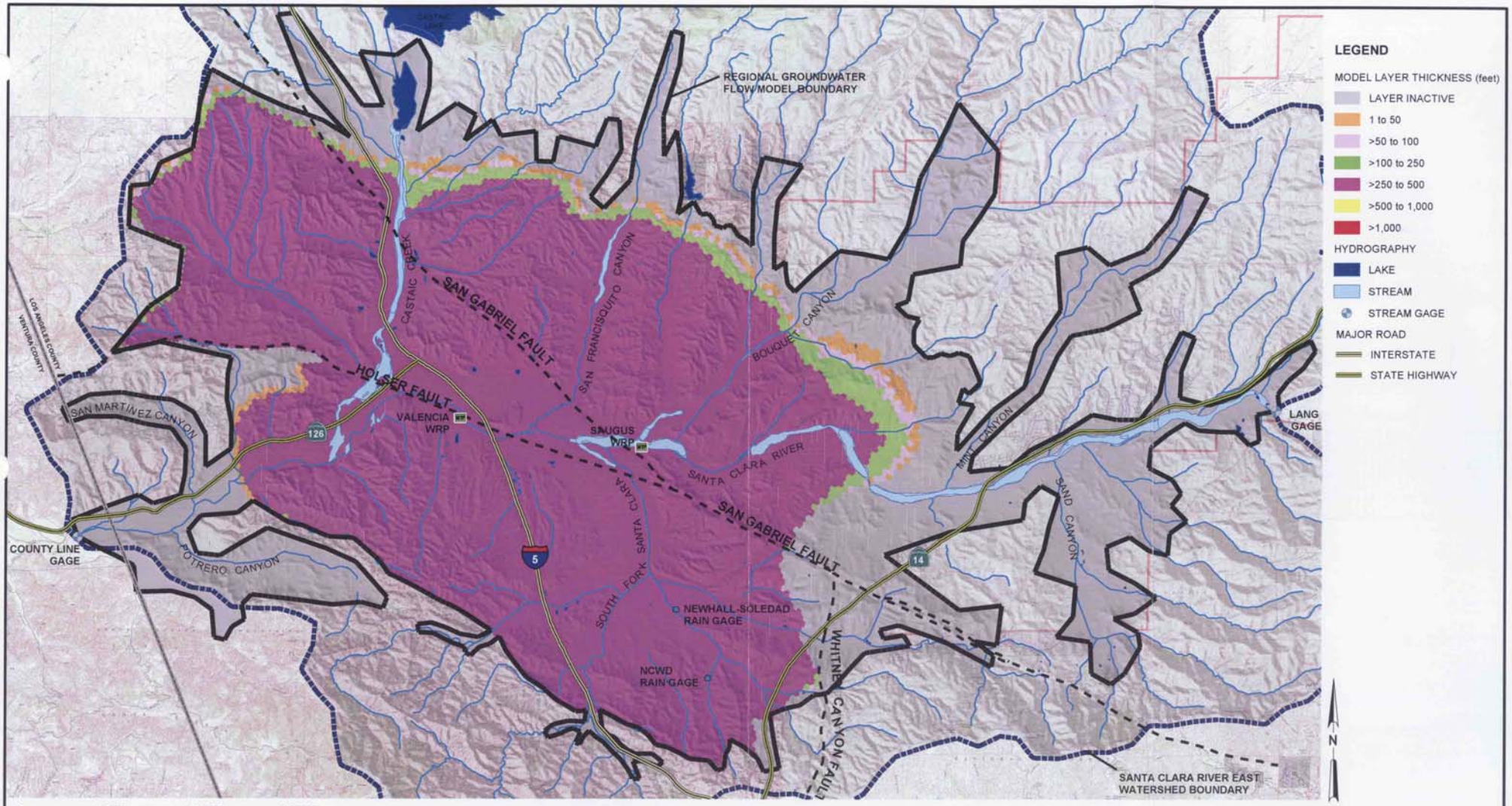

FIGURE 3-4
THICKNESS OF MODEL LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG021.MXD FIG03-04.PDF 02/02/2004 13:21:28

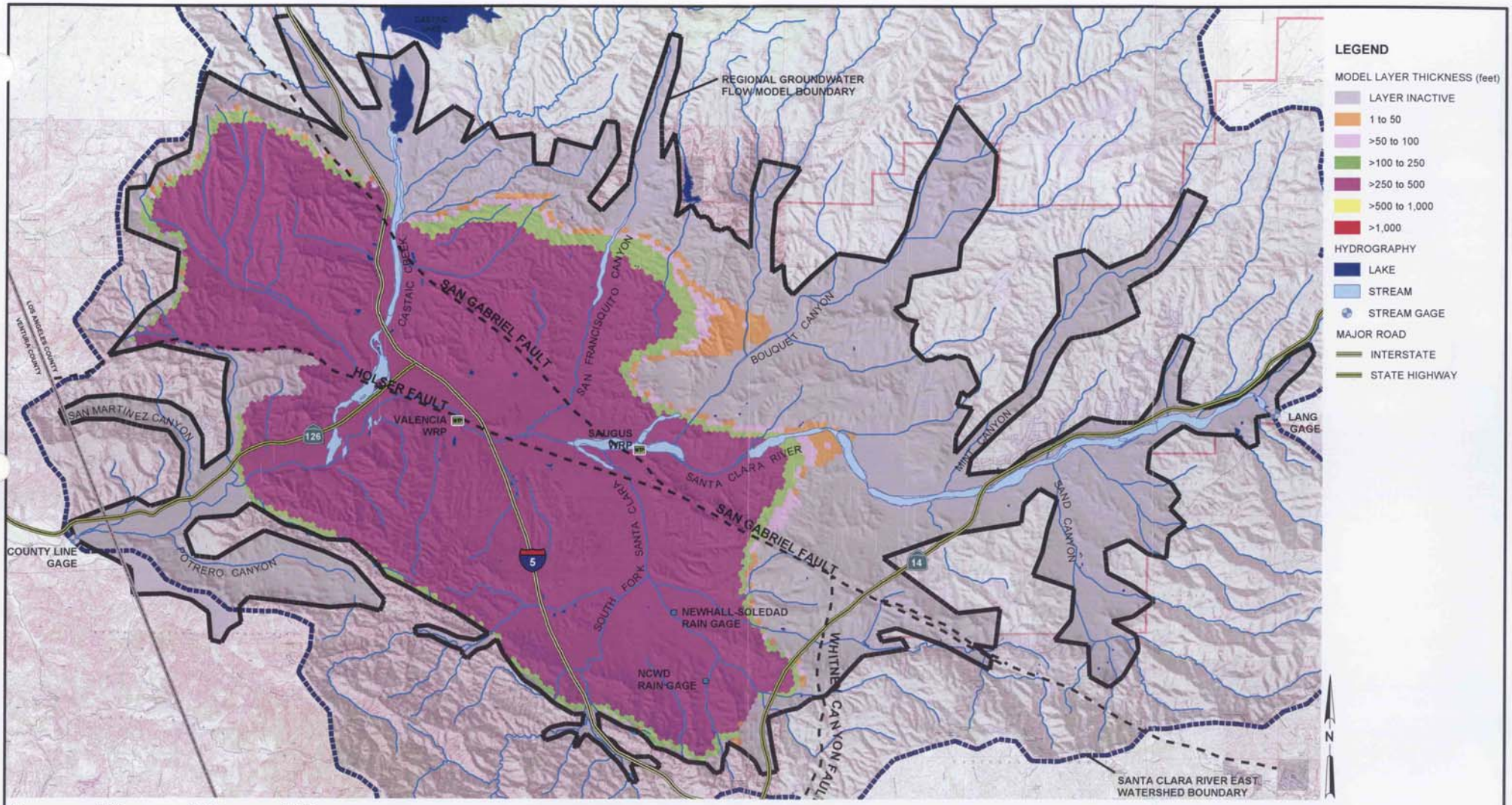

FIGURE 3-5
THICKNESS OF MODEL LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG022.MXD FIG03-05.PDF 02/04/2004 11:14:10

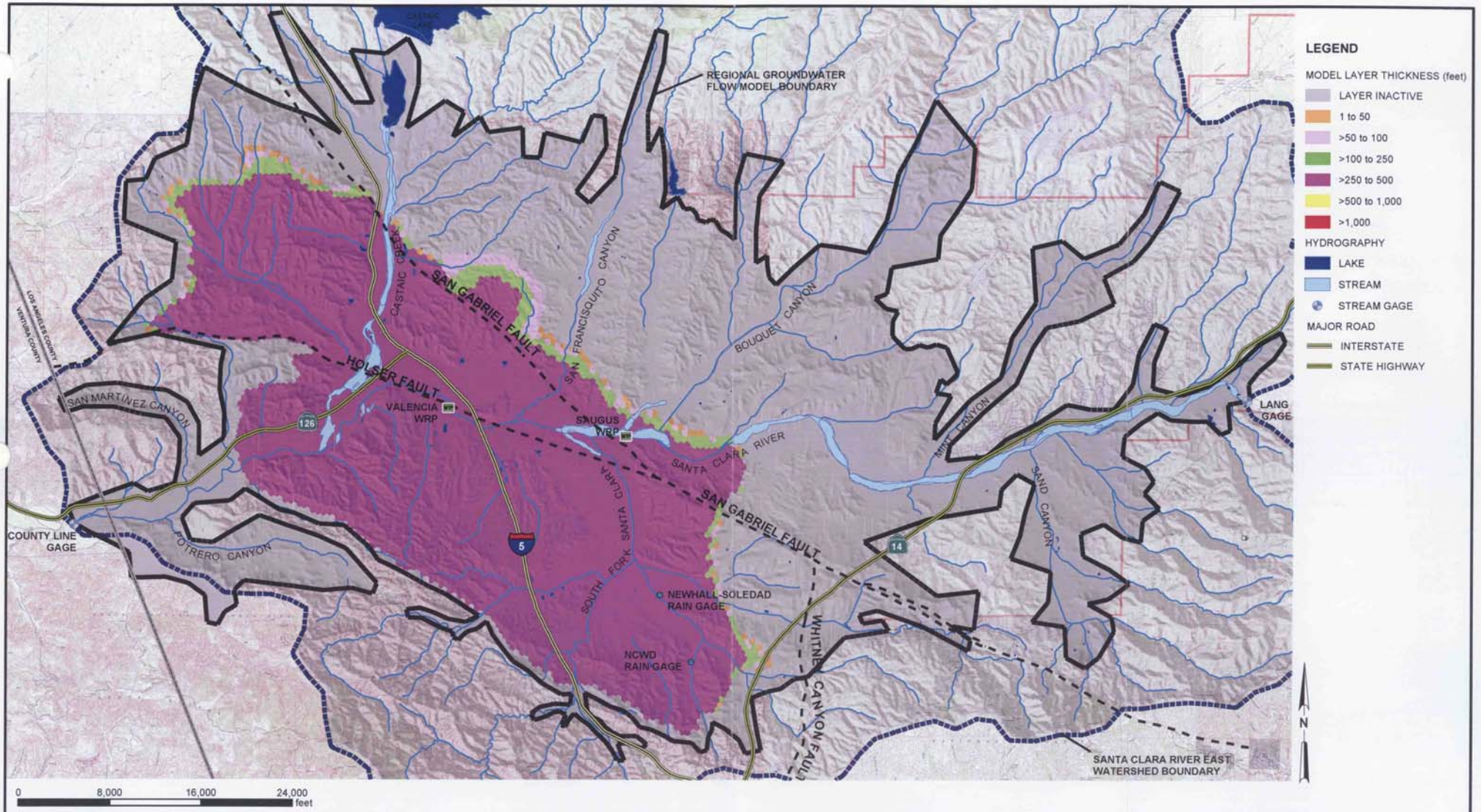

FIGURE 3-6
THICKNESS OF MODEL LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG023.MXD FIG03-06.PDF 02/04/2004 11:19:11

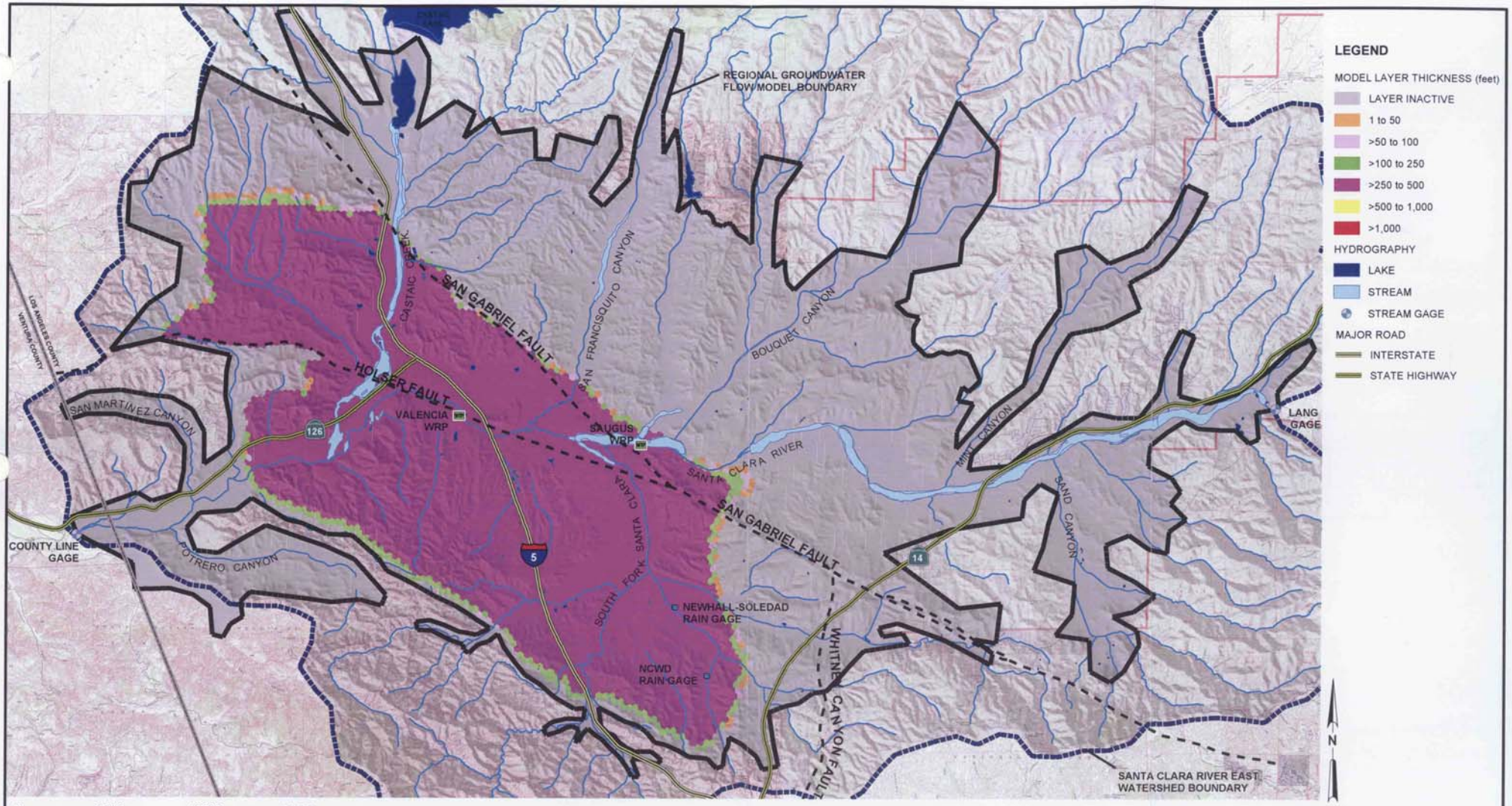

FIGURE 3-7
THICKNESS OF MODEL LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG024.MXD FIG03-07.PDF 02/04/2004 11:23:01

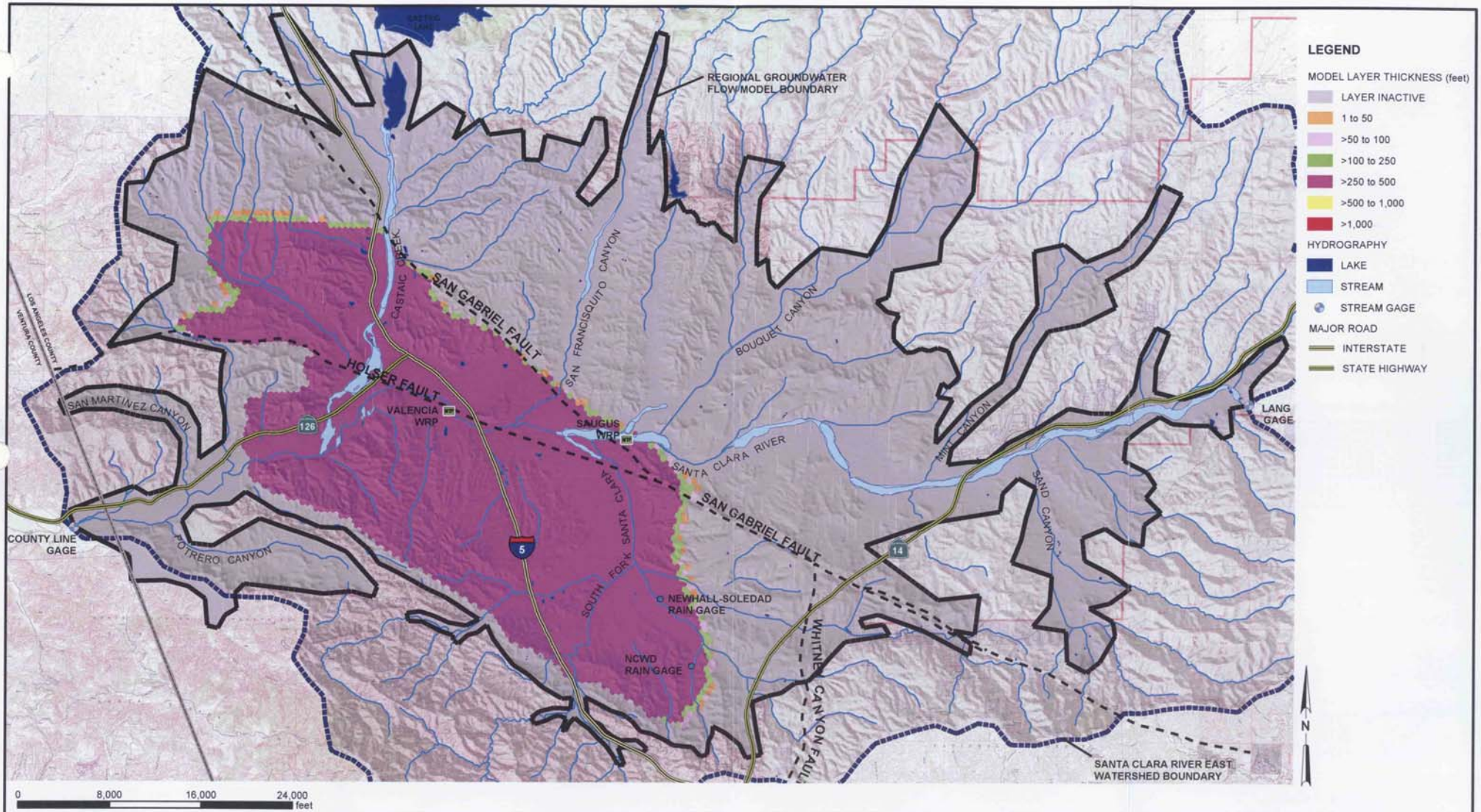

FIGURE 3-8
THICKNESS OF MODEL LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG025.MXD FIG03-08.PDF 02/04/2004 11:26:22

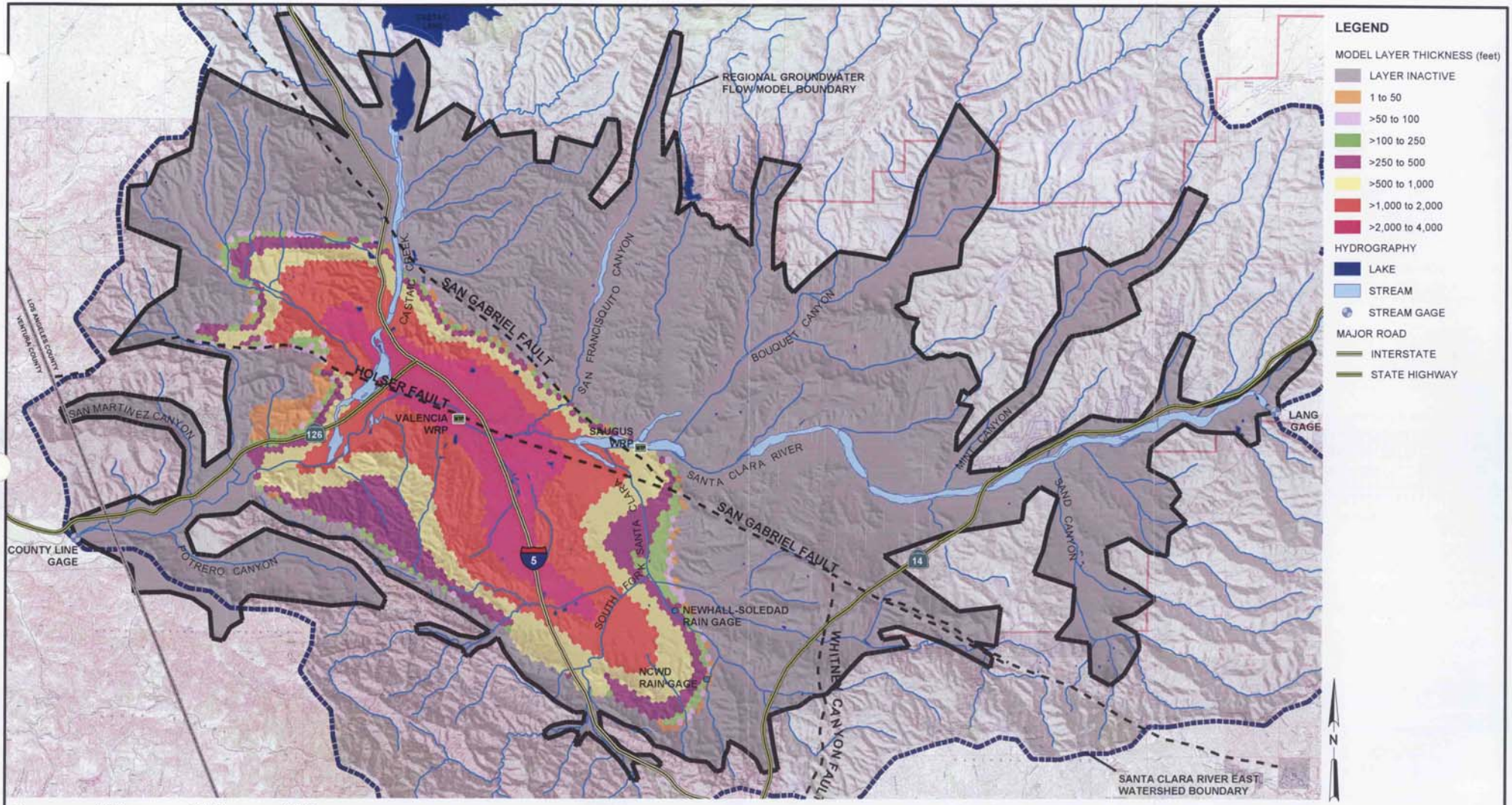

FIGURE 3-9
THICKNESS OF MODEL LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG026.MXD FIG03-09.PDF 02/02/2004 14:09:12

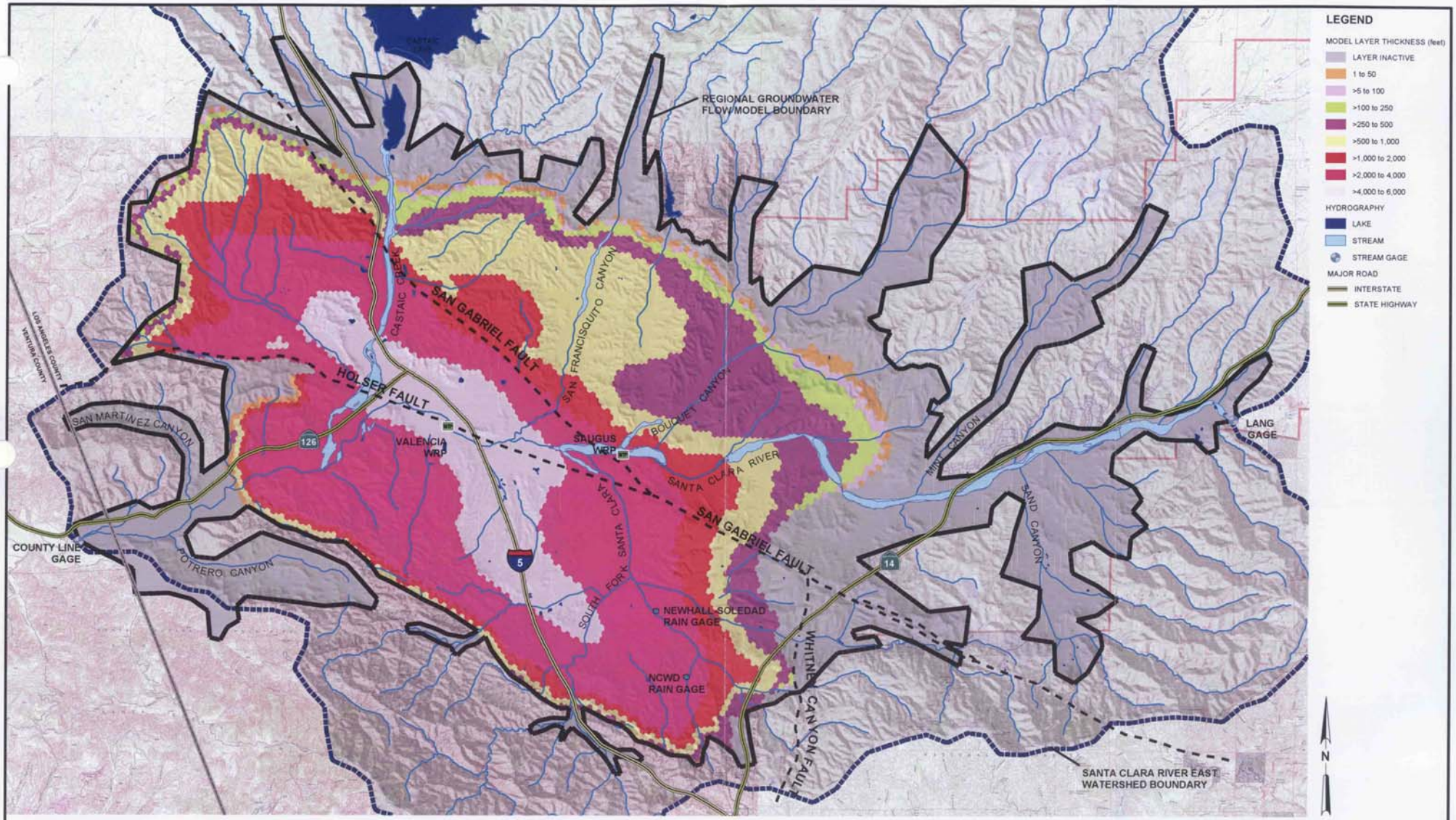

FIGURE 3-10
THICKNESS OF SAUGUS FORMATION (MODEL LAYERS 1 THROUGH 7)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG044.MXD FIG03-10.PDF 02/04/2004 14:19:00

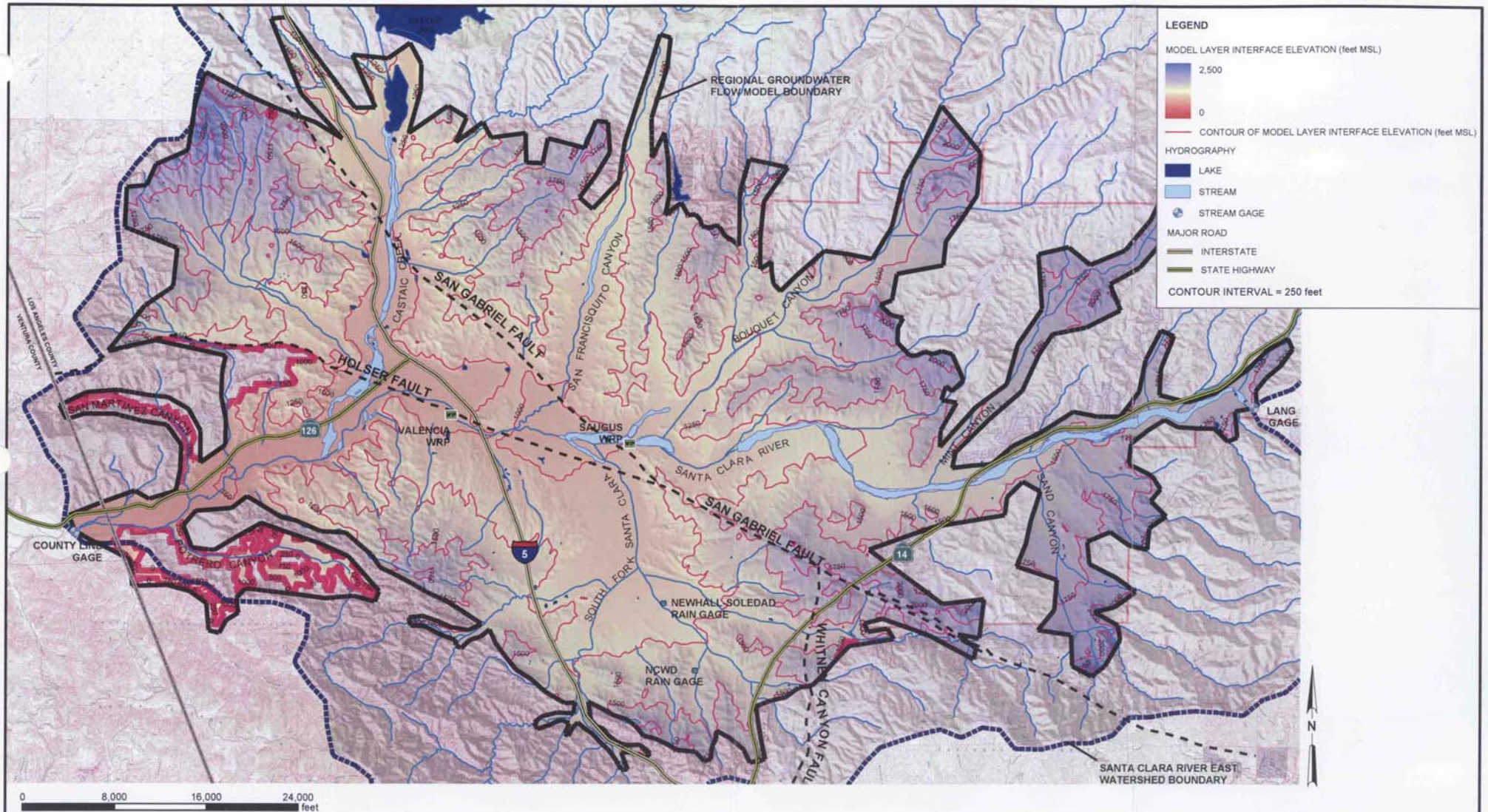

FIGURE 3-11
LAYER 1 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG027.MXD FIG03-11.PDF 02/04/2004 11:36:12

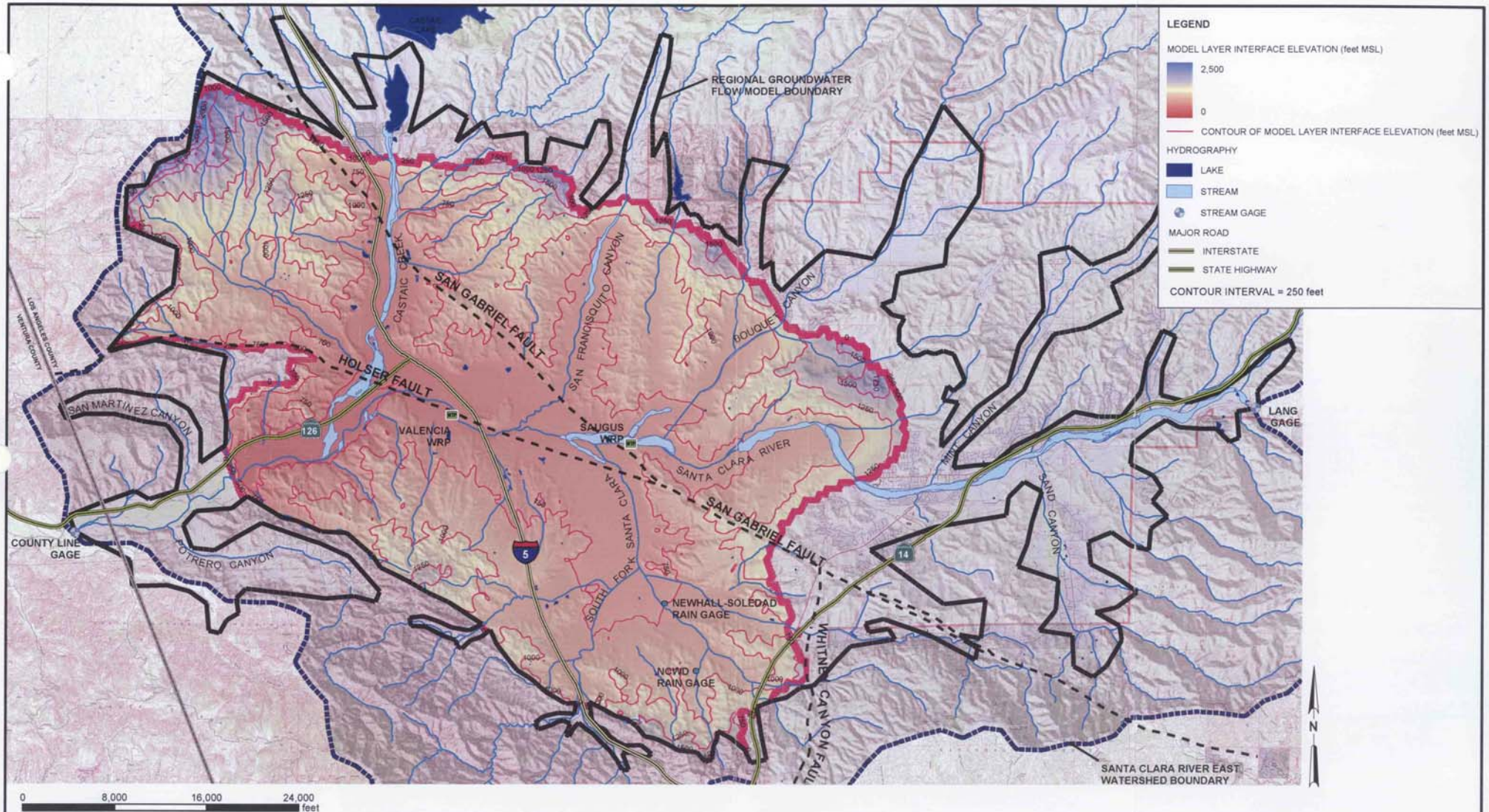

FIGURE 3-12
LAYER 2 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG028.MXD FIG03-12.PDF 02/04/2004 11:36:12

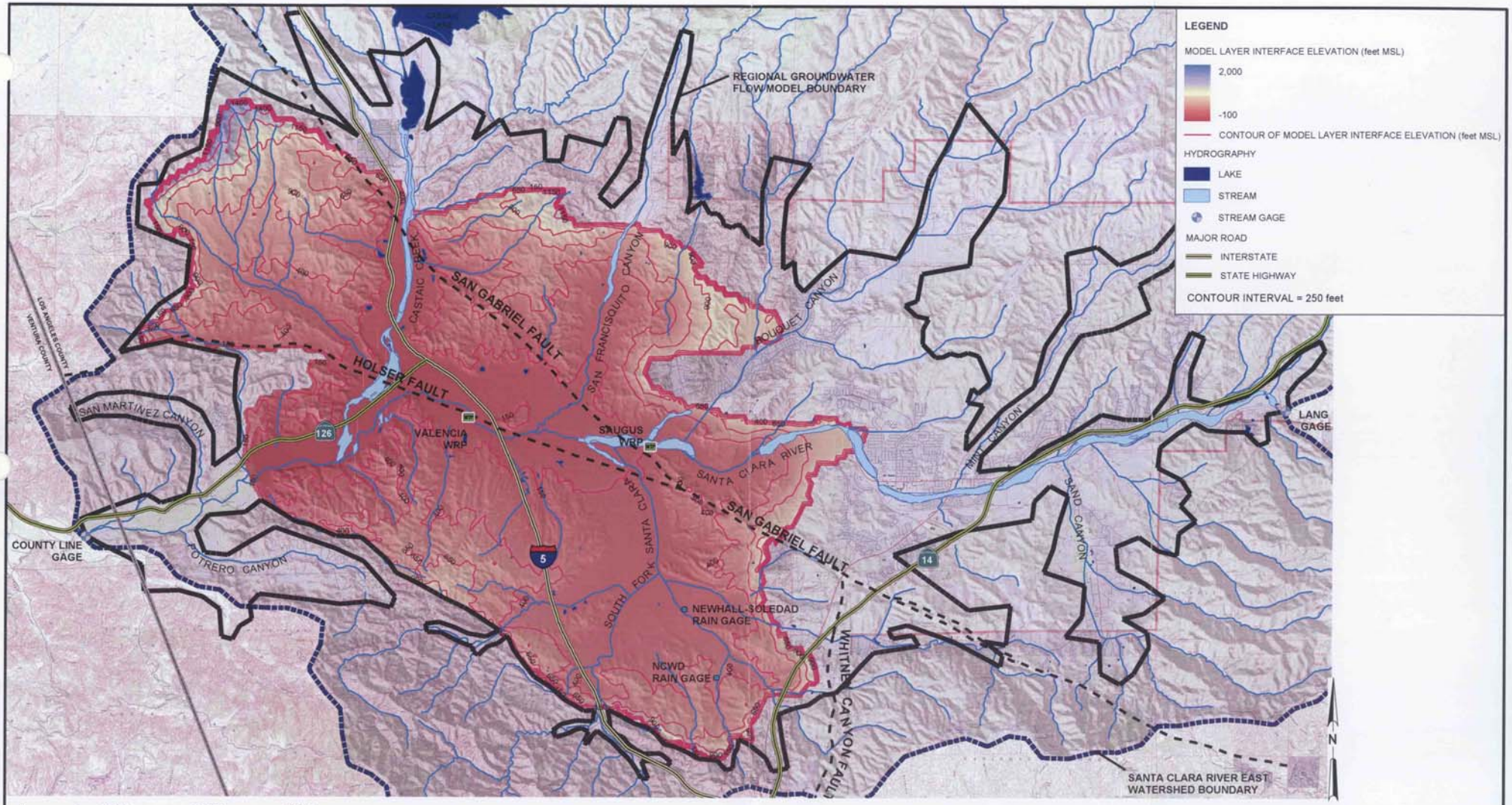

FIGURE 3-13
LAYER 3 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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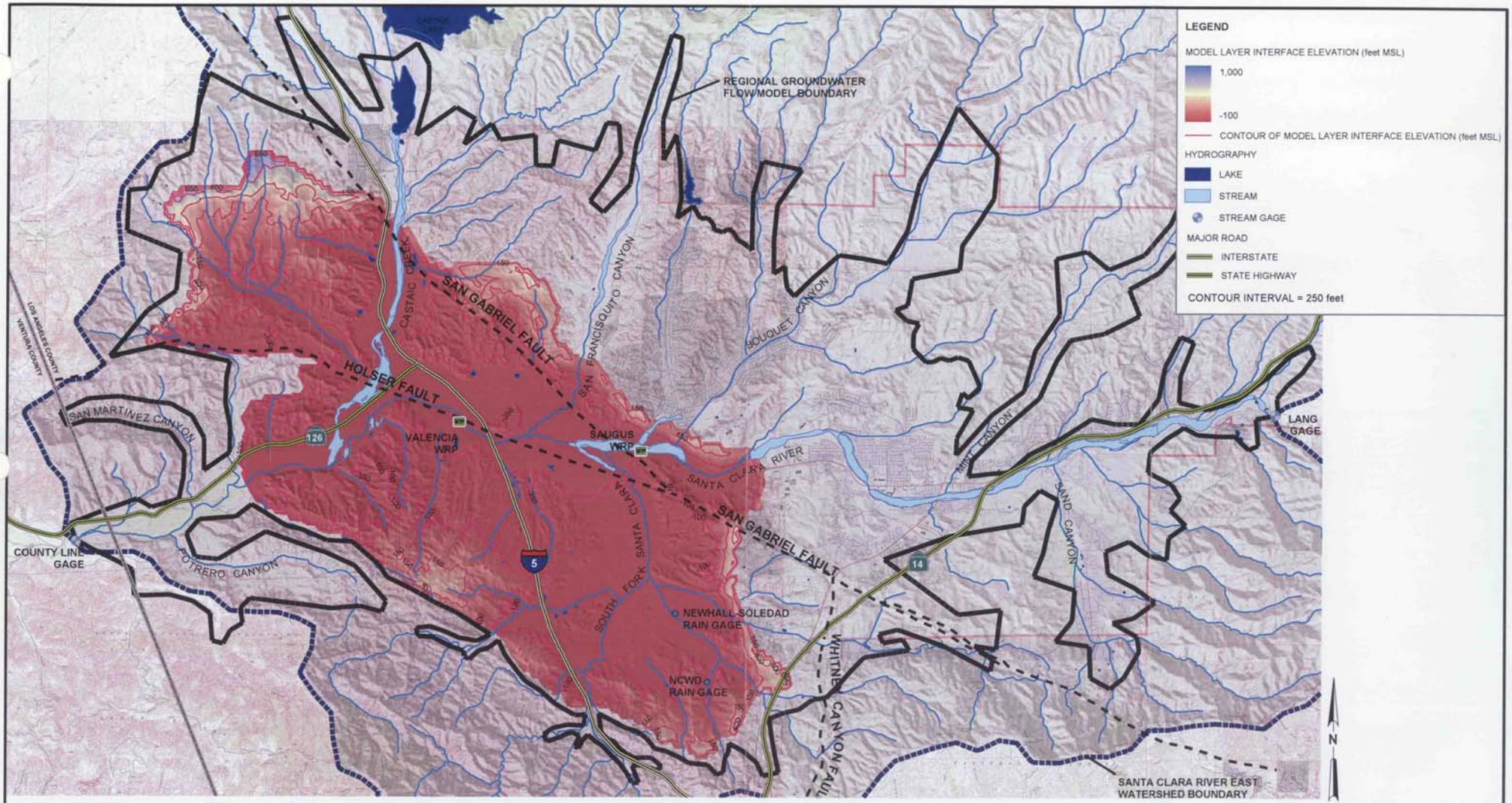

FIGURE 3-14
LAYER 4 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG030.MXD FIG03-14.PDF 02/04/2004 11:53:17

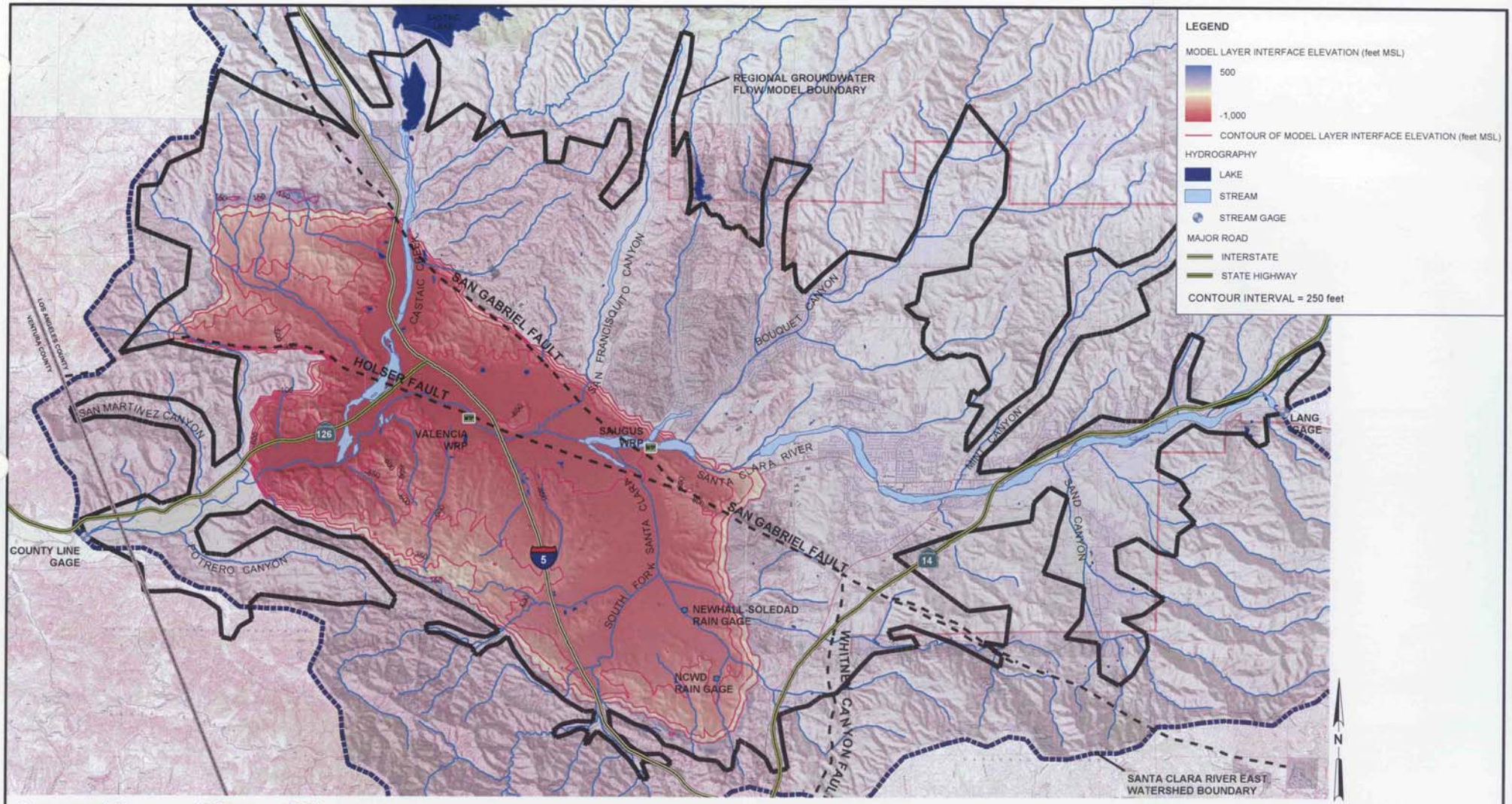

FIGURE 3-15
LAYER 5 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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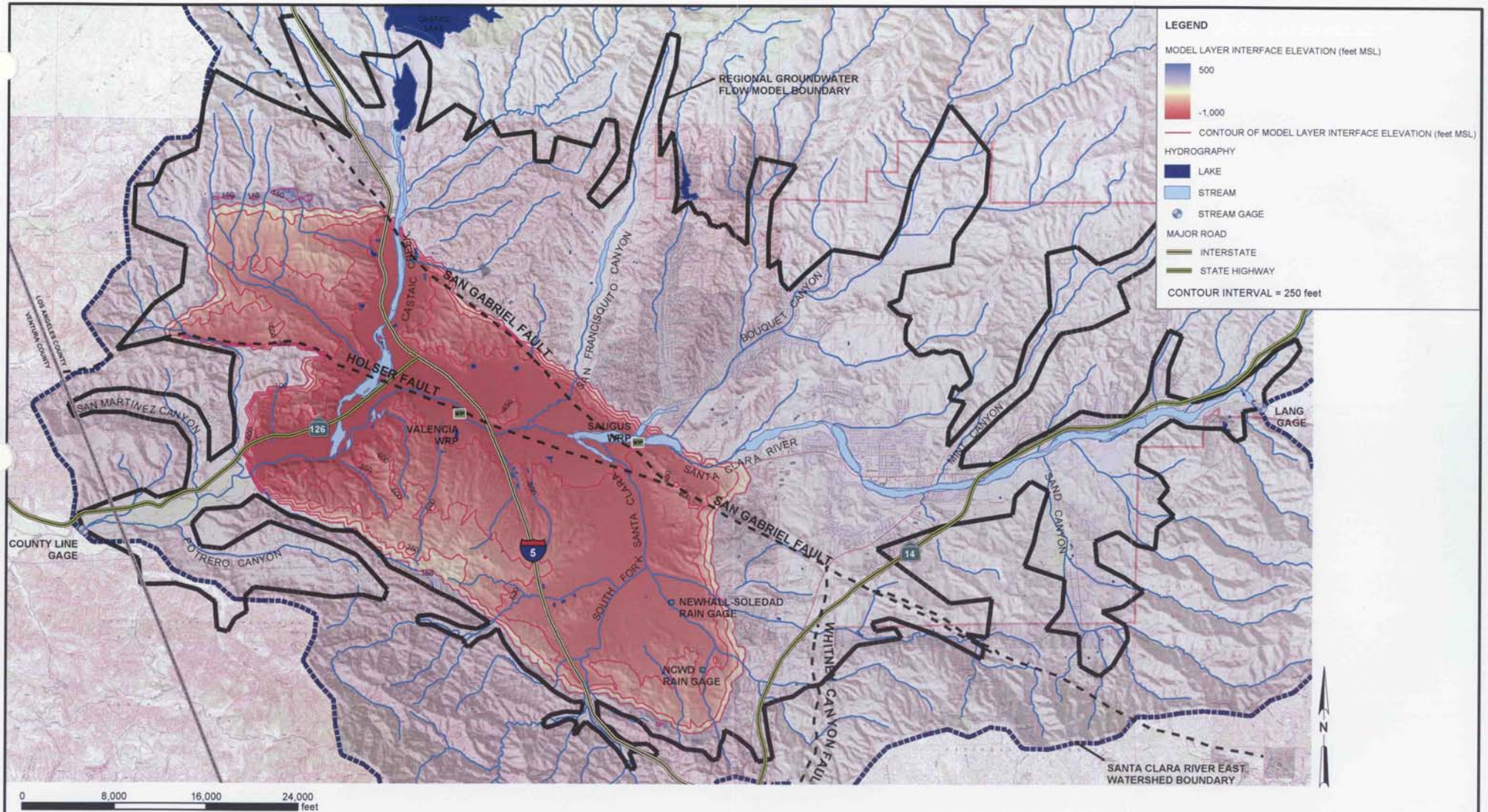

FIGURE 3-16
LAYER 6 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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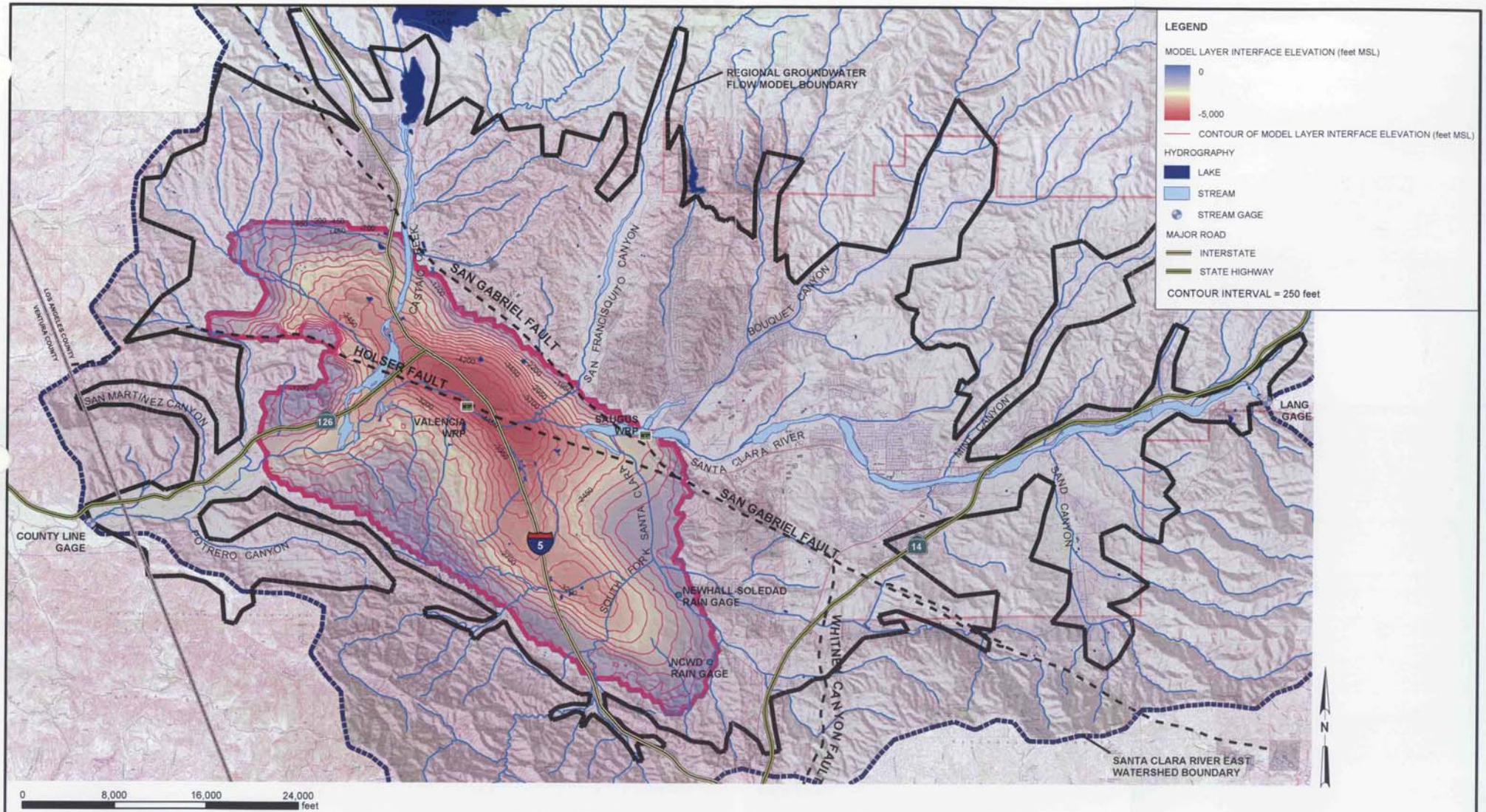

FIGURE 3-17
LAYER 7 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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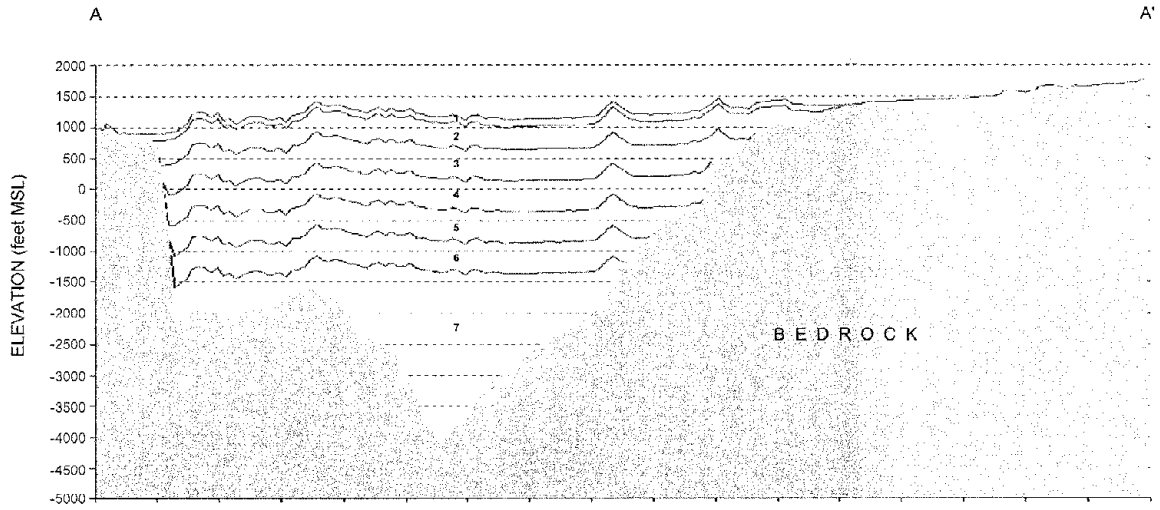
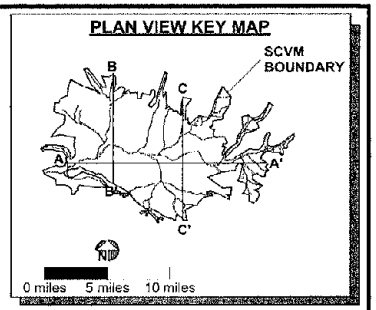
RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG033.MXD FIG03-17.PDF 02/03/2004 13:13:34





LEGEND

1 = MODEL LAYER 1

2 = MODEL LAYER 2

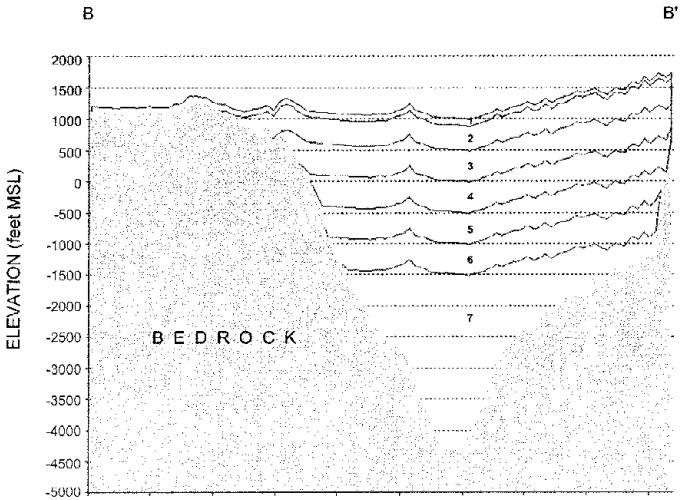
3 = MODEL LAYER 3

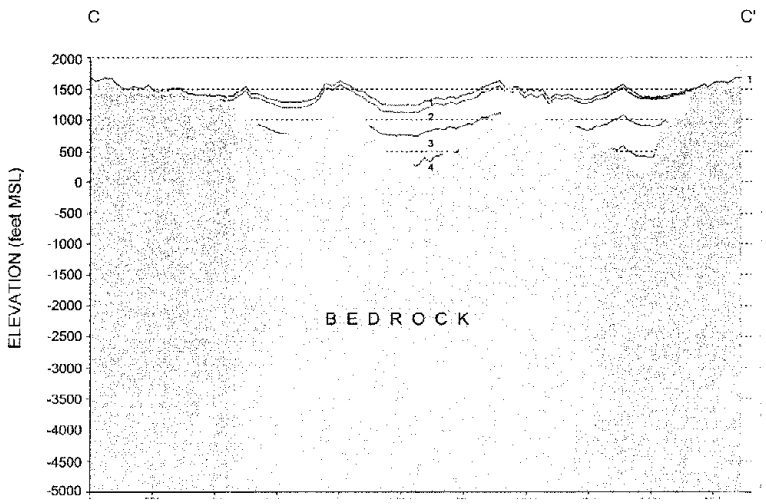
4 = MODEL LAYER 4

5 = MODEL LAYER 5

6 = MODEL LAYER 6

7 = MODEL LAYER 7





HORIZONTAL CROSS SECTION SCALE

0 feet 10,000 feet 20,000 feet

5x VERTICAL EXAGGERATION

FIGURE 3-18
SCHEMATIC CROSS SECTIONS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

SCHEMATICCROSSSECTIONS.SRF

SECTION 4

Model Calibration Process

This section describes the model calibration process. The Regional Model was calibrated according to the *Standard Guide for Calibrating a Ground-Water Flow Model Application,* published by the American Society for Testing and Materials (1996), which describes how to calibrate a model using historical data, including how to establish calibration target data, identify calibration parameters, and compare field data to model calibration results.

Following are discussions of the historical field conditions that were simulated during calibration; the goals of the calibration process; the model parameters (variables) that were adjusted during calibration; and the procedures and target data that were used to conduct the calibration process.

4.1 Calibration Conditions

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation.

4.1.1 Steady-State Calibration

The steady-state calibration was performed for calendar years 1980 through 1985. The purpose of the steady-state model was to simulate average regional flow patterns, regional hydraulic gradients, and groundwater budgets during the initial time period to be modeled as part of the transient calibration effort. The steady-state model also provided initial groundwater elevations for the beginning of the transient model.

During the 1980 through 1985 period:

a. The average precipitation (20.15 in/yr) was approximately 2.5 inches higher than the 1950 through 2000 mean (17.35 in/yr).

b. Alluvial Aquifer pumping decreased slightly (see Table 2-1).

c. Saugus pumping remained relatively constant, between 3,800 and 5,000 AF/yr (see Table 2-2).

d. Importation of SWP water increased steadily, from 1,125 acre-feet in 1980 to 11,823 acre-feet in 1985.

e. WRP discharges into the Santa Clara River increased from approximately 7,400 AF in 1980 to approximately 9,600 AF in 1985.

f. Groundwater elevations in the Alluvial Aquifer remained relatively stable, except for a slight decline in the eastern part of the valley during 1984 and 1985, due to below-normal rainfall during those years.

g. Groundwater elevations in the Saugus Formation remained relatively stable.

Hence, even though SWP imports and WRP discharges increased during this period, groundwater elevations did not rise, instead remaining fairly stable or decreasing slightly due to the relatively stable natural hydrologic conditions during this 6-year period and the below-normal rainfall in 1984 and 1985. Consequently, this time period was deemed suitable for the steady-state portion of the model calibration effort.

4.1.2 Transient Calibration

The transient calibration was performed for calendar years 1980 through 1999 to create a model capable of simulating seasonal and long-term variations in groundwater elevations, groundwater recharge, and groundwater discharge for a historical period characterized by variable rainfall and recharge and changing land use and water use patterns. This 20-year period was chosen for the following reasons:

a. The volume of data is greater during this period than in previous years. In particular, SCWC and VWC installed several production wells in the Saugus Formation during this time period. Also, regular monitoring of groundwater levels was performed at more wells during this period than before.

b. Annual pumping volumes are well known before and after the 1970s, but are not as well known during that decade. Hence, it would be more difficult to calibrate a model during the 1970s because of the uncertainties in pumping volumes during that time.

c. Significant urban growth occurred in the valley between 1980 and 1999. This growth resulted in changes in land use and increased importation of SWP water, from 1,125 acre-feet in 1980 to 27,302 acre-feet in 1999.

d. The local hydrology and the hydrology of the SWP system varied considerably during this period, and included single-year and multi-year droughts both locally and in the SWP system. (See Section 2.6.3.3.) Specifically, the groundwater elevations in the Alluvial Aquifer and the Saugus Formation showed multi-year periods of water level decline followed by multi-year periods of water level recovery. Consequently, calibrating to this period would allow a model to predict basin conditions during and between future drought periods.

4.2 Calibration Goals

The success of the model calibration was determined by its ability to satisfy specific calibration goals that were established by the CH2M HILL project team and the Purveyors. Separate calibration goals were defined for the steady-state model and the transient model. The specific goals are given below, along with a discussion of how calibration success was measured. Calibration goals are comprised of quantitative (statistical) and qualitative criteria.

4.2.1 Calibration Goals for the Steady-State Model

a. **Groundwater Flow Directions.** Correctly simulate groundwater flow directions in the Alluvial Aquifer and Saugus Formation, as defined by regional groundwater elevation contour maps prepared by RCS (1985, 1986, 2002) for various periods in both aquifer systems. (See Figures 2-7 and 2-8.)

b. **Groundwater Elevation Residuals.** At each target well, simulate groundwater elevations to within 10 feet in the Alluvial Aquifer and 25 feet in the Saugus Formation, compared with observed average groundwater elevations during this period. The value of the modeled groundwater elevation minus the observed average groundwater elevation is called the residual error (residual). A positive residual at a given target well indicates that the model simulates too high a groundwater elevation. Conversely, a negative residual indicates that the model simulates too low a groundwater elevation.

c. **Statistics of Groundwater Elevation Residuals.** Achieve the following statistics for the residuals on a modelwide scale (i.e., for the combined group of calibration target wells):

   1. A mean residual as close to zero as possible.

   2. A mean residual that is less than 5 percent of the range in groundwater elevations measured at the target wells.

   3. A root-mean-square (RMS) error of less than 10 feet for the residuals at Alluvial Aquifer target wells and less than 25 feet for the residuals at Saugus target wells.

   4. A normalized RMS error of 10 percent or less. The normalized RMS error equals the modelwide RMS error divided by the range in groundwater elevations across the entire model domain.

   5. A normalized residual standard deviation of less than 10 percent. The normalized residual standard deviation equals the standard deviation of the residuals divided by the range in groundwater elevations across the entire model domain.

   6. Minimize the degree of spatial bias in the distribution of the residuals. Specifically, avoid creating large areas where the residuals are predominantly positive or predominantly negative. A well-calibrated model shows a scattering of negative and positive residuals within any given localized area.

d. **Groundwater Gradients.** Simulate the direction and magnitude of groundwater gradients across the model domain, including a significant horizontal gradient in the Saugus Formation that exists across the San Gabriel Fault (as measured at four multi-port monitoring wells located on the Whittaker-Bermite property, east of wells SCWC-Saugus1 and SCWC-Saugus2).

e. **Groundwater Below Ground Surface.** At nodes where streams are not present, maintain groundwater elevations below ground surface. At stream nodes, groundwater elevations should also be below ground surface in most ephemeral reaches, though a limited number of nodes can have higher groundwater elevations in the downstream ephemeral reaches, where the exact location of the transition from ephemeral to perennial conditions is variable over time and is only approximately known.

f. **Groundwater Discharge to River.** Simulate a groundwater discharge to the Santa Clara River on the order of 29,000 AF/yr, which is the estimated average baseflow during the steady-state model period (see Section 2.6.2.5).

4.2.2 Calibration Goals for the Transient Model

a. **Water Level Trends/Hydrographs.** Match observed fluctuations in groundwater elevations.

b. **Groundwater Below Ground Surface.** Maintain groundwater elevations below ground surface in the same general areas as previously discussed for the steady-state model.

c. **Total River Flow at County Line Gage.** Match the observed Santa Clara River flows measured at the County Line gage.

d. **Groundwater Discharge to River.** Match the estimated groundwater discharge rates to the Santa Clara River.

Discussions of how these calibration goals are met by the Regional Model are contained in Section 4.4.

4.3 Calibration Variables

The following variables were the subject of model calibration and testing:

a. The horizontal hydraulic conductivity (Kh) and the vertical anisotropy (R), which is the ratio of horizontal to vertical hydraulic conductivity

b. The storage coefficients

c. The relationship between rainfall and stormwater runoff in the tributary watersheds lying upstream of the groundwater basin

d. The riverbed permeabilities in gaining and losing reaches of stream systems, particularly in the ephemeral reach of the Santa Clara River and in Castaic Creek

e. ET parameters (primarily rooting depth and the maximum potential ET rate)

4.3.1 Horizontal Hydraulic Conductivity and Vertical Anisotropy

Because the Regional Model consists of over 17,000 active nodes in each of the seven model layers, the calibration process relied on the definition of zones of uniform hydraulic conductivity (K), spanning multiple nodes in a given layer and, in some areas, spanning multiple layers. Specifically, in a given layer, a geographic area was defined as a zone, and the Kh and R values were assigned to all model cells in that zone.

The number of zones and their locations were assigned in the model by primarily considering the hydrostratigraphy and the locations of target wells in the various calibration models, then considering the spatial variations in saturated thickness as summarized by RCS (2002). During the course of the calibration process, adjustments were made to the locations of the zone boundaries and the number of zones. Figures 4-1 and 4-2 show the geographic area designations for the Alluvial Aquifer and Saugus Formation, respectively. In the final calibrated Regional Model, 48 zones were used in the Alluvial Aquifer and 8 zones were used in the Saugus Formation, including a zone along the San Gabriel fault.

The values of Kh for each zone in the Alluvial Aquifer were specified at the beginning of the calibration process from the analyses of specific capacity tests (Table 2-3). In the Saugus Formation, Kh and R values were initially defined from the ASR test analysis (CH2M HILL, 2001) and, in the case of Kh values, also from slug test results on the Whittaker-Bermite property (CH2M HILL, 2003). During calibration, attempts were made to keep these values as close to the initial assigned values as possible. However, adjustments were made if changes to other parameter values were unable to bring the model into calibration.

4.3.2 Storage Coefficients

Model layer 1 was assigned a specific yield of 0.10 to simulate this layer as unconfined. The specific yield was allowed to range between values as low as 0.075 and as high as 0.15. The final Regional Model used a value of 0.10 at each node in layer 1 for both the Alluvial Aquifer and the Saugus Formation (see Section 5).

In model layers 2 through 7, which simulate portions of the Saugus Formation lying below the uppermost model layer, the storage coefficients were allowed to range between 10^{-4} and 10^{-3}, based on analyses of the ASR test results (RCS, 2001) and pumping tests at other Saugus wells (RCS, 2002).

4.3.3 Stormwater Runoff in Upstream Watersheds

See Section 3.6 and Appendix C for discussions of the SWRM, which determined the amount of stormwater generated in upstream watersheds that is available to recharge the Alluvial Aquifer.

4.3.4 Riverbed Permeabilities

The establishment of streambed permeabilities for perennial (gaining) and ephemeral (losing) stream reaches are discussed separately below.

4.3.4.1 Perennial (Gaining) Streams

The streambed conductance terms in the MicroFEM® drain and wadi packages regulate the rate of water exchange between groundwater and surface water along selected stream reaches in the valley. As discussed in Section 3.5, the wadi package is used along the perennial reach of the Santa Clara River, and the drain package is used in the river's ephemeral reach and along Castaic Creek to drain groundwater during periods of high water table conditions. For the drain and wadi packages, the streambed conductance at each node where these packages are used is defined from the following relationship:

$$C = (a/LW) * ([0.5*b_{aq}/Kv_{aq}] + [b_{stream}/Kv_{stream}]) \quad (1)$$

where at each stream node:

a = wetted area of the streambed

L = one-half of the combined lengths of the two grid segments (lines) that connect the stream node to the adjoining upstream and downstream stream nodes

W = the width of the streambed

b_{aq} = the thickness of the Alluvial Aquifer beneath the stream node

Kv_{aq} = the vertical hydraulic conductivity of the Alluvial Aquifer beneath the stream node

b_{stream} = the thickness of the riverbed sediments

Kv_{stream} = the vertical hydraulic conductivity of the riverbed sediments

The calibrated Regional Model uses values of 2 feet for b_{aq} and 10 ft/day (3.5×10^{-3} centimeters per second [cm/sec]) for Kv_{aq}.

4.3.4.2 Ephemeral (Losing) Streams

During the transient calibration phase of model development, the SWRM adjusted the streambed conductance terms for Castaic Creek and for the ephemeral reach of the Santa Clara River. Adjustments in streambed conductance values were made for the following reasons:

a. To integrate this term into the transient model calibration process

b. To account for the variations in streambed conductance that arise from:

   1. Variations in riverbed permeability along the length of the streambed
   2. Variations in riverbed permeability that can occur at a given location due to sediment scouring and redeposition processes that occur during storm runoff periods
   3. Variations in streambed conductance that arise from variations in the width of the river (greatest during storm runoff periods, smallest during low-flow periods)

The adjustment of streambed conductance values during calibration of the transient model was performed for each month and was conducted in an iterative manner by running both the SWRM and the Regional Model repeatedly until the streambed conductance terms or groundwater elevations showed no significant changes (see Appendix C).

4.3.5 Evapotranspiration Parameters

The ET rooting depth was set at 10 feet to correspond to typical rooting depths for phreatophytes such as the willow and cottonwood trees that are present in the riparian corridor along the perennial reach of the Santa Clara River. The maximum potential ET rate was set at 6 feet per year (ft/yr) during model calibration. Ground surface elevation was specified by importing USGS Digital Elevation Model files.

4.4 Calibration Procedure and Target Calibration Data

The steady-state and transient models were calibrated by running the Regional Model and comparing results to the calibration goals described in Section 4.2. The comparison of model results with calibration goals relied on the use of target data that consisted of groundwater elevation data, groundwater discharge to the river, and total flow in the river. Following are discussions of the target calibration data.

4.4.1 Groundwater Elevation Target Data

Alluvial Aquifer target wells were selected for each of the Alluvial zones shown in Figure 4-1. In the Saugus Formation, most wells were used as targets (Figure 4-2). Generally, the selected target wells were those with the greatest number of groundwater elevation measurements during the periods 1980 through 1985 for the steady-state model and 1980 through 1999 for the transient model. Some wells were measured routinely through 1985 but not through 1999, and some wells were not measured until after 1985. Therefore, the list of wells used as targets is different for the steady-state and transient models.

Figure 4-1 shows the target wells for the Alluvial Aquifer, and Figure 4-2 shows the target wells for the Saugus Formation. Table 4-1 provides location and construction information for each target well. The target wells include (1) purveyor-owned production wells; (2) production wells located at the Wayside Honor Rancho (WHR) facility; and (3) a network of non-pumping or low-pumping monitoring wells where water levels have been measured routinely by the Los Angeles County Flood Control District (LACFCD) for many years.

For the production wells, the available water level measurements have been recorded as pumping elevations and static elevations. Static elevations are collected when the well is not pumping. Model-simulated groundwater elevations at a pumping well will be higher than those measured under pumping conditions for the following reasons:

a. In the model, pumping is assigned at these wells, but the pumping nodes have much larger areas than the diameter of the borehole in which each well is completed.

b. The field measurements of groundwater elevations under pumping conditions measure lower groundwater elevations than exist in the aquifer adjacent to the borehole, due to well losses across the borehole wall and the screen or slotted pipe.

Therefore, for model calibration purposes, the calibration goal at target wells that pump was to simulate groundwater elevations as close to the static elevations as possible, while also ensuring that simulated elevations were higher than the pumping elevations. More importantly, the transient calibration effort focused on the periods with the greatest groundwater elevation changes, and the analysis specifically focused on the slopes of the hydrographs, not just the absolute magnitudes of the groundwater elevations.

In the tributary canyons east of I-5, geologic logs were unavailable for many of the LACFCD wells. The total depths and open intervals for many of these wells suggested that they were completed in the geologic units underlying the alluvium, probably due to limited saturated thickness in the alluvium, particularly in the upper reaches of each canyon. For this reason, no targets were selected in Mint Canyon or upstream of the SCWC-Clark production well in Bouquet Canyon. In Sand Canyon, only the well farthest downstream, 7188A, was deemed suitable for use as an Alluvial Aquifer target well. Along the South Fork Santa Clara River, geologic logs and well construction data indicate that all target wells are constructed in the Saugus Formation, not the alluvium. The geologic data indicate that there is very limited saturated thickness in the alluvium in this area.

4.4.2 Santa Clara River Baseflow and Total Flow

Target river flow data to which the Regional Model results were compared were the total gaged flow at the County Line gage and estimates of how much of the gaged flow consisted of groundwater discharge to the river (baseflow).

The simulated total flow at the County Line gage equaled the sum of:

a. The simulated groundwater discharge to the river as calculated by the groundwater model from all wadi and drain nodes

b. The volume of water in the streams that the Visual Basic program (described in Section 3.6 and Appendix C) calculated as surplus stream flow that would not infiltrate to the underlying Alluvial Aquifer

This simulated total flow was compared directly with County Line gage results. The simulated groundwater discharge to the river was compared with the estimated values of river baseflow described previously in Section 2.6.2.5 of this report and listed in Table 2-6. For the steady-state model, the average baseflow during the period 1980 through 1985 was approximately 29,000 AF/yr.

4.4.3 Adjustments to Model Parameters

The steady-state and transient calibration process involved the adjustment of multiple parameters. Initially, the calibration effort focused on the steady-state model, where adjustments were made to Kh and Kv values and streambed coefficients, particularly in the gaining reaches of streams, to establish groundwater elevations, gradients, and flow directions. Attention was then devoted to the transient model, where the parameters receiving adjustment were the storativity, Sy, and the stormwater infiltration rates. Adjustments to Kh and Kv values that had been established during steady-state calibration were considered during transient calibration, but adjustments to these parameters were found to be unnecessary.

Initially, these efforts to calibrate the steady-state and transient models used a fixed, specified relationship between precipitation and stormwater to define the amount of water available for potential infiltration to groundwater. As Appendix C discusses, this relationship was in the form of an empirical power-function equation developed by Turner (1986). The empirical equation uses power-function coefficients that Turner (1986) developed from measurements of the yields from 68 different watersheds throughout California. Although the equation was used throughout the calibration process, including in the final model, the steady-state and transient calibration processes indicated that the empirical power-function coefficients reported by Turner (1986) generated too much stormwater and groundwater recharge to the Santa Clarita Valley during dry years and too little stormwater and groundwater recharge during wet years. This was determined by comparing hydrographs of measured and modeled groundwater elevations and river flows. After many attempts to achieve calibration by adjusting other model parameters, it was concluded that a different set of power coefficients would need to be developed for the Santa Clarita Valley. Consequently, during the final stages of calibration, adjustments to the model focused primarily on the values of these coefficients and on the values of the streambed vertical hydraulic conductivity. Calibration was considered complete once it was determined that the calibration goals were achieved or that no further improvements to the model were possible.

Tables

TABLE 4-1
Target Wells for Calibration of the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Well Name	Location	Model Zone	Well in Steady-State Model	Well in Transient Model	Year Drilled	Status 1986	Status 2001	Well Use	Easting (feet)[a]	Northing (feet)[a]	Measuring Point Elevation (feet MSL)	Total Depth (feet bgs)	Depth to Top of Open Interval (feet bgs)	Depth to Base of Open Interval (feet bgs)	Type of Open Interval	Drilling Method	Sanitary Seal Depth (feet bgs)	Depth of Pump Intake (feet bgs)
Alluvial Aquifer West of I-5																		
NLF-B11	Santa Clara River	C1c	No	Yes	---	Active	Active	Agricultural supply	6362161	1971971	886							
NLF-B10	Santa Clara River	C1c	Yes	No	1956	Active	Active	Agricultural supply	6364235	1974541	901.4	142	30	130	Knife cut			
NLF-B7	Santa Clara River	C1c	No	Yes	1946	Active	Active	Agricultural supply	6364397	1973939	901.6	102	18	88	Knife cut			
NLF-C5	Santa Clara River	C1b	Yes	No	1939	Active	Active	Agricultural supply	6371746	1977874	960.1	139	31	133	Knife cut			
NLF-C6	Santa Clara River	C1b	No	Yes	1939	Active	Active	Agricultural supply	6371835	1978154	966	103	26	93	Knife cut			
NLF-E4	Santa Clara River	C1a	Yes	Yes	1940	Active	Active	Agricultural supply	6374844	1982371	982.5	142	50	136	Knife cut			
6995D	Santa Clara River	C1a	Yes	No	1970	Active	Active	Water levels	6379091	1983329	1018						0	
NLF-G45	Santa Clara River	B1b1	No	Yes	---	Active	Active	Agricultural supply	6381356	1982222	1030	140	40	140				
7076C	Santa Clara River	B1b1	Yes	No	---	Active	Destroyed?	Water levels	6385042	1980084	1059						0	
Alluvial Aquifer between I-5 and Soledad Canyon																		
VWC-I	Santa Clara River	B1b2	No	Yes	1945	Active	Inactive	Municipal supply	6388567	1981657	1090	171	30	165			55	120
NLF-S3	Santa Clara River	B1a	No	Yes	---	Active	Destroyed	Agricultural supply	6393334	1978292	1129	250	95	205				
VWC-N	Santa Clara River	B1a	No	Yes	1936	Active	Active	Municipal supply	6395527	1976081	1130	280	76	237	Knife cut		50	140
VWC-K2	Santa Clara River	B1a	Yes	No	1945	Active	Active	Municipal supply	6395788	1976021	1132	242	62	230	Knife cut		50	63
NLF-R	Santa Clara River	B1a	Yes	No	---	Active	Destroyed	Agricultural supply	6397463	1977860	1157	160	40	140				
7067D	Santa Clara River	B1a	No	Yes	1964	Active	Destroyed?	Water levels	6398546	1977483	1157.5						0	
VWC-Q2	Santa Clara River	B1a	No	Yes	1954	Active	Active	Municipal supply	6399032	1977459	1158	170	76	126				100
Alluvial Aquifer in Soledad Canyon																		
SCWC-Stadium	Santa Clara River	A1e1	Yes	Yes	1946	Active	Active	Municipal supply	6402385	1974713	1197	130	33	130	Knife cut	Unknown		130
VWC-T4	Santa Clara River	A1e1	Yes	No	1953	Active	Active	Municipal supply	6403350	1975164	1191	150	50	135	Knife cut		50	100
VWC-T2	Santa Clara River	A1e1	No	Yes	1952	Active	Active	Municipal supply	6403623	1975127	1201	150	50	138	Knife cut			100
LACFCD-7107C	Santa Clara River	A1d1	Yes	No	---	Active	Destroyed?	Water levels	6410792	1975622	1276						0	
SCWC-Honby	Santa Clara River	A1d1	No	Yes	1959	Active	Active	Municipal supply	6411408	1977202	1282	226	50	202	Factory	Rotary	30	130
7127D	Santa Clara River	A1d2	Yes	Yes	1974	Active	Active	Water levels	6417808	1977062	1333	157					0	
SCWC-N.Oaks West	Santa Clara River	A1d4	Yes	No	1940	Active	Active	Municipal supply	6421187	1972857	1392	136	80	118	Knife cut	Unknown		110
SCWC-N.Oaks East	Santa Clara River	A1d4	No	Yes	1940	Active	Active	Municipal supply	6421651	1972936	1398	132	81	150	Knife cut	Unknown		130
7148K	Santa Clara River	A1c1	No	Yes	---	Active	Active	Water levels	6423523	1973851	1435						0	
7158K	Santa Clara River	A1c2	Yes	No	1965 or earlier	Active	Active	Water levels	6427699	1973490	1460						0	
7168C	Santa Clara River	A1c2	Yes	Yes	---	Active	Active	Water levels	6430088	1974149	1488						0	
SCWC-Mitchell	Santa Clara River	A1c2	No	Yes	1976	Active	Active	Municipal supply	6430168	1974420	1489	262	76	246	125 Mesh	Rotary	76	162
SCWC-Sand Canyon	Santa Clara River	A1c3	Yes	No	1973	Active	Active	Municipal supply	6432953	1975589	1523	127	60	140	Factory	Rotary	60	112
7178D	Santa Clara River	A1c3	Yes	No	1950 or earlier	Active	Active	Water levels	6433648	1975837	1528						0	
SCWC-Lost Canyon 2	Santa Clara River	A1c3	No	Yes	1965	Active	Active	Municipal supply	6433582	1975573	1530	310	95	125	Factory	Rotary	30	295
7177B	Santa Clara River	A1b1	No	Yes	1949 or earlier	Active	Active	Water levels	6434745	1976476	1542						0	
7177P	Santa Clara River	A1b1	Yes	No	---	Active	Active	Water levels	6434036	1976556	1542						0	
7187C	Santa Clara River	A1b2	Yes	No	---	Active	Active	Water levels	6435847	1977582	1548						0	
7197	Santa Clara River	A1b2	Yes	Yes	1945 or earlier	Active	Destroyed?	Water levels	6437790	1977821	1579						0	
7197D	Santa Clara River	A1b2	No	Yes	---	Active	Active	Water levels	6438053	1977798	1582						0	
NCWD-Pinetree1	Santa Clara River	A1b2	No	Yes	1986	Active	Active	Municipal supply	6439881	1977964	1588	235	50	210			20	160
7197G	Santa Clara River	A1b2	Yes	No	1974 or earlier	Active	Active	Water levels	6440544	1978061	1600						0	
Alluvial Aquifer along Castaic Creek																		
VWC-D	Castaic Creek	C2b	No	Yes	1950	Active	Active	Municipal supply	6375668	1987267	1036	142	60	136	Knife cut		50	100
6993A	Castaic Creek	C2b	Yes	Yes	1958 or earlier	Active	Active	Water levels	6377865	1992457	1067						0	
6981D	Castaic Creek	C2a	Yes	Yes	1972 or earlier	Active	Active	Water levels	6376437	2000534	1127						0	
NCWD-Castaic3	Castaic Creek	C2a	No	Yes	1961	Active	Active	Municipal supply	6376475	2002309	1141	135	55	136				100
6980E	Castaic Creek	C2a	No	Yes	1962 or earlier	Active	Active	Water levels	6376282	2002242	1144						0	
6980G	Castaic Creek	C2a	Yes	No	1962 or earlier	Active	Destroyed?	Water levels	6376020	2002731	1151						0	

TABLE 4-1
Target Wells for Calibration of the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Well Name	Location	Model Zone	Well in Steady-State Model	Well in Transient Model	Year Drilled	Status 1986	Status 2001	Well Use	Easting (feet)[a]	Northing (feet)[a]	Measuring Point Elevation (feet MSL)	Total Depth (feet bgs)	Depth to Top of Open Interval (feet bgs)	Depth to Base of Open Interval (feet bgs)	Type of Open Interval	Drilling Method	Sanitary Seal Depth (feet bgs)	Depth of Pump Intake (feet bgs)
Alluvial Aquifer in Other Tributary Canyons to the Santa Clara River																		
VWC-W6	San Francisquito Canyon	B4c	Yes	Yes	1952	Active	Active	Municipal supply	6393601	1985449	1159	158	90	153	Knife cut		50	100
7066D	Bouquet Canyon	B2c	Yes	Yes	---	Active	Active	Water levels	6400238	1979734	1182						0	
7086B	Bouquet Canyon	B2c	Yes	No	---	Active	Active	Water levels	6405151	1981611	1247						0	
SCWC-Clark	Bouquet Canyon	B2c	No	Yes	1946	Active	Active	Municipal supply	6405894	1983061	1267	160	20	120	Knife cut	Unknown		110
7095	Bouquet Canyon	B2b	Yes	No	1930 or earlier	Active	Active	Water levels	6409922	1986103	1323	146					0	
7188A	Sand Canyon	A3b	No	Yes	1952	Active	Active	Water levels	6434878	1972313	1588						0	
Saugus Formation																		
VWC-160	Santa Clara River	E	Yes	Yes	1984	Active	Active	Municipal supply	6388950	1976191	1101	2000	950	2000	Louvers	Rotary	65	260
7048C	Santa Clara River	E	Yes	Yes	1981	Active	Destroyed?	Water levels	6395222	1974491	1147						0	
VWC-157	S. Fork Santa Clara River	E	Yes	Yes	1962	Active	Active	Municipal supply	6395696	1974099	1151	2008	586	2008	Vertical slots	Rotary	15	340
VWC-201	S. Fork Santa Clara River	E	No	Yes	1989	Not Built	Active	Municipal supply	6394125	1973032	1152	1690	540	1670	Louvers	Mud rotary	460	360
SCWC-Saugus1	S. Fork Santa Clara River	E	No	Yes	1988	Not Built	Inactive	Municipal supply	6397847	1973452	1162	1640	490	1620	Wire wrap screen	Reverse	450	500
SCWC-Saugus2	S. Fork Santa Clara River	E	No	Yes	1988	Not Built	Inactive	Municipal supply	6398514	1972540	1158	1612	490	1591	Wire wrap screen	Reverse	460	500
NCWD-11	S. Fork Santa Clara River	F	Yes	Yes	1973	Active	Active	Municipal supply	6399004	1968019	1187	1136	200	1075	Louvers	Reverse rotary	150	340
NCWD-13	S. Fork Santa Clara River	F	No	Yes	1990	Not Built	Active	Municipal supply	6399098	1967327	1194	1300	420	750			50	445
NCWD-12	S. Fork Santa Clara River	F	Yes	Yes	1985	Inactive	Active	Municipal supply	6399282	1965920	1206	1340	485	1280	Louvers	Reverse rotary	420	400
NCWD-10	S. Fork Santa Clara River	F	Yes	Yes	1961	Active	Inactive	Municipal supply	6399388	1965803	1207	1555	780	1544	Louvers	Rotary	114	335
5851	S. Fork Santa Clara River	F	Yes	Yes	1966	Active	Active	Water levels	6396468	1962593	1233						0	
5851A	S. Fork Santa Clara River	F	Yes	No	1968	Active	Active	Water levels	6396432	1962504	1233						0	
5842F	S. Fork Santa Clara River	A	Yes	No	1974	Active	Active	Water levels	6395286	1960869	1248						0	
NCWD7	S. Fork Santa Clara River	F	Yes	Yes	1954	Active	Inactive	Municipal supply	6401264	1962732	1251	994	520	974	Knife cut	Cable tool		306
5841	S. Fork Santa Clara River	F	Yes	No	1973	Active	Active	Water levels	6393394	1963704	1256						0	
5871D	S. Fork Santa Clara River	F	Yes	No	1948 or earlier	Active	Active	Water levels	6402392	1962734	1262						0	
7053C	San Francisquito Canyon	D	Yes	No	---	Active	Destroyed?	Water levels	6397679	1992663	1291						0	
5882	S. Fork Santa Clara River	A	Yes	No	1931 or earlier	Active	Active	Water levels	6406409	1957586	1327						0	
5873E	S. Fork Santa Clara River	A	Yes	No	1957	Active	Active	Water levels	6403977	1957147	1353						0	
NCWD-9	S. Fork Santa Clara River	A	Yes	Yes	1958	Active	Inactive	Municipal supply	6404122	1956997	1354	675	311	674	Louvers	Rotary	75	230
5831	S. Fork Santa Clara River	A	Yes	No	1962	Active	Active	Water levels	6391103	1961398	1381						0	
7053D	San Francisquito Canyon	D	Yes	No		Active	Active	Water levels	6398884	1990433	1402						0	
5912A	S. Fork Santa Clara River	A	Yes	No	1948 or earlier	Active	Active	Water levels	6414810	1960110	1445						0	
7043C	San Francisquito Canyon	D	Yes	No	---	Active	Active	Water levels	6392762	1994816	1528						0	

[a]Coordinates are listed in California State Plane, NAD83 Datum, Zone V.

Notes:
Wells without owner designations belong to the Los Angeles County Flood Control District (LACFCD).
-- = No data available.
N. = north.
S. = south.

Figures

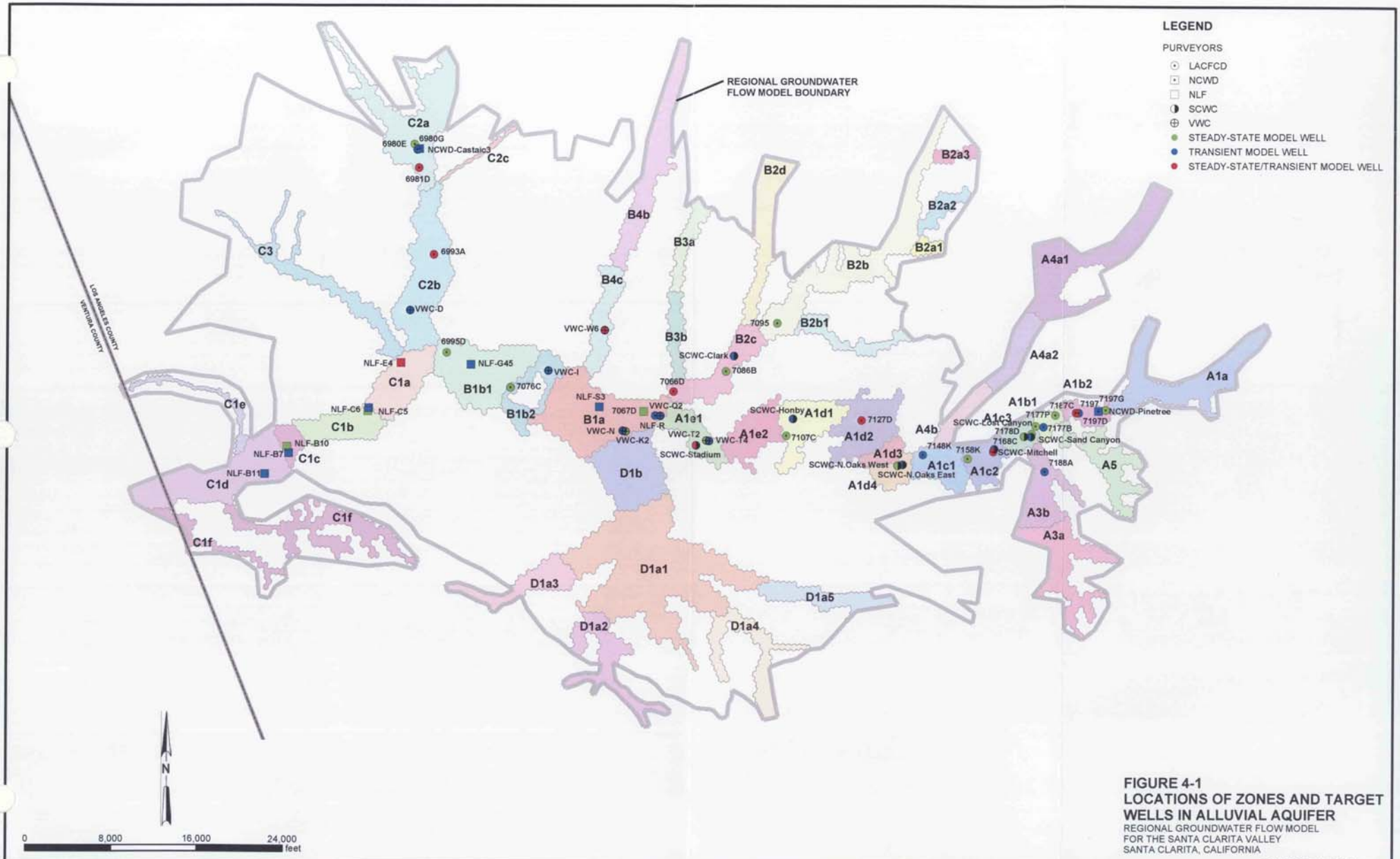


FIGURE 4-1
LOCATIONS OF ZONES AND TARGET WELLS IN ALLUVIAL AQUIFER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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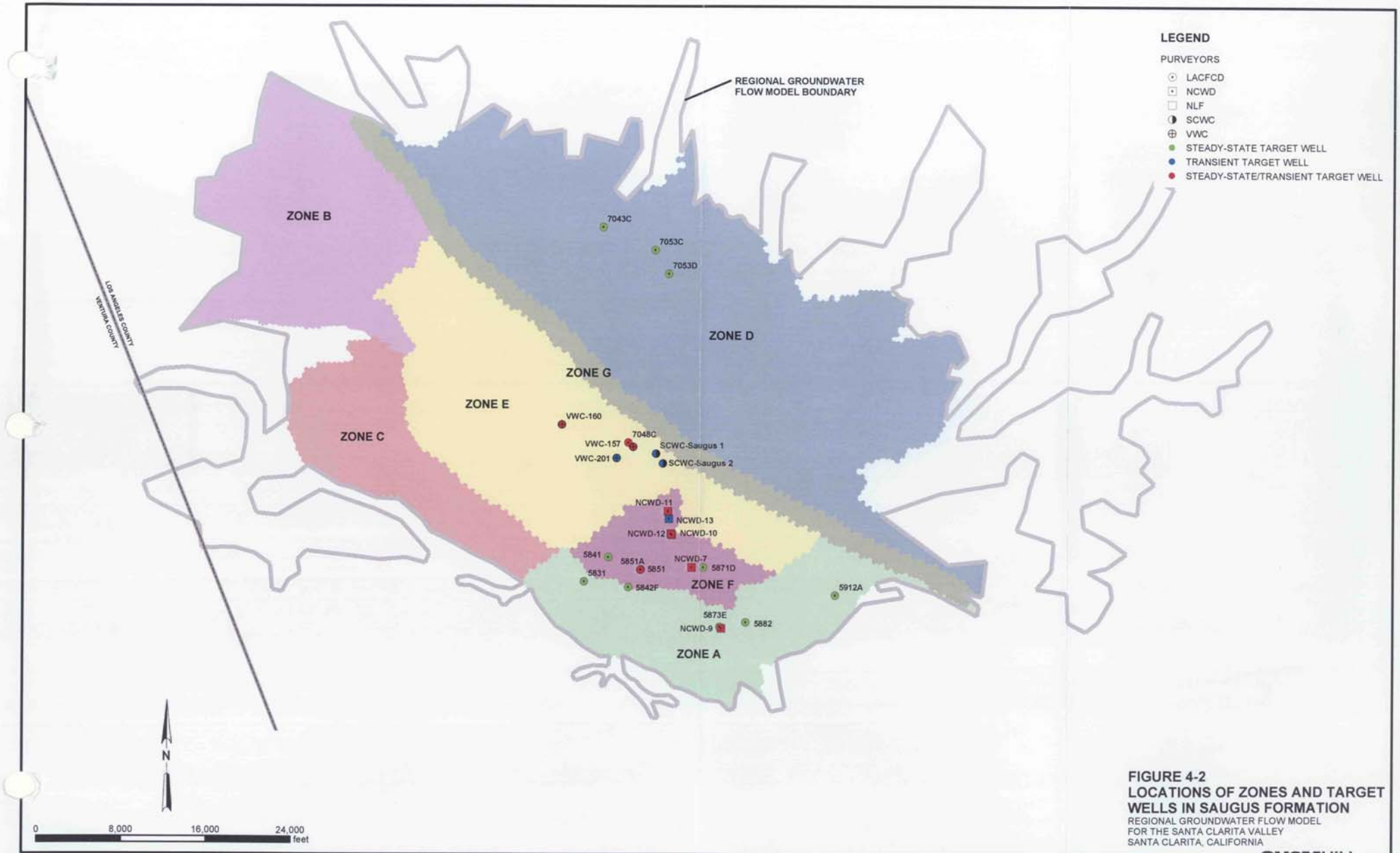

FIGURE 4-2
LOCATIONS OF ZONES AND TARGET WELLS IN SAUGUS FORMATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 5

Calibration Results and Sensitivity Analysis

This section of the report presents the calibrated Regional Model and a sensitivity analysis of the Regional Model. Sections 5.1 and 5.2 discuss the calibration quality of the steady-state and transient models (respectively) with reference to the calibration goals discussed in Section 4.2. Section 5.3 discusses the groundwater budgets for both models. Section 5.4 describes a sensitivity analysis that further evaluated calibration quality by comparing the sensitivity of the model-predicted groundwater elevations and river flows to the values of key model parameters.

The distribution of Kh in the calibrated model is presented on Figures 5-1 through 5-7 for model layers 1 through 7, respectively. Table 5-1 summarizes the values of transmissivity, thickness, and hydraulic conductivity in the 48 alluvial zones. Table 5-2 summarizes values of the other calibrated hydraulic properties that are used in the model.

5.1 Calibration Results for the Steady-State Model

Following are discussions of how the calibrated model compares with the six calibration goals established for the 1980 through 1985 steady-state model.

5.1.1 Groundwater Flow Directions – Calibration Goal 1

Figure 5-8 shows simulated groundwater elevations and flow directions in the Alluvial Aquifer as computed by the steady-state model. The groundwater flow directions are from east to west along the Santa Clara River, which is in agreement with published contour maps for the Alluvial Aquifer (see Figure 2-7). The contours show a very flat hydraulic gradient in the lower reach of the valley containing the South Fork Santa Clara River, which also agrees with published interpretations.

Figures 5-9 through 5-14 show groundwater elevation contour maps for layers 2 through 7 of the Regional Model, which represent the Saugus Formation. Layer 3 (Figure 5-10) is situated from 500 feet bgs to 1,000 bgs and is partially or fully screened by several of the Saugus production wells that are situated in the valley containing the South Fork Santa Clara River. In this area, the model-simulated flow directions in layer 3 are in good general agreement with published interpretations (see Figure 2-8).

5.1.2 Groundwater Elevation Residuals – Calibration Goal 2

Figure 5-15 is a scatter plot comparing simulated and observed average groundwater elevations for target wells in both the Alluvial Aquifer and the Saugus Formation. For a perfect simulation, each point shown on the figure would lie on the diagonal line. The figure shows that the Alluvial Aquifer target wells lie very close to the diagonal line, indicating a very good calibration to the observed average groundwater elevations from 1980 through 1985. For the Saugus Formation, there is greater variability. Some Saugus wells plot very close to the diagonal line, while one well (5882) lies 80 feet above the line and another well

(5831) lies 80 feet below the line. These two particular wells are near the southern model boundary, where the available water level data indicate that the groundwater gradients in the Saugus are very steep compared to areas closer to the Saugus production wells. Nonetheless, the Saugus wells are generally close to the diagonal line and do not plot consistently above or consistently below the line, indicating that the Saugus Formation is closely calibrated in the steady-state model.

Table 5-3 lists the residuals for Alluvial and Saugus wells. The residuals are also plotted on Figures 5-16 through 5-19. Positive residuals indicate that the Regional Model over-predicts the groundwater elevation, and negative residuals indicate that it under-predicts the groundwater elevation. Observations regarding the residuals are as follows:

a. Figure 5-16 shows the magnitudes of the groundwater elevation residuals for the 21 target wells in the Alluvial Aquifer that lie along the Santa Clara River. The plot shows the target wells in order from the downstream end of the valley (left side) to the upstream limit of the valley (right side). The plot shows that 13 of the 21 wells have residuals in the range of –5 to +5 feet, and that only one well (7158K) does not meet the 10-foot residual criterion for Goal 2. The plot also shows little, if any, spatial bias in the direction of the residuals; specifically, long reaches of the river do not show consistently positive or consistently negative residuals. Consequently, the groundwater elevations are very well calibrated along the Santa Clara River.

b. Figure 5-17 shows an equivalent plot for Alluvial Aquifer wells located in three of the tributary canyons. In these areas, where gradients are steep, the modeled groundwater elevations are generally within 10 to 11 feet of the average measured elevations. The plot indicates a tendency to slightly under-predict groundwater elevations, particularly in the upper-most reach of Bouquet Canyon, but the residuals generally meet the criterion for Goal 2.

c. Figures 5-18 and 5-19 show similar residual plots for production wells and for LACFCD monitoring wells, respectively, in the Saugus Formation. Three of the seven production wells meet the 25-foot residual criterion for Goal 2, and three of the monitoring wells meet this criterion. Both plots indicate a tendency to under-predict static groundwater elevations, particularly in four wells that are near the outer limits of the Saugus Formation (wells NCWD-9, 5831, 7043C, and 7053D). However, the water levels in these four wells appear to be anomalously high, compared with the water levels in surrounding wells. Consequently, the water level data indicate that these wells (particularly the three LACFCD wells) are constructed in perched Saugus zones lying above the regional Saugus aquifer system, and the negative residuals at these wells correspond to the anomalously high groundwater elevations. Excluding these four wells, three of the six production wells and five of the ten LACFCD monitoring wells meet the Goal 2 criterion, indicating that the steady-state calibration of the Saugus Formation is adequate, particularly because the focus of the model calibration effort is transient calibration, which is discussed in Section 5.2.

5.1.3 Statistics of Groundwater Elevation Residuals – Calibration Goal 3

Table 5-4 lists the residual statistics for target wells in both aquifer systems. The table shows statistics for the same wells listed in Table 5-3 and shown on Figures 5-16 through 5-19,

except for Saugus wells 5831, 7043C, and 7053D. Table 5-4 shows that the residual statistics for the Alluvial Aquifer generally meet the criteria specified in Goal 3. For the Saugus Formation, the statistics meet the mean residual criterion, but the statistics for the square of the residuals are slightly above the criteria of (1) less than 25 feet for RMS error or (2) 10 percent or less for normalized RMS error. The Regional Model as a whole, however, with the Alluvial Aquifer and Saugus Formation combined, meets all Goal 3 criteria.

5.1.4 Groundwater Gradients – Calibration Goal 4

In the Alluvial Aquifer, the results for the first three calibration goals indicate that the steady-state model simulates groundwater gradients quite well, and therefore meets Goal 4.

For the Saugus Formation, the residuals for the NCWD wellfield in the South Fork Santa Clara River are consistently negative. However, the residual at the upgradient end of the wellfield at NCWD-7[5] is similar in magnitude to the average residual at the downgradient end of the wellfield at NCWD-10 and NCWD-11. Consequently, the gradients in this area are simulated reasonably well. Simulated gradients from the NCWD wellfield to the downgradient well VWC-160 are slightly low, as suggested by the more negative residuals in the NCWD wellfield and the less negative residual at VWC-160.

Additionally, recent water level data from the Whittaker-Bermite property indicate that the gradients are well simulated within the Saugus Formation in that area, which lies east and northeast of NCWD's wellfield. Table 5-5 shows the calculations of the model-simulated and measured groundwater gradients between wells MP-1 and MP-2, which are both on the downthrown side of the San Gabriel fault, and between MP-2 and MP-3, which are located on the downthrown side and upthrown side of the fault, respectively. These calculations are based on three rounds of manual water level measurements that were taken from January through October in 2003. Between wells MP-1 and MP-2, the gradients are almost perfectly matched. However, across the San Gabriel fault, the modeled gradient is approximately half as large as the measured gradient because the simulated groundwater elevation is low at MP-3.

Several attempts were made during model calibration to reduce the Saugus permeability to very low levels across the fault, but no further increases in MP-3 water levels could be obtained. The calibrated Regional Model uses a permeability along the fault that is between 100 and 1,000 times lower than the permeability of adjoining Saugus areas. Although the Regional Model was unable to simulate as high a groundwater elevation as has been measured recently at MP-3, it does simulate a substantial drop in groundwater elevations across the San Gabriel fault, which is consistent with the understanding of the limited hydraulic connection across the fault (see Section 2.4.2 and Figure 2-9). Therefore, the Regional Model is well calibrated across the fault because it simulates the permeability differences that exist on each side of the fault and also simulates the very limited movement of groundwater across the fault that is indicated by the significant difference in groundwater elevations that has been measured in the multi-port wells on each side of the fault.

[5] Well NCWD-9 is located farther upgradient, but has been used only sparingly since 1987.

5.1.5 Groundwater Below Ground Surface – Calibration Goal 5

Groundwater elevations simulated by the steady-state model are below ground surface at all non-stream nodes and in each tributary stream. Along the Santa Clara River, a small number of nodes showed groundwater elevations above the streambed in the western portion of Soledad Canyon, and also at and immediately upstream of Round Mountain, a Saugus outcrop that likely lies at shallow depths beneath the river itself. The reach of the river west of I-5 was calculated to be predominantly gaining (groundwater above ground surface). However, the Regional Model predicts that the river is losing over a reach extending between approximately 0.75 mile upstream to 0.5 mile downstream of the location where the river crosses over the western limit of the Saugus Formation. In this area, the riverbed has a gentler slope than in adjoining areas, and the riverbed does not lie beneath the water table in this particular reach.

5.1.6 Groundwater Discharge to River – Calibration Goal 6

The model-simulated groundwater discharge to the river was 28,600 AF/yr, which closely agrees with the 29,000 AF/yr value estimated from the hydrograph separation process described in Section 2.6.2.5.

5.2 Calibration Results for the Transient Model

Following are discussions of how the calibrated Regional Model compares with the four calibration goals established for the 1980 through 1999 transient model.

5.2.1 Groundwater Elevation Trends/Hydrographs – Calibration Goal 1

Trends in groundwater elevations are discussed for the following areas:

a. The Alluvial Aquifer along the Santa Clara River, west of I-5, as shown on Figure 5-20

b. The Alluvial Aquifer along the Santa Clara River, between I-5 and Soledad Canyon, as shown on Figure 5-21

c. The Alluvial Aquifer along the Santa Clara River in Soledad Canyon, as shown on Figure 5-22

d. The Alluvial Aquifer along Castaic Creek, as shown on Figure 5-23

e. The Alluvial Aquifer in other tributary canyons to the Santa Clara River, as shown on Figure 5-24

f. The Saugus Formation, where targets are located along the South Fork Santa Clara River, as shown on Figure 5-25

As discussed in Section 4.4.1, the calibration goal at target production wells was to simulate groundwater elevations that were higher than the pumping elevations and as close as possible to the static elevations. Therefore, the hydrographs show the model-simulated groundwater elevations, the measured static groundwater elevations, and, for production wells, the measured pumping groundwater elevations.

5.2.1.1 Alluvial Aquifer West of I-5

Modeled and measured groundwater elevations both show long-term stability, with no significant increases or decreases during the 1980 through 1999 transient calibration period. The Regional Model simulates somewhat greater seasonal variation in groundwater elevations than is suggested by the field measurements. However, the field measurements were collected infrequently. In general, the Regional Model is well calibrated in this area because of the close match between simulated and measured groundwater elevations and because it simulates the long-term stability of groundwater elevations in this area.

5.2.1.2 Alluvial Aquifer Between I-5 and Soledad Canyon

North of the Santa Clara River, near the mouth of San Francisquito Canyon, the Regional Model simulates the observed trends in static groundwater elevations at wells NLF-S3 and VWC-I during the period that data are available. The groundwater elevation trends are particularly well simulated at VWC-I starting in mid-1996, when the water level measurement frequency increased at this well.

Just upstream and along the south side of the river, the Regional Model simulates the trends in static water levels at well VWC-N very closely throughout the 20-year simulation period. The Regional Model also simulates the trends in static water levels quite well at well VWC-Q2, near the mouth of Soledad Canyon. In this same area, monitoring well 7067D simulates groundwater elevations that are somewhat lower than measured elevations, and the 40-foot fluctuation in simulated water levels at this well is of a generally similar magnitude as the observed fluctuation of 50 feet.

5.2.1.3 Alluvial Aquifer In Soledad Canyon

At wells throughout Soledad Canyon, the Regional Model closely simulates the regional decline in groundwater elevations during the late 1980s and early 1990s. The simulated and measured declines are especially close for wells in the eastern portion of this area, such as SCWC-North Oaks, SCWC-Mitchell, SCWC-Lost Canyon 2, and NCWD-Pinetree1.

Although the sharp increases in groundwater elevations in 1992 and 1993 are modeled well, these same wells (in the eastern half of Soledad Canyon) are unable to maintain high enough groundwater elevations during short dry periods that occur intermittently from 1993 through 1999. During this period, wells further to the west, such as SCWC-Stadium, VWC-T2, SCWC-Honby, and 7127D show better matches between modeled and measured groundwater elevations. Many model runs were performed to try to maintain higher water levels in eastern Soledad Canyon, but no substantial improvements could be made, suggesting that the lack of stream gage data at the Lang gage during this period may be responsible for the discrepancies.

A visual inspection of the former Lang gage station was conducted on July 17, 2003 during the model calibration process. The equipment that records the depth of water in the river was observed to be approximately 3 to 4 feet above the bed of the river at the time of the inspection. Although high river flows are known to have occurred since the time the gage was abandoned, it is unlikely that the bed elevation would have been lowered 3 or 4 feet by the net sediment scouring and redeposition processes that occur during high river flows. This observation means there likely was more flow occurring in the river prior to October

1989 than was recorded by this gage. This in turn means that measured and estimated flows during the period 1980 through 1999 are likely too low in the Regional Model, which would explain the model's simulation of too rapid a decline in water levels after high river flows recharge the aquifer. In summary, the design of the gage and the absence of data after October 1989 are the likely reasons that the Regional Model has difficulty maintaining sufficiently high groundwater elevations during dry periods in the eastern portion of the Alluvial Aquifer.

5.2.1.4 Alluvial Aquifer Along Castaic Creek

In the upper reaches of the Castaic Creek valley, the Regional Model simulates the measured groundwater elevation trends very well during the drought at wells NCWD-Castaic3, 6980E, and 6980G, though this evaluation is somewhat uncertain during the early 1980s due to infrequent data collection. However, these same wells show too much recovery during the initial post-drought recovery period in 1992, and they also show a small rise in groundwater elevations from 1993 through 1999 that is not indicated by the field measurements.

Farther downstream, the Regional Model closely matches the measured groundwater elevation trends at well 6993A well until the last few years of the drought, when groundwater elevations do not drop sufficiently. Well VWC-D (farther downstream) is modeled even better, but also shows a bit too much fluctuation during the mid- and late 1990s.

5.2.1.5 Alluvial Aquifer in Other Tributary Canyons to the Santa Clara River

At production well VWC-W6 in the lower reaches of San Francisquito Canyon, the Regional Model appears to simulate the measured groundwater elevations well, except for a possibly insufficient decline in early 1992 at the conclusion of the regional drought.

In Bouquet Canyon, the Regional Model closely simulates the measured groundwater elevation changes at the SCWC-Clark production well, although the groundwater elevations are a bit high throughout the simulation. The groundwater elevation trends are also well simulated farther downstream at monitoring well 7066D, though the groundwater elevations are somewhat under-predicted throughout the simulation.

In Sand Canyon, the simulation at monitoring well 7188A is good, although there is some uncertainty at the end of the drought due to the lack of data collection during 1990 and 1991.

5.2.1.6 Saugus Formation

In general, the Regional Model simulates the trends in groundwater elevations quite well at each Saugus production and monitoring well. Simulated and measured static groundwater elevations agree particularly well in the NCWD wellfield at the observation well (5851) and each NCWD production well.

Farther downgradient, the model tends to slightly over-predict groundwater elevations in the VWC and SCWC production wells (VWC-157, VWC-201, SCWC-Saugus1, and SCWC-Saugus2) and slightly under-predict groundwater elevations in the lone monitoring well (7048-C). However, the Regional Model closely simulates the groundwater elevation trends

at each of these locations, which is the primary consideration for evaluating the quality of the transient calibration process in the Saugus Formation.

5.2.2 Groundwater Below Ground Surface – Calibration Goal 2

This goal was met at each target in the transient model. Of the 44 transient model target wells, 11 had simulated groundwater elevations within 5 feet of ground surface during the wettest periods of the model simulation. Three of these wells were located in the Castaic Valley (6980E, 6981D, and NCWD-Castaic3), one was in lower Sand Canyon (7188A), one was in Bouquet Canyon (SCWC-Clark), and six were in Soledad Canyon (VWC-T2, 7127D, SCWC-Mitchell, SCWC-Lost Canyon 2, 7177B, and NCWD-Pinetree1).

5.2.3 Total River Flow at County Line Gage – Calibration Goal 3

Figure 5-26 compares the modeled and measured total flows of the Santa Clara River at the County Line gage. The figure contains both a linear plot and a semi-logarithmic plot to better illustrate how the modeled and measured flows compare during low flow periods in the river.

Figure 5-26 also shows that the Regional Model adequately replicates seasonal cycles of low and high river flows. Prior to 1992, peak flows during the wettest months tend to be somewhat underestimated, probably because of under-predicted flow in the streams rather than insufficient groundwater discharge to the river. From 1992 through 1997, peak flows match well, but they are again underestimated in 1998 and 1999.

Seasonal low flows, during the summer months, are slightly over-predicted. In years such as 1990, the model over-estimates river flows by approximately 100 to 200 acre-feet per month. In other years, the Regional Model over-estimates the river flows by as much as 1,000 acre-feet per month. To evaluate this further, the estimated and model-simulated groundwater discharges to the river were compared, as discussed below.

5.2.4 Groundwater Discharge to River – Calibration Goal 4

Figure 5-27 compares the model-simulated groundwater discharges to the river with the discharges that have been estimated from hydrograph separation techniques (see Section 2.6.2.5). Because of uncertainty in the amount of treated water that infiltrates the streambed, Figure 5-27 displays a range for the estimated values, varying according to how much of the Saugus WRP treated water is estimated to infiltrate to groundwater as it travels down the Santa Clara River. For the purposes of this comparison, it was estimated that the infiltration could be negligible (blue line) and would be unlikely to exceed 75 percent of the Saugus WRP discharge (green line).

Figure 5-27 shows that the Regional Model simulates the patterns of groundwater discharges well. The Regional Model predicts lower groundwater discharge rates during high flow/high water table periods than were estimated from the hydrograph separation technique, but model uncertainty may not be the cause of this difference. It is equally, if not more, likely that the difference is due to the significant uncertainties associated with the hydrograph separation process during periods of high river flows. Specifically, as discussed in Section 2.6.2.5, it is difficult to determine how much of the receding flow after peak flow

events is due to groundwater discharges versus continued stormwater drainage from within the basin or from upstream watersheds.

Figure 5-27 also shows that the Regional Model tends to predict higher rates of groundwater discharge during dry periods than estimated from the County Line gage. This is consistent with the Regional Model's over-prediction of total river flows, but anecdotal observations at the former gaging station site during low flow periods indicate that the river sometimes carved small channels that diverted a portion of the flow away from the gage, where it could not be measured. Consequently, the differences between modeled and measured total river flows and measured versus estimated groundwater discharges result from uncertainties in both the Regional Model and the gage data.

5.3 Groundwater Budget

Table 5-6 summarizes the groundwater budget for the 1980 through 1985 steady-state model. The values in the table are the average groundwater recharge and discharge rates in AF/yr during this period. As shown in the table, the majority of the recharge occurs from direct rainfall and stormwater flows, with irrigation and Castaic Lake underflow each comprising a very small portion of the total basin recharge. Groundwater discharge during this time period was approximately one-third pumping and one-third discharge to the Santa Clara River, with the rest consisting of subsurface outflow and ET. The table shows that ET is an important part of the groundwater budget, 15 percent of the total groundwater discharge in the basin.

Table 5-7 summarizes the groundwater budget for each year of the 20-year transient model simulation period (1980 through 1999). Figures 5-28 and 5-29 show the annual groundwater recharge and groundwater discharge rates, respectively. Figure 5-30 shows the change in groundwater storage each year, and Figure 5-31 shows the cumulative change in groundwater storage during the simulation period.

As is evident from Figure 5-28, recharge from precipitation and streamflows varies considerably from year to year, ranging from less than 15,000 AF/yr in the driest years to over 100,000 AF/yr in wetter years. In fact, for the five wettest years during this period, the model estimates that groundwater recharge ranged between 175,000 AF/yr and 270,000 AF/yr. In contrast, total groundwater discharges have been less variable (Figure 5-29), ranging from approximately 61,000 AF/yr at the end of the drought in the late 1980s through early 1990s to 116,000 acre-feet during 1998. Table 5-7 and Figure 5-29 together show that this variability in groundwater discharge does not follow the year-to-year pumping patterns, but instead is caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlate well with groundwater recharge patterns. For example, groundwater discharge rates increase during or immediately after significant rainfall years in 1983, 1992 through 1993, 1995, and 1998, and subsequently decrease in response to below-normal precipitation in the ensuing 1 to 2 years. This indicates that the predominant factors influencing changes in storage and groundwater discharge are the local rainfall recharge and stream recharge patterns from year to year, with anthropogenic influences (pumping and irrigation) having a smaller effect on the groundwater system. This is reinforced by Figures 5-30 and 5-31, which show that changes in groundwater storage volumes reflect year-to-year variations in regional rainfall.

5.4 Sensitivity Analysis

Sensitivity analyses were performed on the calibrated Regional Model to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the model. The sensitivity analyses focused on the transient model. Following is a description of the design of the analyses and the findings.

5.4.1 Method of Sensitivity Analysis

Analysis focused on identifying the sensitivity of the transient model to Kh and Kv for both aquifer systems, the permeability of the bed of the Santa Clara River, and, to a lesser degree, the ET parameters.

To perform the analysis, one model variable, or group of variables, was varied upward or downward, and the model was run again. The amount by which each model variable was adjusted upward or downward was based on the range of values that was considered to be plausible for the variable, according to the data analysis that was conducted in support of development of the hydrogeologic conceptual model for the valley, which is described in Section 2 of this report. The following pairs of sensitivity runs were performed:

a. Adjusting the Kh. This parameter was multiplied and divided by a factor of 1.5 in all model layers. The R (Kh:Kv) was left unchanged for these runs, but the change in Kh caused a change in Kv values.

b. Adjusting the R upward or downward by a factor of 4.0. This caused changes to Kv, but not to Kh.

c. Adjusting the storage parameters. In model layer 1, the Sy was adjusted from the calibrated model value of 0.10 to 0.075 and 0.15. In model layers 2 through 7, the storativity was adjusted from the calibrated model value of 5×10^{-4} to values of 1×10^{-4} and 1×10^{-3}. The reductions to Sy and storativity were run simultaneously in a single model run, and the increases in Sy and storativity were run simultaneously in a single model run.

d. Adjusting the riverbed leakage terms at drain and wadi nodes in the Santa Clara River and Castaic Creek. These terms were multiplied and divided by a factor of 10.

e. Adjusting the ET parameters in a way that produced less ET. In one run, the maximum evaporation depth was changed from 10 feet to 5 feet. In another run, the maximum evaporation rate was changed from 6 ft/yr to 3 ft/yr.

5.4.2 Sensitivity Analysis Results

The results of the focused sensitivity analysis are presented as time-series plots of water levels and groundwater discharges to the river. Results are first presented for the aquifer hydraulic parameters (Kh, R, Sy, and storativity), then for the riverbed permeability and ET terms.

5.4.2.1 Sensitivity of Groundwater Elevation Trends to Aquifer Parameters

Figures 5-32 through 5-38 show the sensitivity of Alluvial Aquifer groundwater elevations in the transient model to variations in Kh, R, and Sy. Figures 5-39 through 5-43 show the same information for three Saugus production wells and two Saugus monitoring wells. The results and the conclusions that can be drawn from them are:

a. Alluvial wells in the western part of the basin (NLF-B7 and NLF-G45) show slight sensitivity to the choice of Kh, and little sensitivity to R and Sy. Lower Kh values would degrade the calibration quality of the Regional Model, whereas the tested ranges of the other parameters would have little effect on calibration quality.

b. Further east, VWC-N shows greater sensitivity to each parameter, though it is relatively insensitive to lower Kh values. Lower Kh values or changes to R values would not degrade calibration quality, whereas other parameter changes could potentially degrade the calibration.

c. Results are similar in Soledad Canyon at SCWC-Stadium, SCWC-North Oaks East, and NCWD-Pinetree1. Higher Kh values substantially degrade the calibration quality of the transient model at each of these wells.

d. The transient model was slightly to moderately sensitive to the choice of Alluvial Aquifer Kh in Castaic Creek at well VWC-D. In this area, it showed little sensitivity to R or Sy in the Alluvial Aquifer. The results suggest that higher K values could slightly improve the calibration.

e. Water levels at Saugus production wells along the lower reaches of the South Fork Santa Clara River (VWC-201 and SCWC-Saugus2) are sensitive to the choice of R, moderately sensitive to the choice of Kh, and comparatively insensitive to storativity. The transient model is more sensitive to Kh and storativity at nearby monitoring well 7048C than at the pumping wells. The plots generally indicate the model is well calibrated, although small decreases in Kh might slightly improve the calibration quality.

f. Similar results are seen for production well NCWD-11 and monitoring well 5851 farther upstream in the South Fork Santa Clara River valley. At NCWD-11, the R appears to be particularly well calibrated, as lower values cause groundwater elevations to fluctuate insufficiently, and higher values cause too much fluctuation, and in some cases, model-simulated water levels that are below pumping levels. Changes to Kh would not improve the model, and could in fact degrade it at the monitoring well.

5.4.2.2 Sensitivity of Groundwater Elevation Trends to River and Evapotranspiration Parameters

Figures 5-44 through 5-50 show the sensitivity of Alluvial Aquifer groundwater elevations in the transient model to variations in the riverbed K for drain and wadi nodes and to decreases in the two ET parameters, extinction depth and maximum potential ET rate. Figures 5-51 through 5-55 show the same information for the three Saugus production wells and two Saugus monitoring wells discussed in Section 5.4.2.1. The results and the conclusions that can be drawn from them are:

a. Alluvial wells in the western and central parts of the basin (NLF-B7, NLF-G45, and VWC-N) and along Castaic Creek (VWC-D) are sensitive to the choice of the riverbed K for the drain and wadi nodes. Reduced conductivity values notably increase the groundwater elevations at some wells, while higher values somewhat decrease groundwater elevations. The plots suggest that changes to this term would not improve calibration quality and could substantially degrade the calibration at some of these wells. Further east, in Soledad Canyon, the Regional Model is relatively insensitive to riverbed K in the gaining reaches of the Santa Clara River.

b. Reductions in drain and wadi riverbed K increase groundwater elevations by raising groundwater elevations in the Alluvial Aquifer, to which the Saugus discharges. Decreased riverbed permeability backs up water in the Alluvial Aquifer, and hence in the Saugus Formation. Changes to riverbed permeability do not improve Saugus calibration.

c. Groundwater levels in both the Alluvial Aquifer and the Saugus Formation are insensitive to the choice of ET parameters.

5.4.2.3 Sensitivity of Groundwater Discharge to the River to Changes in Aquifer Parameters

Figures 5-56 shows the sensitivity of discharges of Alluvial Aquifer groundwater to the river to changes in K, R, and Sy. The plots show that the model-calculated discharge to the river is sensitive to Kh, but not to R or Sy. A reduction in Alluvial Aquifer Kh would improve the calibration quality during seasonal or longer dry periods, but at the expense of degrading the calibration during the rainfall season for all but the wettest years. Increasing the Kh would slightly increase the predicted discharges during seasonal or longer dry periods.

5.4.2.4 Sensitivity of Groundwater Discharge to the River to Changes in River and Evapotranspiration Parameters

Figure 5-56 also shows the sensitivity of discharges of Alluvial Aquifer groundwater to the river to changes in riverbed K for drain and wadi nodes and to decreases in the two ET parameters, extinction depth and maximum potential ET rate. Figure 5-56 shows that a lower riverbed permeability would improve calibration during seasonal and longer dry periods, but notably degrade calibration during all rainfall periods. Figure 5-56 shows that reducing the ET extinction depth from 10 feet to 5 feet has little effect on model-calculated discharge to the river, while reducing the maximum ET rate slightly increases the model-calculated discharge.

5.5 Conclusion

The process of calibrating the Regional Model to a 20-year period of groundwater elevation and streamflow data has resulted in a model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary attributes of the model's calibration that makes this tool appropriate for its intended uses are:

a. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased SWP water imports (from outside the valley), and associated changes in land use and water use.

b. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property).

c. Its use of an integrated model of the watershed (the SWRM) to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system.

The calibration process has resulted in a Regional Model that closely simulates, on a monthly basis, total flows in the river and estimated volumes of groundwater discharging to the river. The calibration process has also resulted in a Regional Model that closely simulates the short-term and long-term time-varying trends in groundwater elevations throughout the valley, which is necessary for evaluating groundwater management strategies. The close calibration of the groundwater elevation trends and absolute groundwater elevations in both the Alluvial Aquifer and the Saugus Formation near the Whittaker-Bermite property also renders the Regional Model suitable for particle-tracking analyses, to support the design of a long-term pumping and groundwater treatment plan that will restore impaired water supplies while also preventing contamination in unimpacted portions of the aquifer.

Tables

TABLE 5-1
Alluvial Aquifer Parameters in Calibrated Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Zone	Location	T (ft^2/day)	Kh (ft/day)	Average Alluvium Thickness (feet)
A1a	Santa Clara River below Lang gage	9,000 to 25,500	300	30 to 85
A1b2	Santa Clara River below A1a	31,500	350	90
A1b1	Santa Clara River below A1b2	31,500	350	90
A1c3	Santa Clara River below A1b1	36,000	400	90
A1c2	Santa Clara River below A1c3	49,500	550	90
A1c1	Santa Clara River below A1c2	49,500	550	90
A1d4	Santa Clara River below A1c1	49,500	550	90
A1d3	Santa Clara River below A1d4	16,500	550	30
A1d2	Santa Clara River below A1d3	60,500	550	110
A1d1	Santa Clara River below A1d2	49,500	550	90
A1e2	Santa Clara River below A1d1	63,250	550	115
A1e1	Santa Clara River below A1e2	63,250	550	115
B1a	Santa Clara River at South Fork mouth	54,375 to 79,750	375 to 550	145
B1b2	Santa Clara River below B1a	22,500	375	60
B1b1	Santa Clara River below Bb2	63,250	550	115
C1a	Santa Clara River below B1b1	71,500	550	130
C1b	Santa Clara River below C1a	60,500	550	110
C1c	Santa Clara River below C1b	60,500	550	110
C1d	Santa Clara River below C1c	60,500	550	110
D1b	Lower South Fork Santa Clara River	12,600	105	120
D1a1	Upper South Fork Santa Clara River	5,775	105	55
D1a2	Gavin Canyon	15	0.75	20
D1a3	Pico Canyon	15	0.75	20
D1a4	Newhall Canyon	15	0.75	20
D1a5	Placerita Canyon	200	10	20
A3a	Upper Sand Canyon	1,750	175	10
A3b	Lower Sand Canyon	5,250	105	50
A4a1	Upper Mint Canyon	2,800	140	20
A4a2	Central Mint Canyon	2,100	105	20
A4b	Lower Mint Canyon	13,125	175	75
A5	Oak Spring Canyon	8,750	175	50
B2a1	Unnamed tributary canyon	10,500	105	100
B2a2	Vasquer Canyon	10,500	105	100
B2a3	Texas Canyon	10,500	105	100

TABLE 5-1
Alluvial Aquifer Parameters in Calibrated Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Zone	Location	T (ft^2/day)	Kh (ft/day)	Average Alluvium Thickness (feet)
B2b1	Plum Canyon	10,500	105	100
B2b	Upper Bouquet Canyon	2,625 to 12,600	25 to 90	105
B2c	Lower Bouquet Canyon	22,050	245	90
B2d	Haskell Canyon	6,825	105	65
B3a	Lower Dry Canyon	6,300	105	60
B3b	Upper Dry Canyon	6,300	105	60
B4b	Upper San Francisquito Canyon	6,300	105	60
B4c	Lower San Francisquito Canyon	10,500	105	100
C1e	San Martinez Canyon	5,250	105	50
C1f	Potrero and Salt Canyons	5,250	105	50
C2a	Upper Castaic Creek valley	25,200	315	80
C2b	Lower Castaic Creek valley	35,000	350	100
C2c	Charlie Canyon	10,500 to 17,500	175	60 to 100
C3	Hasley Canyon	3,150	30	105

Notes:

The zones are based on alluvial storage units defined by RCS (1986, 2002).
However, they have been further subdivided in certain areas to facilitate model calibration.

See Figure 4-1 for the locations of the alluvial storage units.

TABLE 5-2
Aquifer Hydraulic Parameters Used in the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Parameter	Aquifer	Value	Comment
Kh	Alluvium	Variable	See Figure 5-1 and Table 5-1.
	Saugus	Variable	See Figures 5-2 through 5-7.
R (Kh:Kv)	Alluvium	10:1	Derived during model calibration process.
	Saugus	50:1 to 100:1	
Sy	Alluvium and Saugus outcrops	0.10	Derived during model calibration process.
Storativity	Saugus below model layer 1	5×10^{-4}	Derived during model calibration process.
Santa Clara River and Castaic Creek streambed thicknesses	Alluvium	2 feet	Assumed thickness of streambed sediments in gaining river reaches.
Santa Clara River and Castaic Creek streambed Kv	Alluvium	10 ft/day (3.5×10^{-3} cm/sec)	Derived during model calibration process.
ET extinction depth	Alluvium and Saugus	10 feet	Corresponds to typical rooting depth for phreatophytes along Santa Clara River.
Potential ET rate	Alluvium and Saugus	6 ft/yr	Estimated maximum water use by phreatophytes along Santa Clara River.

Notes:
cm/sec = centimeters per second
ET = evapotranspiration

TABLE 5-3

Residual Errors for 1980 through 1985 Steady-State Calibration Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Aquifer	Owner	Well Name	Number of Measurements	Measured Groundwater Elevation (feet msl)	Modeled Groundwater Elevation (feet msl)	Residual (Modeled - Measured) (feet)	Residual^2 (ft^2)
Alluvium	NLF	B10	5	890.70	889.51	-1.19	1.42E+00
	NLF	C5	14	940.61	945.04	4.44	1.97E+01
	NLF	E4	4	977.18	977.84	0.67	4.45E-01
	LACFCD	6995D	17	1003.04	998.75	-4.29	1.84E+01
	LACFCD	7076C	5	1037.16	1027.58	-9.58	9.18E+01
	VWC	K2	2	1113.00	1114.36	1.36	1.84E+00
	NLF	R	4	1137.50	1129.94	-7.56	5.72E+01
	VWC	T4	14	1180.20	1187.69	7.49	5.61E+01
	SCWC	Stadium	15	1186.27	1184.41	-1.86	3.44E+00
	LACFCD	7107C	51	1258.45	1256.45	-2.00	4.00E+00
	LACFCD	7127D	66	1315.83	1320.11	4.28	1.83E+01
	SCWC	N.Oaks West	45	1378.61	1373.49	-5.12	2.62E+01
	LACFCD	7158K	13	1427.48	1444.48	17.00	2.89E+02
	LACFCD	7168C	13	1464.85	1465.79	0.94	8.85E-01
	LACFCD	7178B	12	1495.78	1493.56	-2.21	4.90E+00
	SCWC	Sand Canyon	60	1504.32	1503.73	-0.59	3.47E-01
	LACFCD	7178D	12	1499.21	1509.63	10.42	1.09E+02
	LACFCD	7177P	11	1523.64	1514.99	-8.65	7.47E+01
	LACFCD	7187C	16	1526.06	1534.57	8.51	7.24E+01
	LACFCD	7197	13	1560.34	1556.41	-3.93	1.55E+01
	LACFCD	7197G	3	1577.00	1584.72	7.72	5.96E+01
	LACFCD	6993A	12	1042.95	1032.18	-10.77	1.16E+02
	LACFCD	6981D	3	1092.00	1092.24	0.24	5.66E-02
	LACFCD	6980G	10	1110.77	1107.87	-2.90	8.43E+00
	VWC	W6	5	1146.80	1139.03	-7.77	6.04E+01
	LACFCD	7066D	13	1154.92	1158.65	3.72	1.39E+01
	LACFCD	7086B	9	1227.33	1216.15	-11.19	1.25E+02
	LACFCD	7095	11	1297.96	1277.59	-20.38	4.15E+02
Saugus	LACFCD	5841	14	1114.98	1104.27	-10.71	1.15E+02
	LACFCD	5842F	13	1154.65	1111.16	-43.49	1.89E+03
	LACFCD	5851	45	1137.58	1109.08	-28.50	8.12E+02
	LACFCD	5851A	42	1140.77	1109.09	-31.68	1.00E+03
	LACFCD	5871D	13	1138.03	1117.18	-20.85	4.35E+02
	LACFCD	5873E	3	1286.67	1243.22	-43.44	1.89E+03
	LACFCD	5882	11	1251.99	1318.26	66.26	4.39E+03
	LACFCD	5912A	10	1424.13	1441.47	17.34	3.01E+02
	LACFCD	7048C	47	1110.32	1099.48	-10.84	1.17E+02
	LACFCD	7053C	9	1266.52	1267.60	1.08	1.16E+00

TABLE 5-4

Statistics of Residual Errors for 1980 through 1985 Steady-State Calibration Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Statistic	Alluvial Aquifer	Saugus Formation	Combined System	Criterion for Goal 3
Target Groundwater Elevations				
Number of Target Wells	28	10	38	---
Maximum Groundwater Elevation	1,577	1,424	1,577	---
Minimum Groundwater Elevation	891	1,110	891	---
Range in Groundwater Elevations	686	314	686	---
Statistics for Residuals				
Mean Residual	-1.19	-10.48	-3.63	As close to zero as possible
Mean Residual / Range in Groundwater Elevations	-0.2%	-3.3%	-0.5%	5%
Standard Deviation of Residuals	7.62	31.39	17.86	---
Standard Deviation of Residuals / Range in Groundwater Elevations	1.1%	10.0%	2.6%	10%
Statistics for Residual^2 Values				
Sum of Residual^2 Values	1,664	10,954	12,617	---
Average of Residual^2 Values	59	1,095	332	---
Root-Mean-Square Error (RMS)	8	33	18	10 feet for Alluvial, 25 feet for Saugus
RMS / Range in GW Elevations	1.1%	10.5%	2.7%	10%

Note:

An entry of --- means no criterion was established.

TABLE 5-5

Comparison of Modeled and Measured Horizontal Hydraulic Gradients for Multi-Port Monitoring Wells Near the San Gabriel Fault

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	MP-3	MP-2	MP-1	MP-2
Modeled Groundwater Elevation (feet)	1,225.52	1,092.02	1,084.78	1,092.02
Measured Groundwater Elevation (feet)	1,304.46	1,074.28	1,066.99	1,074.28
Residual Error (feet)	-78.94	17.74	17.79	17.74
Easting (feet)	6,406,801	6,405,215	6,399,944	6,405,215
Northing (feet)	1,971,284	1,968,850	1,970,850	1,968,850
Distance Between Wells		2,905.13		5,637.68
Difference in Modeled Groundwater Elevations		133.50		-7.24
Difference in Measured Groundwater Elevations		230.18		-7.29
Modeled Horizontal Gradient		-4.60E-02		1.28E-03
Measured Horizontal Gradient		-7.92E-02		1.29E-03
Modeled Gradient / Measured Gradient		0.58		0.99

Notes:

Wells MP-1 and MP-2 are located on the west (downthrown) side of the fault.

Well MP-3 is located on the east (upthrown) side of the fault.

Measured groundwater elevations are the average of measurements from January through July of 2003.

Wells MP-1 and MP-2 are in model layer 4; well MP-3 is in model layer 2.

TABLE 5-6

Groundwater Budget for 1980 through 1985 Steady-State Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Total Recharge	**AF/yr**	**Percent**
Rainfall	35,000	44.8
Streams	38,200	48.8
Irrigation	3,300	4.2
Subsurface Inflow (Castaic)	1,700	2.2
Total	**78,200**	**100.0**

Total Discharge	**AF/yr**	**Percent**
Discharge to Santa Clara River	28,600	36.6
Evapotranspiration	12,000	15.3
Subsurface Outflow	6,600	8.4
Pumping	31,000	39.6
Total	**78,200**	**100.0**

TABLE 5-7

Annual Water Budgets Calculated by the Calibrated Regional Model for 1980 through 1999

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Castaic Dam Underflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
1980 to 1981	41,003	3,375	43,226	1,705	89,310	35,542	30,507	15,387	6,691	88,128	1,181	1,181
1981 to 1982	12,102	3,871	13,148	1,700	30,821	35,209	22,304	9,214	6,641	73,368	-42,547	-41,365
1982 to 1983	52,415	3,022	35,134	1,700	92,270	24,918	25,583	11,157	6,695	68,353	23,917	-17,448
1983 to 1984	183,342	2,657	79,681	1,700	267,380	23,169	51,128	26,020	7,017	107,333	160,047	142,598
1984 to 1985	1,316	3,606	10,714	1,705	17,341	30,645	32,258	19,609	6,647	89,158	-71,817	70,781
1985 to 1986	2	3,279	9,082	1,700	14,063	28,963	25,369	10,629	6,572	71,533	-57,470	13,311
1986 to 1987	43,258	3,211	26,471	1,700	74,641	28,658	27,557	12,354	6,668	75,236	-595	12,716
1987 to 1988	11,915	2,991	9,694	1,700	26,299	27,085	24,434	8,601	6,566	66,686	-40,386	-27,670
1988 to 1989	27,949	3,075	17,106	1,705	49,835	27,571	23,518	8,752	6,613	66,454	-16,619	-44,289
1989 to 1990	0	3,393	7,899	1,700	12,993	30,415	21,004	6,676	6,520	64,614	-51,621	-95,911
1990 to 1991	0	3,787	9,092	1,700	14,579	31,652	18,151	4,711	6,530	61,043	-46,464	-142,375
1991 to 1992	51,315	3,397	28,933	1,700	85,345	41,067	19,924	6,963	6,647	74,600	10,745	-131,630
1992 to 1993	131,293	3,850	60,449	1,705	197,296	37,567	27,043	14,114	6,906	85,629	111,666	-19,964
1993 to 1994	113,547	3,773	64,341	1,700	183,361	39,741	34,976	22,598	6,875	104,191	79,170	59,207
1994 to 1995	813	4,415	13,436	1,700	20,365	44,120	21,612	12,839	6,586	85,157	-64,793	-5,586
1995 to 1996	114,663	4,517	60,647	1,700	181,527	42,009	32,426	21,314	6,887	102,637	78,890	73,305
1996 to 1997	46,312	5,205	30,512	1,705	83,734	45,574	25,888	17,092	6,762	95,317	-11,583	61,721
1997 to 1998	17,485	5,267	16,277	1,700	40,729	47,051	21,488	12,791	6,667	87,997	-47,268	14,453
1998 to 1999	138,991	4,758	90,634	1,700	236,084	42,043	41,283	26,213	6,959	116,498	119,585	134,039
1999 to 2000	26	5,343	13,714	1,700	20,783	46,867	24,335	15,943	6,607	93,752	-72,969	61,070
Minimum	0	2,657	7,899	1,700	12,993	23,169	18,151	4,711	6,520	61,043	-72,969	-142,375
Maximum	183,342	5,343	90,634	1,705	267,380	47,051	51,128	26,213	7,017	116,498	160,047	142,598
Average	49,387	3,840	32,010	1,701	86,938	35,493	27,539	14,149	6,703	83,884	3,053	5,907
Median	34,476	3,689	21,789	1,700	62,238	35,376	25,476	12,815	6,657	85,393	-14,101	6,949

Note:

All flow volumes are listed in AF/yr.

Figures

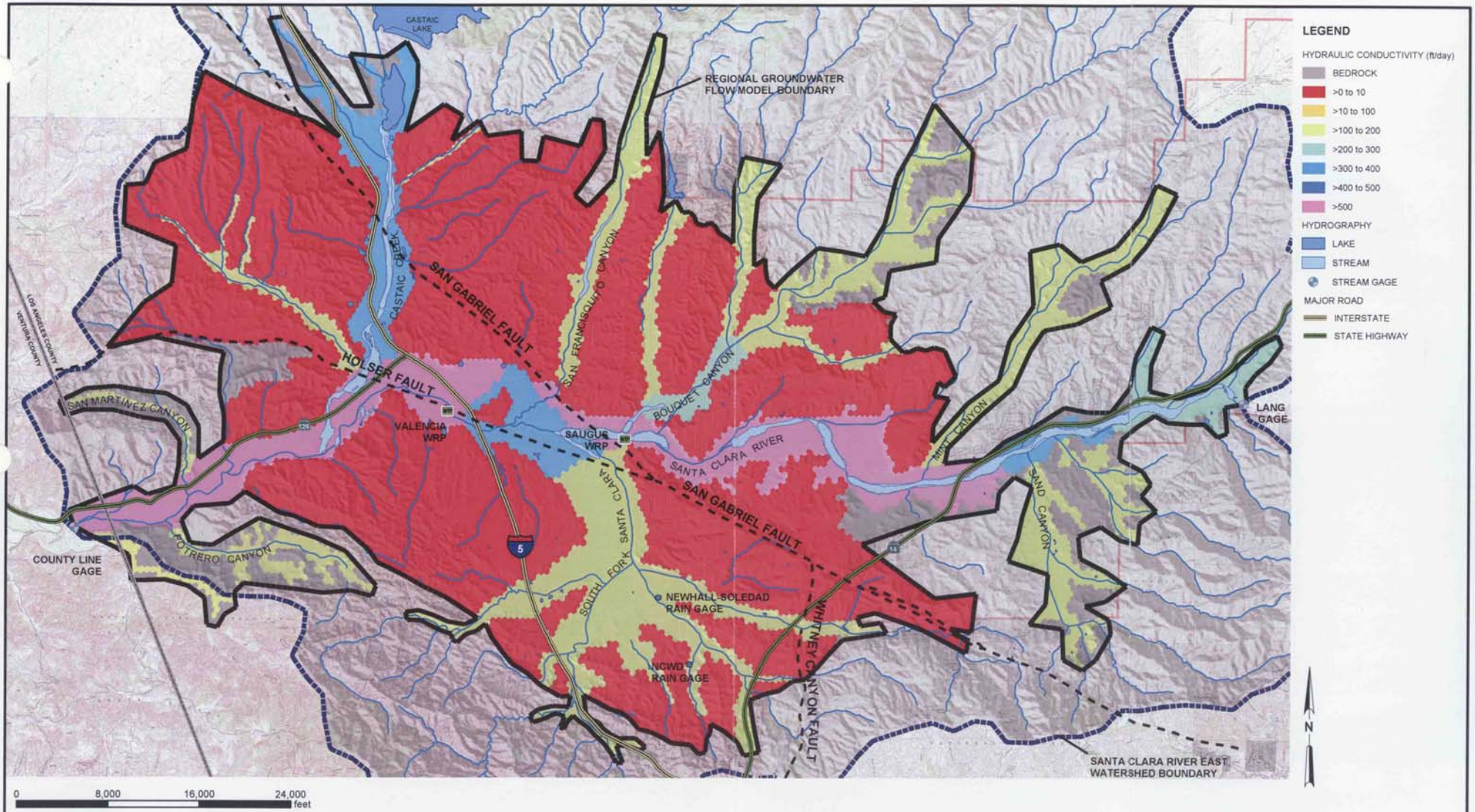

FIGURE 5-1
HYDRAULIC CONDUCTIVITY LAYER 1
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG036.MXD FIG05-01.PDF 01/28/2004 19:28:25

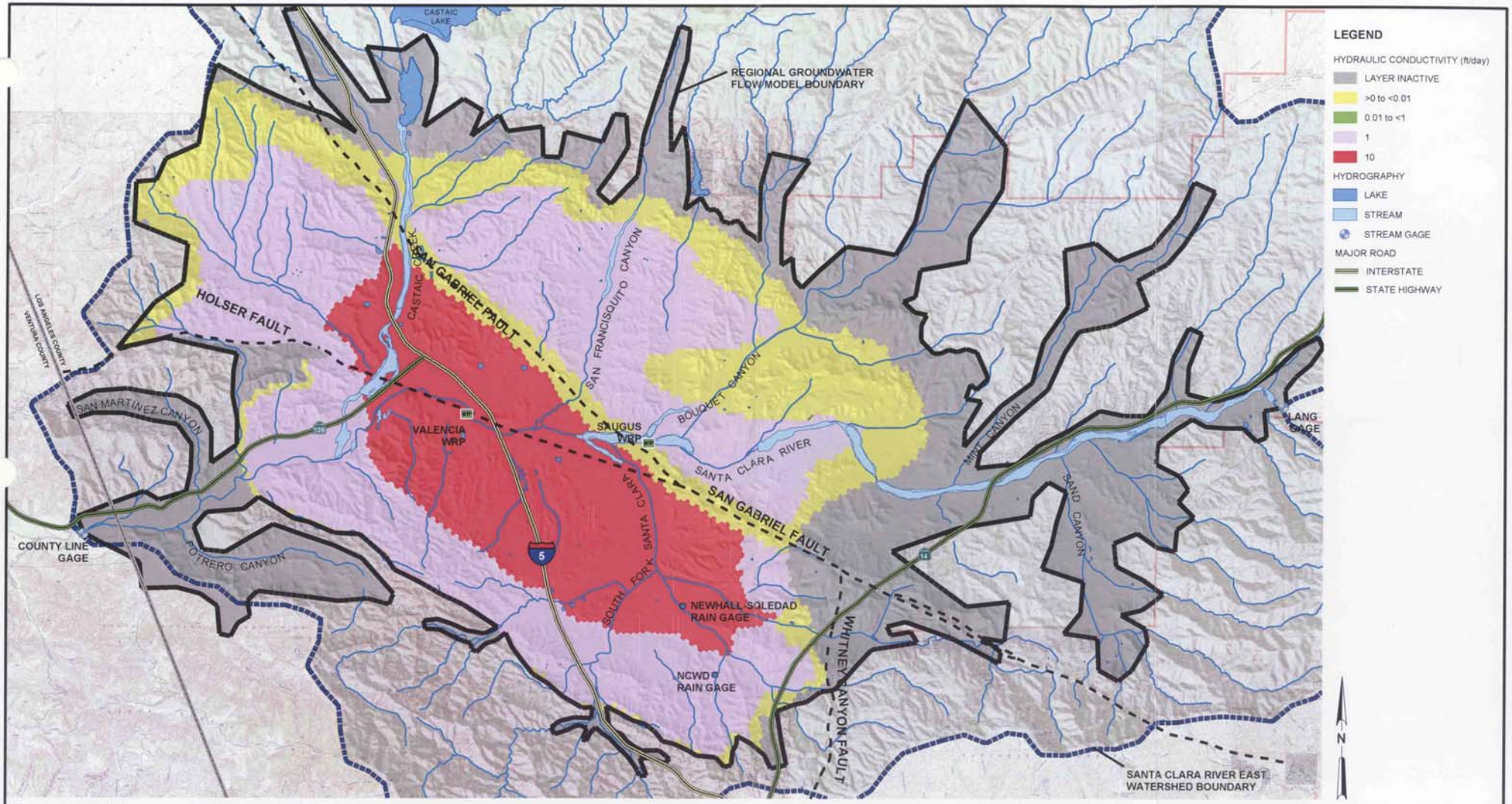

FIGURE 5-2
HYDRAULIC CONDUCTIVITY LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG037.MXD FIG05-02.PDF 01/22/2004 17:55:45

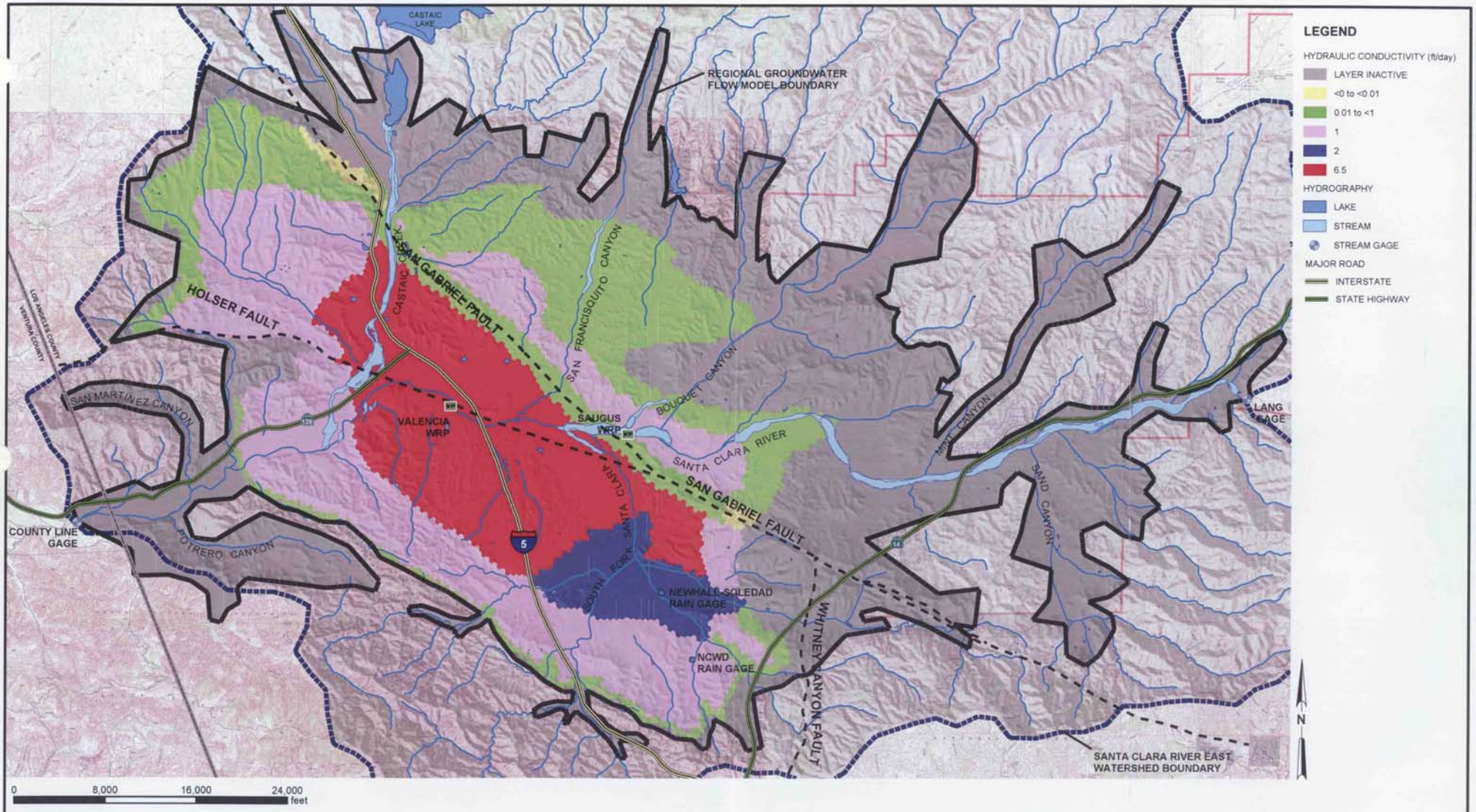

FIGURE 5-3
HYDRAULIC CONDUCTIVITY LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG039.MXD FIG05-03.PDF 01/22/2004 18:08:34

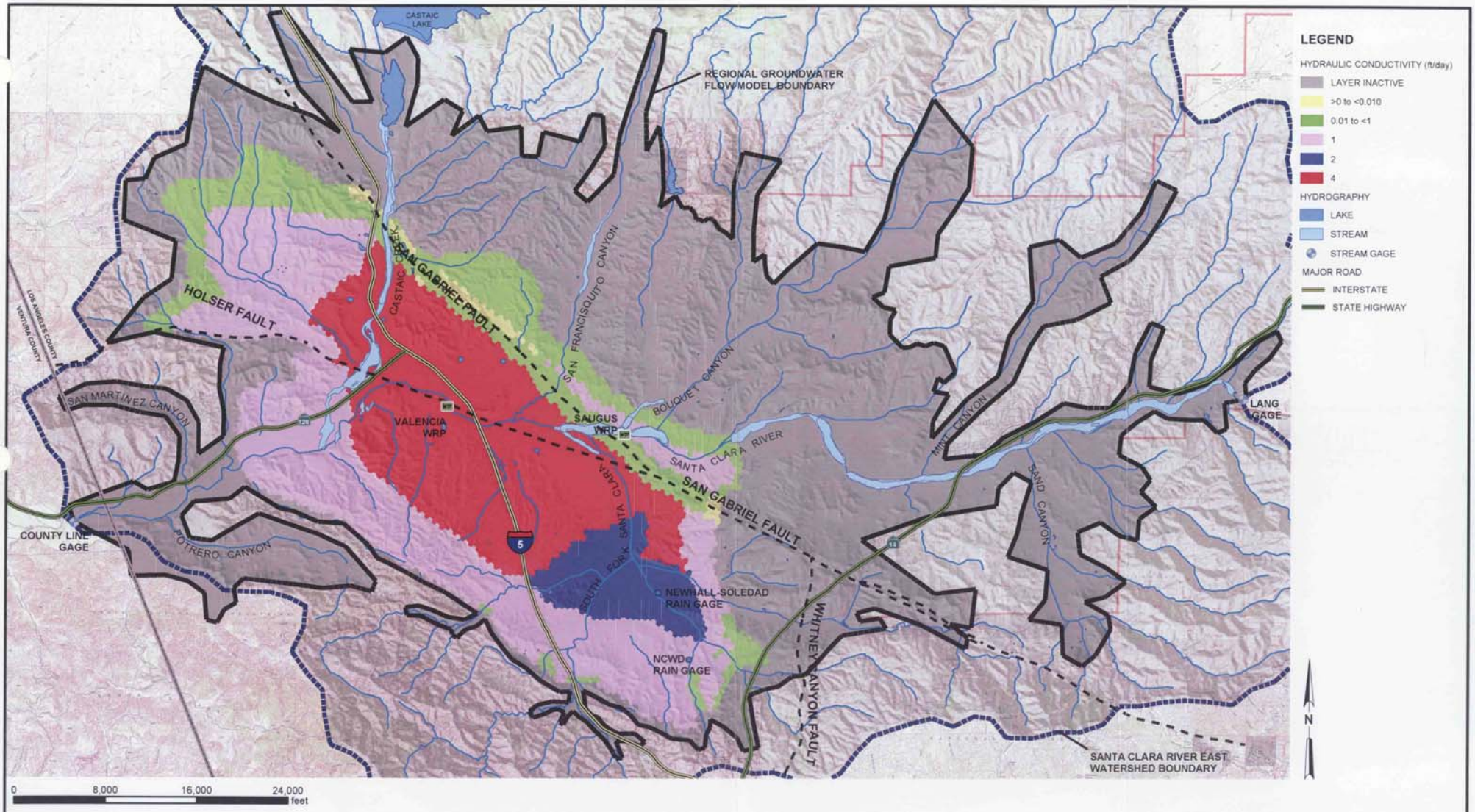

FIGURE 5-4
HYDRAULIC CONDUCTIVITY LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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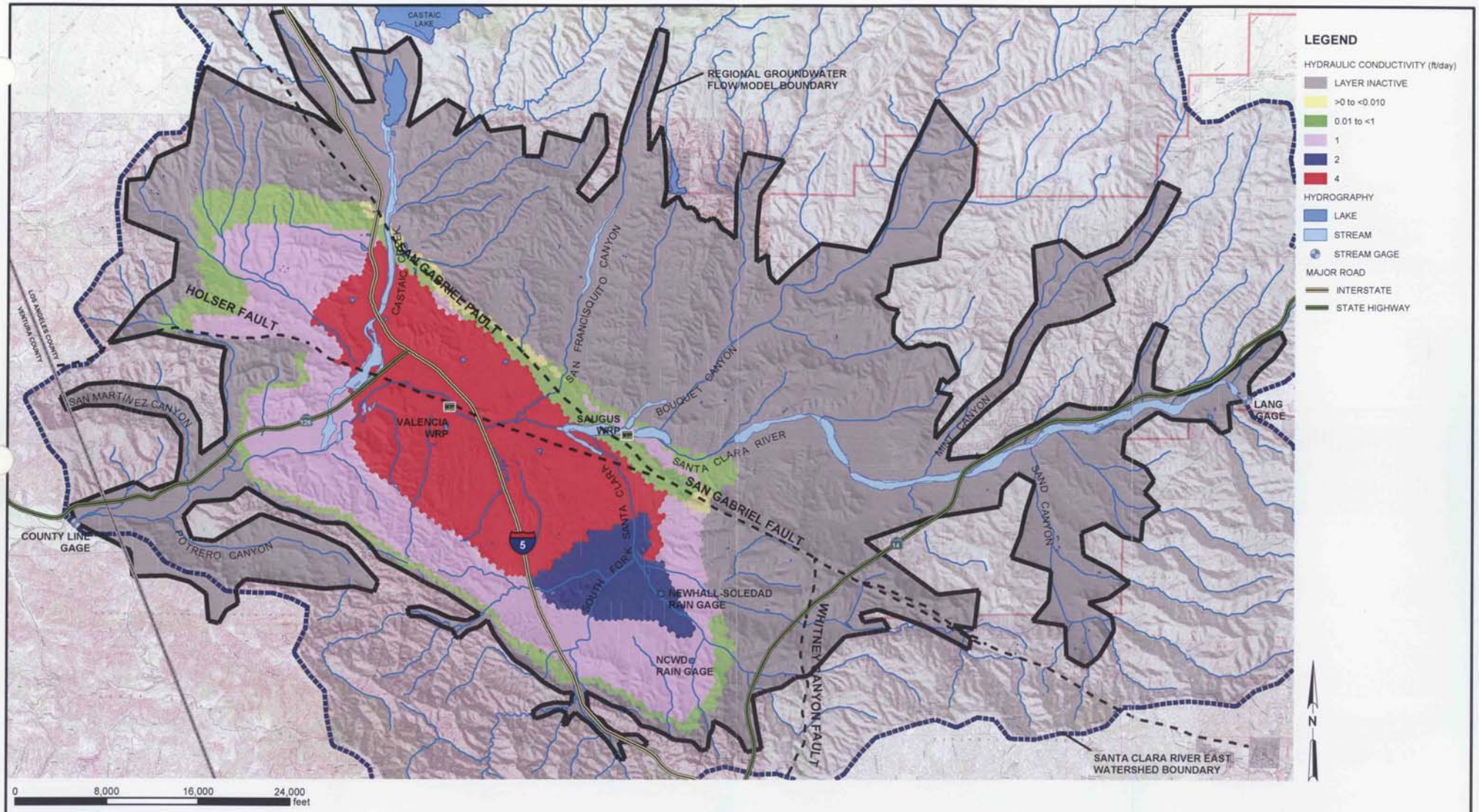

FIGURE 5-5
HYDRAULIC CONDUCTIVITY LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG041.MXD FIG05-05.PDF 01/22/2004 18:16:22

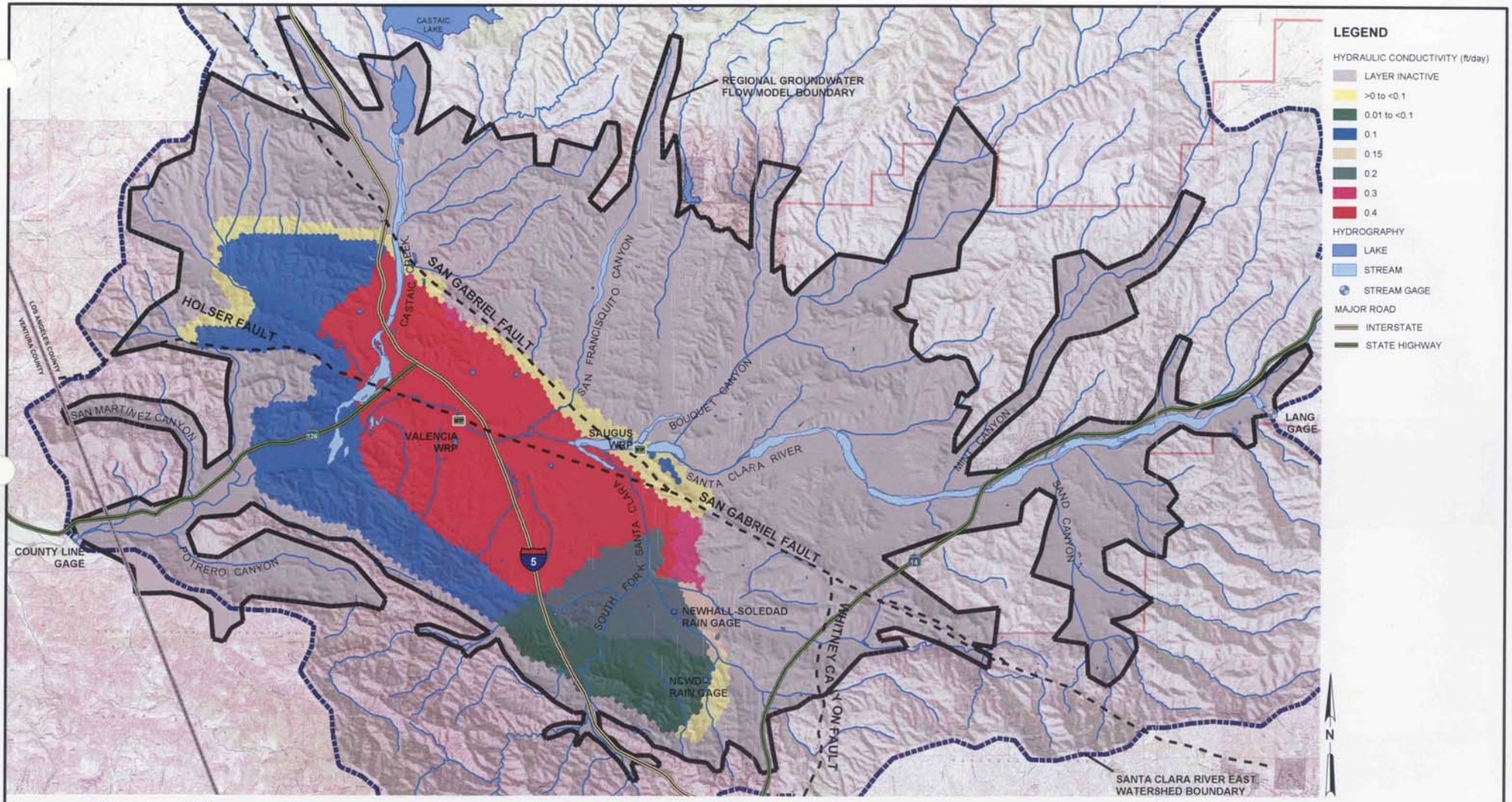

FIGURE 5-6
HYDRAULIC CONDUCTIVITY LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG038_.MXD FIG05-06.PDF 01/22/2004 18:47:29

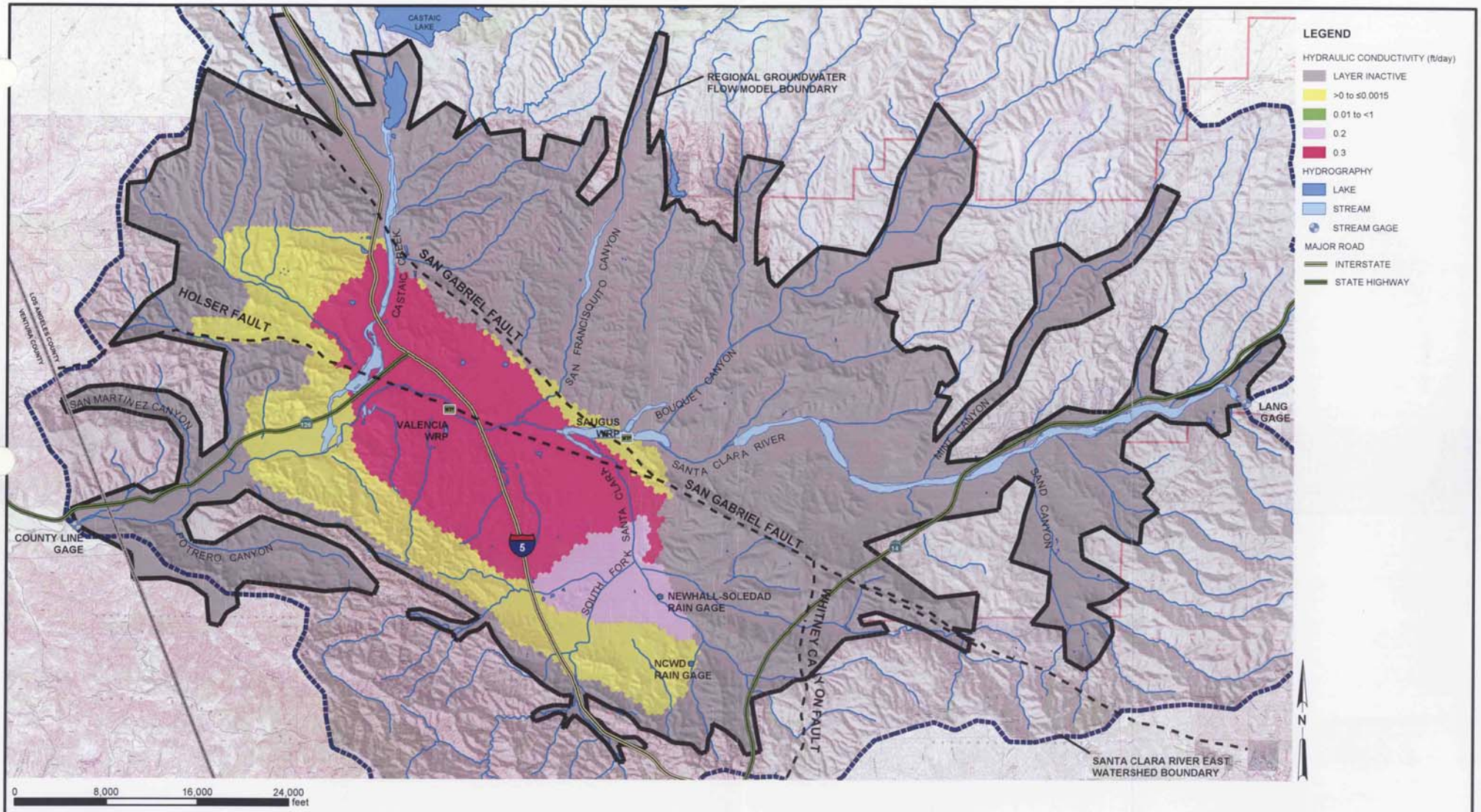

FIGURE 5-7
HYDRAULIC CONDUCTIVITY LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG042.MXD FIG05-07.PDF 01/22/2004 18:22:27

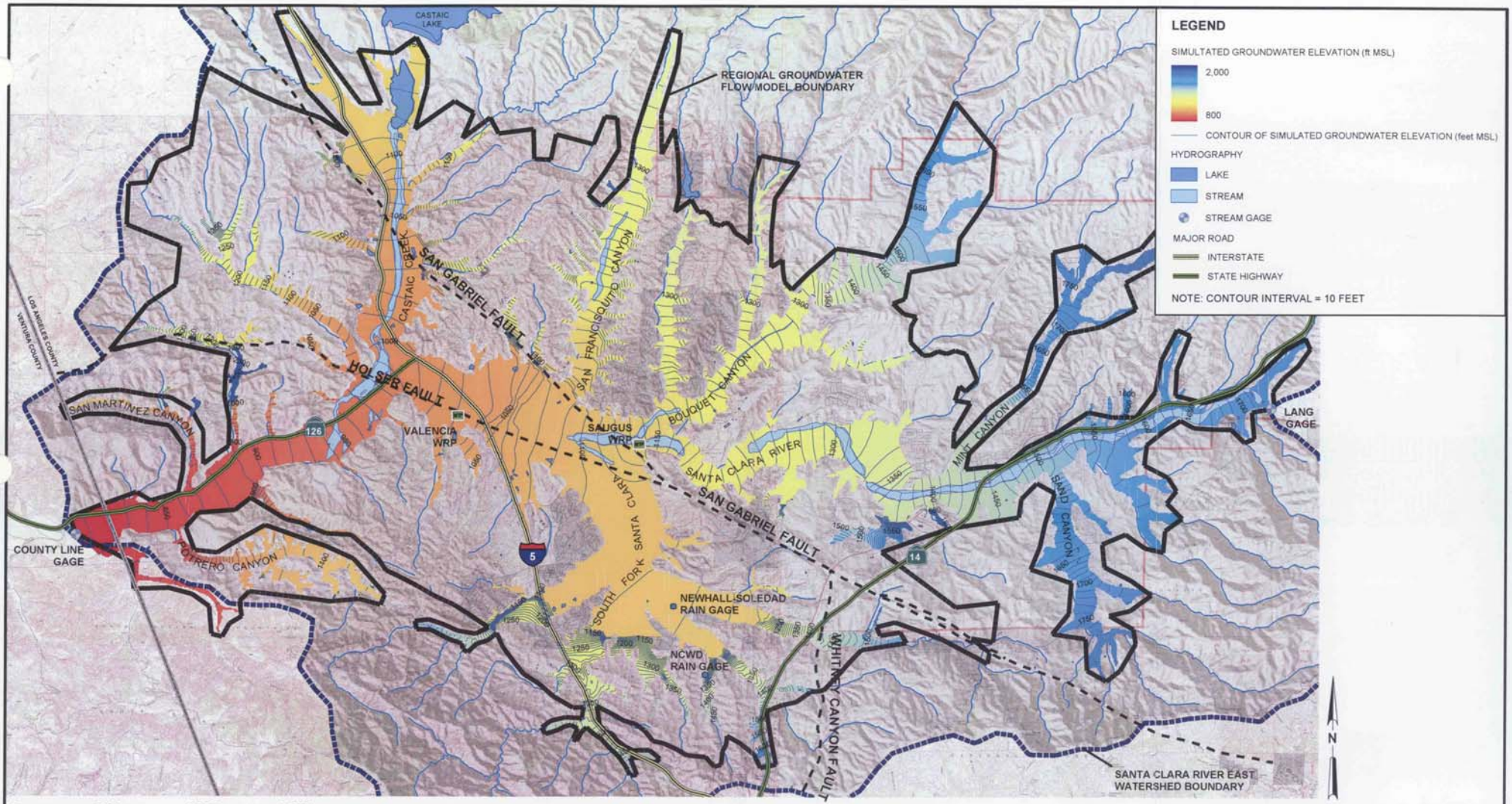

FIGURE 5-8
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR ALLUVIAL AQUIFER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG052.MXD FIG05-8.PDF 02/03/2004 08:46:47

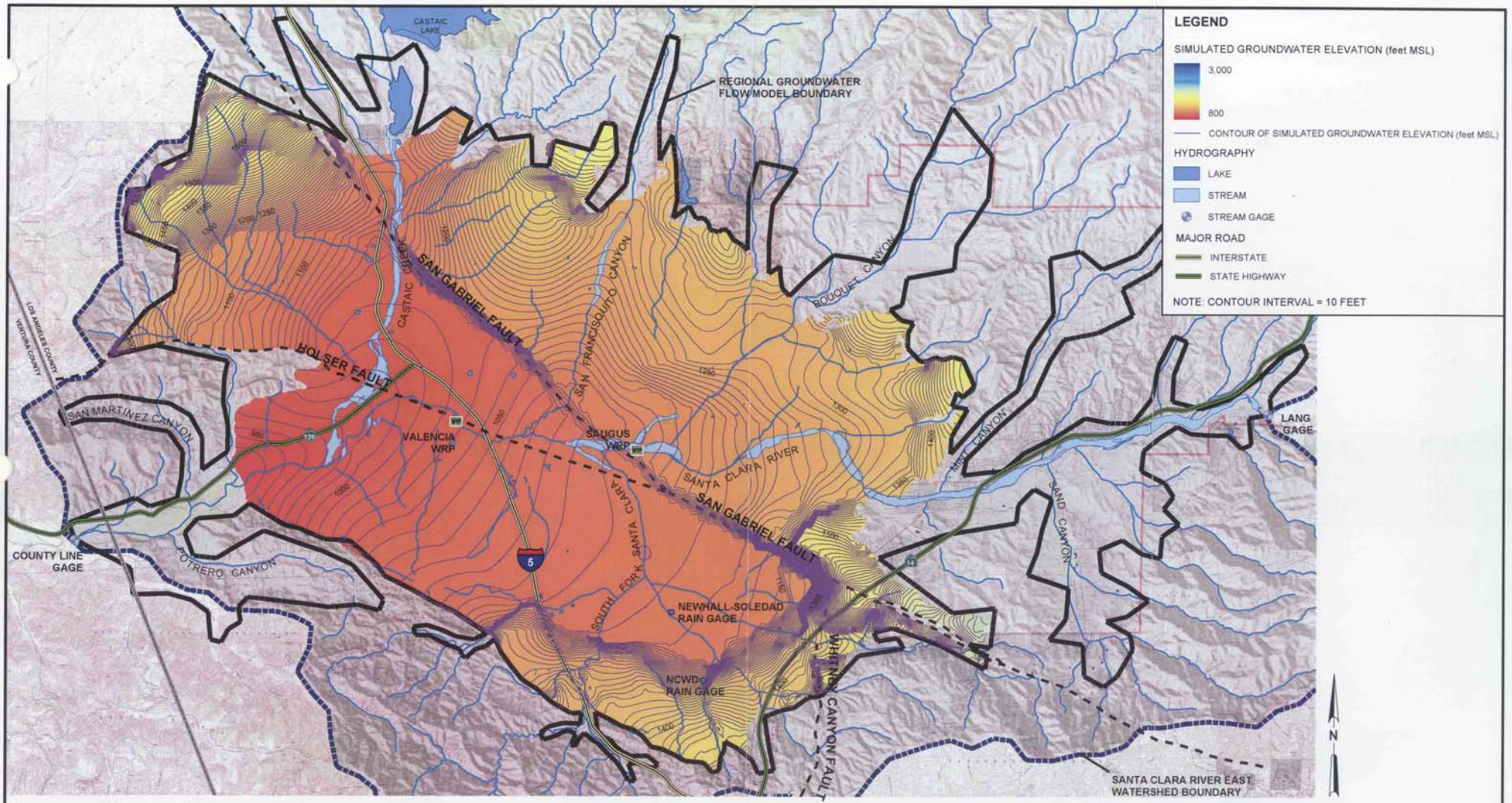

FIGURE 5-9
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG046.MXD FIG05-9.PDF 02/02/2004 10:58:01

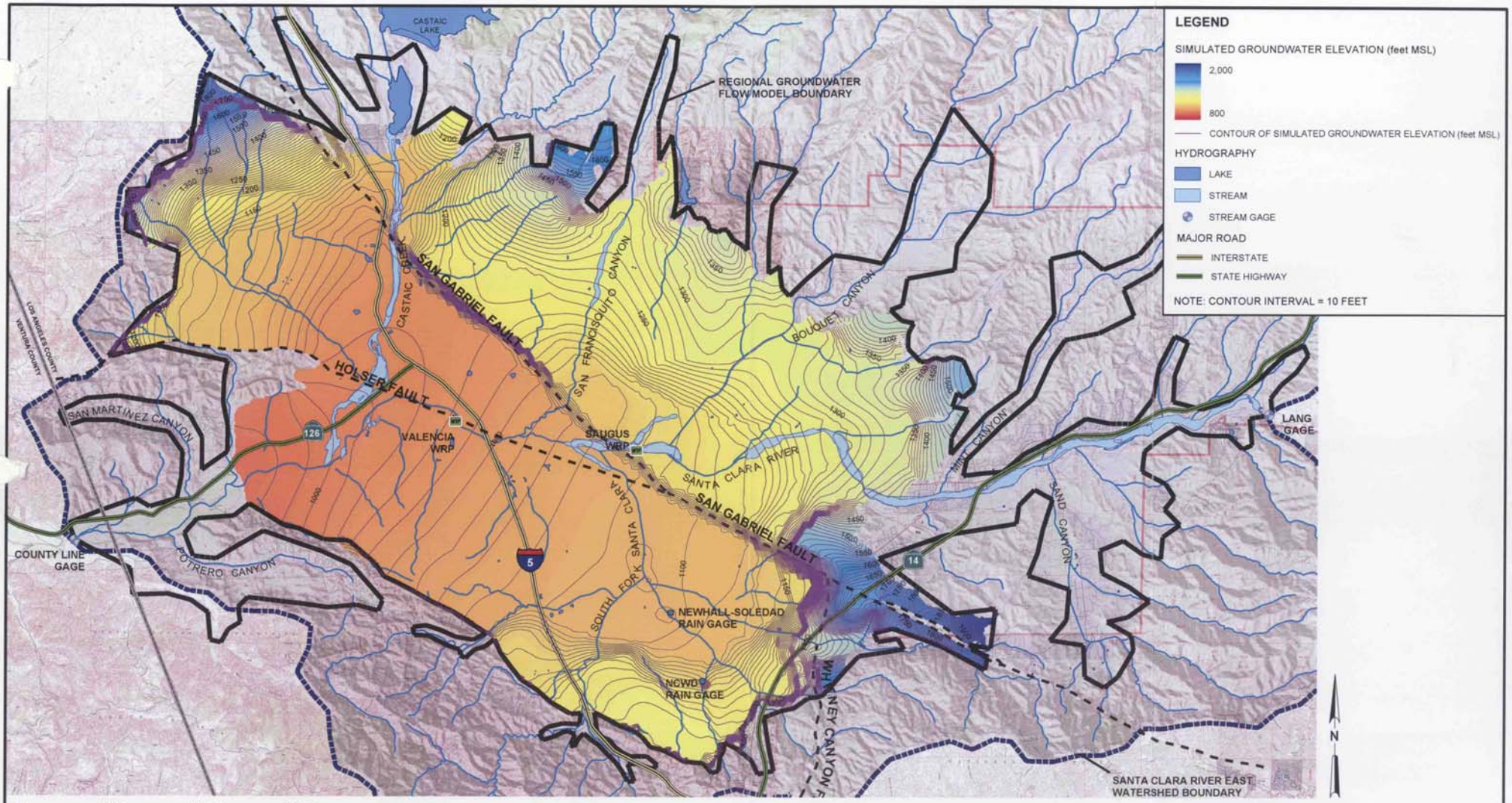

FIGURE 5-10
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG045.MXD FIG05-10.PDF 02/02/2004 10:42:32

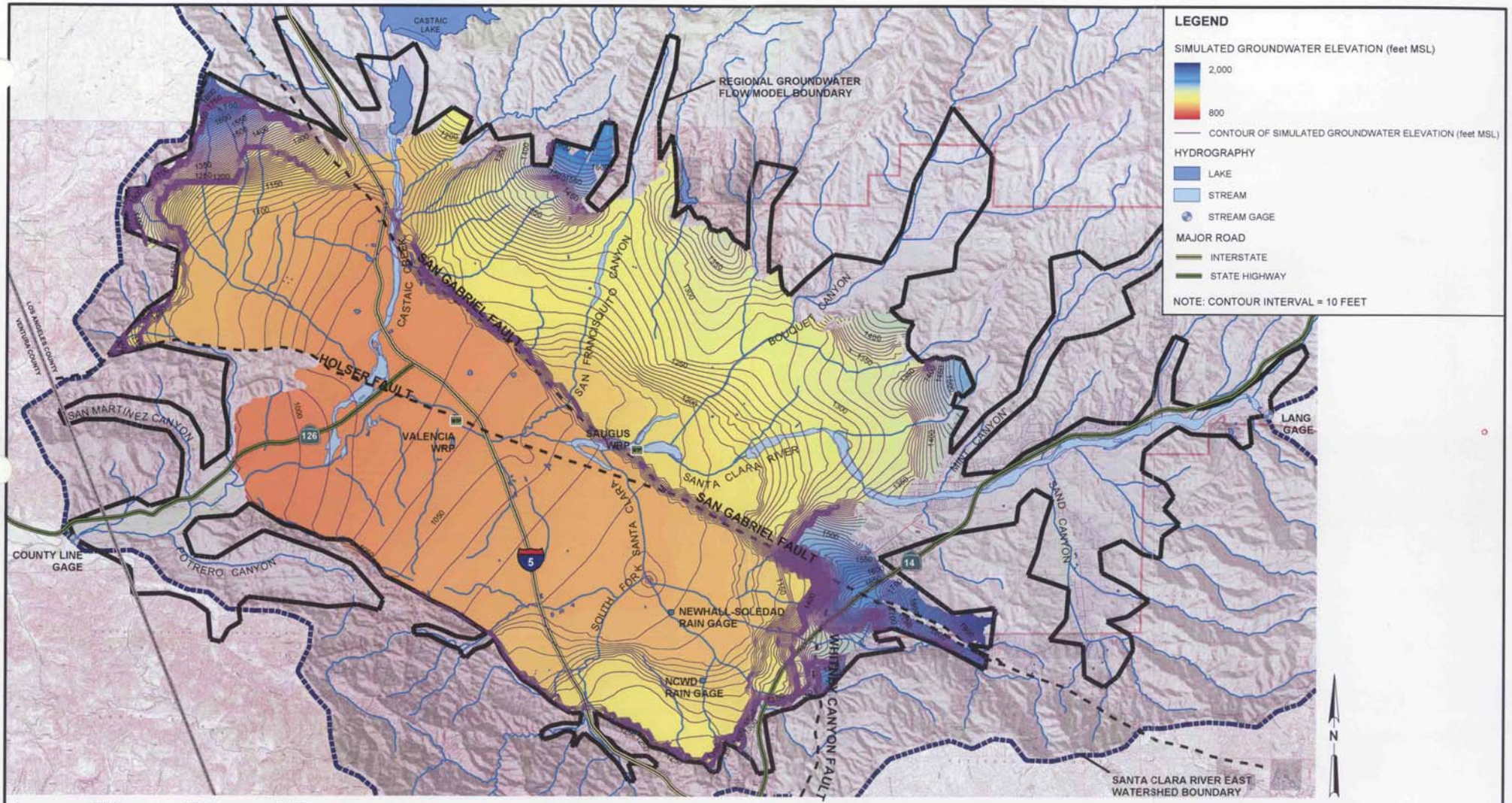

FIGURE 5-11
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG047.MXD FIG05-11.PDF 02/02/2004 10:07:23

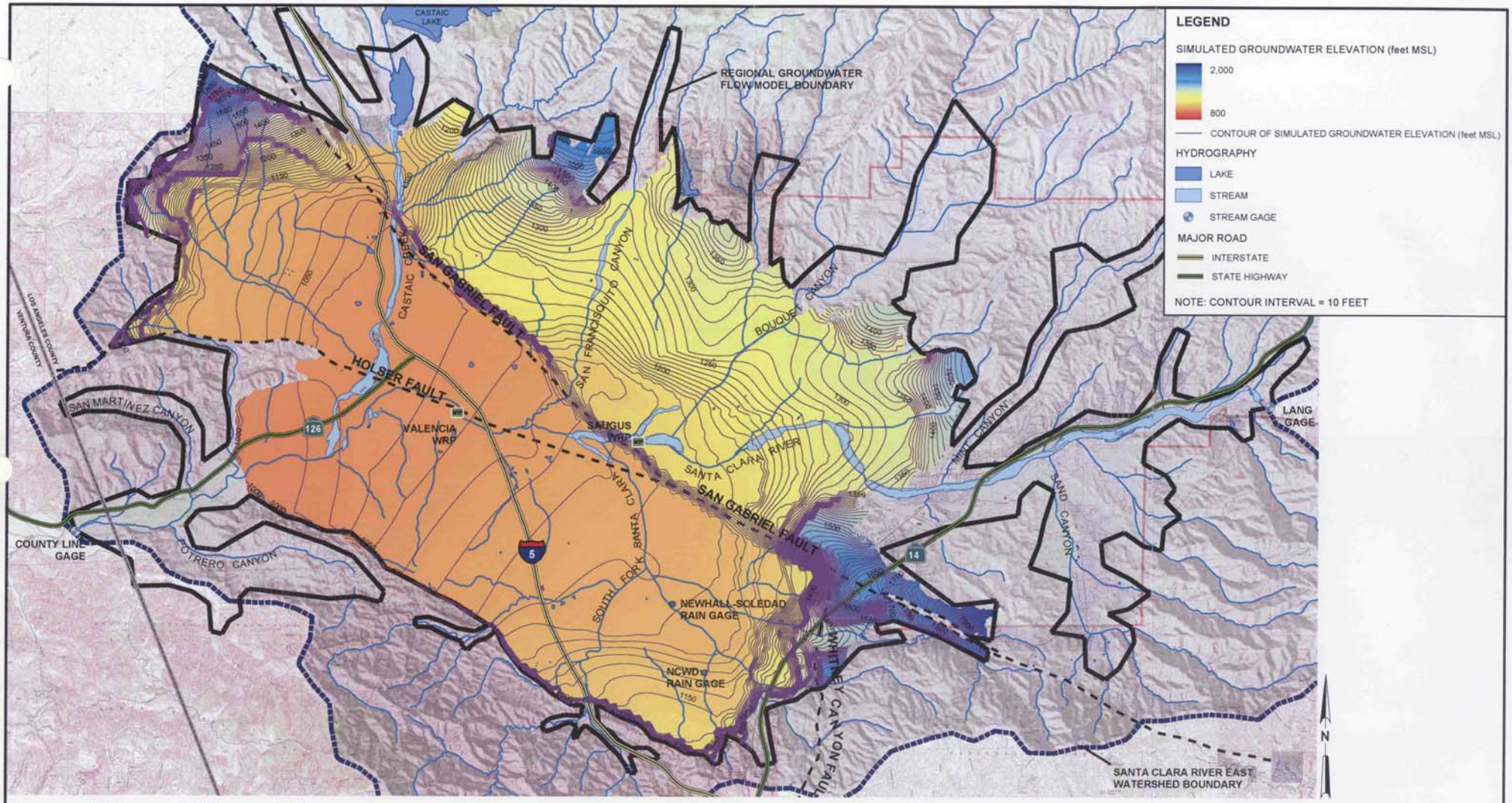

FIGURE 5-12
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG048.MXD FIG05-12.PDF 02/02/2004 11:04:46

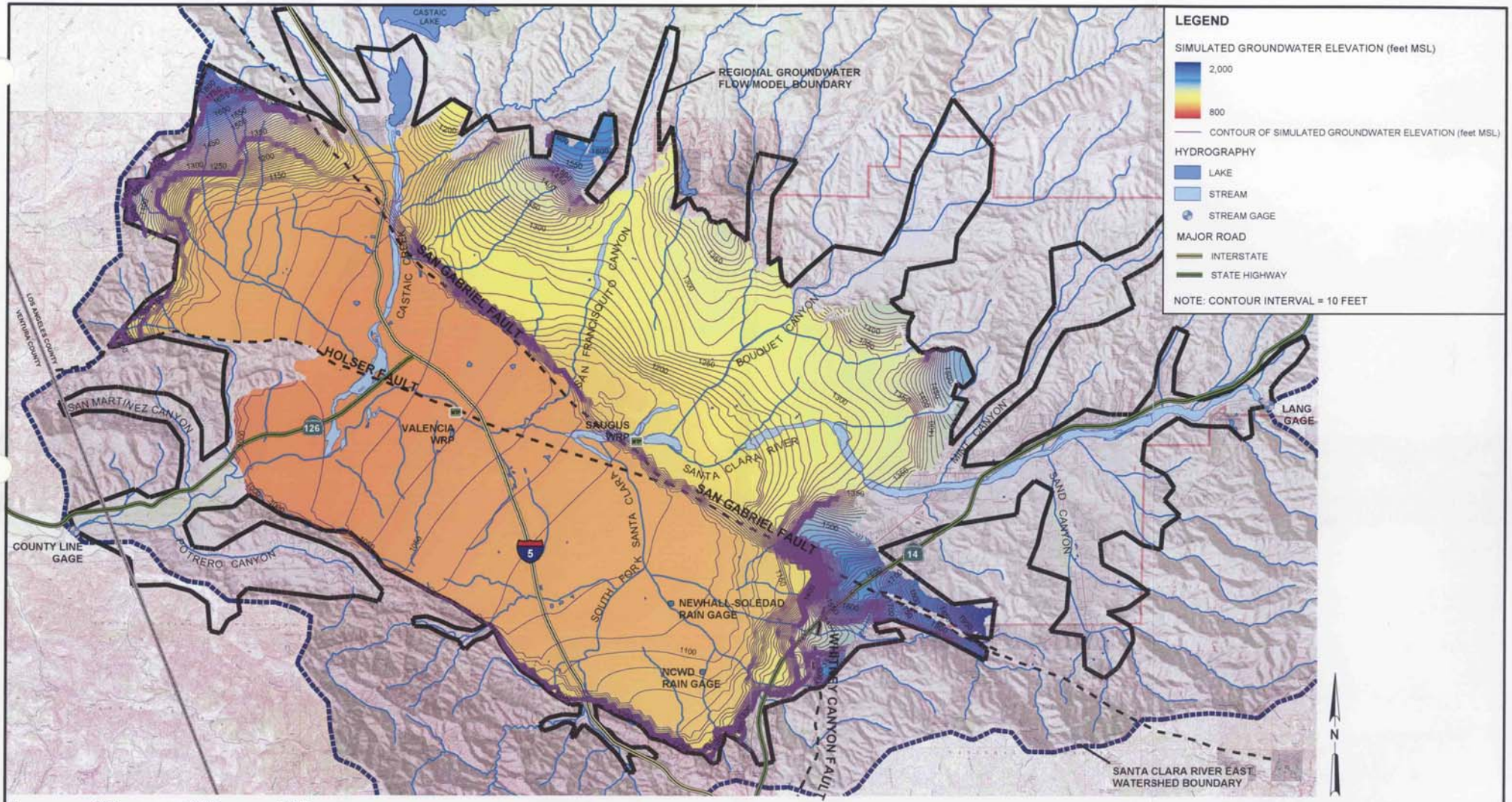

FIGURE 5-13
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG051.MXD FIG05-13.PDF 02/02/2004 11:11:08

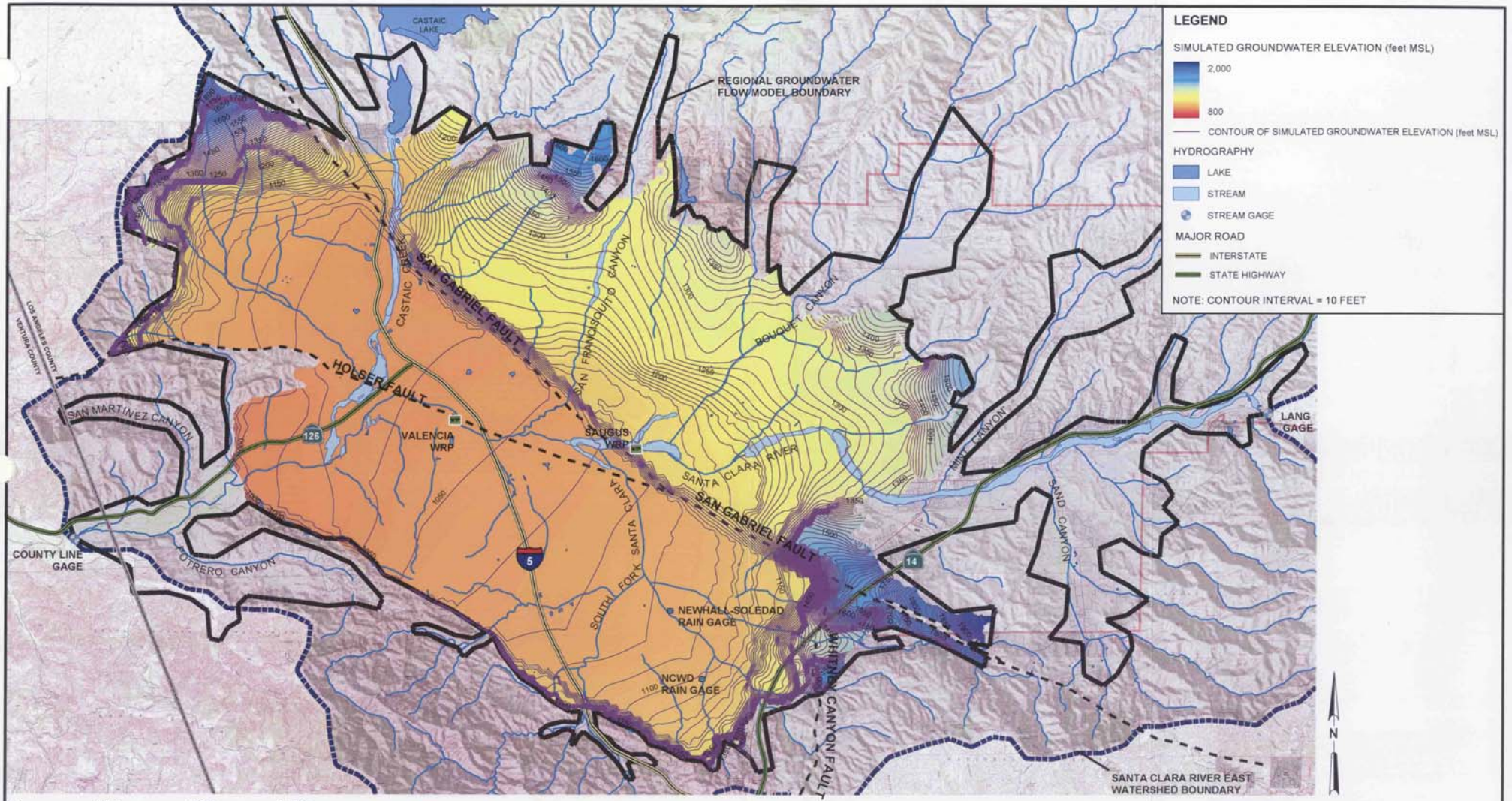

FIGURE 5-14
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG050.MXD FIG05-14.PDF 02/02/2004 11:18:17

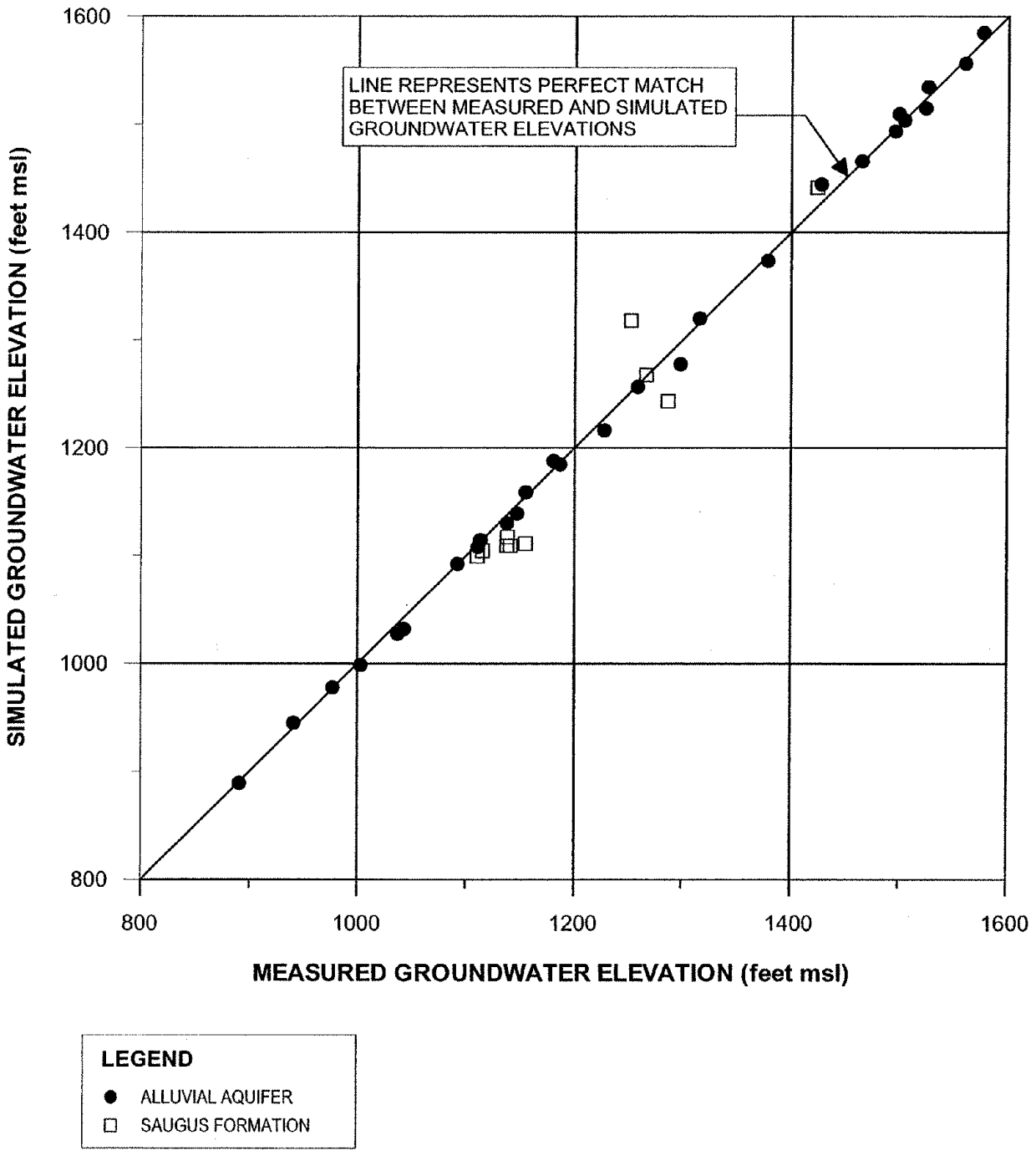

FIGURE 5-15
SIMULATED VERSUS MEASURED GROUNDWATER ELEVATIONS FOR THE STEADY-STATE MODEL
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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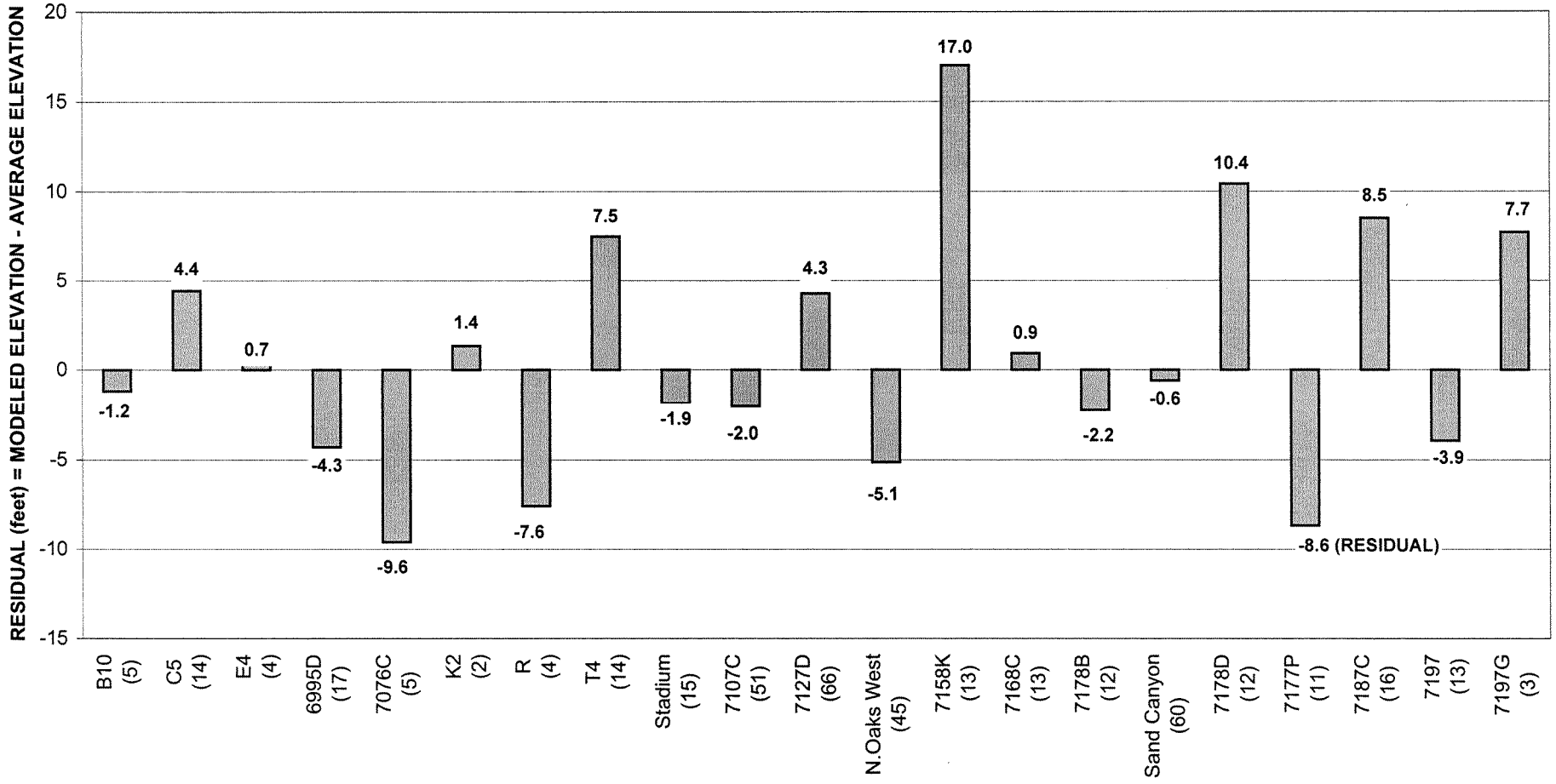

FIGURE 5-16
STEADY-STATE MODEL ERROR FOR ALLUVIAL AQUIFER TARGET WELLS ALONG THE SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

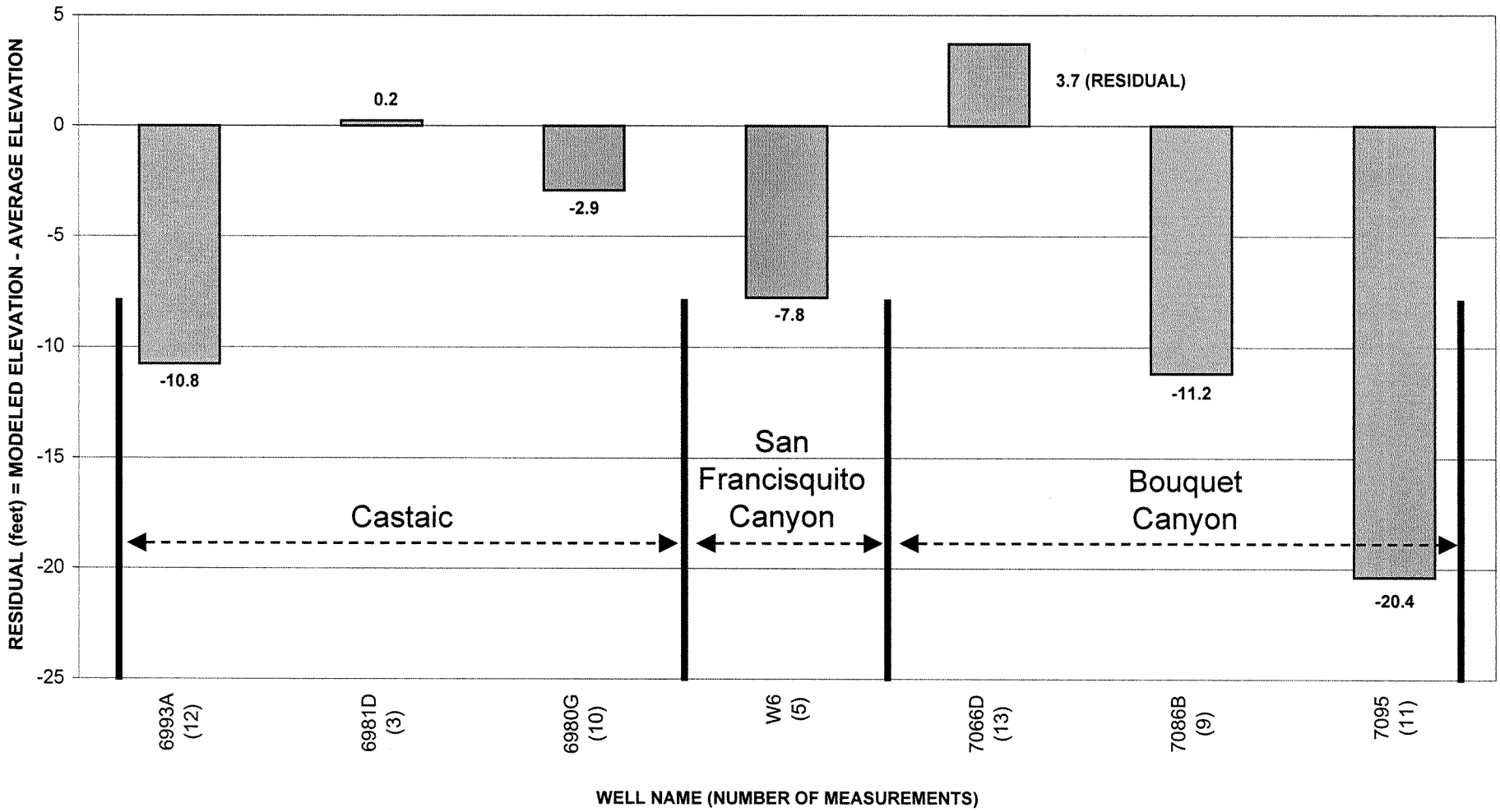

FIGURE 5-17
STEADY-STATE MODEL ERROR FOR ALLUVIAL AQUIFER TARGET WELLS AWAY FROM THE SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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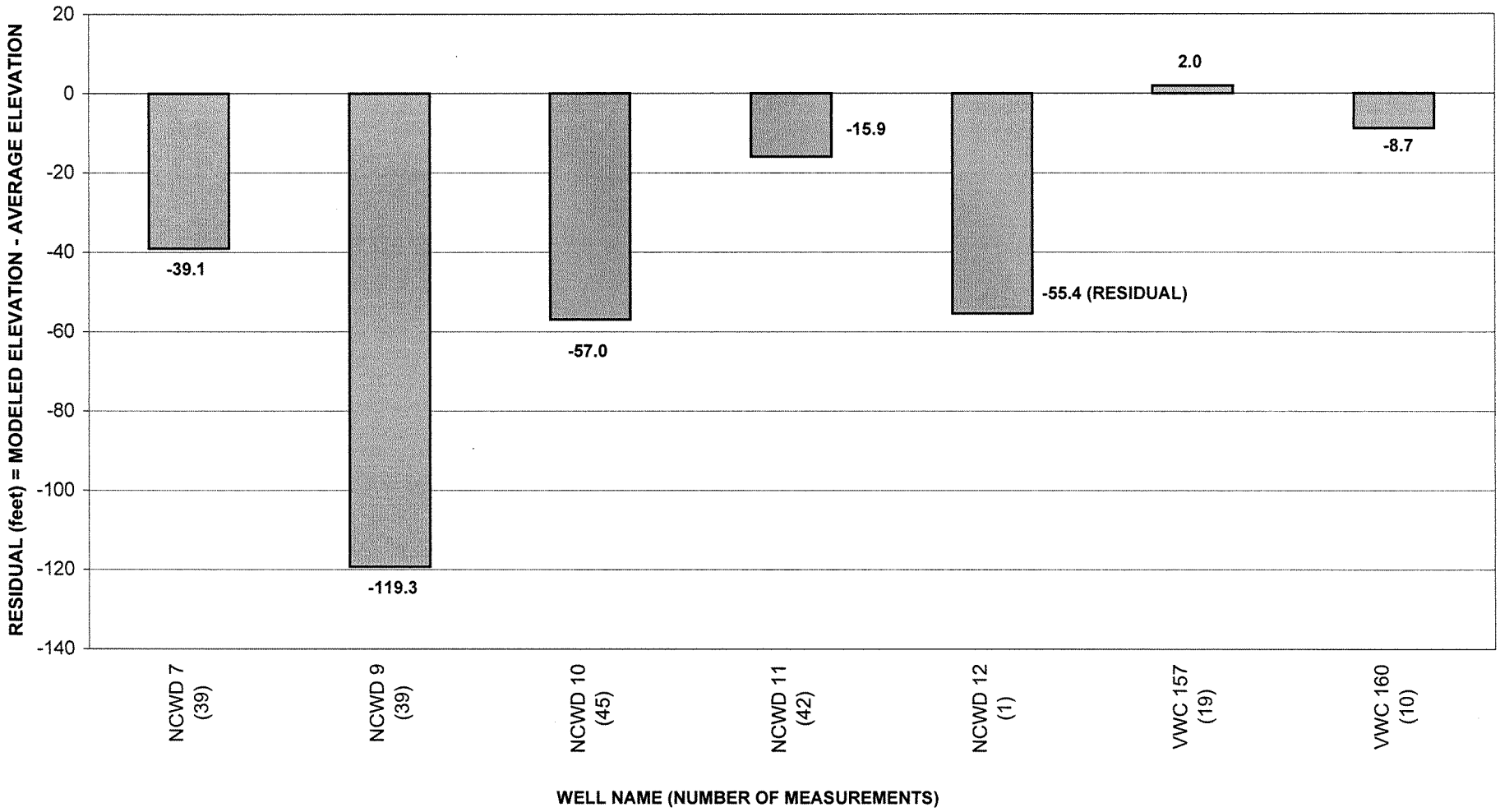
178973-403.xls/Fig 5-17



NOTE:
ALL WELLS SHOWN ON THIS PLOT ARE LOCATED IN THE SOUTH FORK SANTA CLARA RIVER VALLEY

FIGURE 5-18
STEADY-STATE MODEL ERROR FOR SAUGUS FORMATION PRODUCTION WELLS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

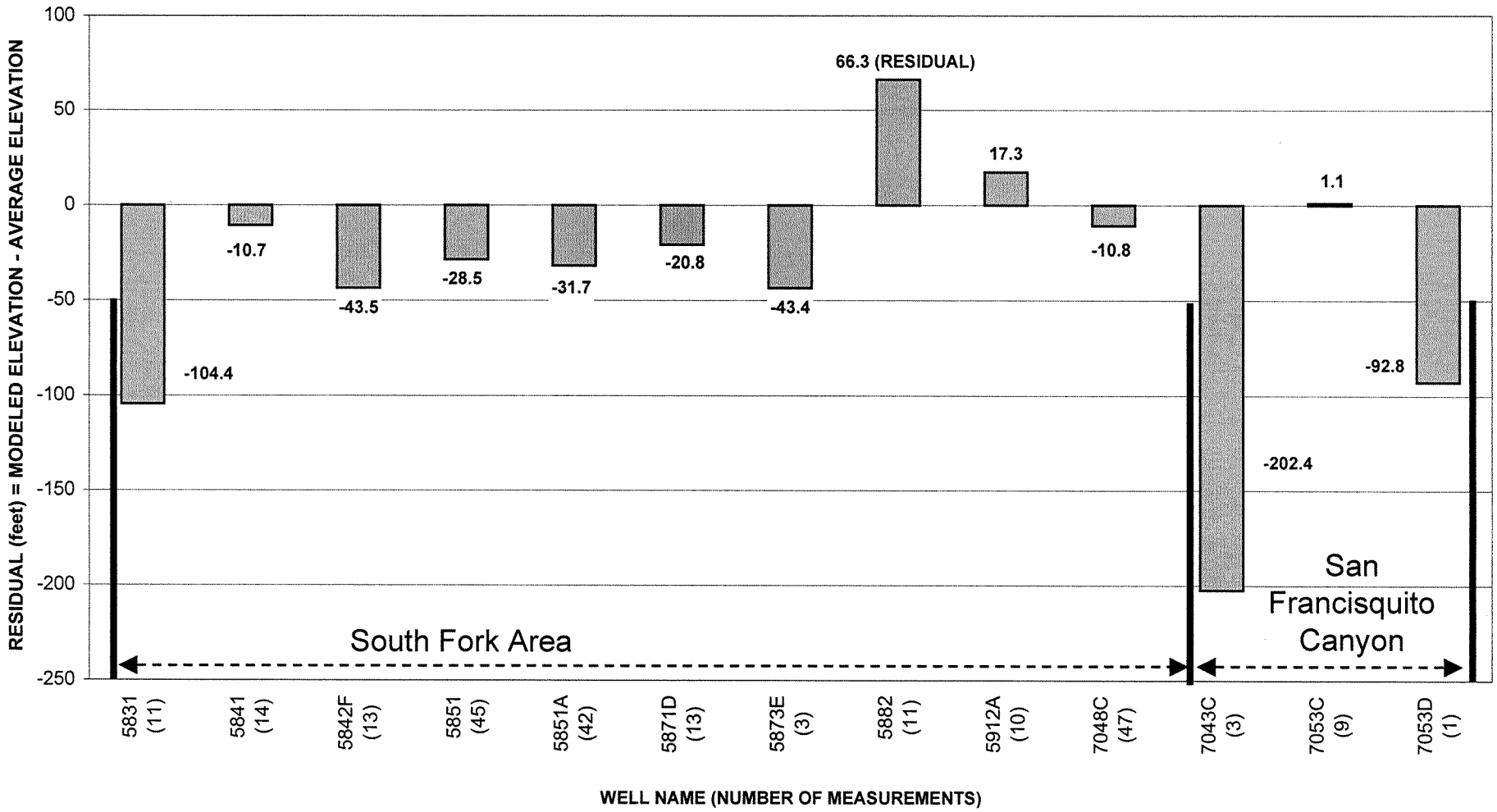


FIGURE 5-19
STEADY-STATE MODEL ERROR FOR SAUGUS FORMATION OBSERVATION WELLS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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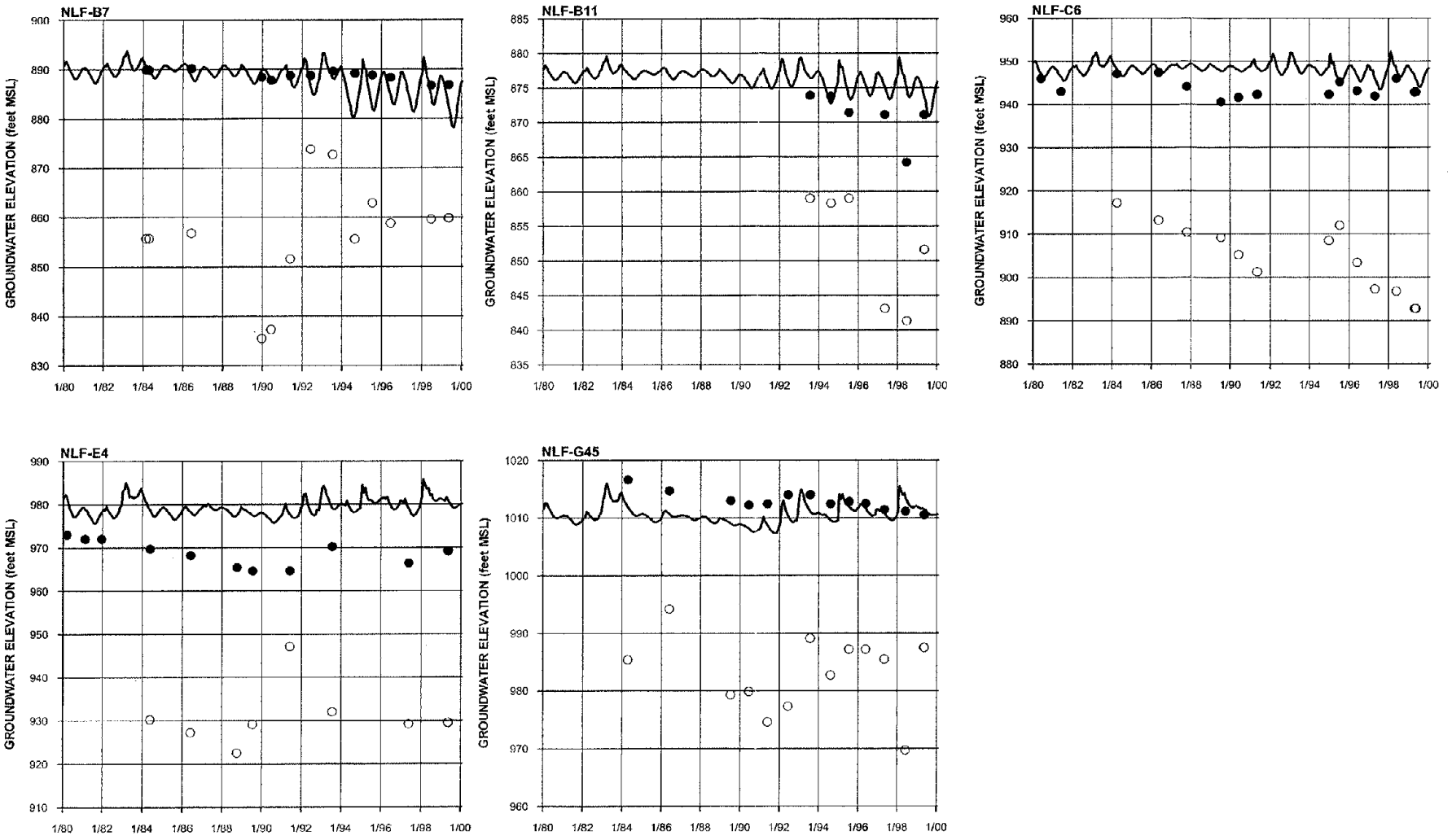

NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

FIGURE 5-20
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS WEST OF INTERSTATE 5
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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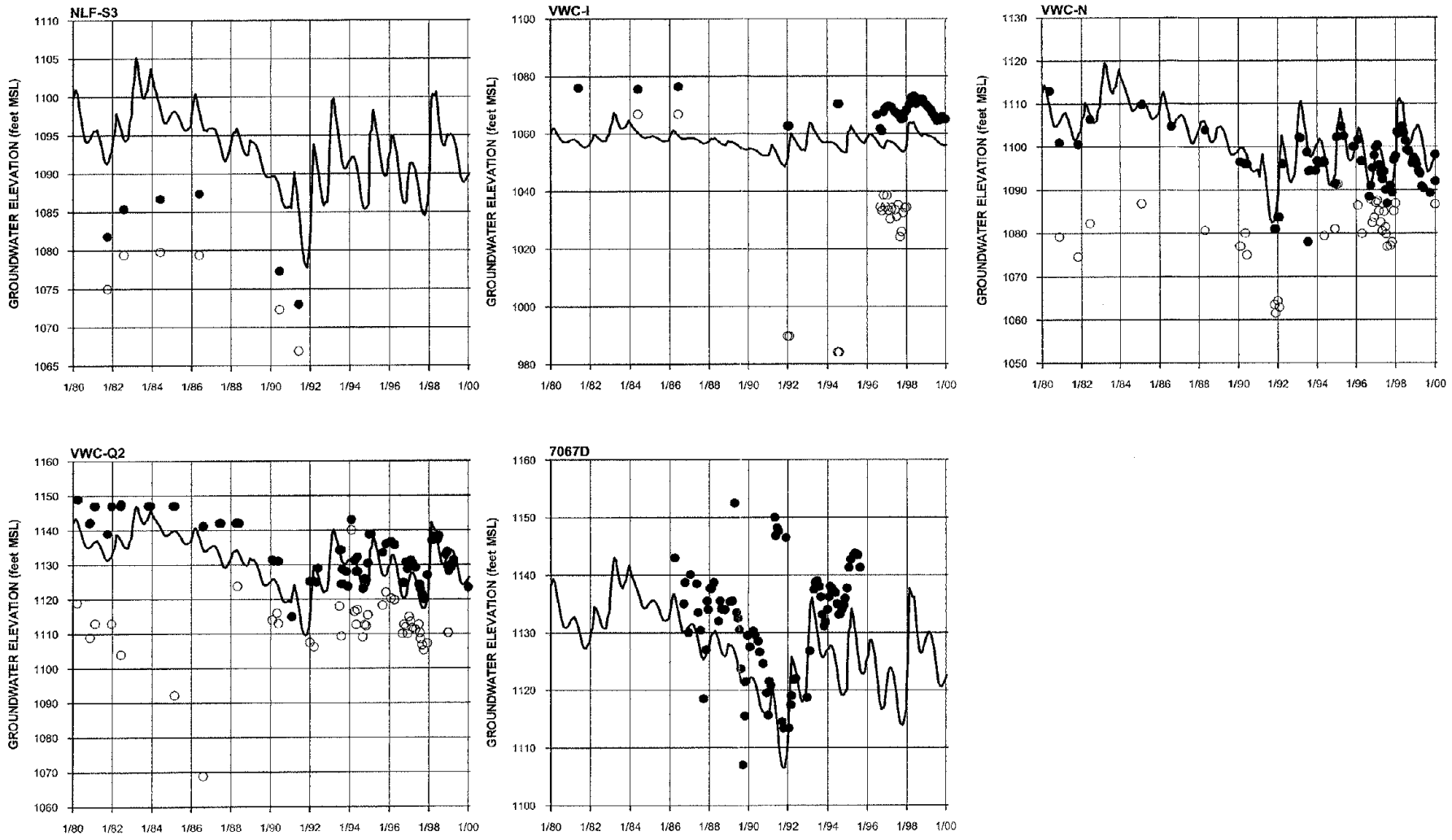


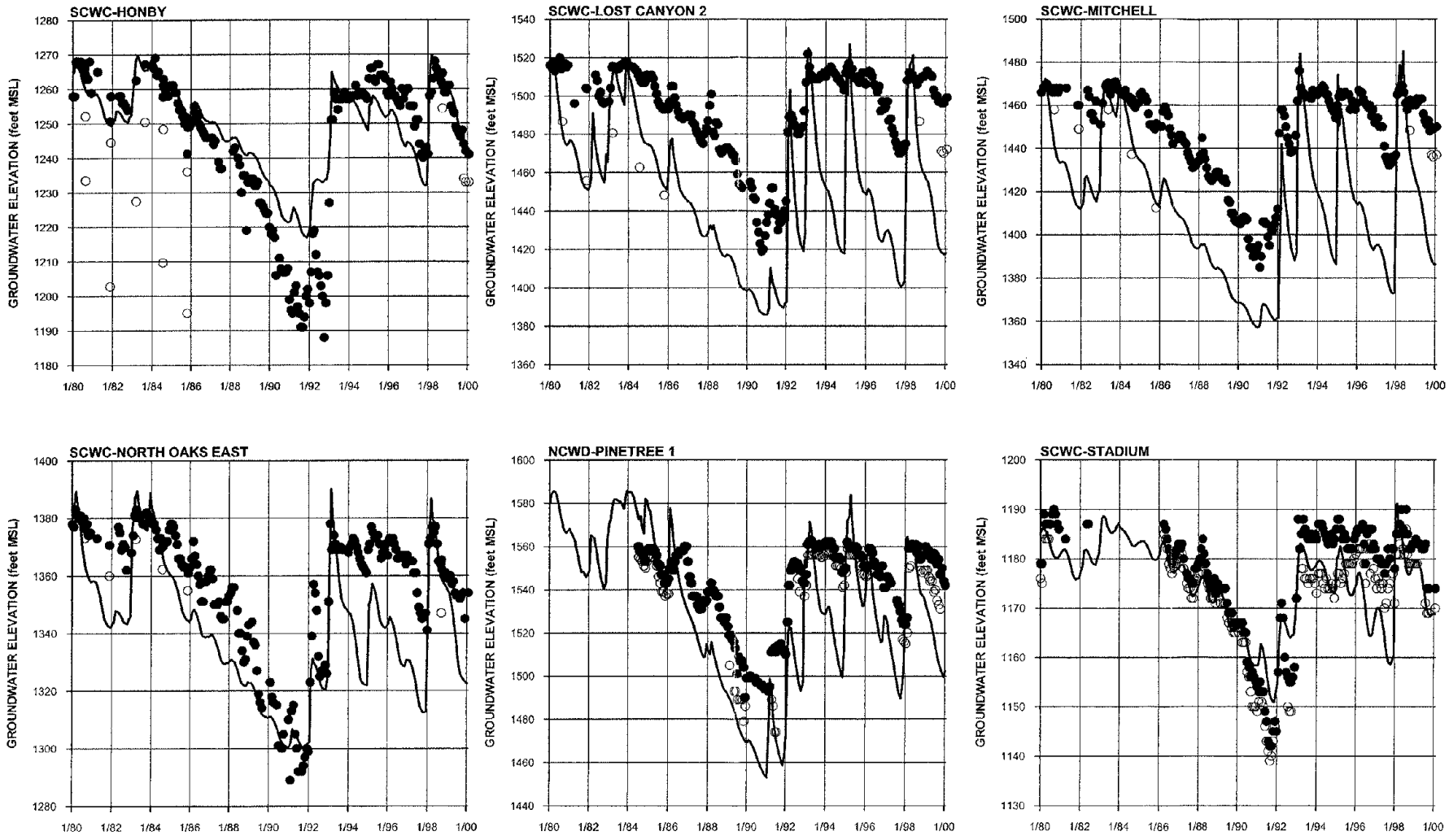
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

FIGURE 5-21
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS BETWEEN INTERSTATE 5 AND SOLEDAD CANYON

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

175570-312.GRF



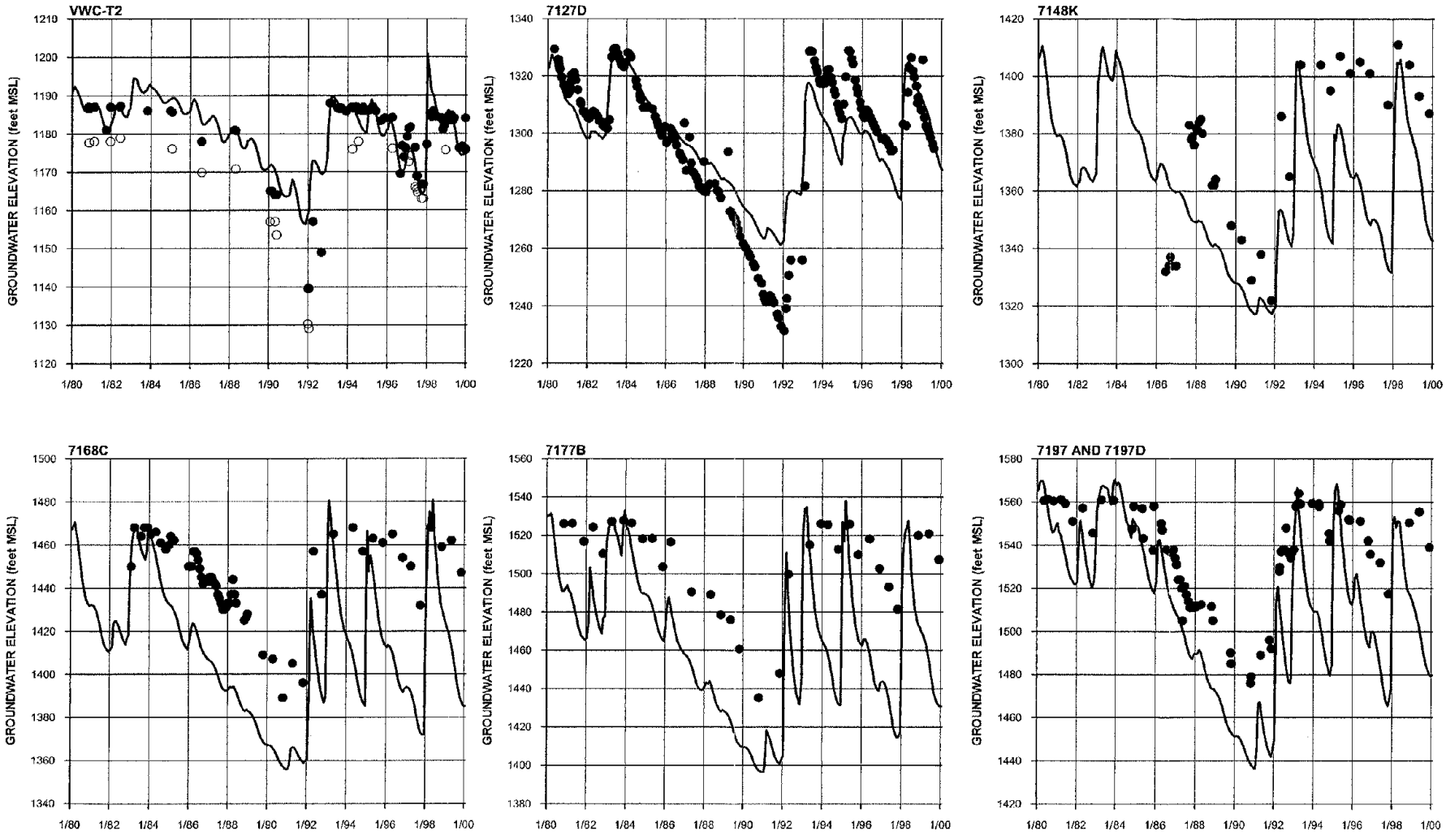
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

178973-313.GRF

FIGURE 5-22
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 1 OF 2)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



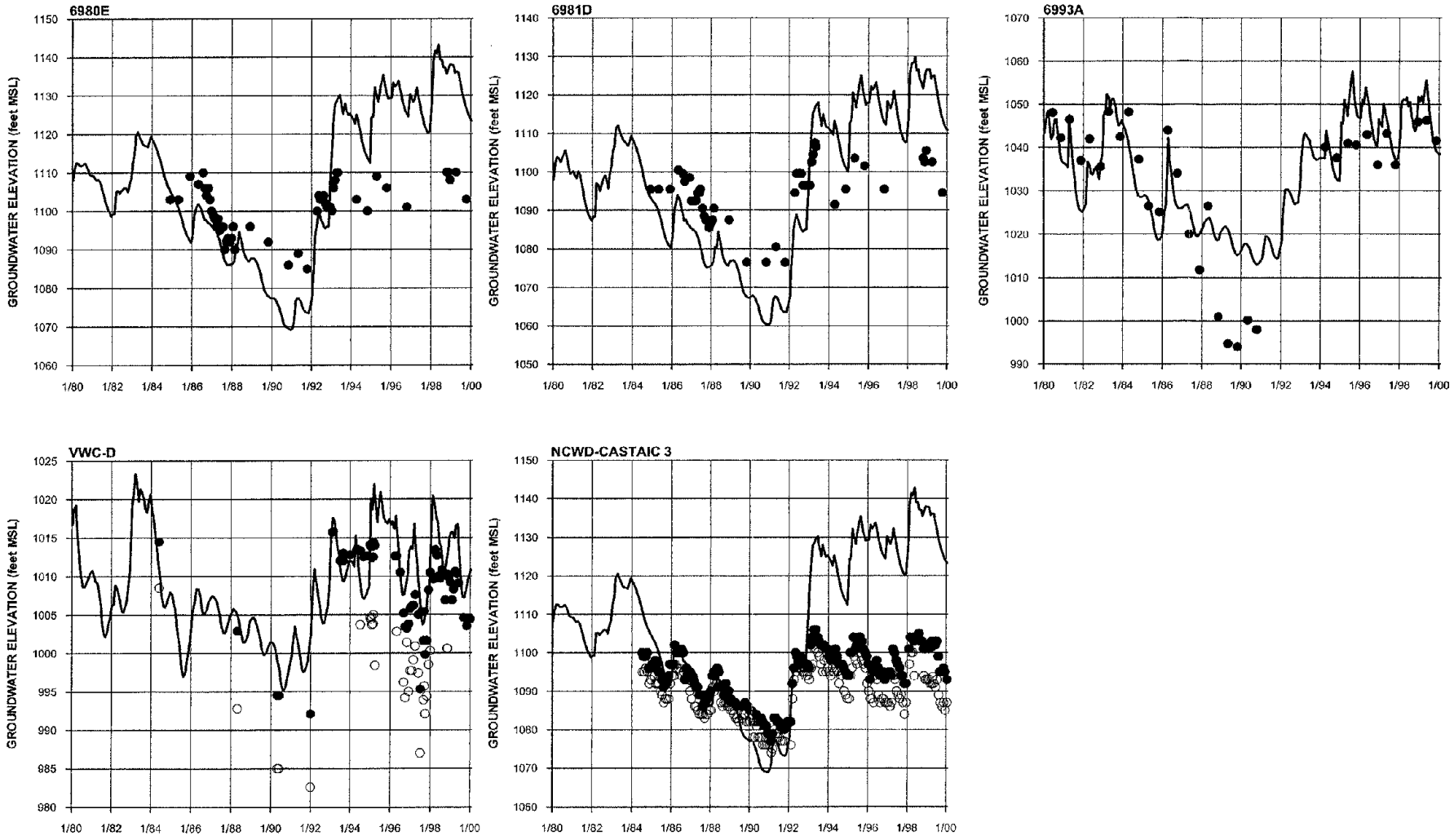
NOTE: SEE FIGURE 2-3 FOR LOCATION OF WELLS.

178973-314.GRF

FIGURE 5-22
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 2 OF 2)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



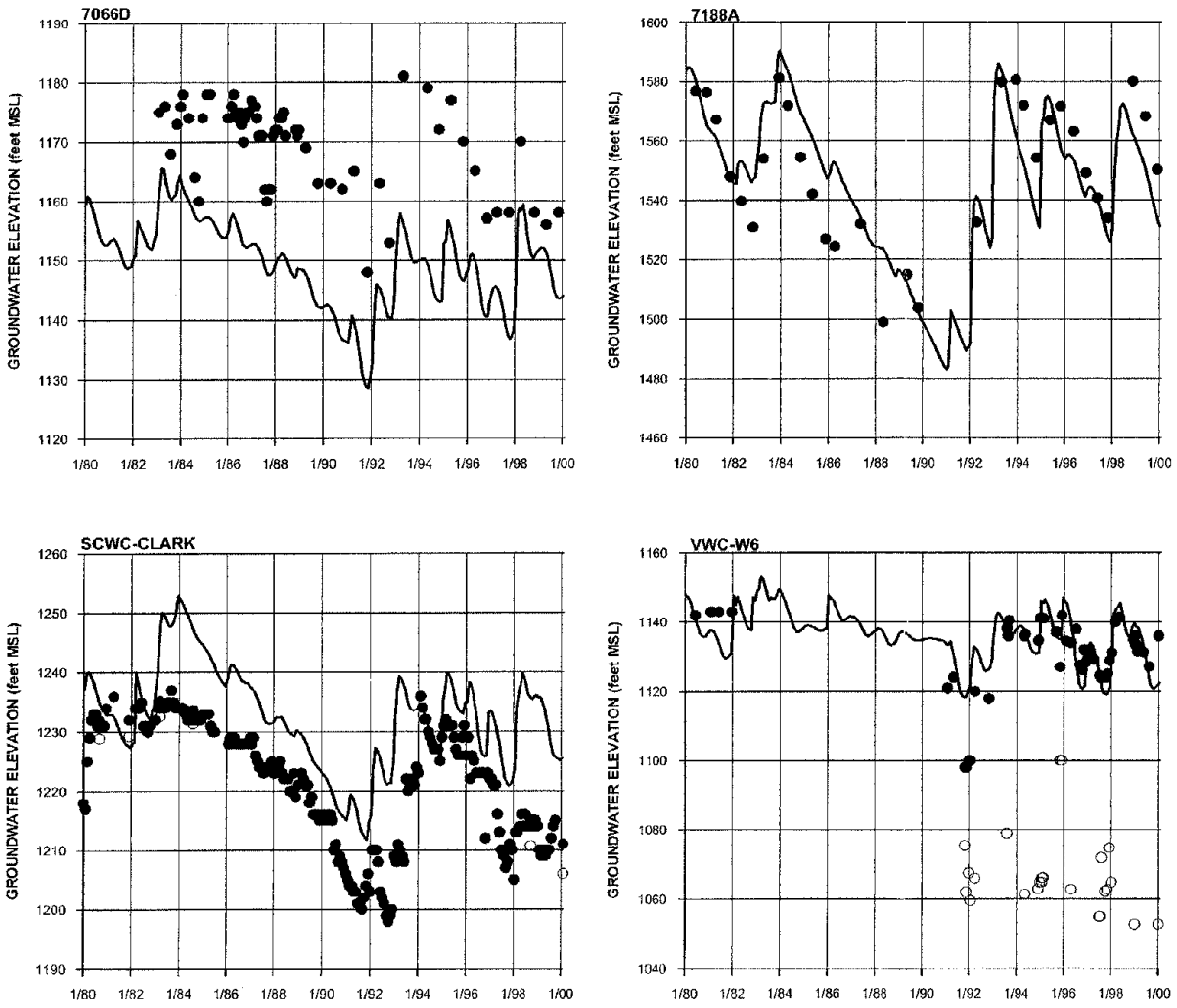
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-315.GRF

FIGURE 5-23
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS ALONG CASTAIC CREEK

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



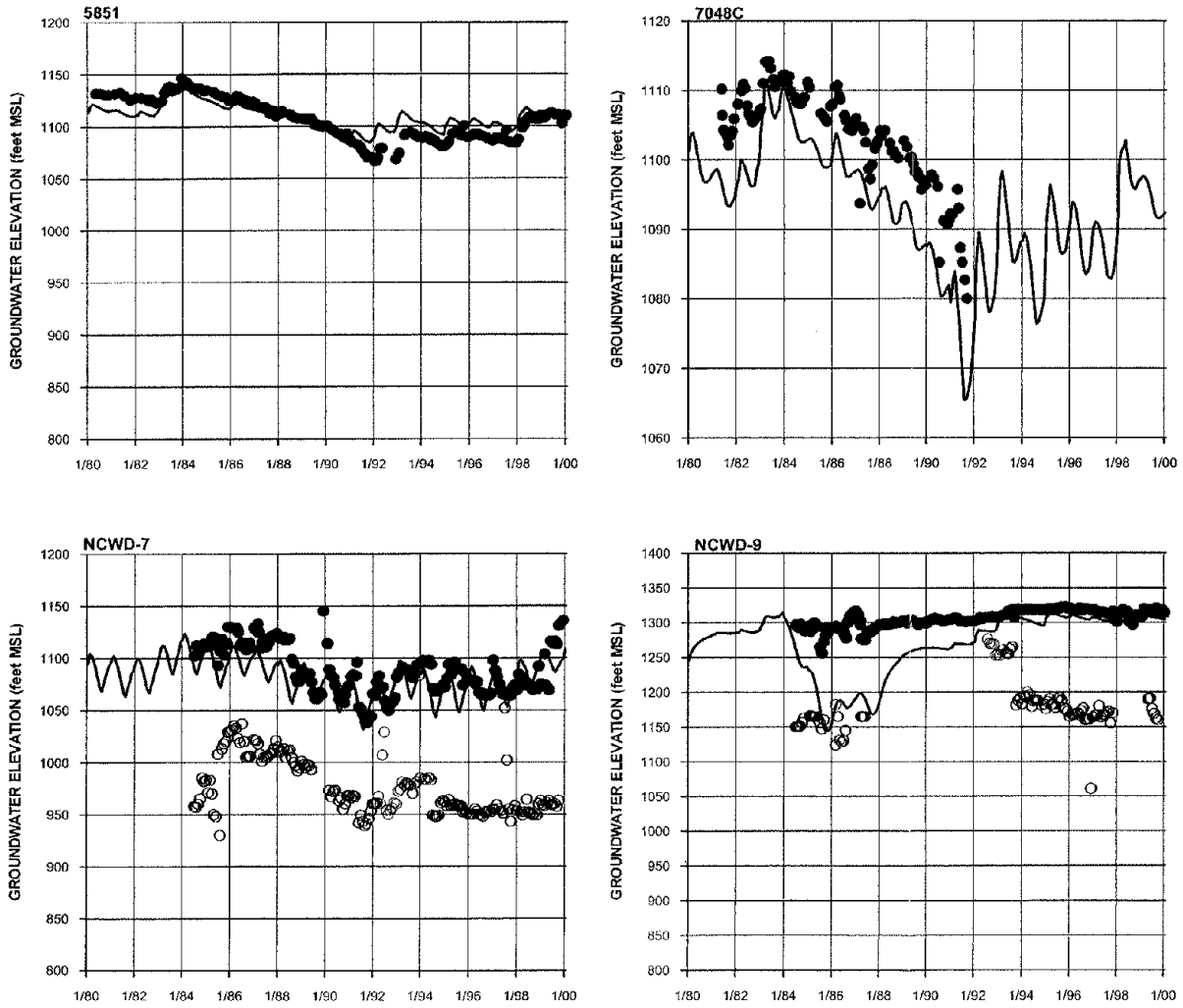
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-316.GRF

FIGURE 5-24
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN OTHER TRIBUTARY CANYONS TO THE SANTA CLARA RIVER

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



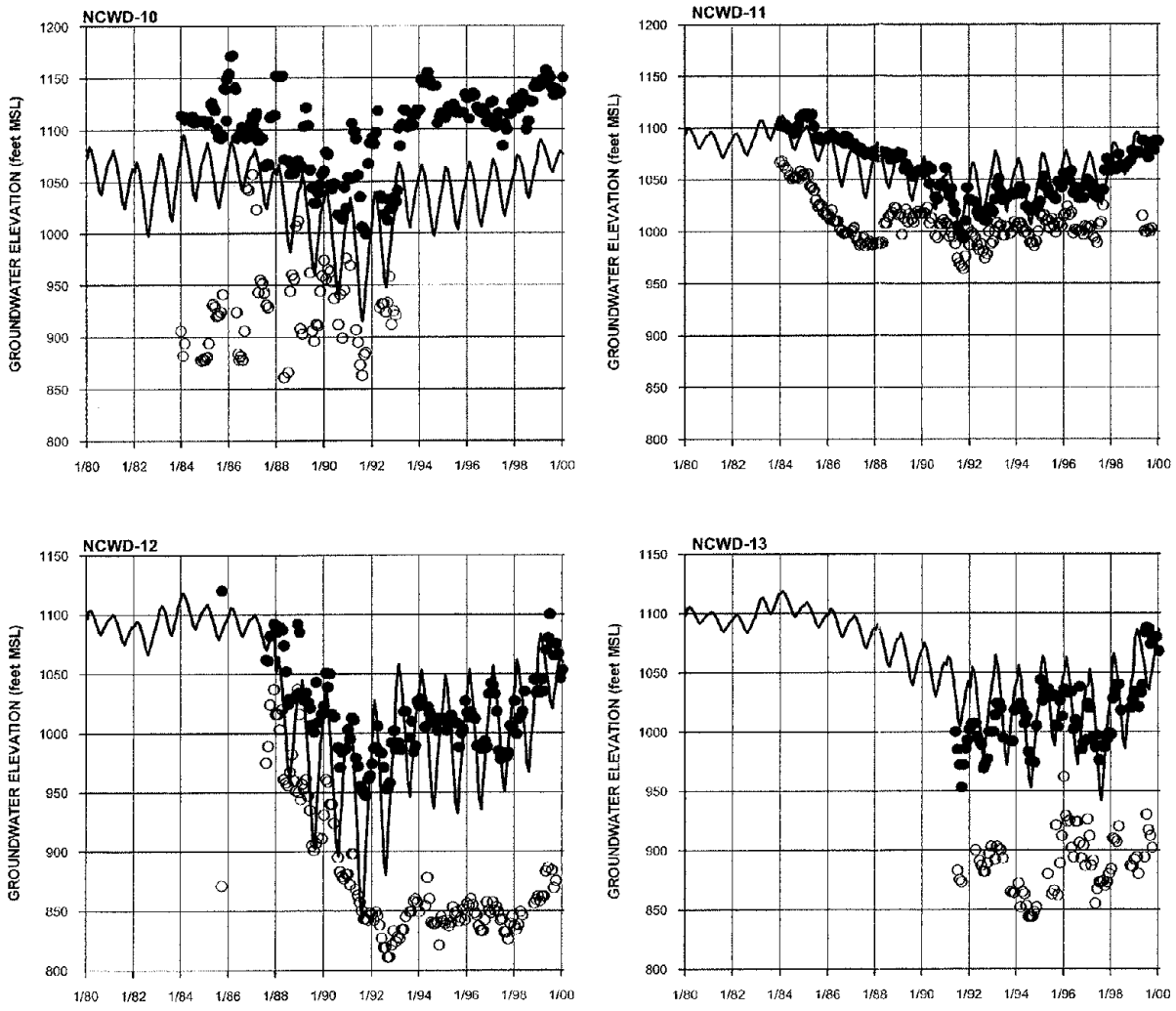
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-319.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 1 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



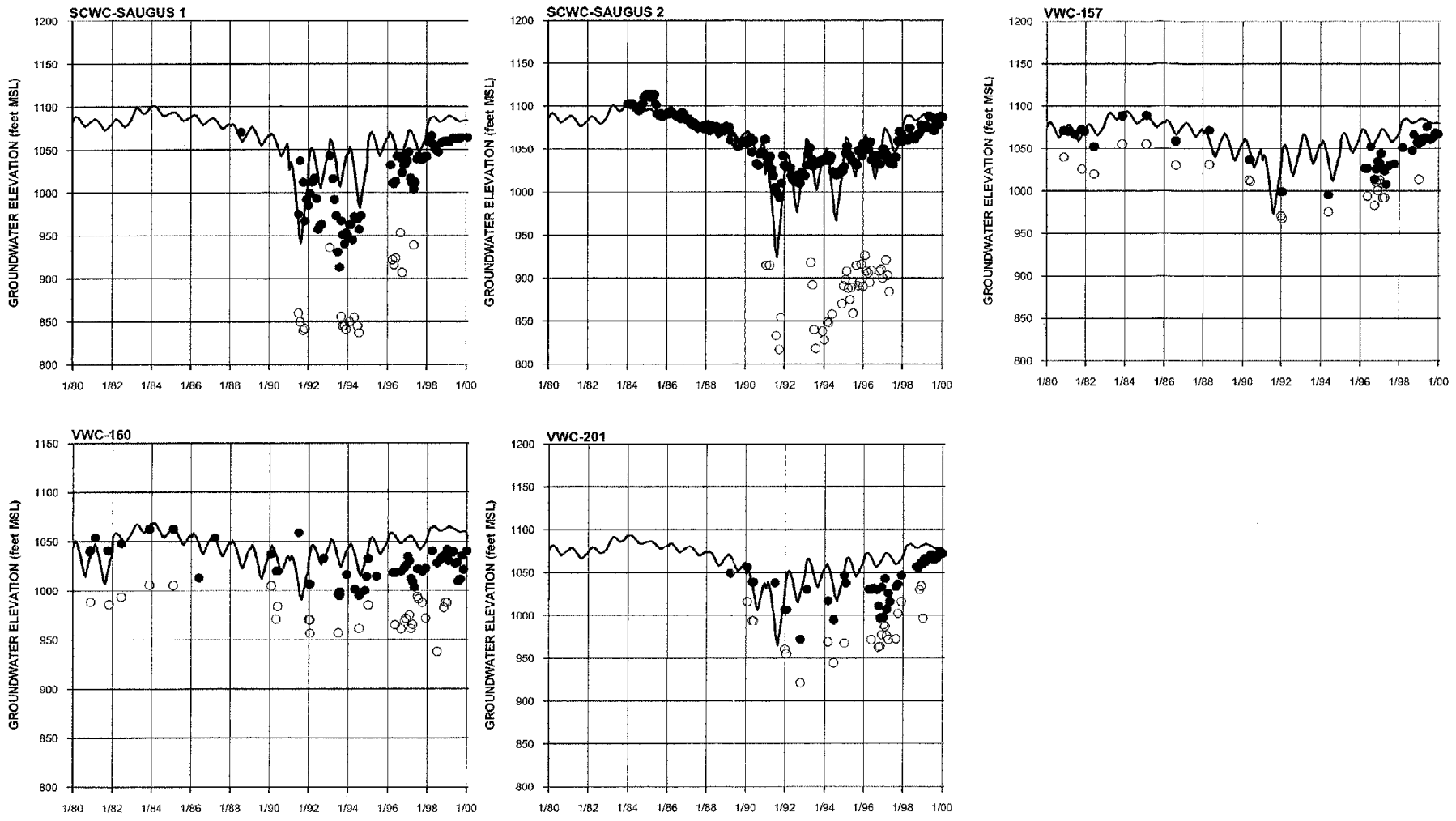
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-317.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 2 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-318.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 3 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

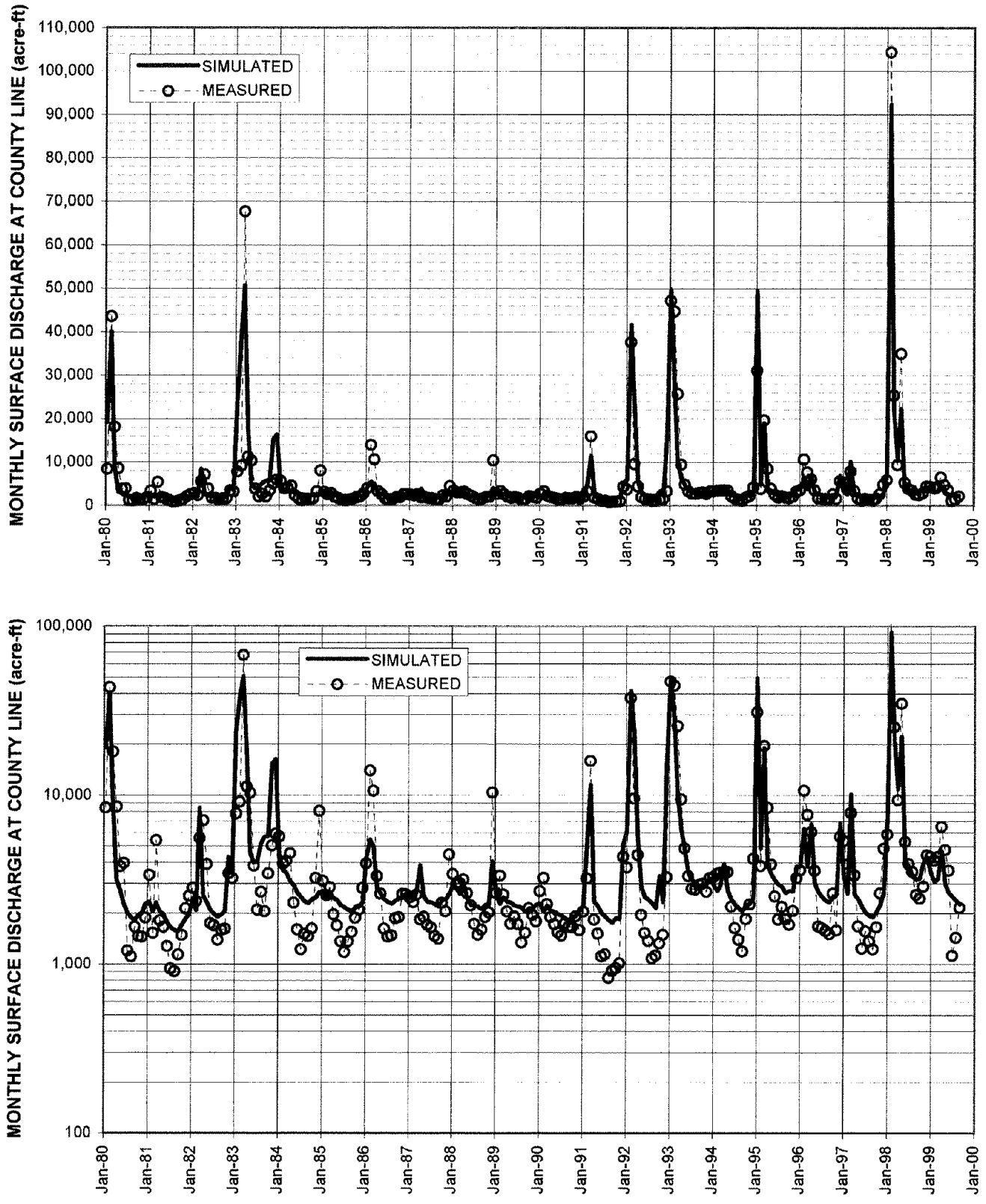


FIGURE 5-26
SIMULATED VERSUS MEASURED HYDROGRAPHS OF SANTA CLARA RIVER FLOW AT COUNTY LINE
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

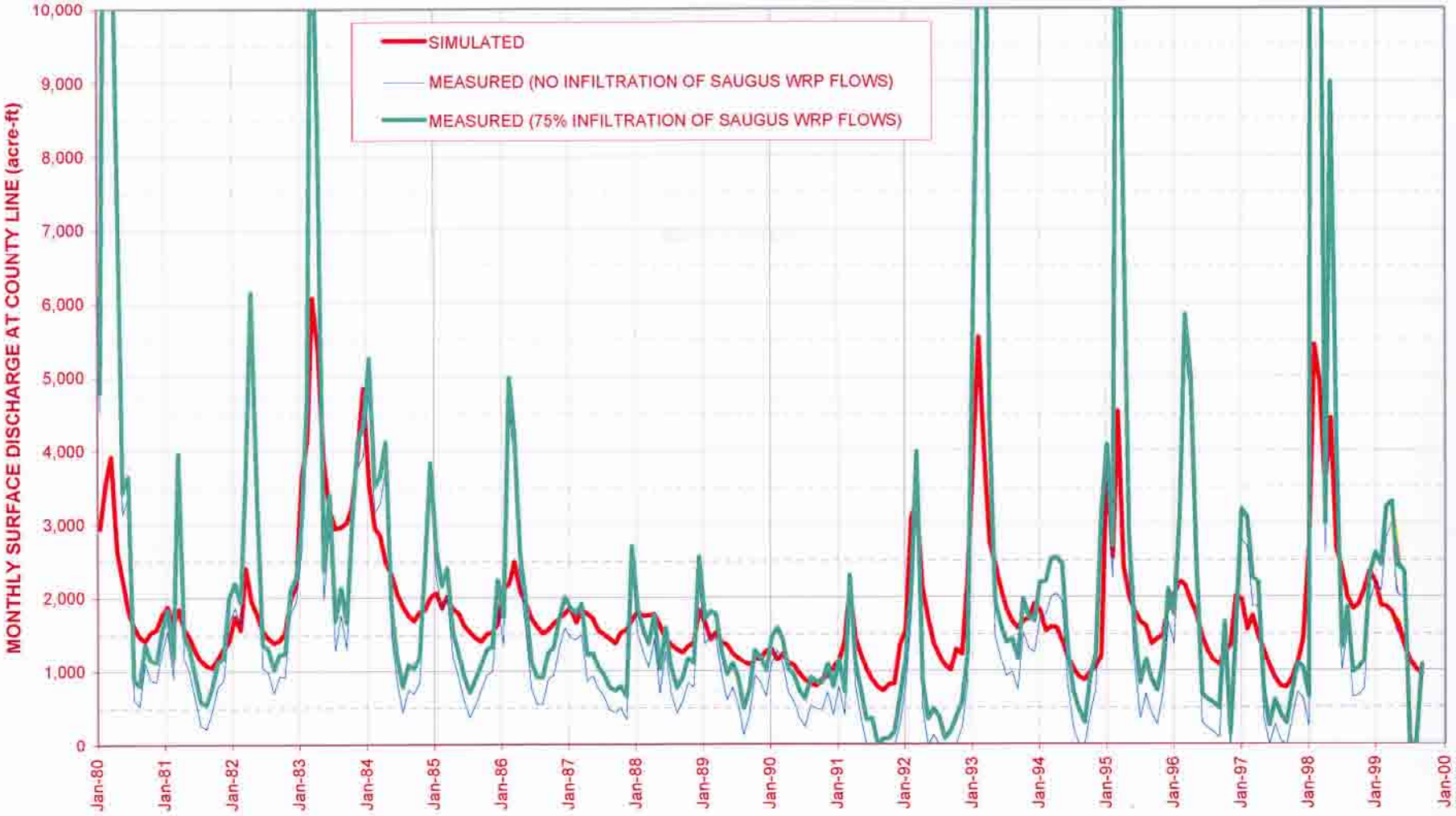


FIGURE 5-27
SIMULATED VERSUS MEASURED HYDROGRAPH OF GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

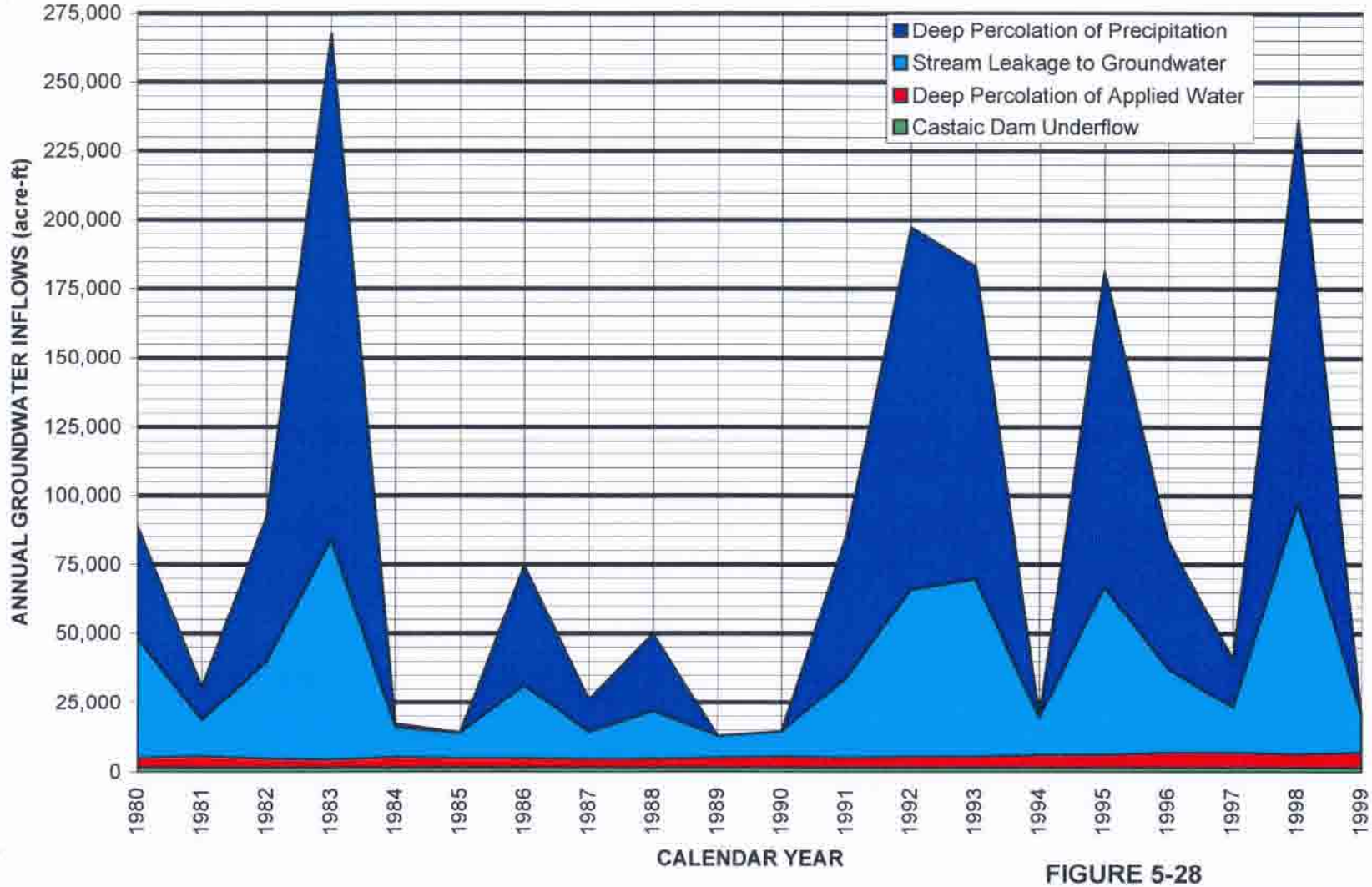


FIGURE 5-28
ANNUAL GROUNDWATER INFLOWS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

04/04/2004
178973-410.xls/Fig 5-28

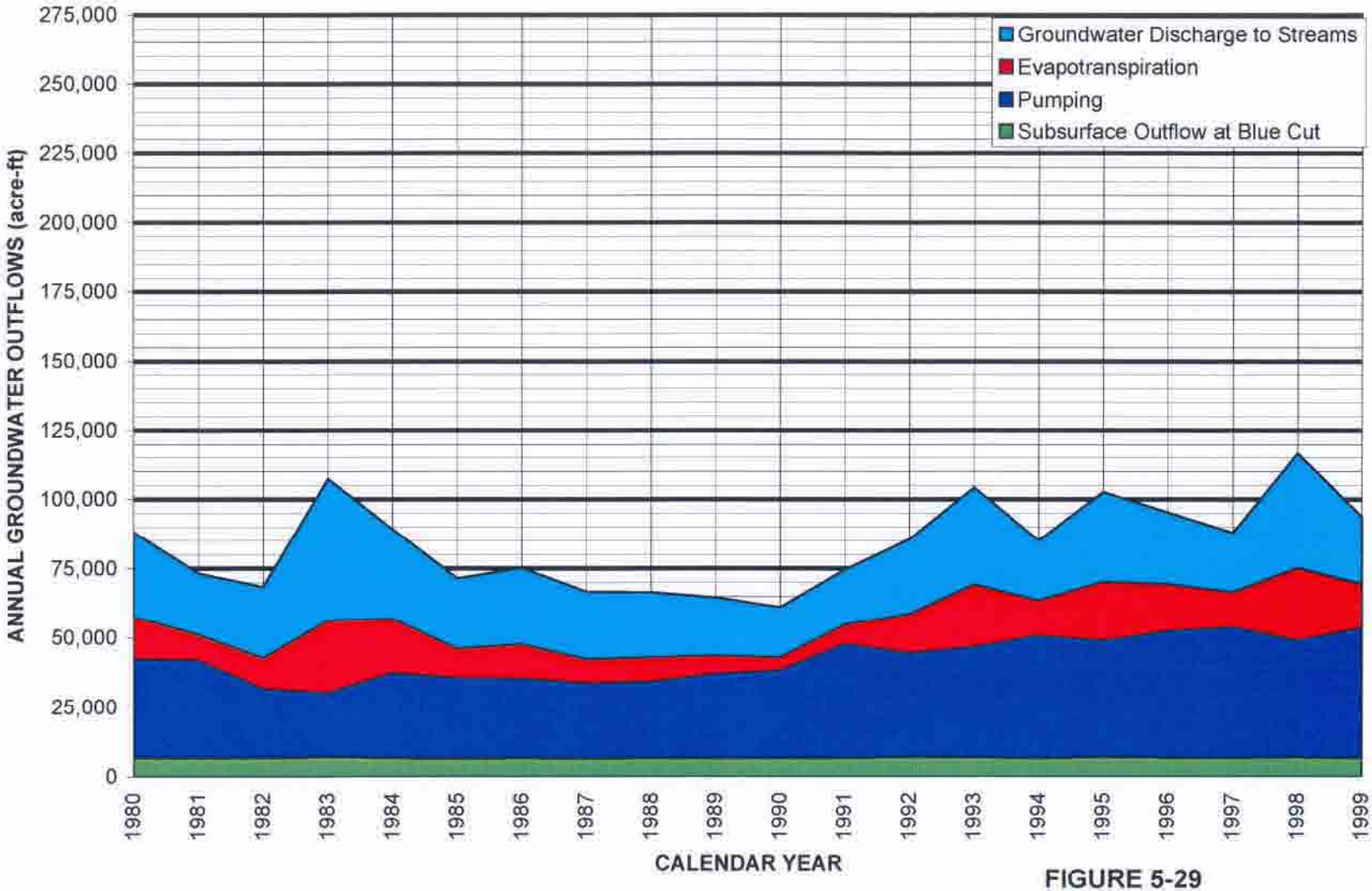


FIGURE 5-29
ANNUAL GROUNDWATER OUTFLOWS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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04/04/2004
178973-410.xls/Fig 5-29

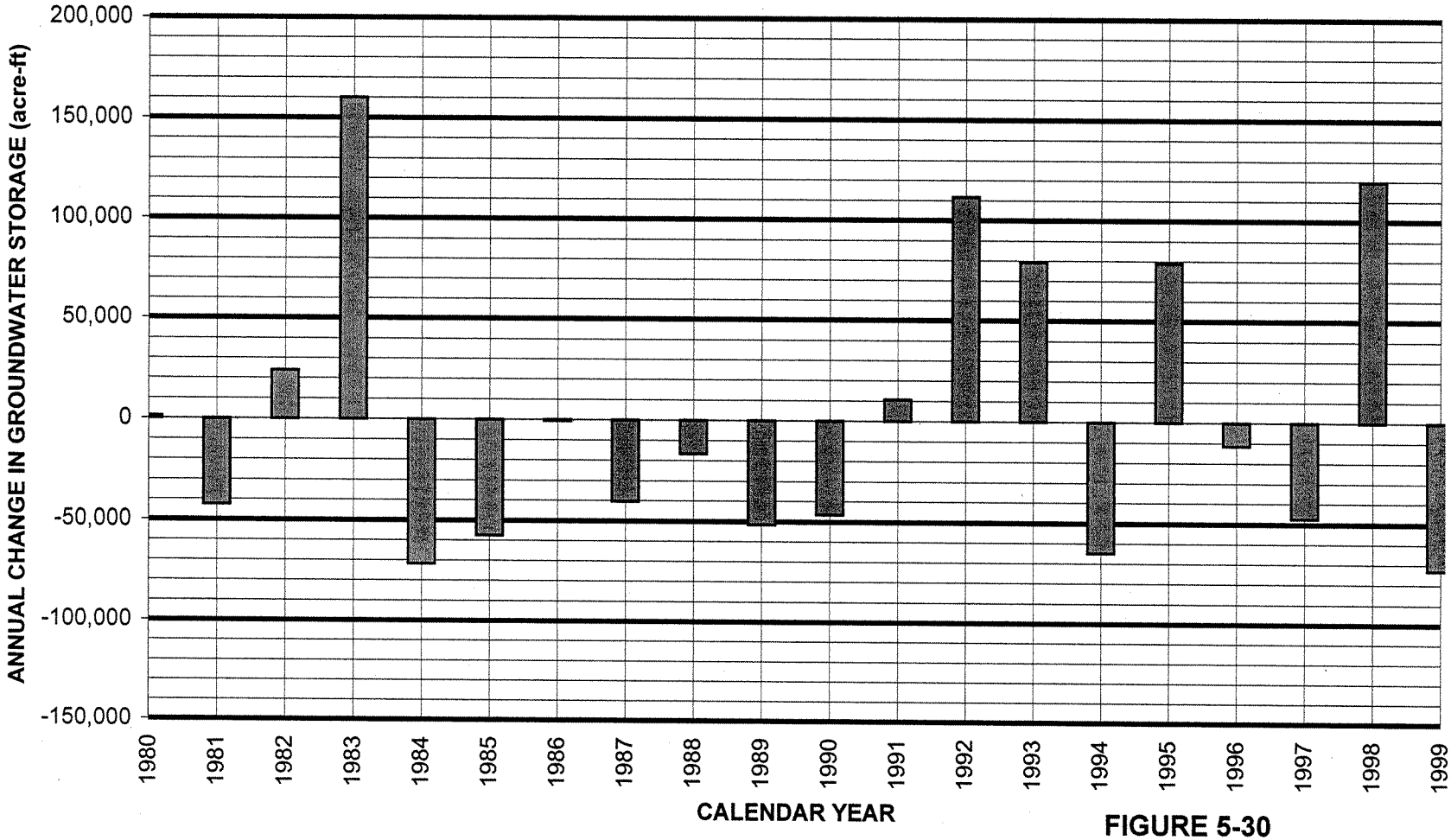

FIGURE 5-30
ANNUAL CHANGE IN GROUNDWATER STORAGE
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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04/04/2004
178973-410.xls/Fig 5-30

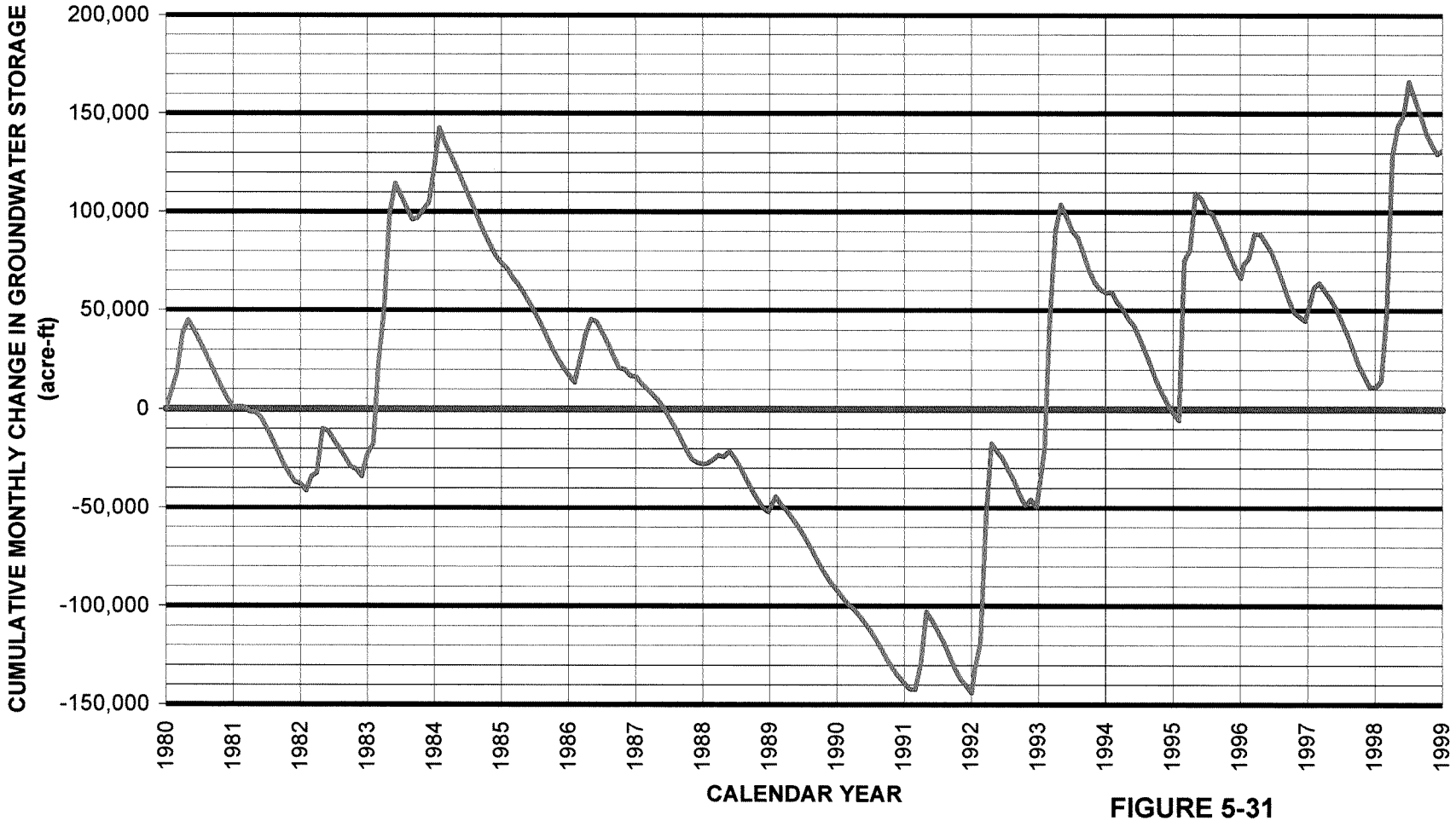

FIGURE 5-31
CUMULATIVE CHANGE IN GROUNDWATER STORAGE
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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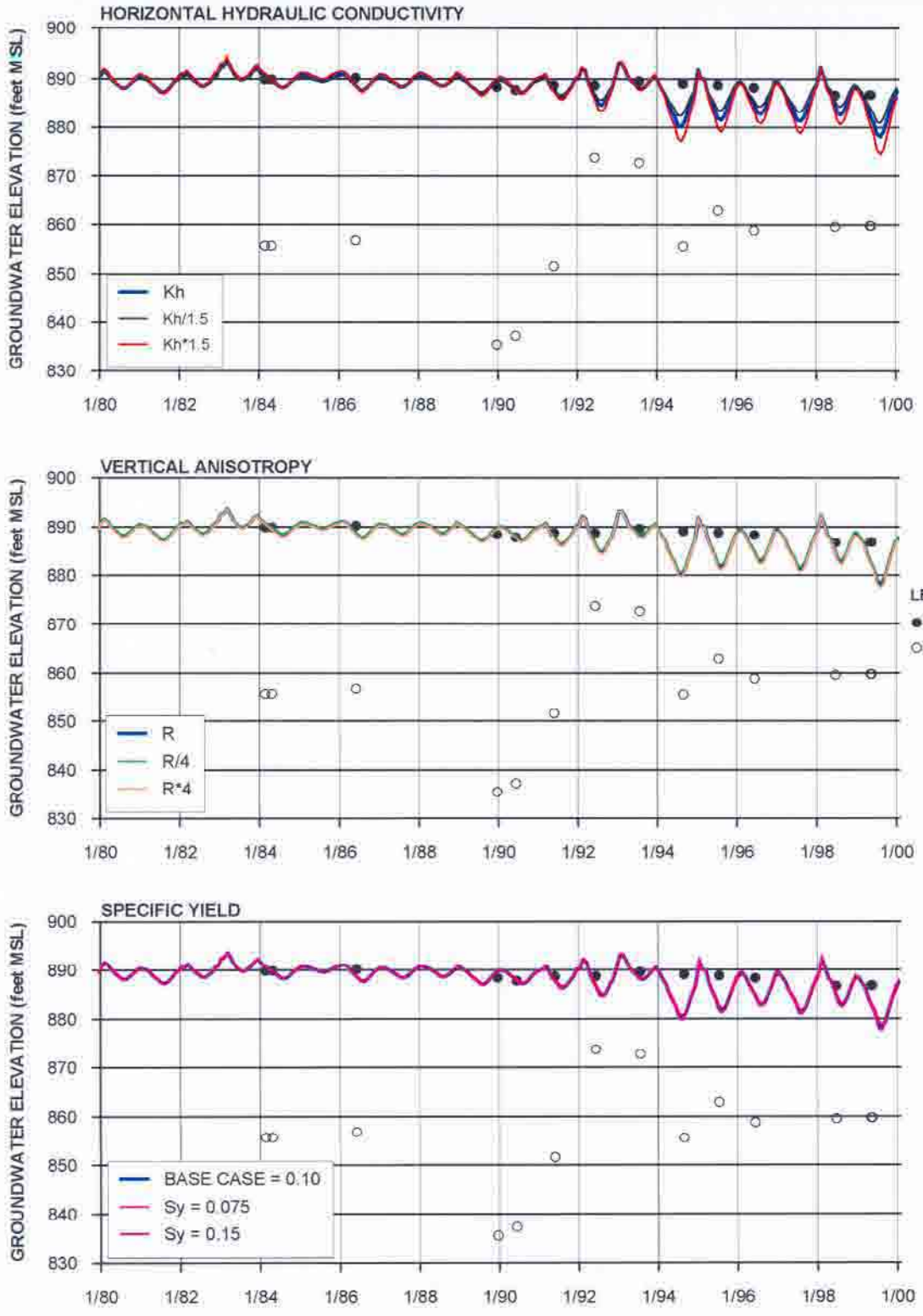
04/04/2004
178973-410.xls/Fig 5-31

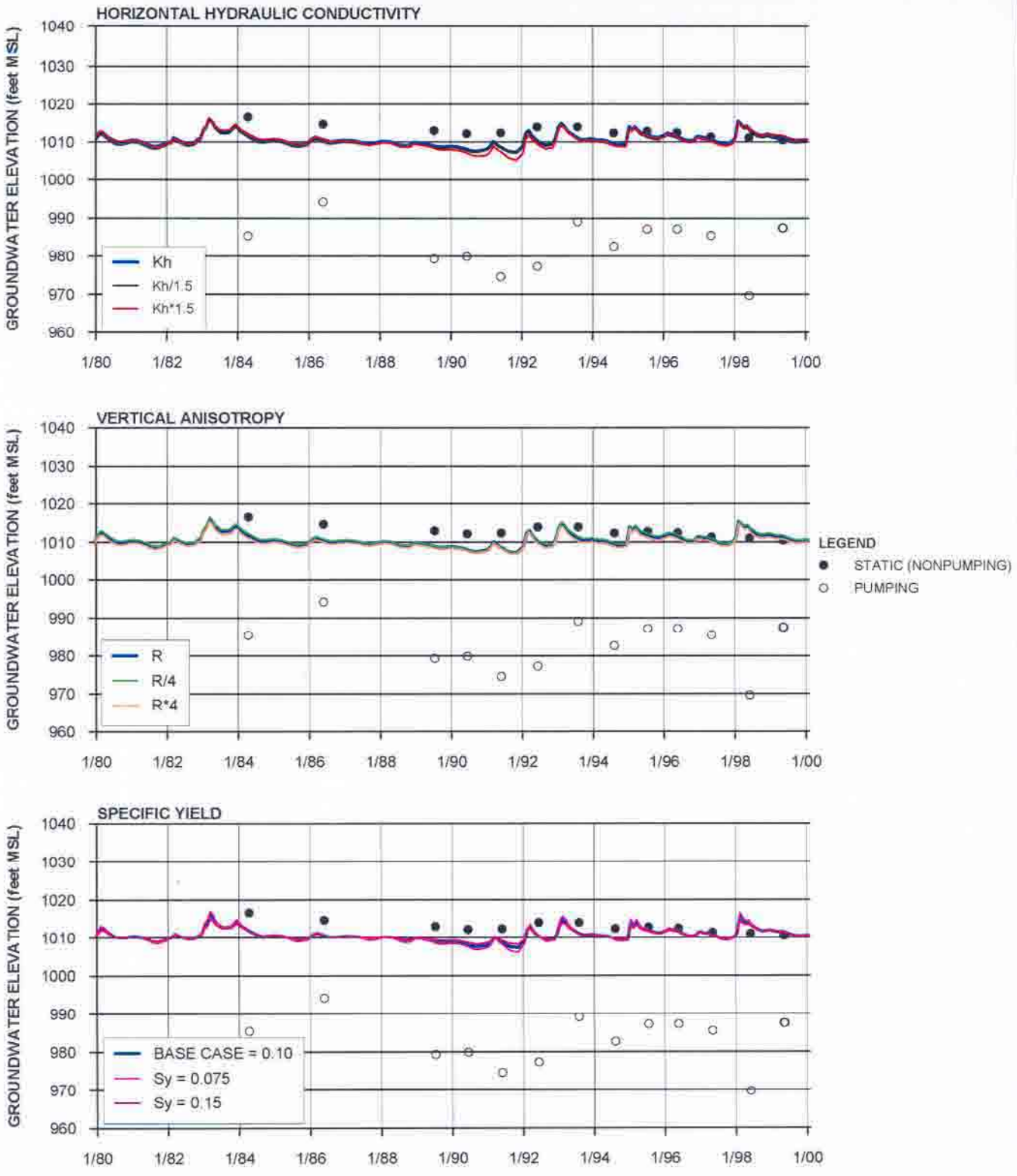


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-32
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-B7 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-311.GRF

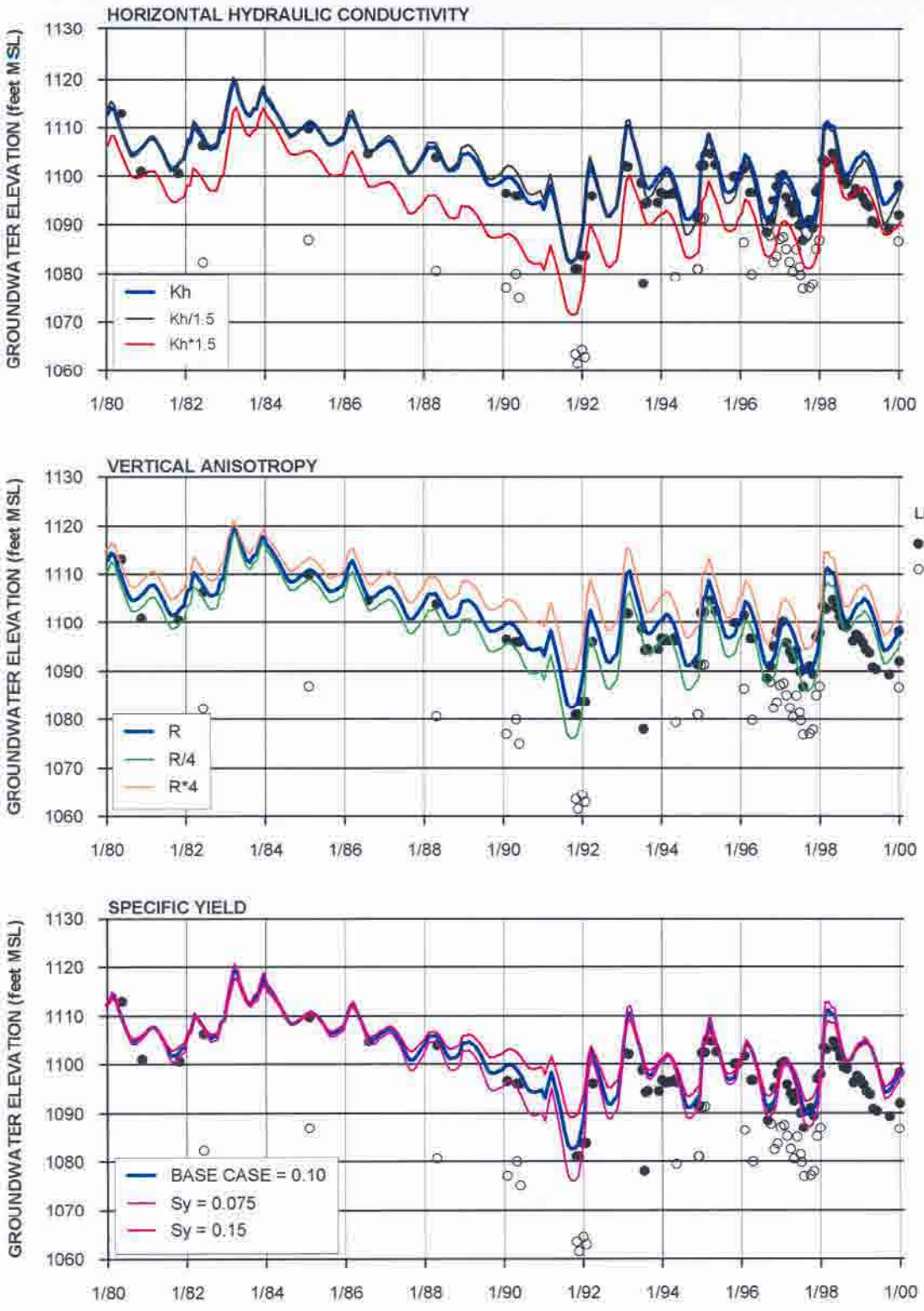


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-33
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-G45 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-320.GRF

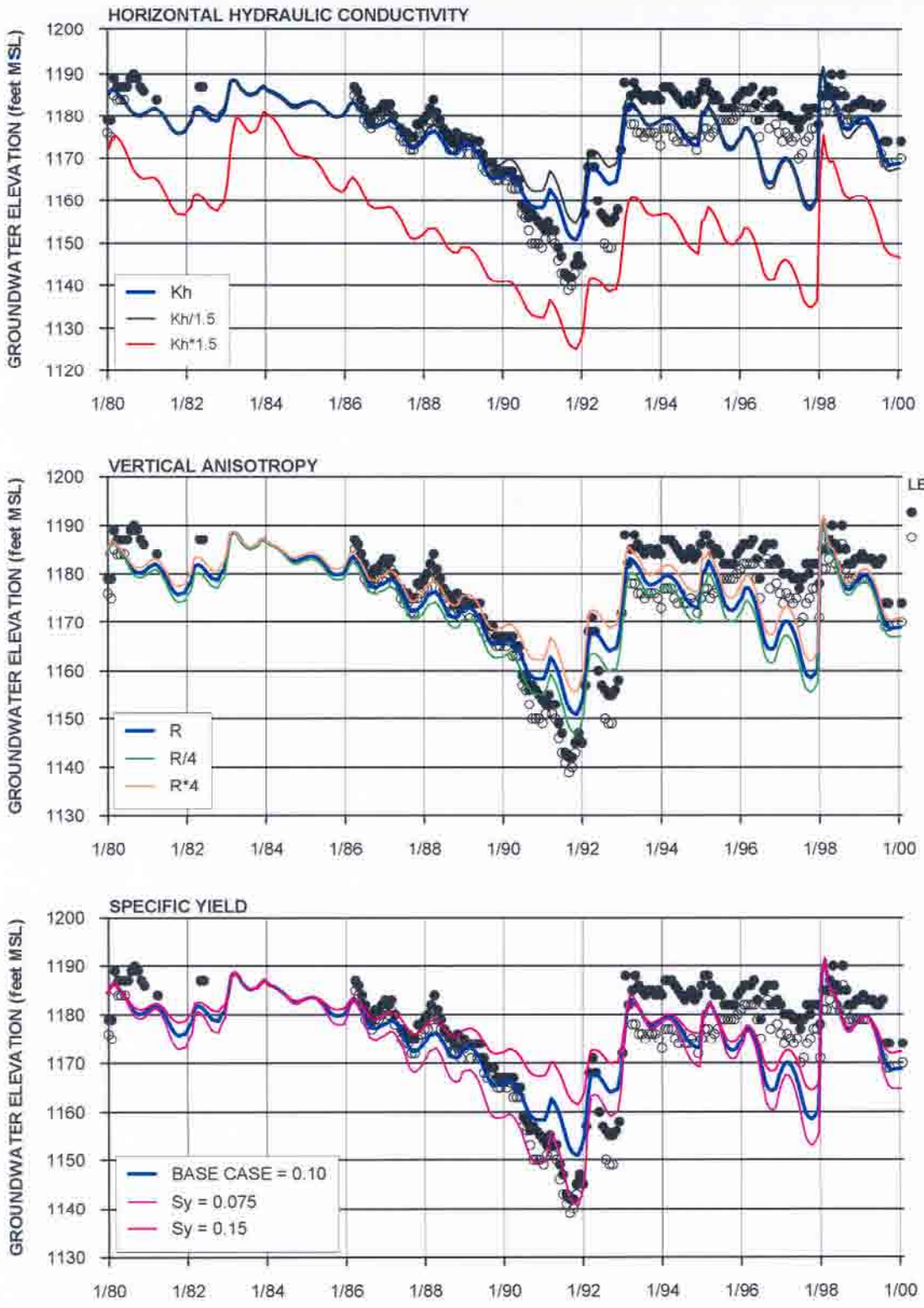


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-34
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-N TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-321.GRF

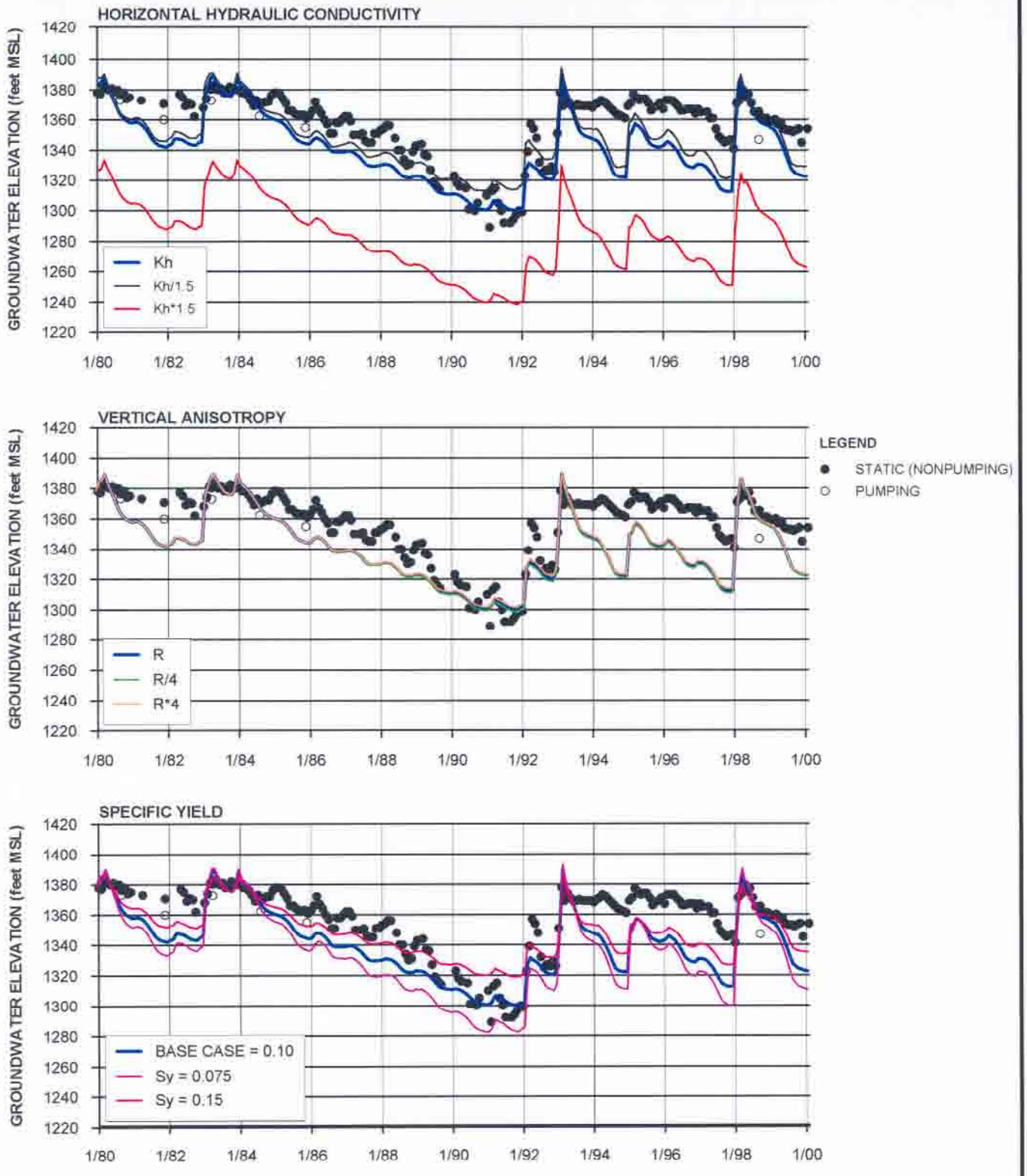


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-35
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-STADIUM TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-322.GRF

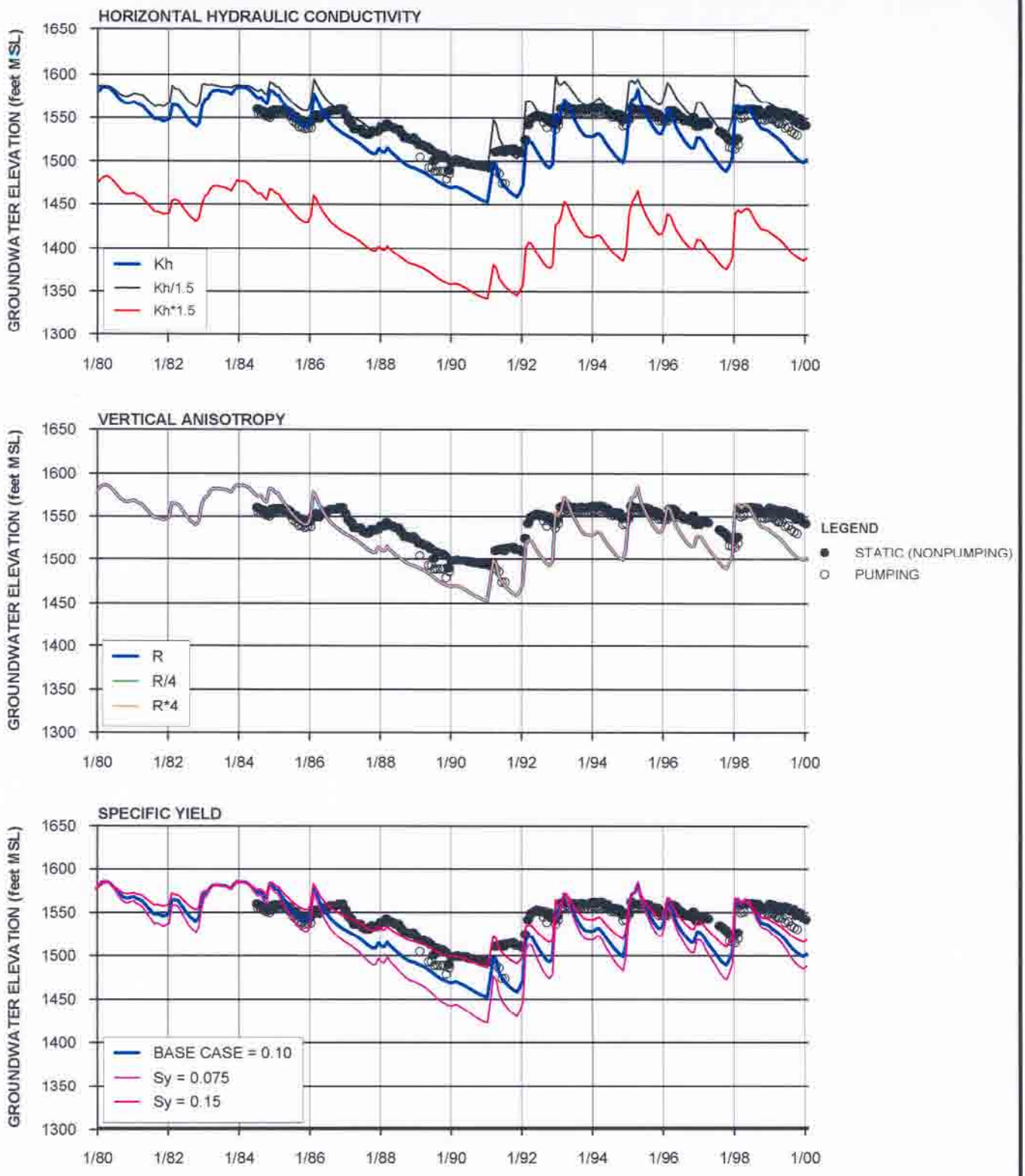


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-36
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-NORTH OAKS EAST TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-325.GRF

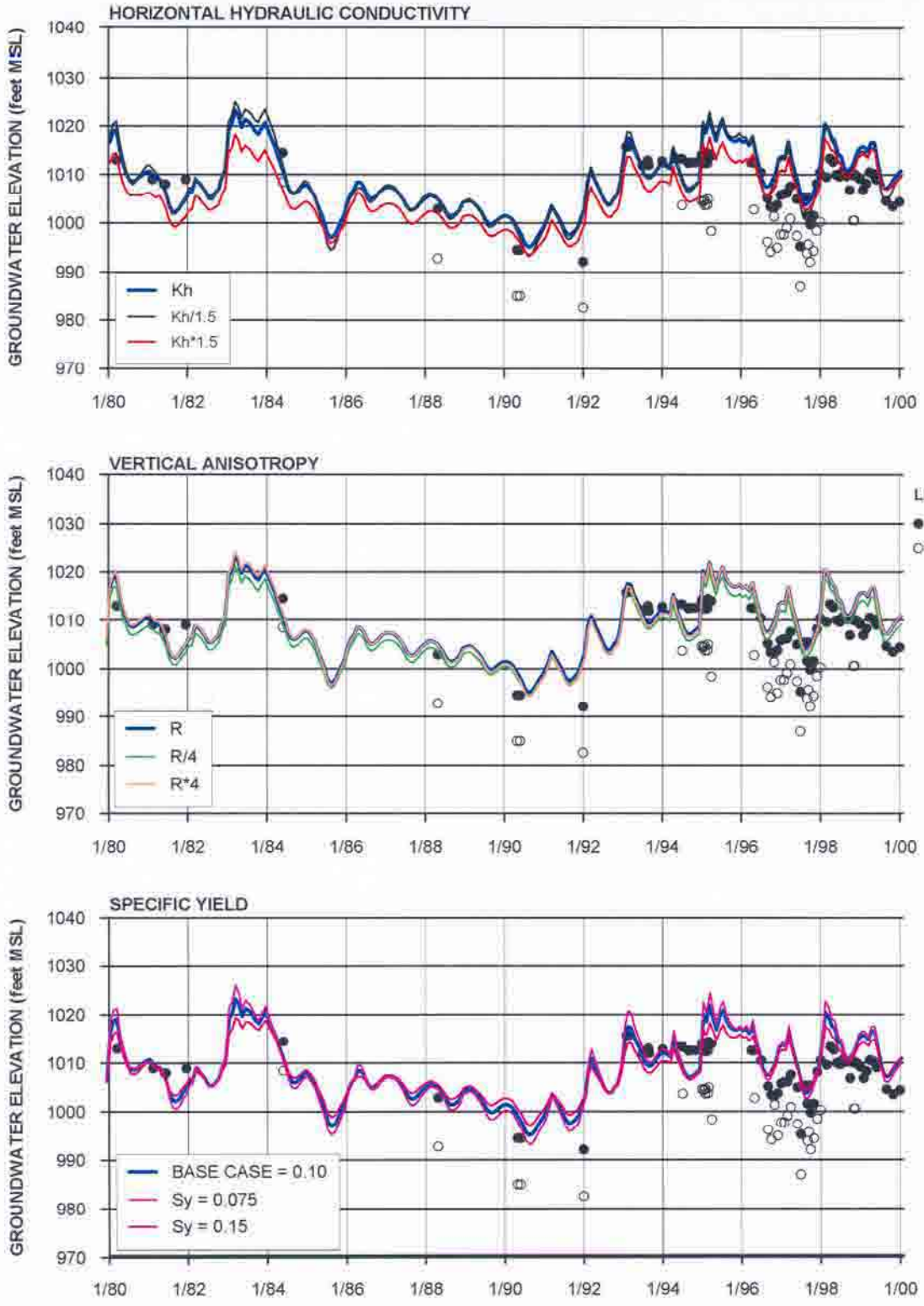


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-37
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NCWD-PINETREE1 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-323.GRF

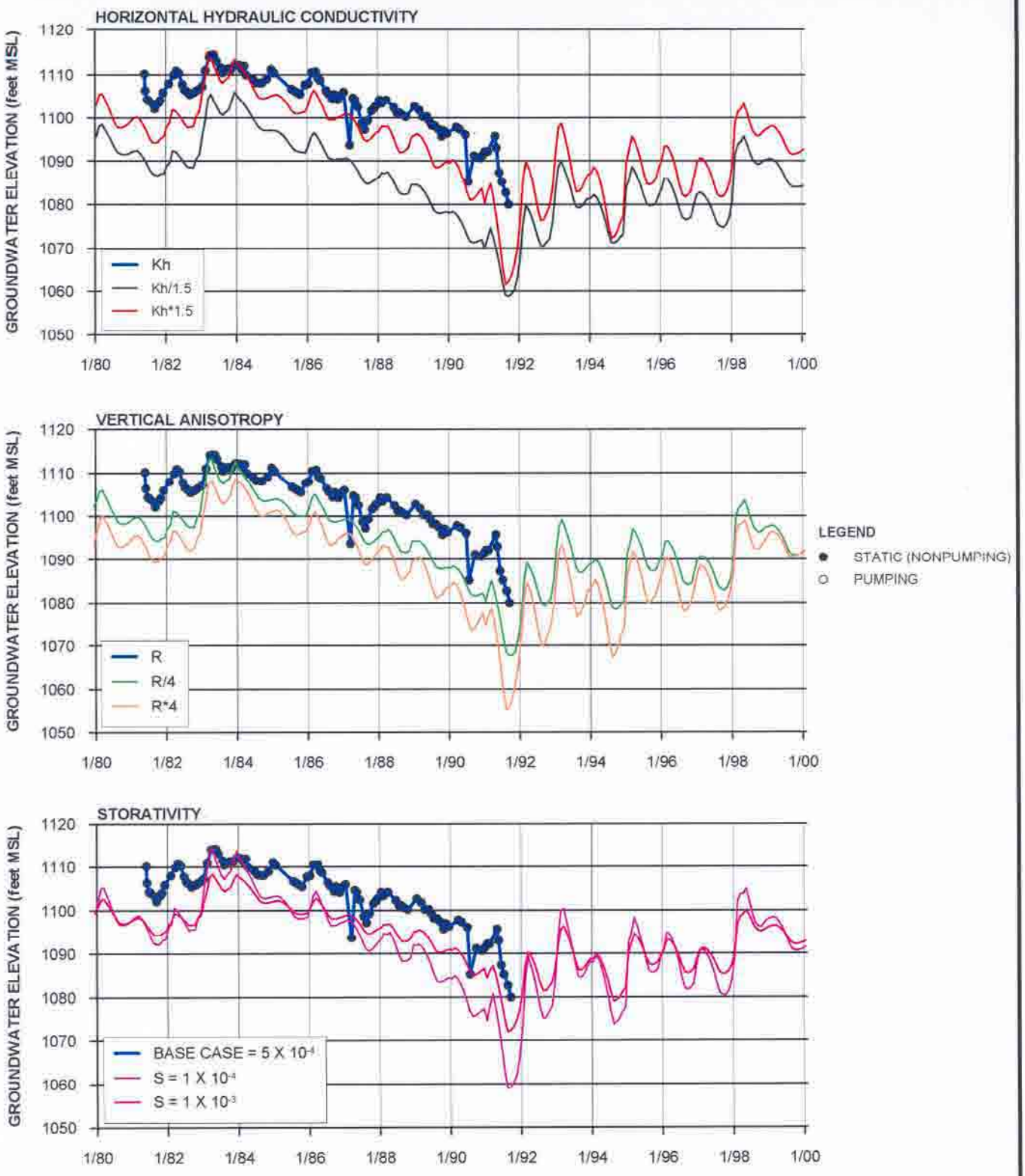


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-38
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-D TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-324.GRF

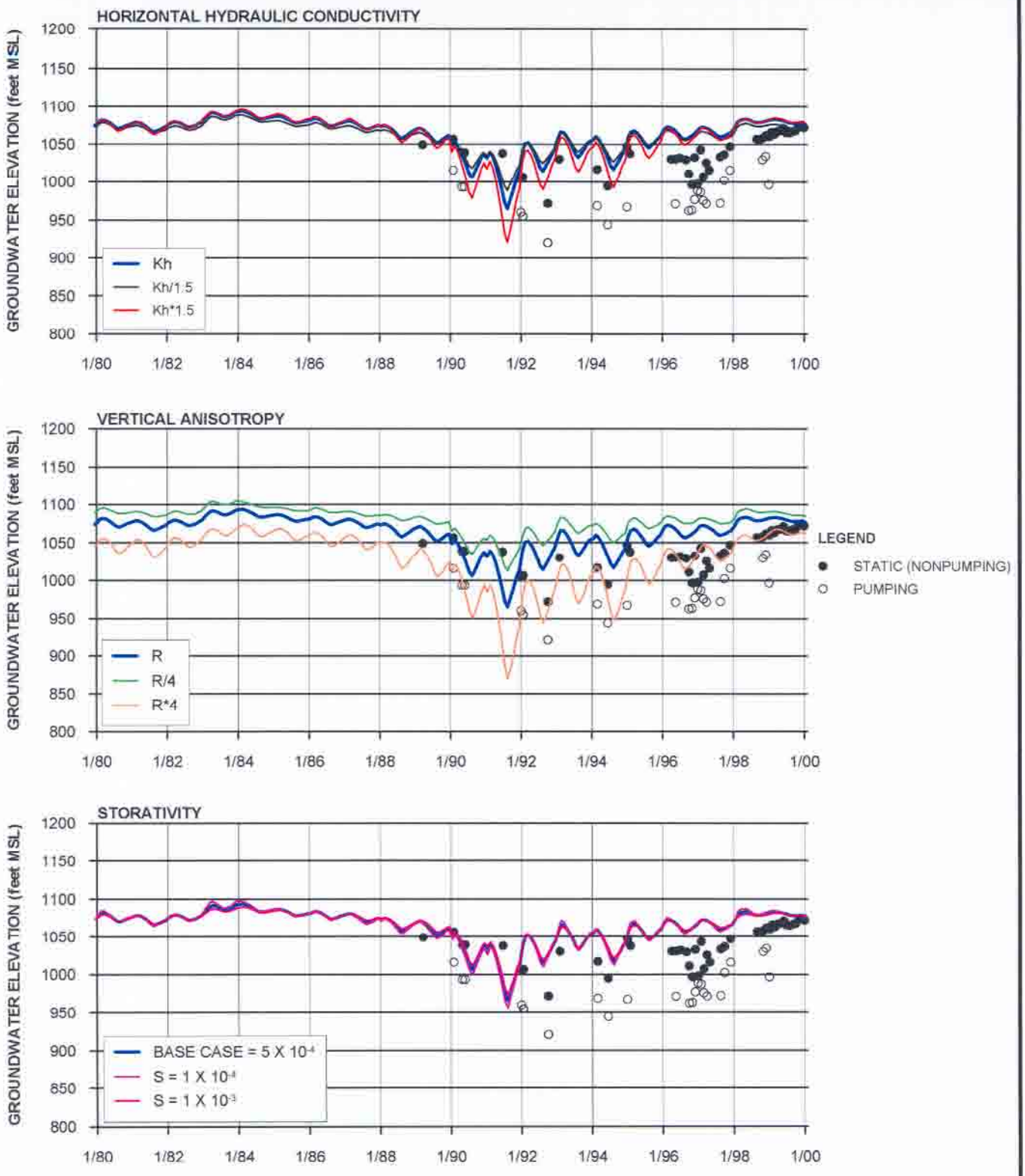


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-39
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 7048C TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-327.GRF



NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-40
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT VWC-201 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-328.GRF

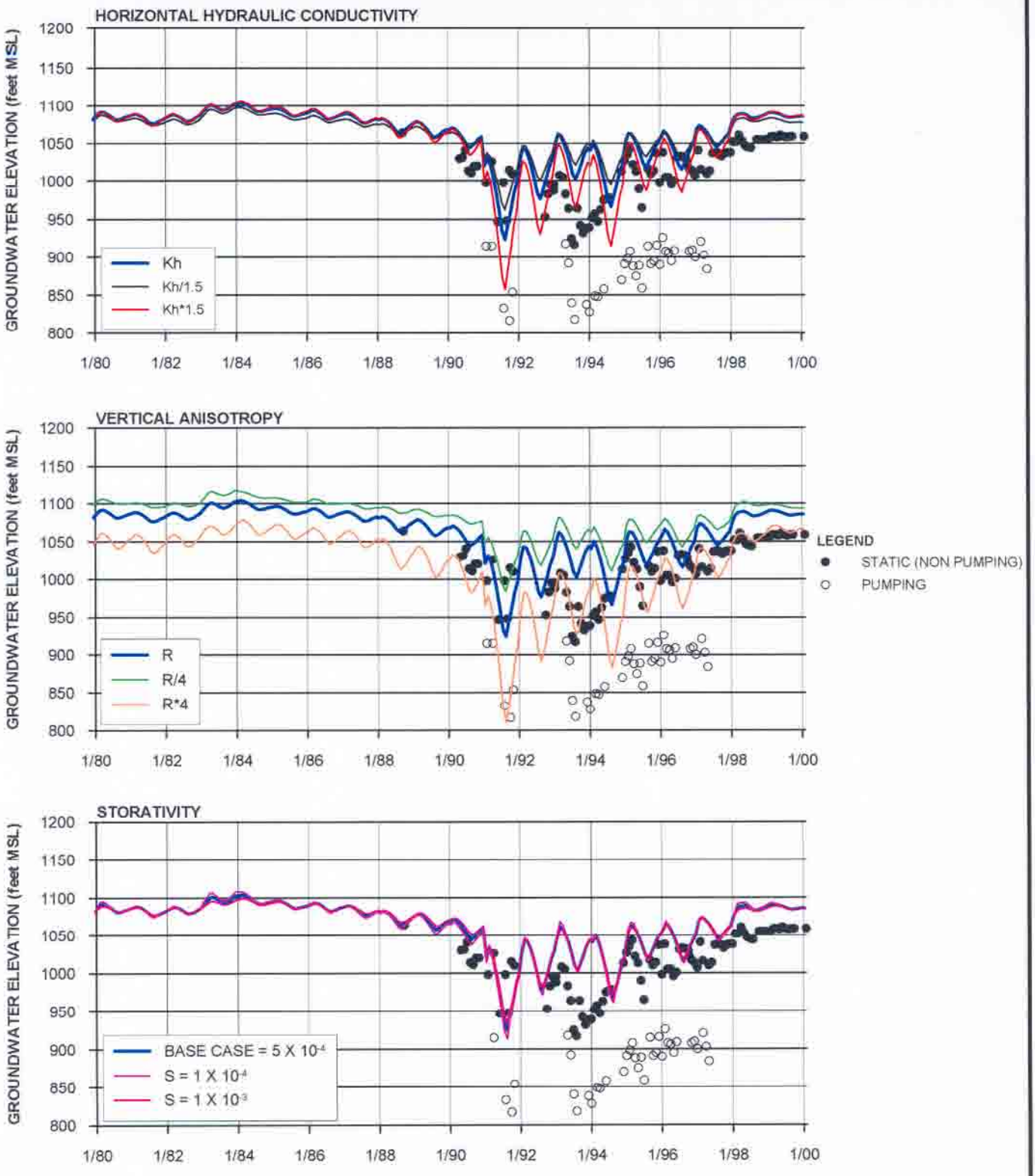


FIGURE 5-41
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT SCWC-SAUGUS 2 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

CH2MHILL

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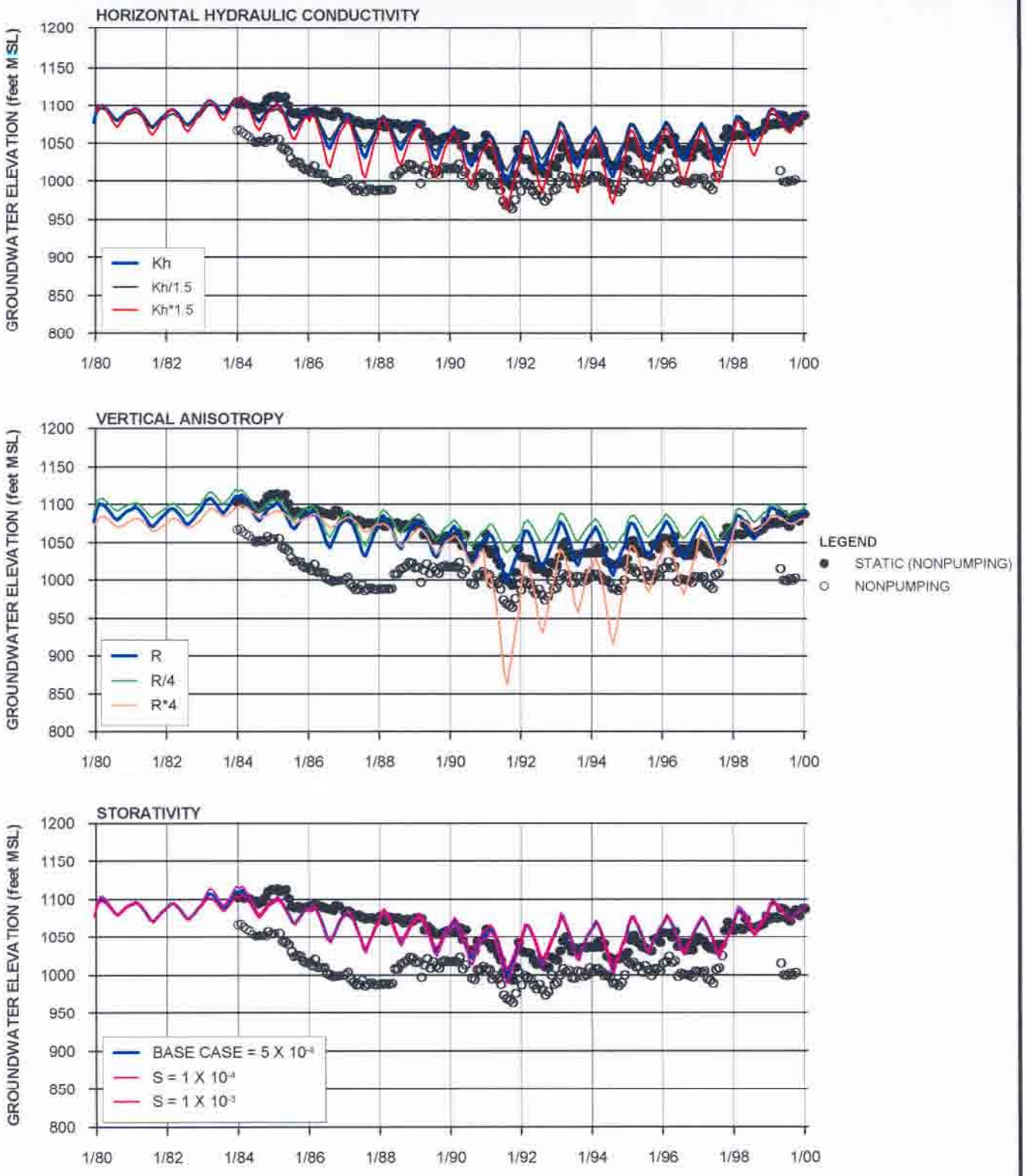
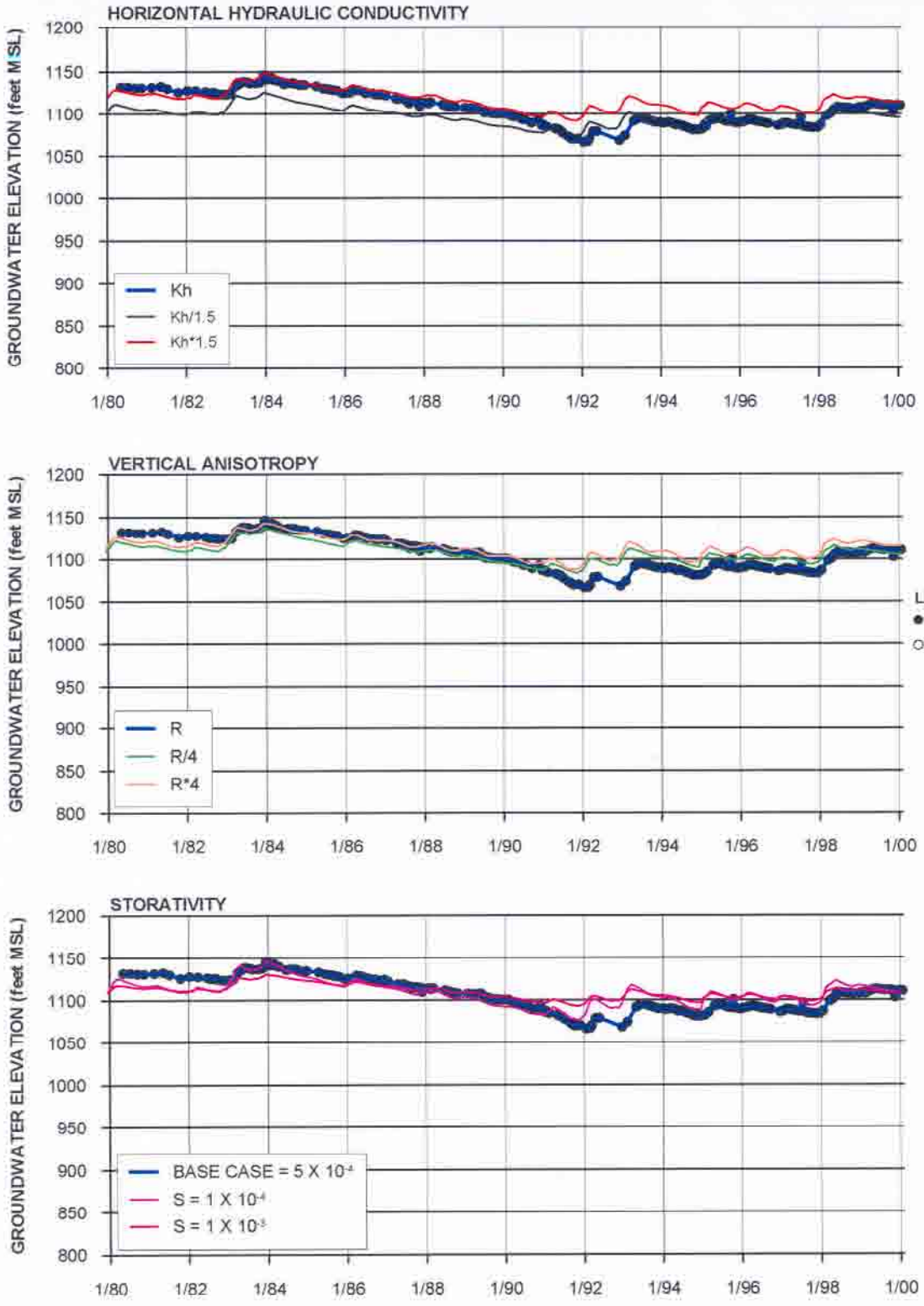


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-42
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT NCWD-11 TO AQUIFER PARAMETER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-330.GRF

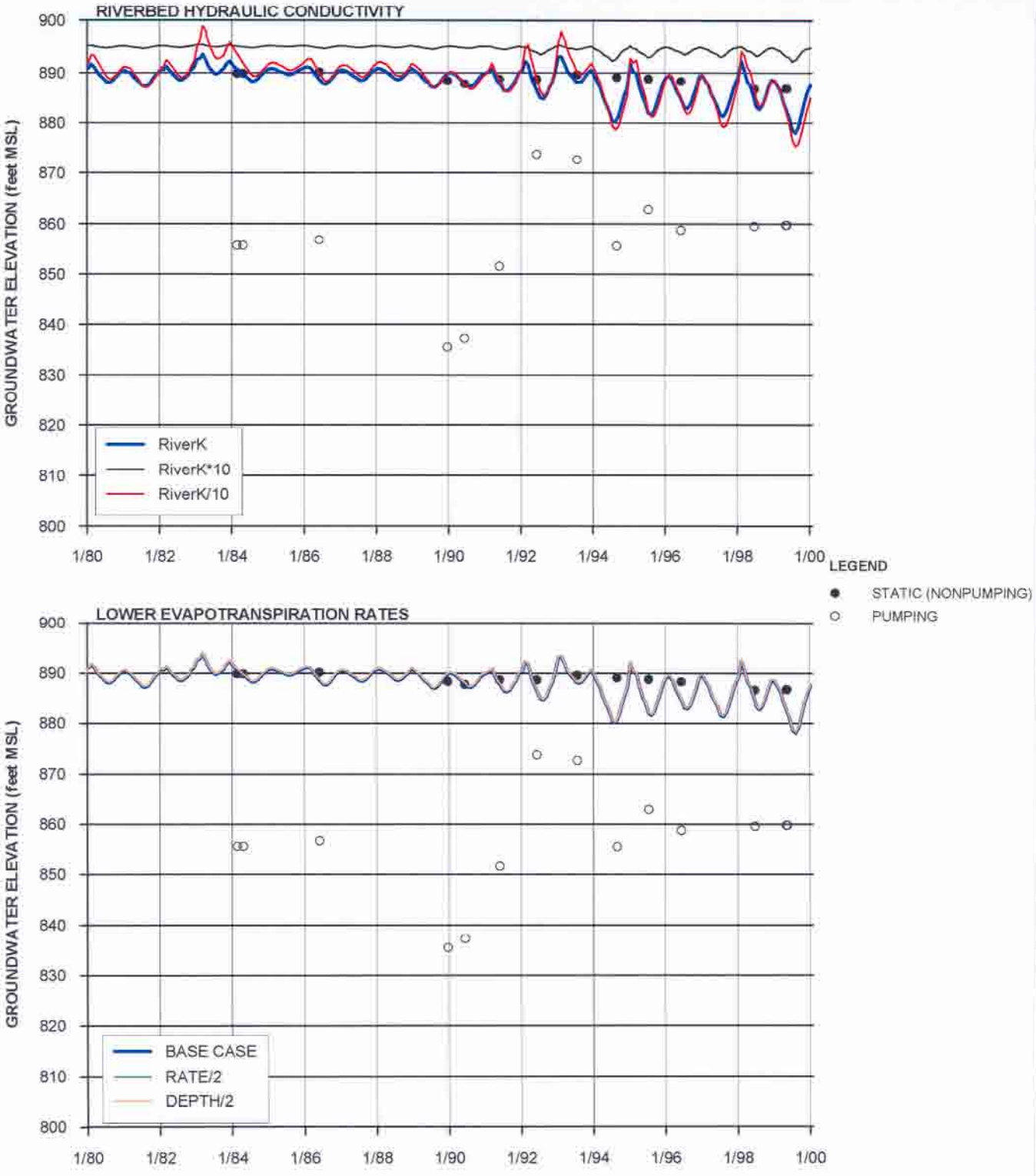


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-43
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 5851 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-331.GRF



NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-44
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-B7 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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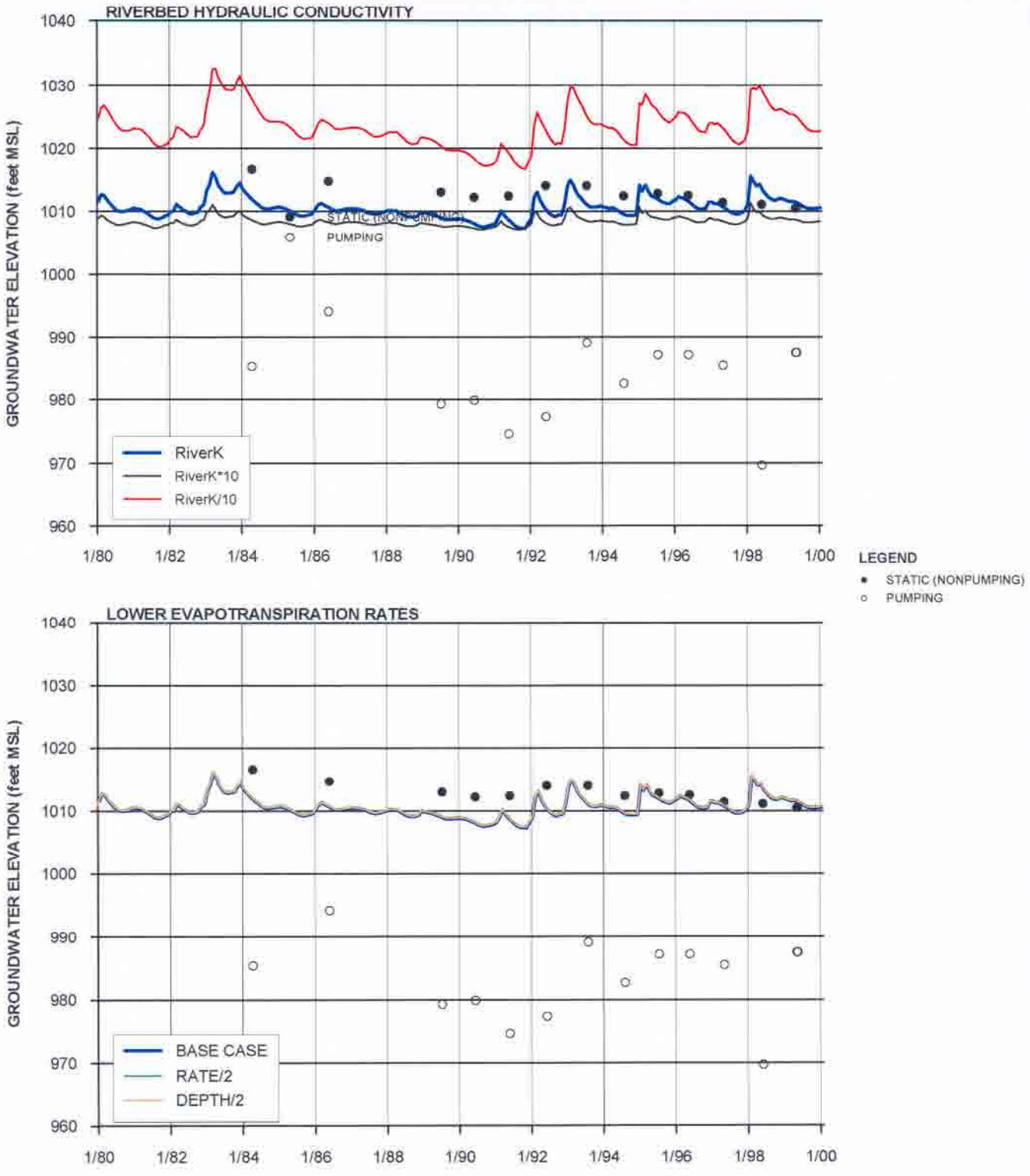
178973-332.GRF



NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-45
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-G45 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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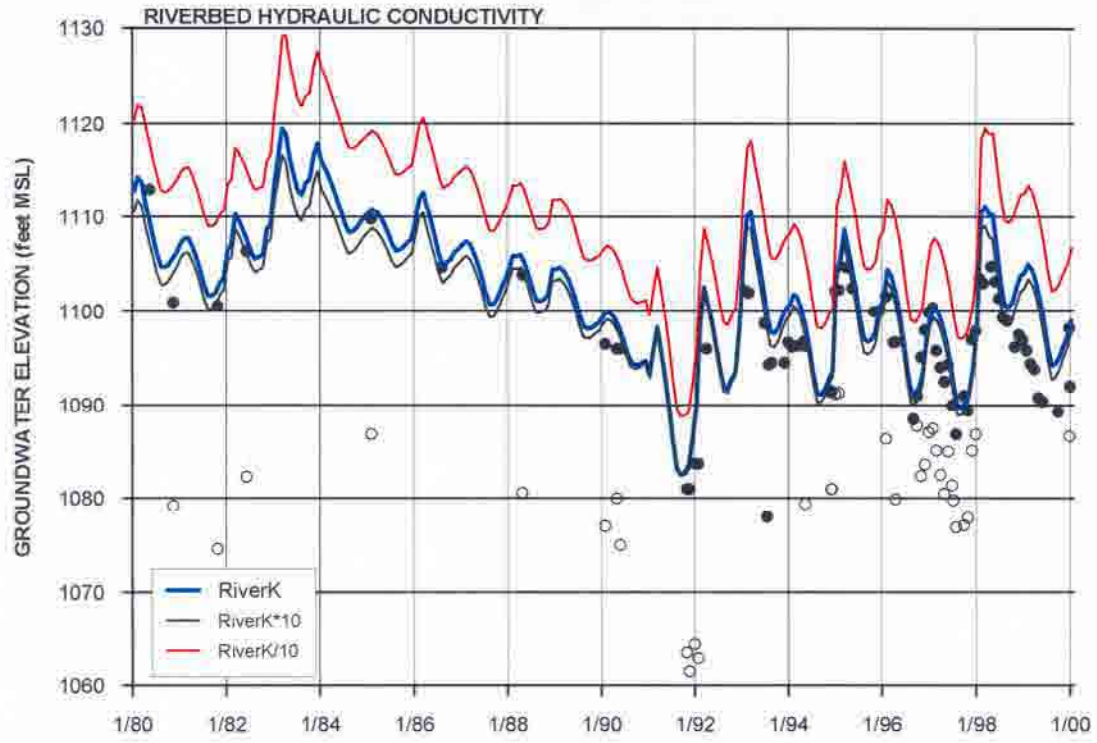
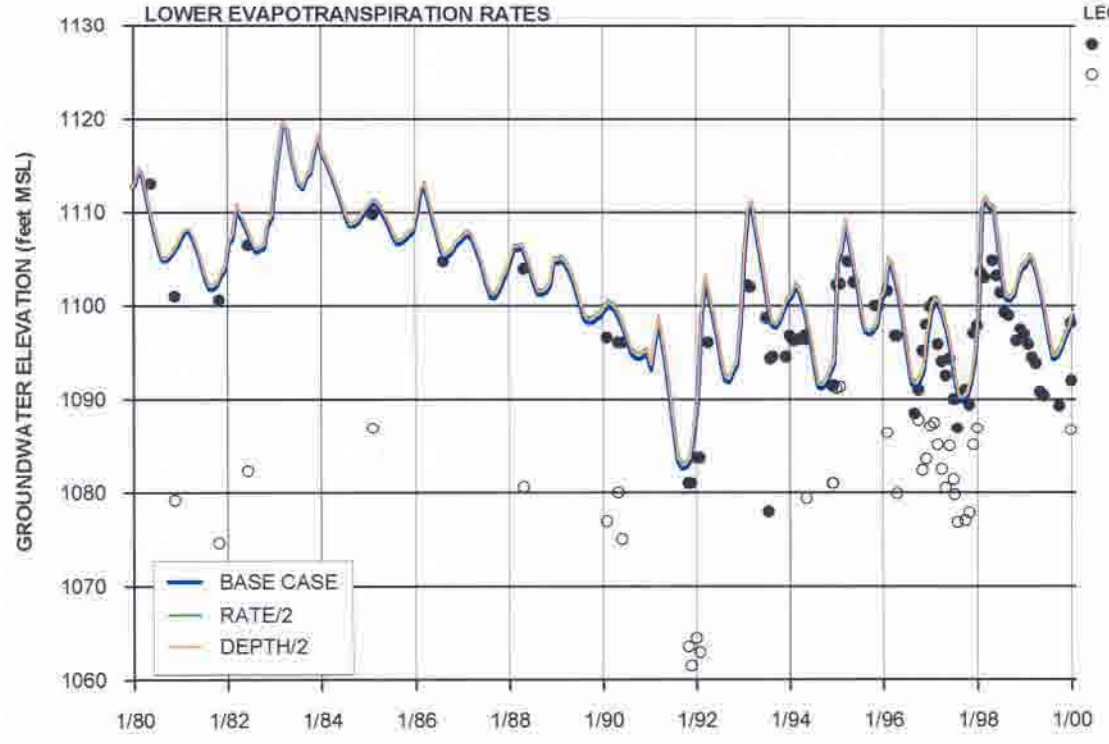


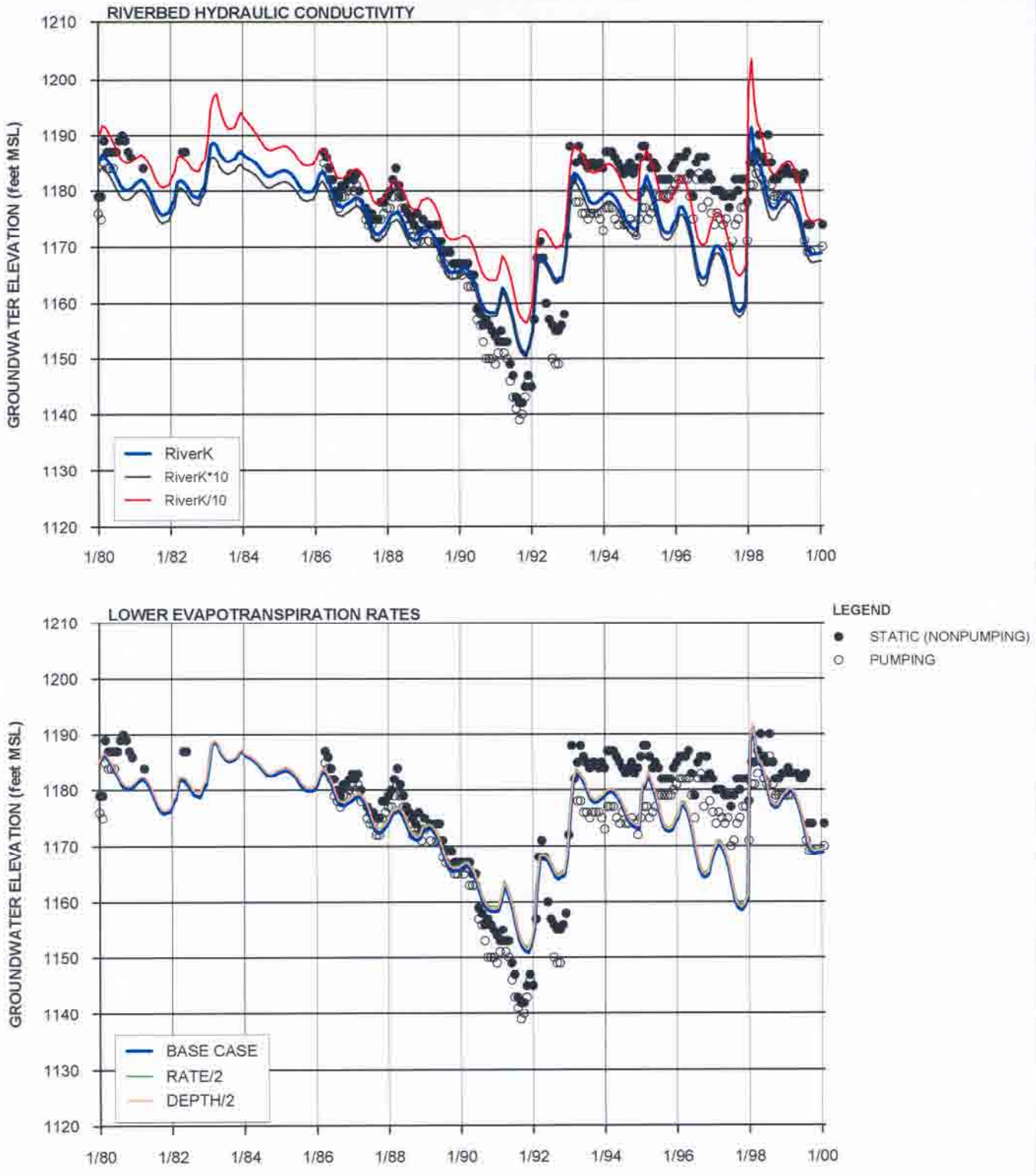


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-46
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-N TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-334.GRF

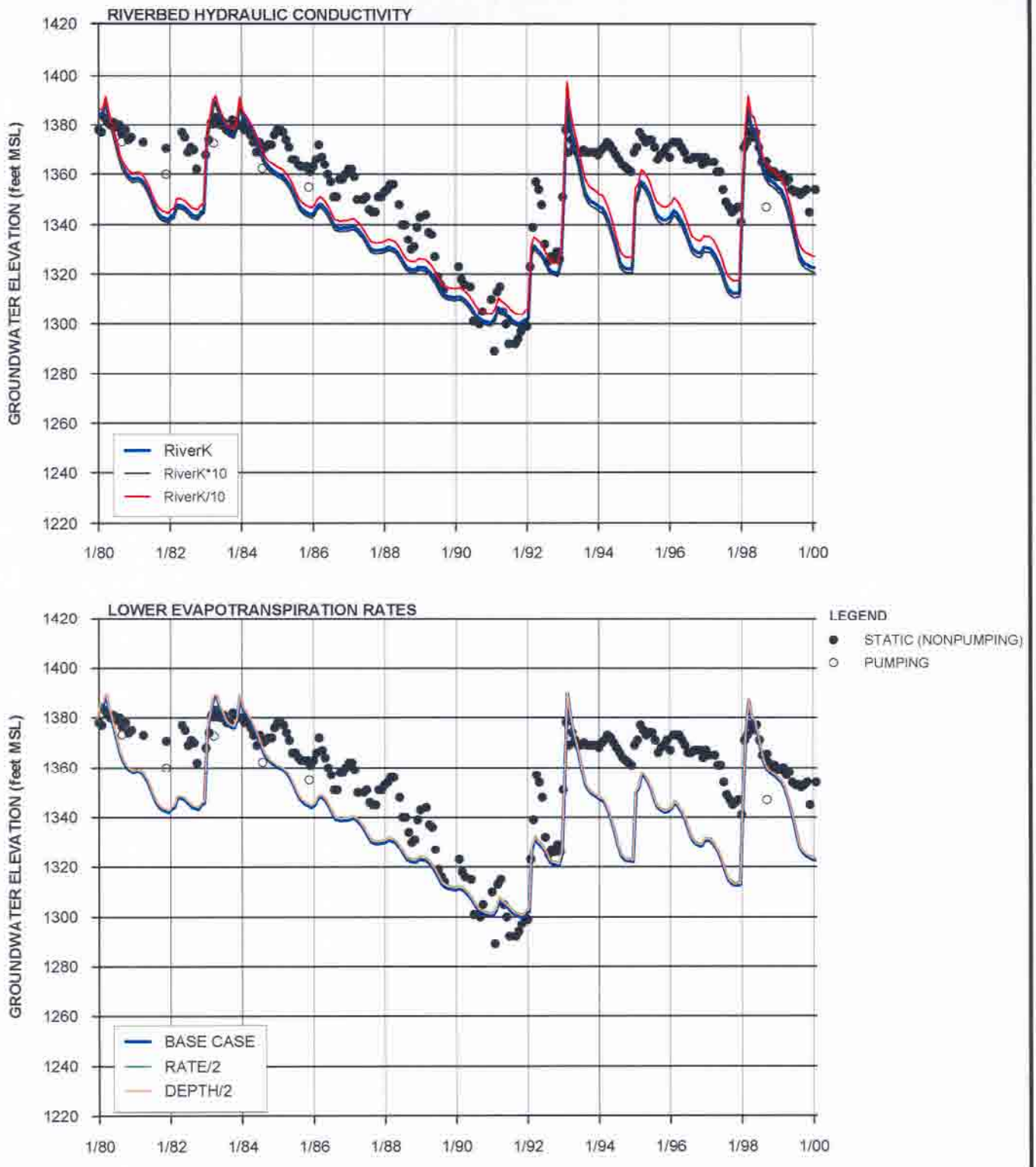


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-47
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-STADIUM TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-335.GRF

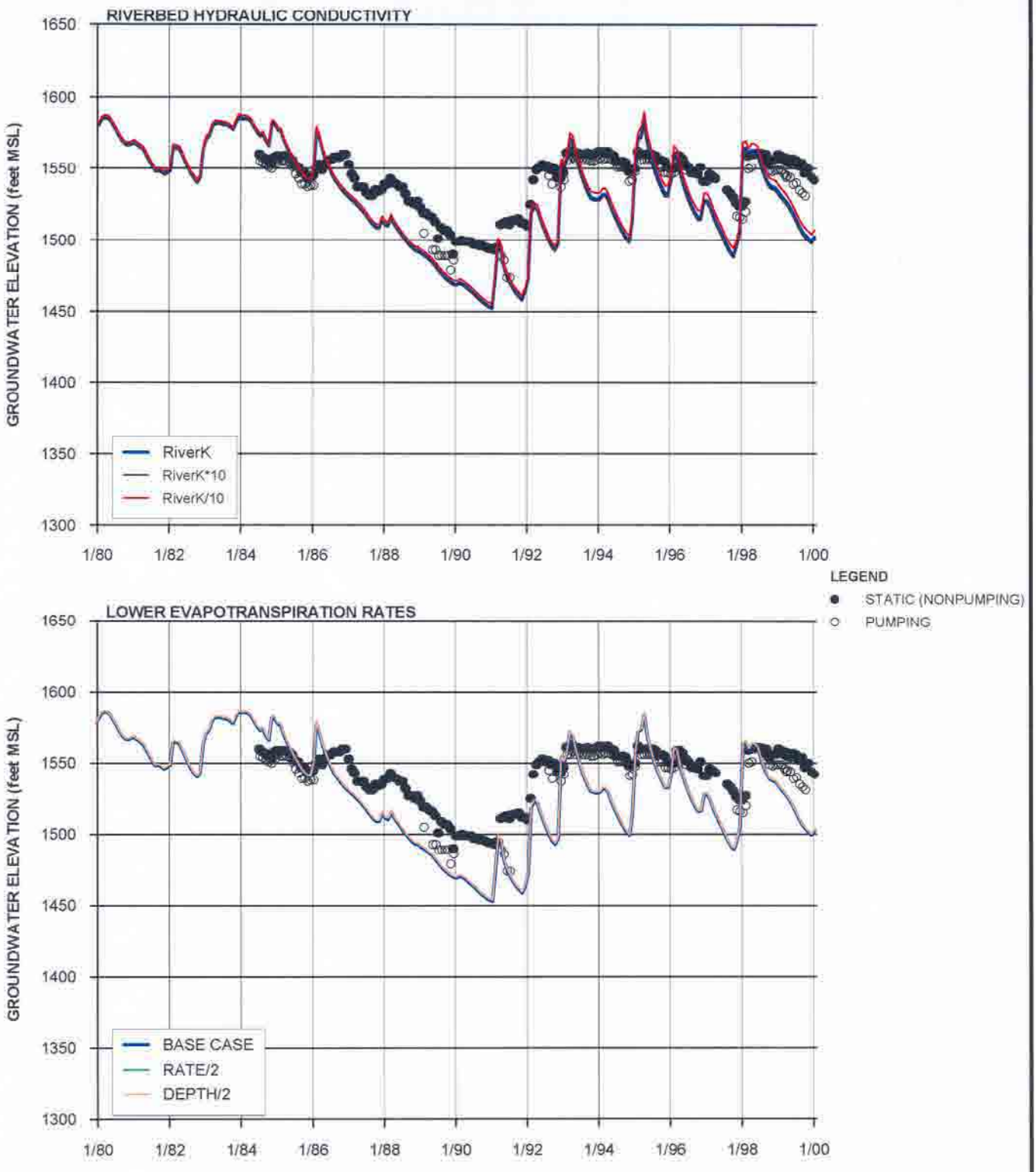


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-48
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-NORTH OAKS EAST TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-336.GRF

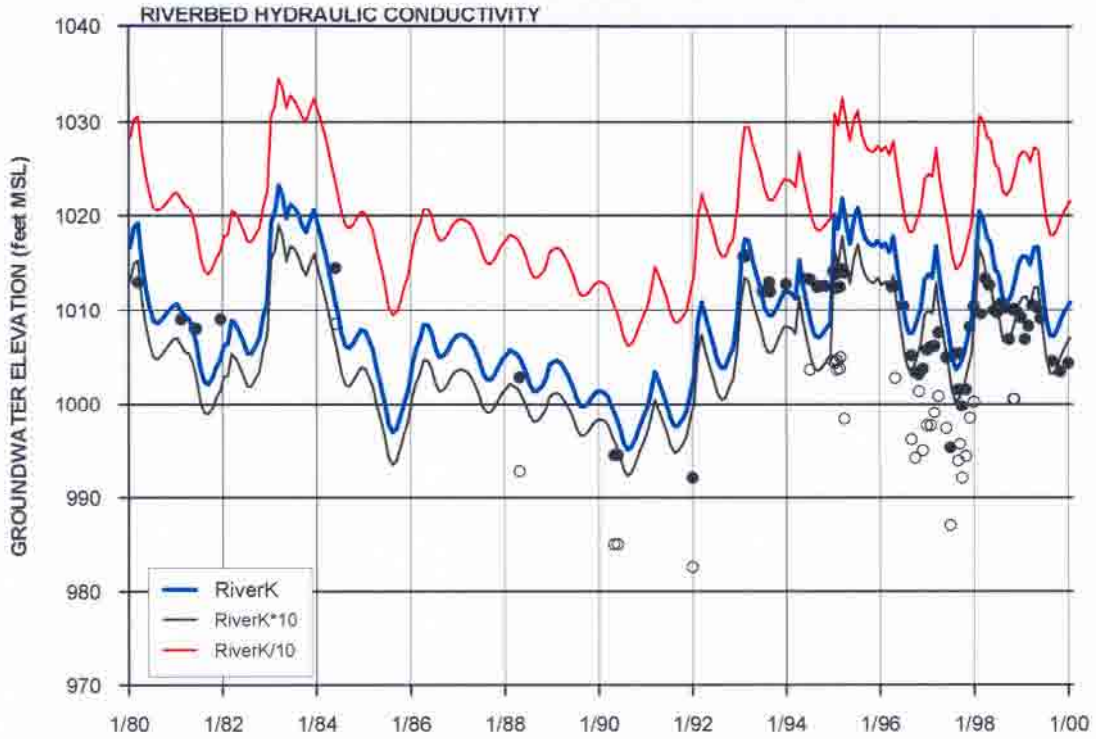


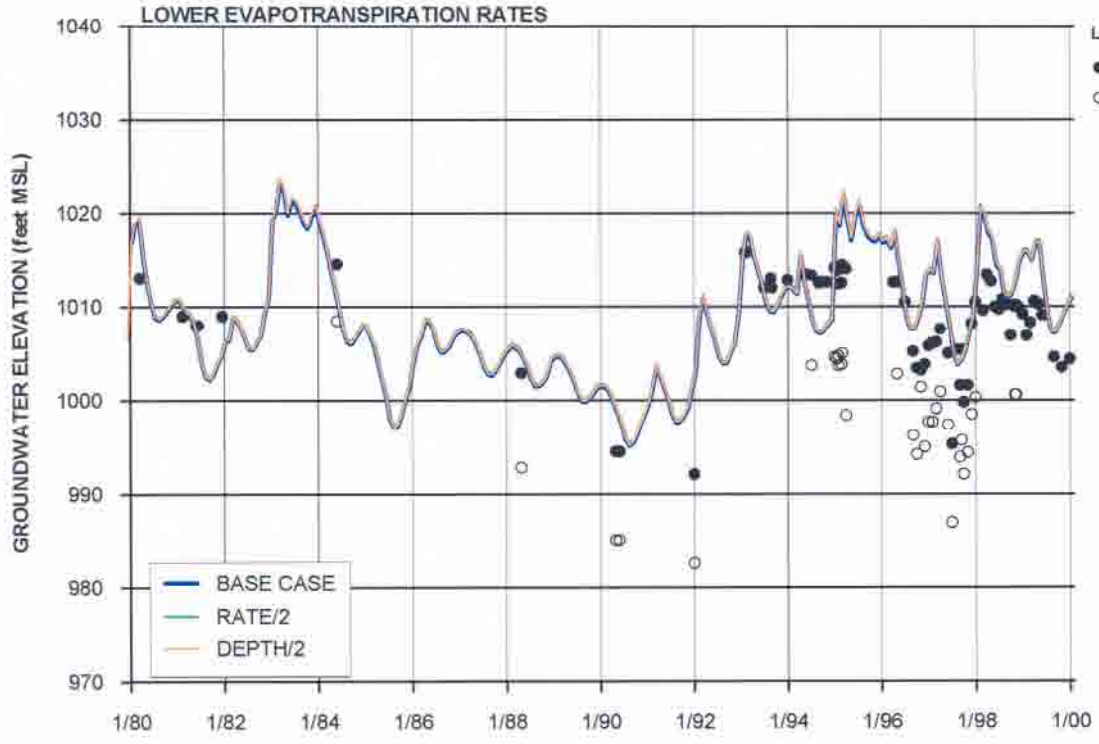
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-49
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-PINETREE1 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-337.GRF



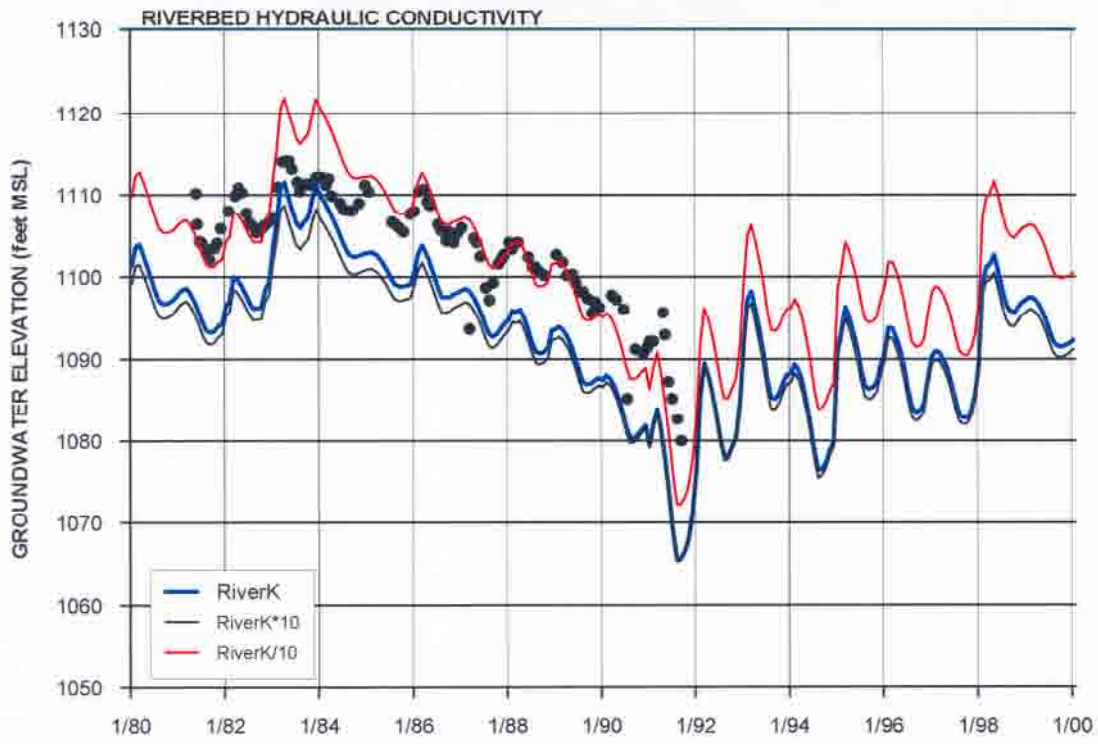


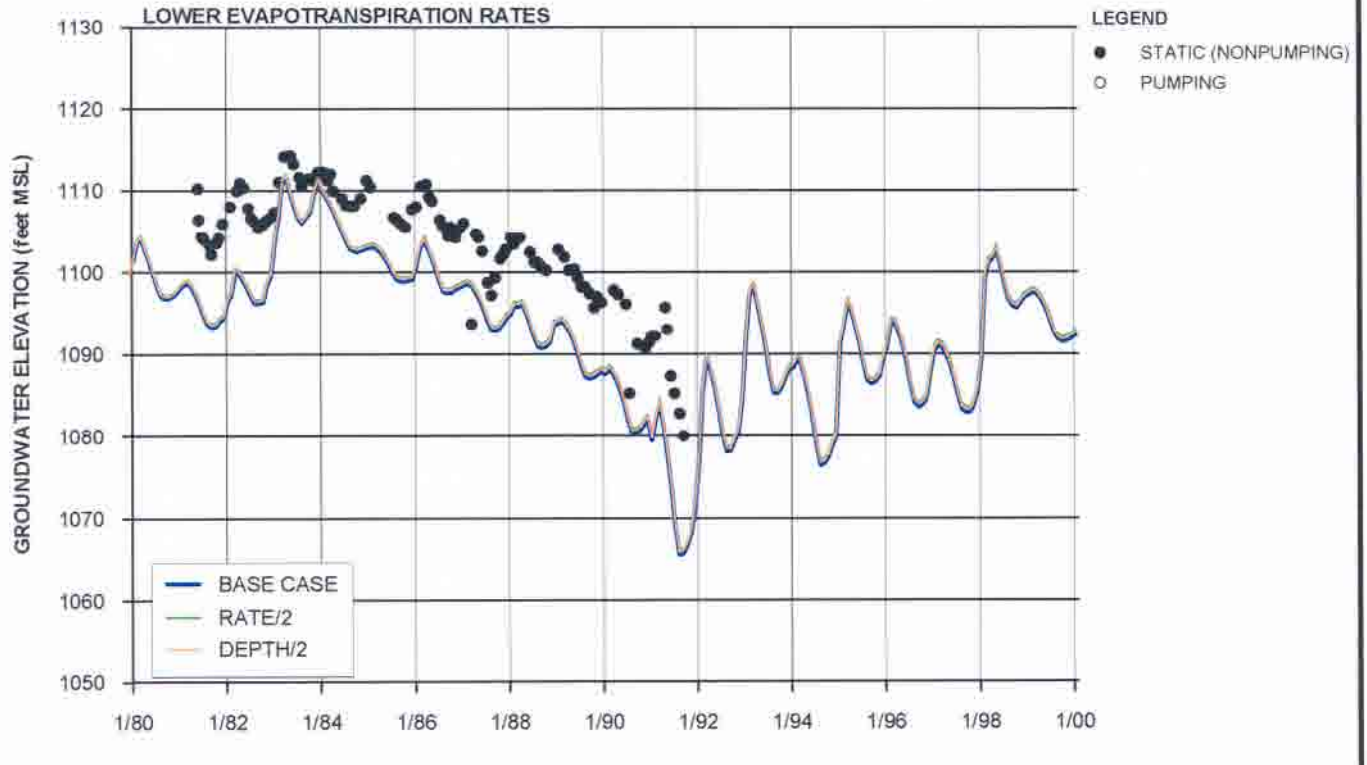
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-50
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-D TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-338.GRF



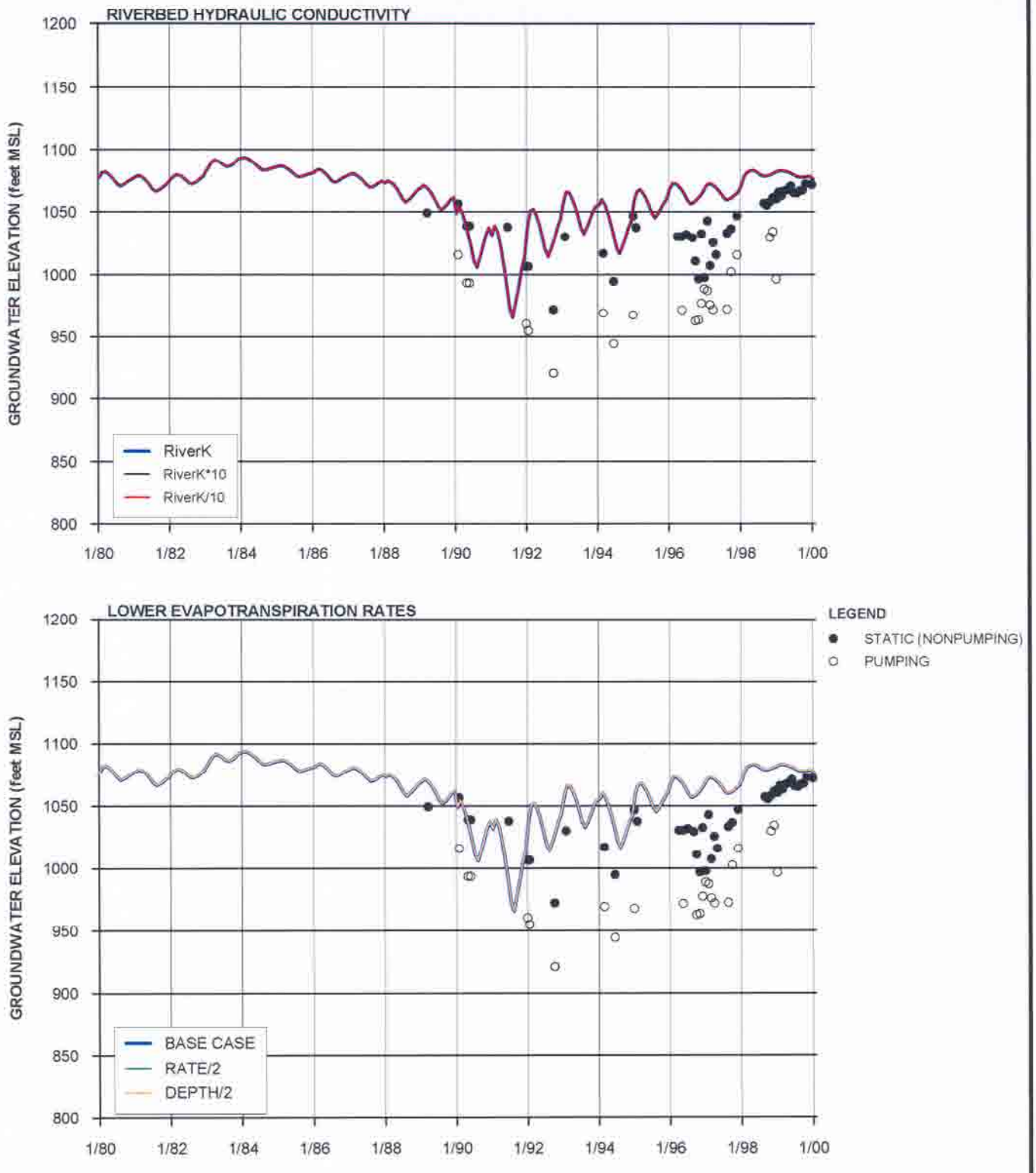


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-51
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 7048C TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-339.GRF

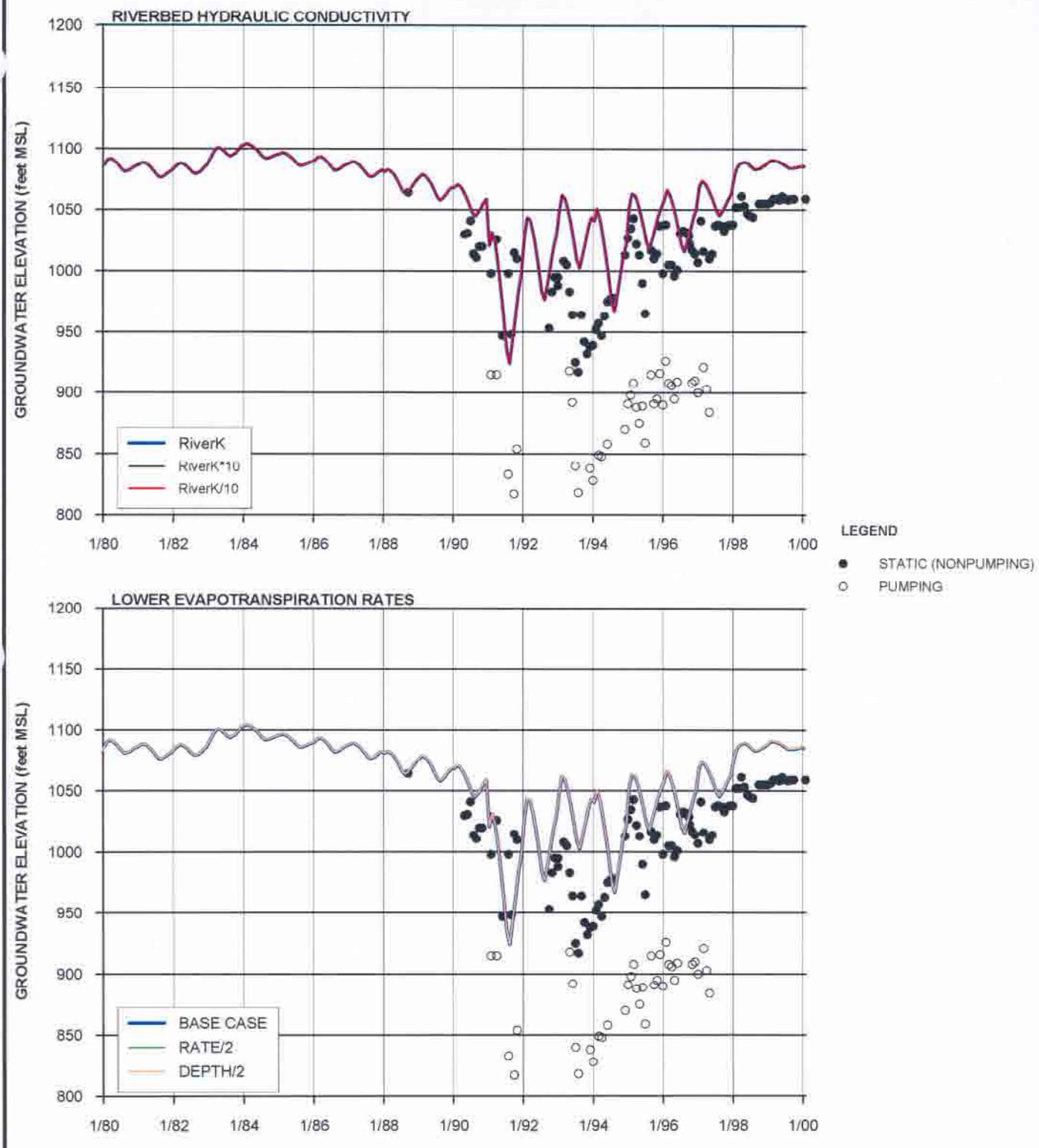


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-52
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT VWC-201 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-340.GRF

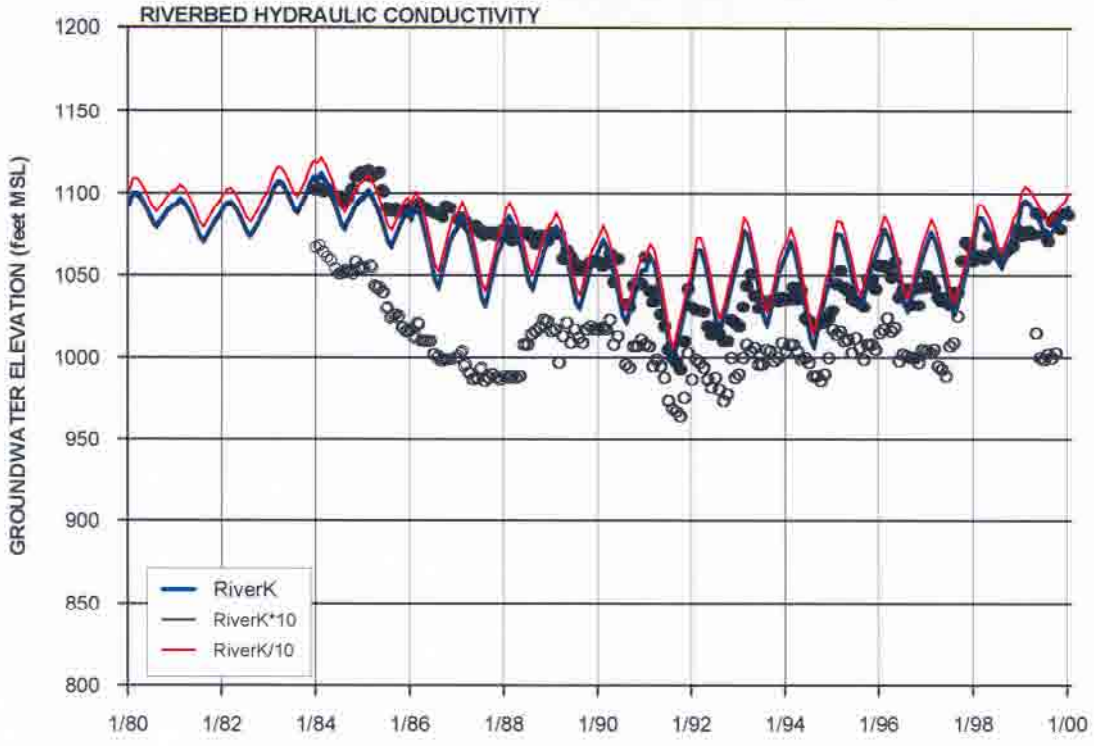


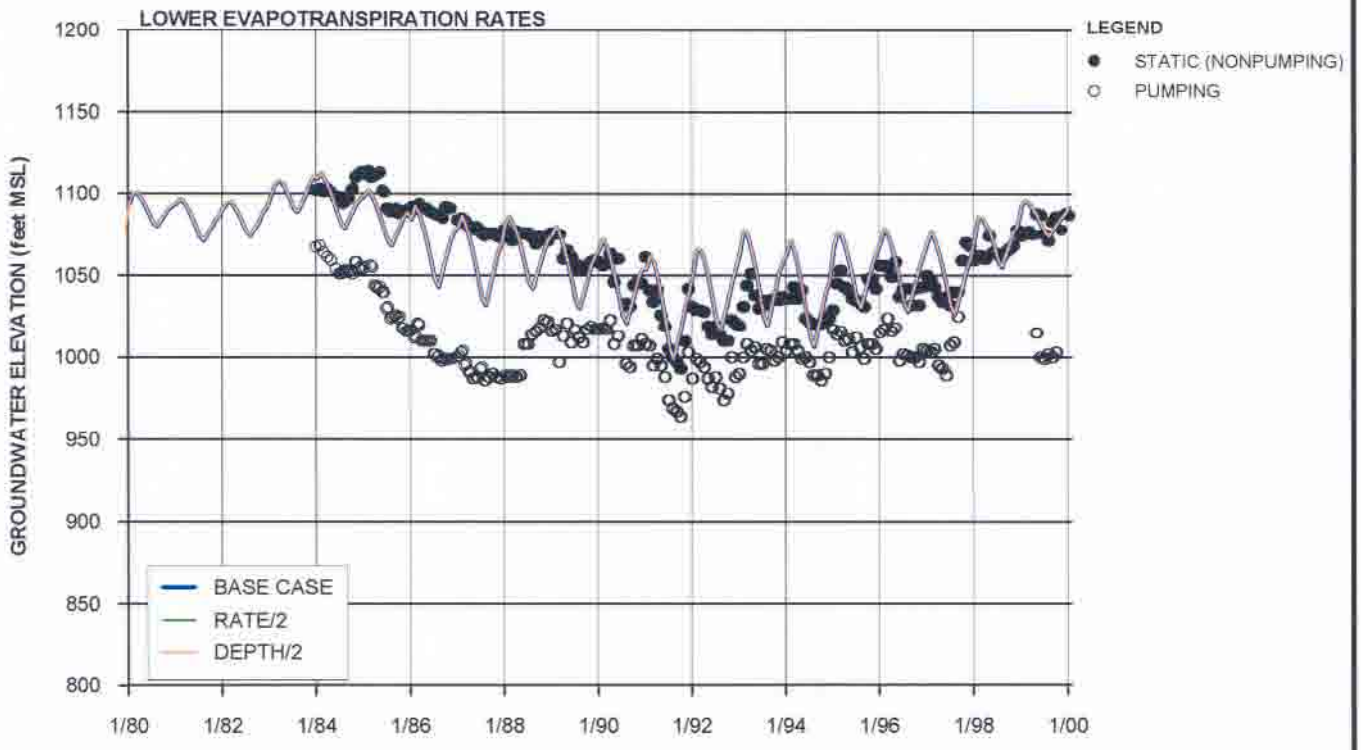
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-53
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT SCWC-SAUGUS 2 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-341.GRF





NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-54
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT NCWD-11 TO RIVER AND EVAPORTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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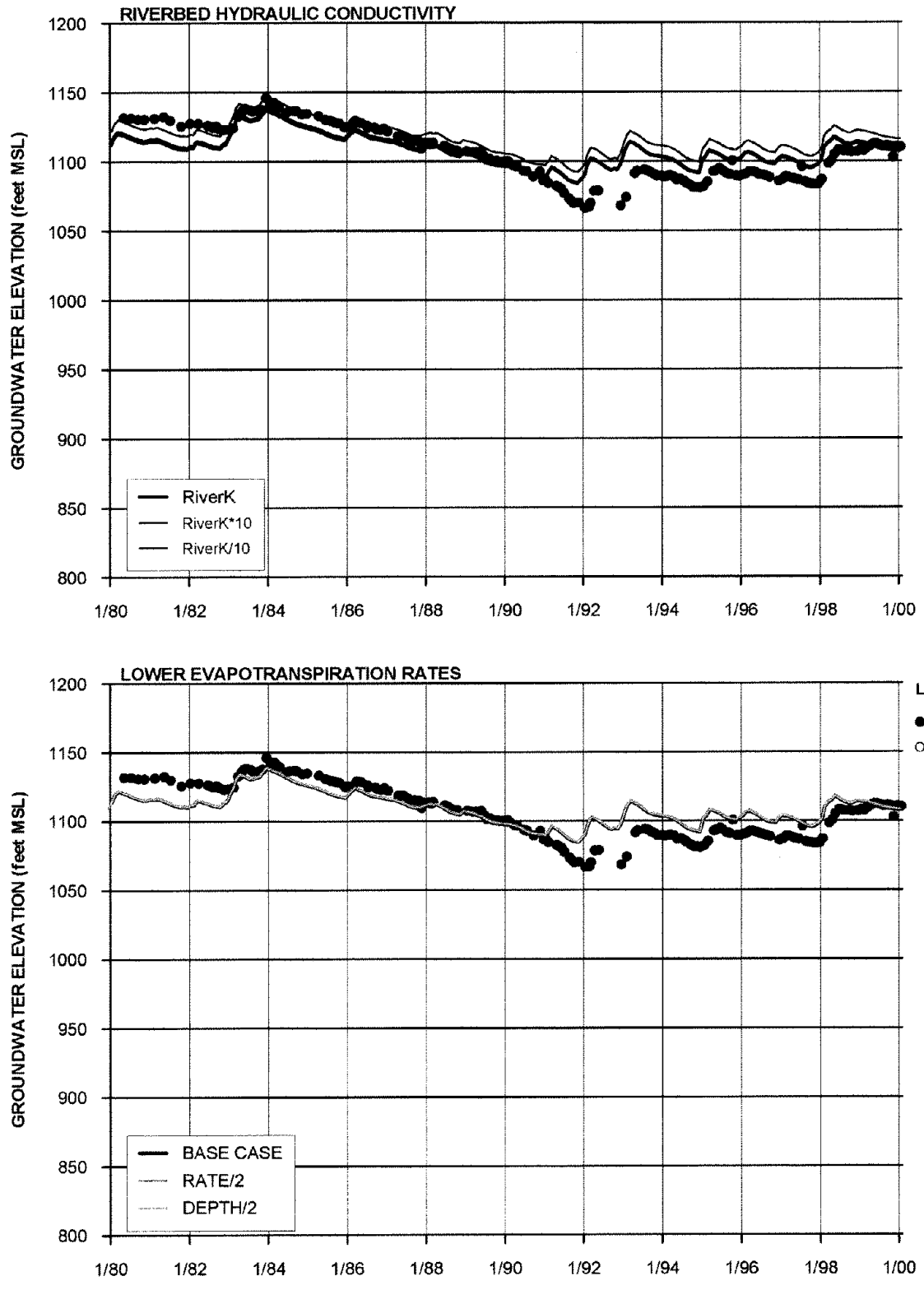
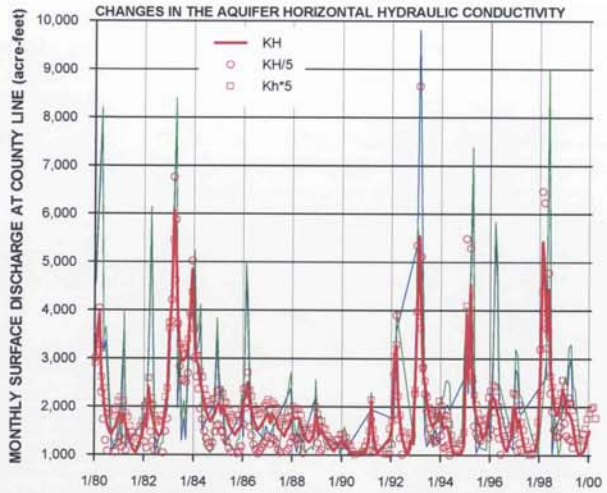


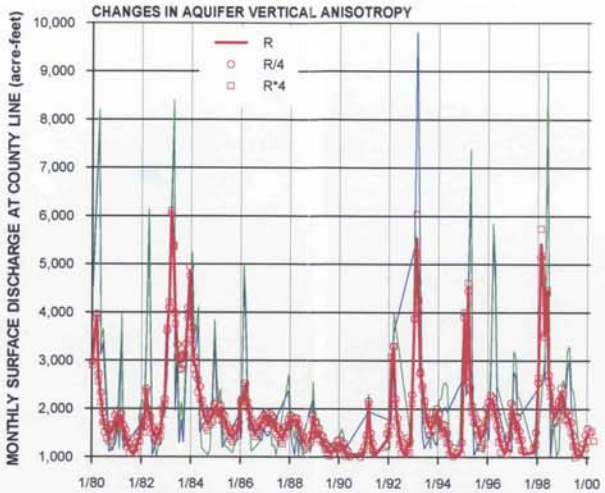
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

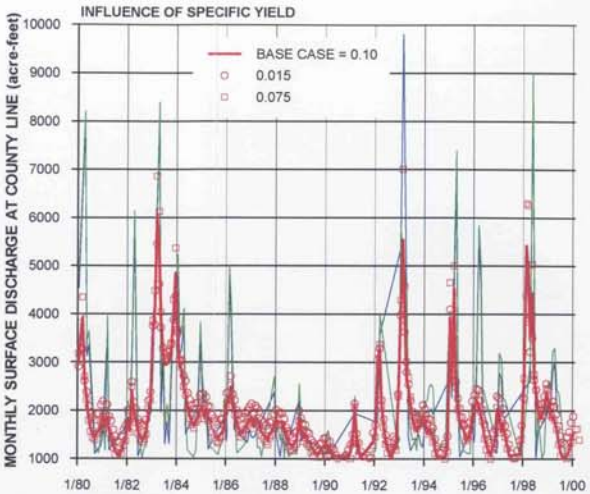
FIGURE 5-55
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 5851 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

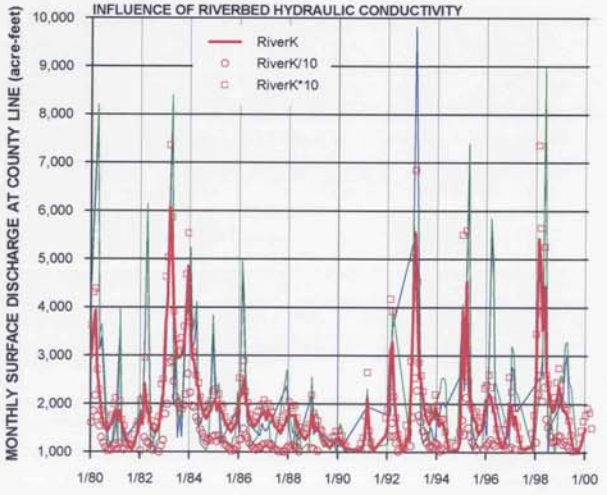
CH2MHILL

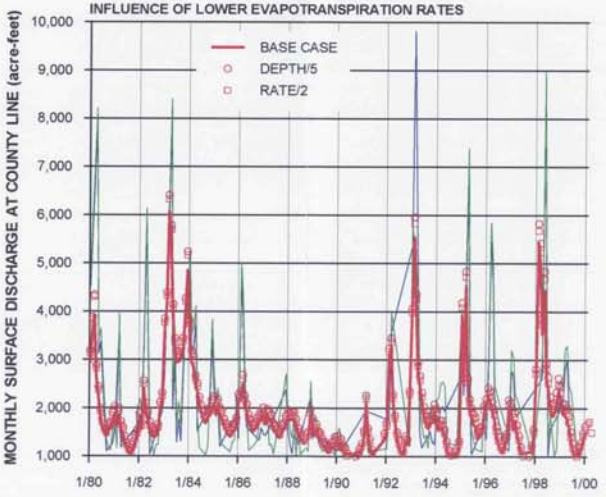
178973-343.GRF











LEGEND

MEASURED (NO INFILTRATION OF SAUGUS WRP FLOWS)
MEASURED (75% INFILTRATION OF SAUGUS WRP FLOWS)

NOTES:

1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
4. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
5. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)

FIGURE 5-56
SENSITIVITY OF GROUNDWATER DISCHARGES TO THE SANTA CLARA RIVER TO AQUIFER, RIVER, AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

175570-345.GRF

CH2MHILL

SECTION 6

Model Applicability to Local Water Resource Management

The Purveyors have developed the Regional Model as the main computer tool for their use in ongoing management of the groundwater resources in the Santa Clarita Valley. Among the objectives in developing the model were (1) to be able to evaluate the long-term sustainability (yield) of the Alluvial and Saugus aquifer systems under a range of existing and potential future water resource management conditions, and (2) to facilitate general management of water quantity and water quality issues.

The Regional Model simulates groundwater flow in the two aquifers that are present in the Santa Clara River Valley East Groundwater Subbasin. It has been developed using the database and GIS that were developed by, and are being used by, the Purveyors to manage the valley's water resources. The modeling effort built upon previous and ongoing hydrogeologic studies in the valley (RCS, 1986, 1988, 2001, 2002; CH2M HILL, 2003), as well as previous modeling efforts (CH2M HILL, 1996, 2001, 2002). Key aspects of the Regional Model's construction and calibration include the following:

a. The Regional Model covers the entire Santa Clara River Valley East Groundwater Subbasin, from the Lang stream gage, at the eastern end of the valley, to Blue Cut, just west of the county line.

b. The Regional Model includes the SWRM, which determines the monthly volume of rainfall that is available to streams that are tributaries to the Santa Clara River. The SWRM also computes how much of the runoff can recharge the Alluvial Aquifer, the locations of the recharge, and the amount of flow that remains in each stream. Further, the SWRM calculates how much flow occurs in the Santa Clara River due to tributary inflows and to WRP discharges. Together, the SWRM and the Regional Model allow for estimation of the time-varying magnitudes of total river flow and groundwater discharges to the river. In summary, the Regional Model is actually a groundwater flow model coupled with an empirical tool that estimates stormwater generation from each watershed lying upstream of, and extending into, the Regional Model's boundaries.

c. The Regional Model has been calibrated on a monthly basis to time-varying hydrologic conditions that were observed from 1980 through 1999. Calibration data consisted of groundwater elevations in both aquifers at production and monitoring wells; estimated fluctuations in groundwater discharges to the Santa Clara River; and gaged flows in the Santa Clara River. Consequently, the Regional Model is calibrated not only to groundwater elevation trends, but also to the flows of water into and out of the valley.

The Regional Model has been specifically designed for use in managing groundwater resources on a local and regional scale. Its design and calibration make it a useful tool for:

a. Evaluating groundwater management strategies, including analyzing basin operations over multi-year wet/dry cycles

b. Evaluating ASR projects or other aquifer recharge projects

c. Evaluating options for locating new or proposed water supply wells, with consideration of the avoidance and management of any contamination in the aquifer system

d. Evaluating the restoration of pumping capacity that has been impacted by perchlorate contamination in the vicinity of the Whittaker-Bermite property in the central part of the valley

Nonetheless, because no model is perfect, it should be used with care, and all model results should be examined by qualified and experienced hydrogeologists and water resource managers. Specific recommendations for the continued use and maintenance of this tool, including hydrogeologic data needs, are as follows:

a. Future predictive modeling activities should include sensitivity analyses on key model variables, particularly the Kh and Kv of both aquifer systems. This recommendation is based on the sensitivity analysis results, which show that groundwater elevations and groundwater discharge to the Santa Clara River are both sensitive to these parameters.

b. Streamflow monitoring should resume at the Lang gage, to better understand the magnitudes and timing of Santa Clara River flows into the valley. Stream gaging was discontinued at this location after October 1989. Because inflow in the Santa Clara River is one of the principal sources of water, the absence of data at this location is likely the primary reason that the Regional Model has difficulties simulating historical water level trends during certain periods at wells in the eastern-most portion of the valley. Without data from the Lang gage, simulations of future water level trends in this area will be uncertain, due to the Regional Model's tendency to under-predict groundwater elevations during drought periods.

c. The Regional Model and the SWRM should both be updated as water use conditions change in the future. Specific activities that merit updates to these tools include the planned implementation of recycled water use in the valley, continued urbanization in currently undeveloped and agricultural lands, and the increasing import of SWP water in response to increasing urban water demands.

d. Transient calibration runs should eventually be performed to test the transient model's ability to simulate conditions after 1999. The success of this activity will be more likely if streamflow data are collected at the Lang gage.

e. The Regional Model's calibration in the Saugus Formation should be tested whenever new wells are completed in this aquifer. Specifically, long-term water level monitoring should commence in these wells, and controlled pumping tests should be conducted to provide quantitative estimates of aquifer properties at new well locations, particularly in areas where wells have not been previously constructed.

f. Other activities described in the MOU between Ventura County and the Purveyors should continue, in order to provide data that can be used to improve the Regional Model and management of the local water resources. These data include pumping, rainfall, WRP discharge, streamflow, and groundwater elevation information. In particular, the groundwater elevation monitoring program that has been conducted for the past several years at production and monitoring wells should continue. Data from this program, collected by the Purveyors and LACFCD, provide valuable information for identifying and understanding the changes that occur in the hydrologic system, including the relationships between groundwater and surface water.

SECTION 7

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Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation.** The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights.** Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

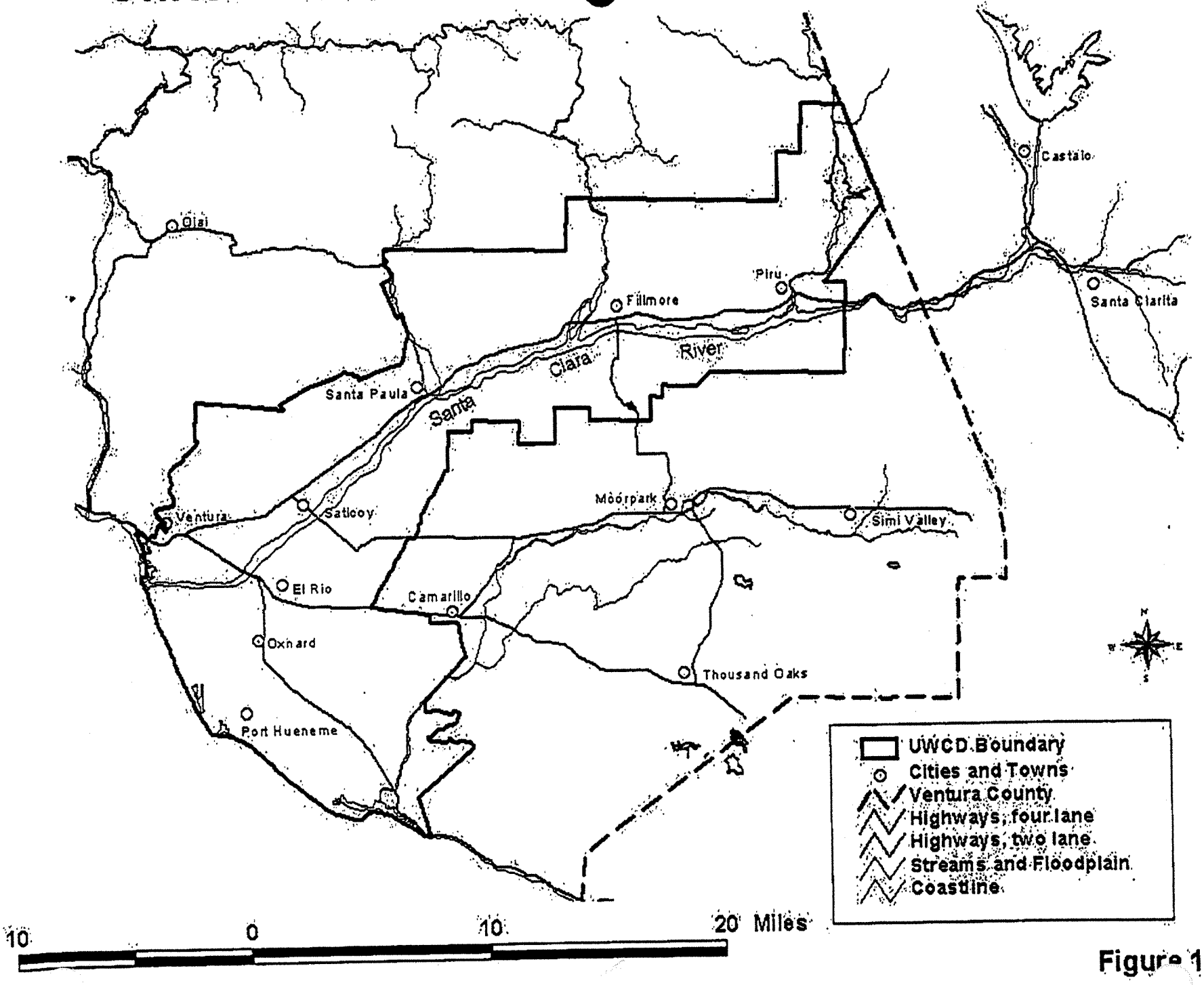


Figure 1-1

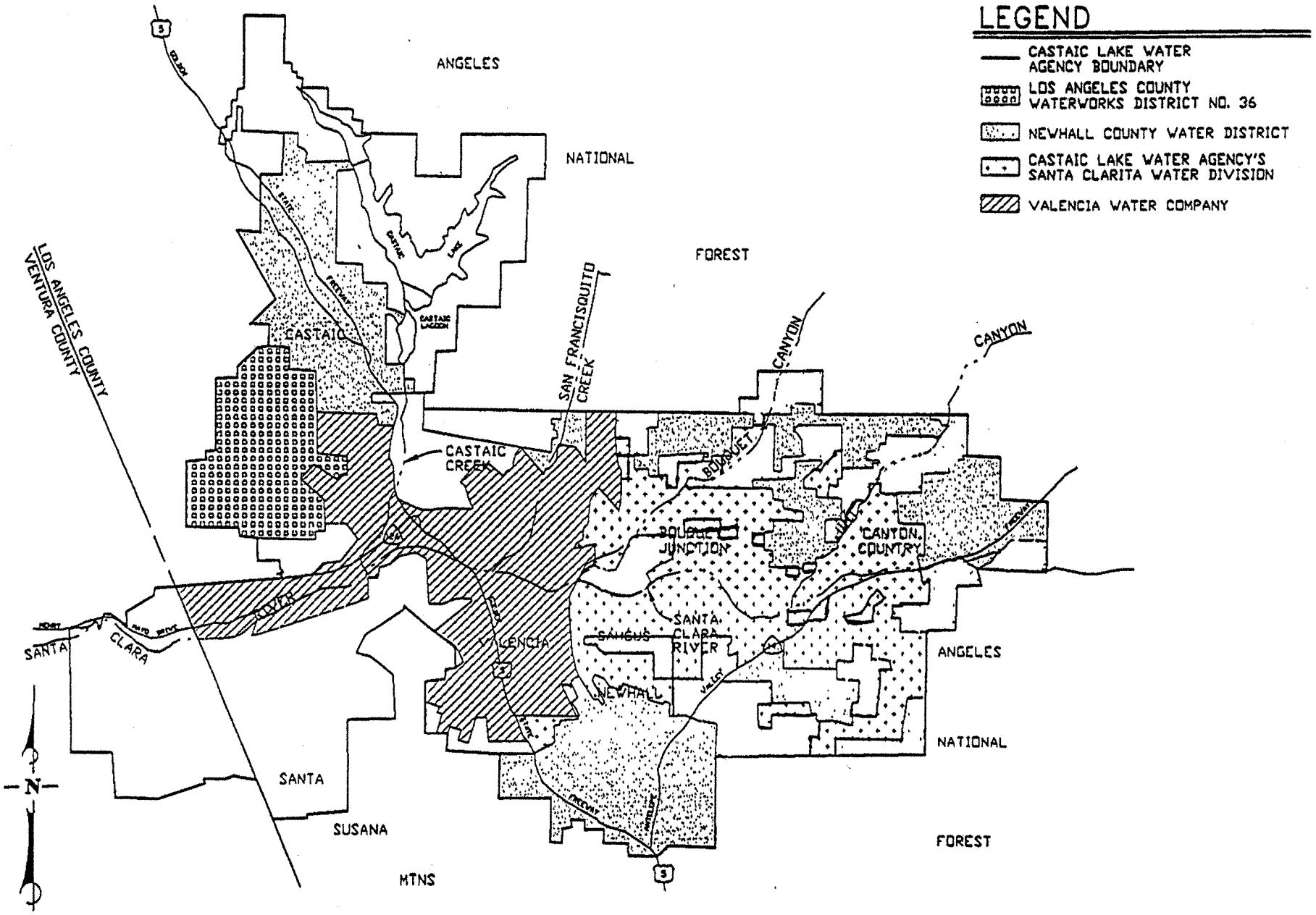


FIGURE 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

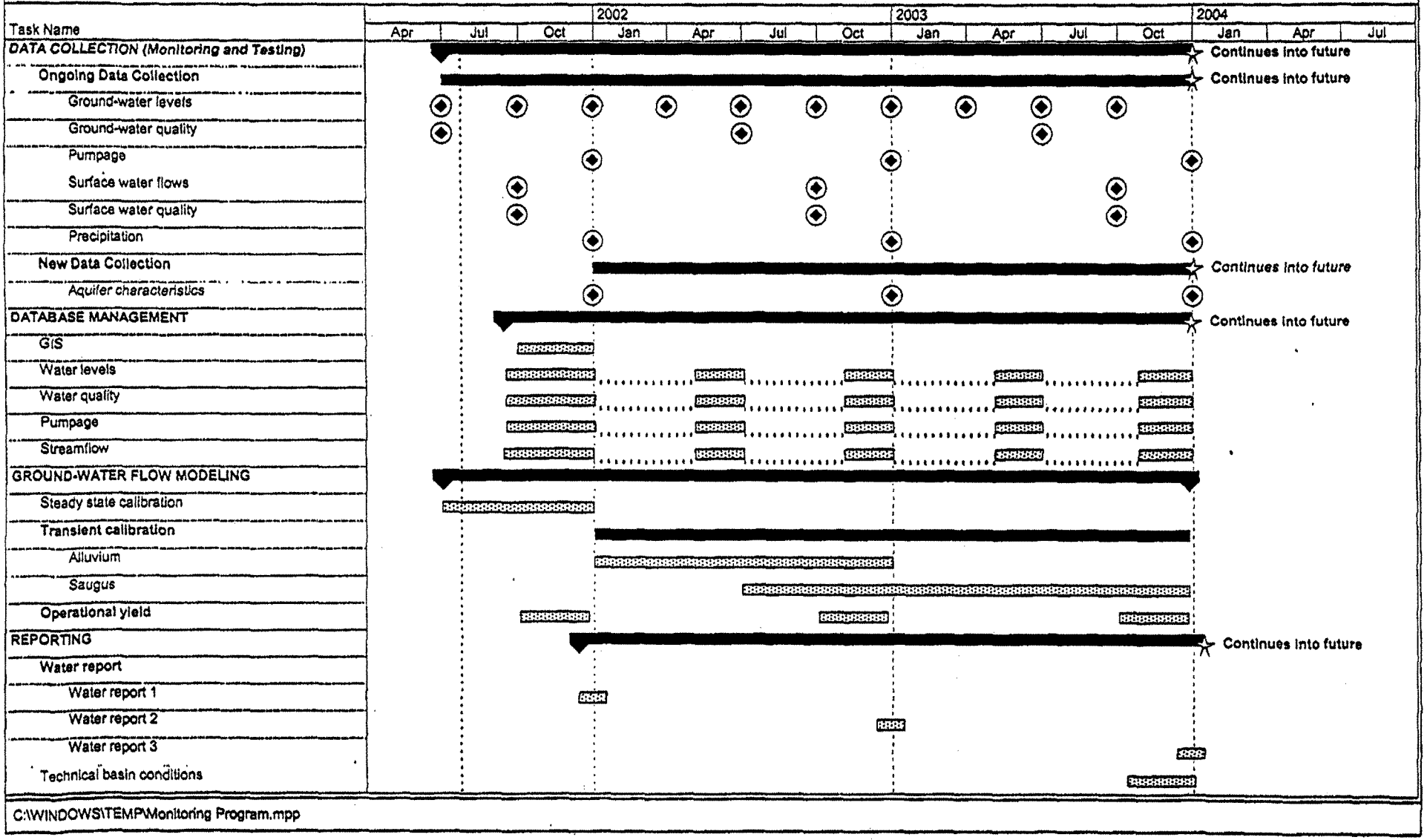
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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APPENDIX B

Analyses of Specific Capacity Test Data for the Alluvial Aquifer

Specific capacity data are available for production wells in the Alluvial Aquifer through 2000. Tables B-1 through B-6 present these data and the calculations of estimated transmissivity (T) and horizontal hydraulic conductivity (Kh) values, along with how these values compare with the values used in the calibrated groundwater flow model at each well location. Rows in bold font identify specific capacity tests that were considered to provide the best indications of aquifer properties.

The tables show the testing data for different geographic areas in the Alluvial Aquifer[1], as well as the estimated drawdown in the aquifer formation for different values of well efficiency. Because of the unconfined nature of the Alluvial Aquifer system, the following equations were used to calculate T and Kh (Driscoll, 1986):

$$s = s_{well} * E$$

$$T = 1500 * Q / s \qquad (1)$$

$$Kh = T / (7.48 * b_{typical})$$

where:

s = the estimated drawdown in the aquifer formation

s_{well} = the measured drawdown in the well during the efficiency test

E = the well estimated efficiency

T = the transmissivity (gallons per day per foot [gpd/ft])

Q = the pumping rate (gallons per minute [gpm])

Q/s = specific capacity of the well

Kh = the horizontal hydraulic conductivity of the alluvial aquifer (feet per day [ft/day])

$b_{typical}$ = the typical long-term average saturated thickness (feet [ft]) of the alluvial aquifer at the location of the specific well

For each test, Tables B-1 through B-6 show the data and the calculations for drawdown, T, and Kh at different estimated well efficiencies (70 percent is the typical efficiency of a well that is in good condition; 50 percent reflects a well that is less efficient).[2] As shown in the table, the T and Kh values vary widely with location, as well as over time at individual wells. The table uses bold font to identify those tests that are believed to be the least affected

[1] See Figure 2-3 for well locations. See also Figure 4-1 for the locations of the target wells and zones that were used during calibration of the Alluvial Aquifer in the Santa Clarita Valley Groundwater Model (Regional Model).

[2] Well efficiency is a function of the design, construction, and condition of the well.

by well efficiency issues (i.e., show the highest specific capacity values) and therefore provide the best estimate of aquifer parameter values at each well location. Specific conclusions from this analysis are:

a. In the western alluvium along the main Santa Clara River valley (west of I-5), it appears that few wells have high enough efficiencies to provide estimates of Alluvial Aquifer Kh values. The highest specific capacities for the Alluvial Aquifer are indicated by only about 19 of the 335 tests performed in this area. For these 19 tests and a well efficiency of 70 percent, the Kh ranges from approximately 300 to 1,000 ft/day and is typically approximately 500 to 600 ft/day. The Regional Model uses a Kh of 550 ft/day throughout this area.

b. In the central valley, between I-5 and Soledad Canyon, 8 of the 11 tested wells appear to provide usable estimates of Alluvial Aquifer Kh values. These wells indicate a Kh range typically between 250 and 600 feet/day, though one well (NLF-R2) indicates Kh values potentially as high as 800 ft/day or greater. The Regional Model uses values between 245 and 375 ft/day in most of this area, and 550 ft/day at the very eastern edge of this area, at the mouth of Soledad Canyon.

c. In the lower reach of Soledad Canyon, most wells indicate Kh values ranging from 600 ft/day to more than 1,000 ft/day. Only the SCWC-Honby well suggests lower Kh values of approximately 300 to 550 ft/day. The Regional Model uses a Kh of 550 ft/day throughout this area.

d. In the upper reach of Soledad Canyon, the Kh values show more variability from well to well than lower Soledad Canyon. Kh values in upper Soledad Canyon range from approximately 300 to 700 ft/day at some wells, and 900 to 1,500 ft/day at the other wells. The Regional Model uses Kh values ranging from 350 ft/day at the eastern end of the canyon to 550 ft/day farther west.

e. In the tributary canyons north of the Santa Clara River, Alluvial Aquifer Kh values tend to be slightly lower than along the Santa Clara River main valley.

    1. Along Castaic Creek, Kh values are commonly between 350 and 600 ft/day, though a few tests suggest values as high as 800 to 1,000 ft/day. The Regional Model uses a value of 315 ft/day below Castaic Dam and at the NCWD Castaic wellfield, and 350 ft/day between this wellfield and the alluvial valley containing the Santa Clara River.

    2. In San Francisquito Canyon, the W series wells owned by VWC and NLF suggest Kh values of approximately 200 to 400 ft/day. The Regional Model uses a value of 105 ft/day.

    3. In Bouquet Canyon, the two SCWC wells suggest Kh values of approximately 500 to 900 ft/day. The Regional Model uses a value of 140 ft/day at SCWC-Guida in the central portion of the canyon, and 245 ft/day at SCWC-Clark well in the lower reaches of the canyon.

The estimation of K values from specific capacity test data is a method that provides only an approximation of aquifer properties. This method is valuable for constraining the Regional Model's calibration because specific capacity tests provide the only source of data that allow

estimation and comparison of Alluvial Aquifer properties across the valley. Nonetheless, the method is affected by the following factors and uncertainties:

a. The measured drawdown in a well is affected by the radius of the well and the borehole, and the efficiency of the well at the time it is tested.

b. Yield and drawdown are affected by the length of the well screen and the fraction of the aquifer's thickness that is screened.

c. Fluctuations in water levels that occur seasonally and over multi-year periods affect the yield and drawdown of the well, and also the estimates of saturated thickness that are necessary for performing the calculations.

Reference

Driscoll, Fletcher G. 1986. *Groundwater and Wells*. Second Edition.

Tables

TABLE B-1

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Western Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	B5	**04/24/1984**	**1988**	**6.9**	**288.1**	**6.9**	**4.83**	**3.45**	**82,534**	**115,548**	**60,500**	**110**	**750**	**1,050**	**550**
		06/09/1986	1816	5.6	324.3	5.6	3.92	2.8	92,905	130,067		110	845	1,182	
		10/15/1987	1878	6.6	284.5	6.6	4.62	3.3	81,503	114,104		110	741	1,037	
		10/04/1988	1342	6.7	200.3	6.7	4.69	3.35	57,382	80,334		110	522	730	
		07/20/1989	1659	8.6	192.9	8.6	6.02	4.3	55,262	77,366		110	502	703	
		06/13/1990	1699	8	212.4	8	5.6	4	60,848	85,187		110	553	774	
		05/28/1991	**2013**	**7.6**	**264.9**	**7.6**	**5.32**	**3.8**	**75,888**	**106,243**	**60,500**	**110**	**690**	**966**	**550**
		07/26/1993	1895	7.2	263.2	7.2	5.04	3.6	75,401	105,561		110	685	960	
		08/15/1994	1870	6.3	296.8	6.3	4.41	3.15	85,027	119,037		110	773	1,082	
		07/18/1995	2081	6.5	320.2	6.5	4.55	3.25	91,730	128,422		110	834	1,167	
		06/10/1996	**2045**	**6.5**	**314.6**	**6.5**	**4.55**	**3.25**	**90,126**	**126,176**	**60,500**	**110**	**819**	**1,147**	**550**
		05/08/1997	1898	6.6	287.6	6.6	4.62	3.3	82,391	115,348		110	749	1,049	
		03/28/2000	**2357**	**6**	**392.8**	**6**	**4.2**	**3**	**112,529**	**157,540**	**60,500**	**110**	**1,023**	**1,432**	**550**
NLF	B6	05/21/1984	1473	12.1	121.7	12.1	8.47	6.05	34,864	48,810		110	317	444	
		06/09/1986	1886	15	125.7	15	10.5	7.5	36,010	50,414		110	327	458	
		10/15/1987	1190	10.4	114.4	10.4	7.28	5.2	32,773	45,882		110	298	417	
		07/20/1989	1043	8.4	124.2	8.4	5.88	4.2	35,581	49,813		110	323	453	
		06/13/1990	1083	10.4	104.1	10.4	7.28	5.2	29,822	41,751		110	271	380	
		05/30/1991	1603	11.9	134.7	11.9	8.33	5.95	38,589	54,024		110	351	491	
		06/10/1992	**1746**	**11.6**	**150.5**	**11.6**	**8.12**	**5.8**	**43,115**	**60,361**	**60,500**	**110**	**392**	**549**	**550**
		07/26/1993	1473	6.7	219.9	6.7	4.69	3.35	62,997	88,195		110	573	802	
		08/15/1994	1460	15.5	94.2	15.5	10.85	7.75	26,986	37,781		110	245	343	
		07/19/1995	**1600**	**9.2**	**173.9**	**9.2**	**6.44**	**4.6**	**49,819**	**69,746**	**60,500**	**110**	**453**	**634**	**550**
		06/10/1996	1274	18.6	68.5	18.6	13.02	9.3	19,624	27,473		110	178	250	
		05/08/1997	1394	15.6	89.4	15.6	10.92	7.8	25,611	35,856		110	233	326	
		06/26/1998	1554	15	103.6	15	10.5	7.5	29,679	41,551		110	270	378	
		05/06/1999	1504	13.3	113.1	13.3	9.31	6.65	32,401	45,361		110	295	412	
		05/21/1999	1504	13.3	113.1	13.3	9.31	6.65	32,401	45,361		110	295	412	
		04/21/2000	1086	22.4	48.5	22.4	15.68	11.2	13,894	19,452		110	126	177	
NLF	B7	02/24/1984	832	34.2	24.3	34.2	23.94	17.1	6,961	9,746	60,500	110	63	89	550
		04/24/1984	832	34.2	24.3	34.2	23.94	17.1	6,961	9,746		110	63	89	
		06/03/1986	766	33.4	22.9	33.4	23.38	16.7	6,560	9,184		110	60	83	
		12/21/1989	700	52.9	13.2	52.9	37.03	26.45	3,782	5,294		110	34	48	
		06/12/1990	766	50.5	15.2	50.5	35.35	25.25	4,354	6,096		110	40	55	
		05/29/1991	878	37.1	23.7	37.1	25.97	18.55	6,790	9,505		110	62	86	
		06/10/1992	837	14.9	56.2	14.9	10.43	7.45	16,100	22,540		110	146	205	
		07/23/1993	911	16.9	53.9	16.9	11.83	8.45	15,441	21,618		110	140	197	
		08/30/1994	730	33.5	21.8	33.5	23.45	16.75	6,245	8,743		110	57	79	
		07/17/1995	720	25.9	27.8	25.9	18.13	12.95	7,964	11,150		110	72	101	
		06/11/1996	725	29.5	24.6	29.5	20.65	14.75	7,047	9,866		110	64	90	
		06/26/1998	889	27.1	25.4	27.1	18.97	13.55	7,277	10,187		110	66	93	
		05/10/1999	915	27	33.9	27	18.9	13.5	9,712	13,596		110	88	124	
		05/21/1999	915	27	33.9	27	18.9	13.5	9,712	13,596		110	88	124	
		04/21/2000	945	49.6	19.1	49.6	34.72	24.8	5,472	7,660		110	50	70	
NLF	B10	07/13/1982	1325	33.2	39.9	33.2	23.24	16.6	11,430	16,003	60,500	110	104	145	550
		05/29/1991	1556	38.7	40.2	38.7	27.09	19.35	11,516	16,123		110	105	147	
		07/26/1993	1637	41	39.9	41	28.7	20.5	11,430	16,003		110	104	145	
		08/10/1994	1328	31.9	41.6	31.9	22.33	15.95	11,917	16,684		110	108	152	
		07/18/1995	1409	37.2	37.9	37.2	26.04	18.6	10,858	15,201		110	99	138	
		06/10/1996	1339	40	33.5	40	28	20	9,597	13,436		110	87	122	
		05/08/1997	1316	45.7	28.8	45.7	31.99	22.85	8,251	11,551		110	75	105	
		06/04/1998	1263	36.5	34.6	36.5	25.55	18.25	9,912	13,877		110	90	126	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/06/1999	1259	43.4	29	43.4	30.38	21.7	8,308	11,631		110	76	106	
		05/21/1999	1259	43.4	29	43.4	30.38	21.7	8,308	11,631		110	76	106	
		04/21/2000	1259	39.4	32	39.4	27.58	19.7	9,167	12,834		110	83	117	
NLF	B11	07/27/1993	219	14.9	14.7	14.9	10.43	7.45	4,211	5,896	60,500	110	38	54	550
		08/17/1994	226	15.5	14.6	15.5	10.85	7.75	4,183	5,856		110	38	53	
		07/17/1995	429	12.4	34.6	12.4	8.68	6.2	9,912	13,877		110	90	126	
		05/14/1997	950	28	33.9	28	19.6	14	9,712	13,596		110	88	124	
		06/26/1998	817	22.9	35.7	22.9	16.03	11.45	10,227	14,318		110	93	130	
		05/10/1999	714	19.5	36.6	19.5	13.65	9.75	10,485	14,679		110	95	133	
		05/21/1999	714	19.5	36.6	19.5	13.65	9.75	10,485	14,679		110	95	133	
		04/21/2000	860	26.2	32.8	26.2	18.34	13.1	9,396	13,155		110	85	120	
NLF	C	04/09/1984	1351	49.4	27.3	49.4	34.58	24.7	7,821	10,949	60,500	110	71	100	550
		05/21/1986	1325	54.2	24.4	54.2	37.94	27.1	6,990	9,786		110	64	89	
		10/19/1987	1342	46	29.2	46	32.2	23	8,365	11,711		110	76	106	
		10/04/1988	1336	45	29.7	45	31.5	22.5	8,508	11,912		110	77	108	
		07/10/1989	1360	35.2	38.6	35.2	24.64	17.6	11,058	15,481		110	101	141	
		06/11/1990	1331	36.6	36.4	36.6	25.62	18.3	10,428	14,599		110	95	133	
		05/06/1991	1342	48.3	27.8	48.3	33.81	24.15	7,964	11,150		110	72	101	
		06/08/1992	1257	48	26.2	48	33.6	24	7,506	10,508		110	68	96	
		07/30/1993	1178	26.6	44.3	26.6	18.62	13.3	12,691	17,767		110	115	162	
		08/02/1994	1318	24.6	53.6	24.6	17.22	12.3	15,355	21,497		110	140	195	
		06/28/1995	1290	29	44.5	29	20.3	14.5	12,748	17,848		110	116	162	
		05/30/1996	1238	35.6	34.8	35.6	24.92	17.8	9,969	13,957		110	91	127	
		04/24/1997	1247	34	36.7	34	23.8	17	10,514	14,719		110	96	134	
		05/27/1998	1282	36.3	35.3	36.3	25.41	18.15	10,113	14,158		110	92	129	
		04/27/1999	1152	37.6	30.6	37.6	26.32	18.8	8,766	12,273		110	80	112	
		05/21/1999	1152	37.6	30.6	37.6	26.32	18.8	8,766	12,273		110	80	112	
		04/21/2000	1195	34	35.1	34	23.8	17	10,055	14,078		110	91	128	
NLF	C3	04/17/1984	935	42.4	22.1	42.4	29.68	21.2	6,331	8,864	60,500	110	58	81	550
		05/14/1986	870	54.7	15.9	54.7	38.29	27.35	4,555	6,377		110	41	58	
		07/12/1989	908	37.3	24.3	37.3	26.11	18.65	6,961	9,746		110	63	89	
		06/11/1990	549	25.1	21.9	25.1	17.57	12.55	6,274	8,783		110	57	80	
		05/07/1991	573	24.3	23.6	24.3	17.01	12.15	6,761	9,465		110	61	86	
		06/09/1992	814	45.5	17.9	45.5	31.85	22.75	5,128	7,179		110	47	65	
		07/31/1993	633	31.4	20.2	31.4	21.98	15.7	5,787	8,102		110	53	74	
		08/05/1994	739	19.2	38.5	19.2	13.44	9.6	11,029	15,441		110	100	140	
		07/11/1995	638	23.3	27.4	23.3	16.31	11.65	7,850	10,989		110	71	100	
		06/04/1996	553	30.9	17.9	30.9	21.63	15.45	5,128	7,179		110	47	65	
		05/07/1997	894	62.4	14.3	62.4	43.68	31.2	4,097	5,735		110	37	52	
		06/03/1998	754	64.1	11.8	64.1	44.87	32.05	3,380	4,733		110	31	43	
		05/03/1999	653	74.7	8.7	74.7	52.29	37.35	2,492	3,489		110	23	32	
		05/21/1999	653	74.7	8.7	74.7	52.29	37.35	2,492	3,489		110	23	32	
		04/21/2000	573	53.2	10.8	53.2	37.24	26.6	3,094	4,332		110	28	39	
NLF	C4	04/17/1984	1280	43.2	29.6	43.2	30.24	21.6	8,480	11,872		110	77	108	
		05/14/1986	1056	41	25.8	41	28.7	20.5	7,391	10,348		110	67	94	
		06/11/1990	1130	30	37.7	30	21	15	10,800	15,120		110	98	137	
		05/07/1991	1348	35.9	37.5	35.9	25.13	17.95	10,743	15,040		110	98	137	
		06/09/1992	1225	36.7	33.4	36.7	25.69	18.35	9,568	13,396		110	87	122	
		07/29/1993	834	21.3	39.2	21.3	14.91	10.65	11,230	15,722		110	102	143	
		08/05/1994	**1038**	**12.6**	**82.4**	**12.6**	**8.82**	**6.3**	**23,606**	**33,048**	**60,500**	**110**	**215**	**300**	**550**
		07/11/1995	1248	24.9	50.1	24.9	17.43	12.45	14,353	20,094		110	130	183	
		06/04/1996	1279	25.1	51	25.1	17.57	12.55	14,610	20,455		110	133	186	

TABLE B-1

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/07/1997	1310	27.8	47.1	27.8	19.46	13.9	13,493	18,890		110	123	172	
		06/03/1998	1279	29.4	43.5	29.4	20.58	14.7	12,462	17,447		110	113	159	
		05/03/1999	1072	32	33.5	32	22.4	16	9,597	13,436		110	87	122	
		05/21/1999	1072	32	33.5	32	22.4	16	9,597	13,436		110	87	122	
		04/21/2000	1156	30	38.5	30	21	15	11,029	15,441		110	100	140	
NLF	C5	04/09/1984	674	56.9	11.8	56.9	39.83	28.45	3,380	4,733	60,500	110	31	43	550
		05/15/1986	592	88.2	6.7	88.2	61.74	44.1	1,919	2,687		110	17	24	
		10/19/1987	587	84.3	7	84.3	59.01	42.15	2,005	2,807		110	18	26	
		07/18/1989	697	49.9	14	49.9	34.93	24.95	4,011	5,615		110	36	51	
		06/12/1990	638	68.3	9.3	68.3	47.81	34.15	2,664	3,730		110	24	34	
		05/08/1991	715	63.5	11.3	63.5	44.45	31.75	3,237	4,532		110	29	41	
		06/09/1992	722	63.9	11.3	63.9	44.73	31.95	3,237	4,532		110	29	41	
		07/30/1993	715	41.9	17.1	41.9	29.33	20.95	4,899	6,858		110	45	62	
		08/08/1994	796	13.6	58.5	13.6	9.52	6.8	16,759	23,463		110	152	213	
		07/07/1995	802	14.9	53.8	14.9	10.43	7.45	15,413	21,578		110	140	196	
		05/30/1996	945	21.6	43.8	21.6	15.12	10.8	12,548	17,567		110	114	160	
		05/06/1997	880	18.2	48.4	18.2	12.74	9.1	13,866	19,412		110	126	176	
		06/01/1998	885	21.5	41.2	21.5	15.05	10.75	11,803	16,524		110	107	150	
		04/27/1999	895	21.2	42.2	21.2	14.84	10.6	12,089	16,925		110	110	154	
		05/21/1999	895	21.2	42.2	21.2	14.84	10.6	12,089	16,925		110	110	154	
		04/21/2000	804	17.2	46.7	17.2	12.04	8.6	13,379	18,730		110	122	170	
NLF	C6	04/09/1984	153	29.9	5.1	29.9	20.93	14.95	1,461	2,045	60,500	110	13	19	550
		05/15/1986	137	34.2	4	34.2	23.94	17.1	1,146	1,604		110	10	15	
		10/19/1987	147	33.7	4.4	33.7	23.59	16.85	1,261	1,765		110	11	16	
		07/12/1989	124	31.4	3.9	31.4	21.98	15.7	1,117	1,564		110	10	14	
		06/06/1990	141	36.4	3.9	36.4	25.48	18.2	1,117	1,564		110	10	14	
		05/08/1991	133	41	3.2	41	28.7	20.5	917	1,283		110	8	12	
		12/21/1994	445	33.8	13.2	33.8	23.66	16.9	3,782	5,294		110	34	48	
		07/07/1995	459	33.2	13.8	33.2	23.24	16.6	3,953	5,535		110	36	50	
		05/28/1996	405	39.7	10.2	39.7	27.79	19.85	2,922	4,091		110	27	37	
		04/24/1997	364	44.6	8.2	44.6	31.22	22.3	2,349	3,289		110	21	30	
		05/27/1998	349	49.2	7.1	49.2	34.44	24.6	2,034	2,848		110	18	26	
		04/27/1999	305	50	6.1	50	35	25	1,748	2,447		110	16	22	
		05/21/1999	305	50	6.1	50	35	25	1,748	2,447		110	16	22	
		04/21/2000	260	50.5	5.1	50.5	35.35	25.25	1,461	2,045		110	13	19	
NLF	C7	04/10/1984	1118	44.5	25.1	44.5	31.15	22.25	7,191	10,067	60,500	110	65	92	550
		05/15/1986	1050	42.4	24.8	42.4	29.68	21.2	7,105	9,947		110	65	90	
		10/14/1987	1104	38.5	28.7	38.5	26.95	19.25	8,222	11,511		110	75	105	
		07/10/1989	434	38.3	11.3	38.3	26.81	19.15	3,237	4,532		110	29	41	
		06/11/1990	1067	32.8	32.5	32.8	22.96	16.4	9,311	13,035		110	85	118	
		05/28/1991	1082	37.6	28.8	37.6	26.32	18.8	8,251	11,551		110	75	105	
		06/08/1992	1047	47.1	22.2	47.1	32.97	23.55	6,360	8,904		110	58	81	
		07/31/1993	1054	37.9	27.8	37.9	26.53	18.95	7,964	11,150		110	72	101	
		08/01/1994	1008	39.5	25.5	39.5	27.65	19.75	7,305	10,227		110	66	93	
		06/28/1995	1082	38.1	28.4	38.1	26.67	19.05	8,136	11,390		110	74	104	
		06/03/1996	1032	43.7	23.6	43.7	30.59	21.85	6,761	9,465		110	61	86	
		05/06/1997	995	44.4	22.4	44.4	31.08	22.2	6,417	8,984		110	58	82	
		06/03/1998	919	50.9	18.1	50.9	35.63	25.45	5,185	7,259		110	47	66	
		05/03/1999	944	44.6	21.2	44.6	31.22	22.3	6,073	8,503		110	55	77	
		05/21/1999	944	44.6	21.2	44.6	31.22	22.3	6,073	8,503		110	55	77	
		04/21/2000	914	42.5	21.5	42.5	29.75	21.25	6,159	8,623		110	56	78	

TABLE B-1

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Western Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	C8	10/19/1950	318	76.3	4.2	76.3	53.41	38.15	1,203	1,684	60,500	110	11	15	550
		09/26/1951	365	52.5	7	52.5	36.75	26.25	2,005	2,807		110	18	26	
		10/01/1952	434	39.4	11	39.4	27.58	19.7	3,151	4,412		110	29	40	
		02/08/1955	548	56.4	9.7	56.4	39.48	28.2	2,779	3,890		110	25	35	
		10/04/1956	351	76.4	4.6	76.4	53.48	38.2	1,318	1,845		110	12	17	
		07/05/1957	260	92	2.8	92	64.4	46	802	1,123		110	7	10	
		09/12/1957	522	77	6.8	77	53.9	38.5	1,948	2,727		110	18	25	
		07/30/1958	394	49	8	49	34.3	24.5	2,292	3,209		110	21	29	
		10/31/1958	493	69.3	7.1	69.3	48.51	34.65	2,034	2,848		110	18	26	
		08/05/1959	443	76	5.8	76	53.2	38	1,662	2,326		110	15	21	
		07/06/1960	443	78.4	5.7	78.4	54.88	39.2	1,633	2,286		110	15	21	
		07/20/1961	329	72.3	4.6	72.3	50.61	36.15	1,318	1,845		110	12	17	
		05/31/1962	318	97.2	3.3	97.2	68.04	48.6	945	1,324		110	9	12	
		05/09/1963	271	104.6	2.6	104.6	73.22	52.3	745	1,043		110	7	9	
		07/14/1964	365	87.2	4.2	87.2	61.04	43.6	1,203	1,684		110	11	15	
		08/04/1965	362	88.9	4.1	88.9	62.23	44.45	1,175	1,644		110	11	15	
		11/01/1966	410	85	4.8	85	59.5	42.5	1,375	1,925		110	13	18	
		08/09/1967	377	104	3.6	104	72.8	52	1,031	1,444		110	9	13	
		08/28/1968	332	96.6	3.4	96.6	67.62	48.3	974	1,364		110	9	12	
		08/19/1969	410	75.4	5.4	75.4	52.78	37.7	1,547	2,166		110	14	20	
		07/09/1970	351	71.5	4.9	71.5	50.05	35.75	1,404	1,965		110	13	18	
		08/04/1971	572	76.4	7.5	76.4	53.48	38.2	2,149	3,008		110	20	27	
		01/12/1972	373	122.8	3	122.8	85.96	61.4	859	1,203		110	8	11	
		05/18/1972	414	110.9	3.7	110.9	77.63	55.45	1,060	1,484		110	10	13	
		07/17/1973	439	90.8	4.8	90.8	63.56	45.4	1,375	1,925		110	13	18	
		07/01/1974	419	108.8	3.9	108.8	76.16	54.4	1,117	1,564		110	10	14	
		05/03/1976	363	99.8	3.6	99.8	69.86	49.9	1,031	1,444		110	9	13	
		05/21/1984	546	59	9.3	59	41.3	29.5	2,664	3,730		110	24	34	
		07/10/1989	477	52.7	9.1	52.7	36.89	26.35	2,607	3,650		110	24	33	
		06/12/1990	488	52.2	9.3	52.2	36.54	26.1	2,664	3,730		110	24	34	
		05/06/1991	525	49.4	10.6	49.4	34.58	24.7	3,037	4,251		110	28	39	
		06/08/1992	477	48.6	9.8	48.6	34.02	24.3	2,807	3,930		110	26	36	
		07/30/1993	488	51.6	9.5	51.6	36.12	25.8	2,722	3,810		110	25	35	
		08/02/1994	520	30.4	17.1	30.4	21.28	15.2	4,899	6,858		110	45	62	
		07/11/1995	503	24.6	20.4	24.6	17.22	12.3	5,844	8,182		110	53	74	
		06/03/1996	535	29.3	18.3	29.3	20.51	14.65	5,243	7,340		110	48	67	
		05/06/1997	476	36.9	12.9	36.9	25.83	18.45	3,696	5,174		110	34	47	
		06/01/1998	478	34.5	13.9	34.5	24.15	17.25	3,982	5,575		110	36	51	
		05/03/1999	475	32.7	14.5	32.7	22.89	16.35	4,154	5,816		110	38	53	
		05/21/1999	475	32.7	14.5	32.7	22.89	16.35	4,154	5,816		110	38	53	
		04/21/2000	455	30.8	14.8	30.8	21.56	15.4	4,240	5,936		110	39	54	
NLF	F4	05/24/1984	1473	39.5	37.3	39.5	27.65	19.75	10,686	14,960	71,500	130	82	115	550
		06/02/1986	1511	41	36.9	41	28.7	20.5	10,571	14,799		130	81	114	
		10/03/1988	1897	42.9	44.2	42.9	30.03	21.45	12,662	17,727		130	97	136	
		07/18/1989	1576	35.5	44.4	35.5	24.85	17.75	12,720	17,807		130	98	137	
		06/04/1991	1225	17.5	70	17.5	12.25	8.75	20,053	28,075		130	154	216	
		07/23/1993	1944	38.2	50.9	38.2	26.74	19.1	14,582	20,414		130	112	157	
		05/22/1997	1956	37.2	52.6	37.2	26.04	18.6	15,069	21,096		130	116	162	
		05/11/1999	1868	39.7	47.1	39.7	27.79	19.85	13,493	18,890		130	104	145	
		05/21/1999	1868	39.7	47.1	39.7	27.79	19.85	13,493	18,890		130	104	145	
		04/21/2000	1691	30.5	55.4	30.5	21.35	15.25	15,871	22,219		130	122	171	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	E5	06/10/1992	1320	84	15.7	84	58.8	42	4,498	6,297		130	35	48	
		08/11/1993	1274	63.3	20.1	63.3	44.31	31.65	5,758	8,061		130	44	62	
		12/21/1994	1203	24.9	48.3	24.9	17.43	12.45	13,837	19,372		130	106	149	
		07/25/1995	1191	23.8	50	23.8	16.66	11.9	14,324	20,053		130	110	154	
		05/28/1996	824	13.6	60.6	13.6	9.52	6.8	17,361	24,305		130	134	187	
		05/12/1997	1179	15.1	78.1	15.1	10.57	7.55	22,374	31,324		130	172	241	
		06/04/1998	1022	22.7	45	22.7	15.89	11.35	12,892	18,048		130	99	139	
		06/05/1998	1022	22.7	45	22.7	15.89	11.35	12,892	18,048		130	99	139	
		08/18/2000	**705**	**5.1**	**138.2**	**5.1**	**3.57**	**2.55**	**39,591**	**55,428**	**71,500**	**130**	**305**	**426**	**550**
NLF	E7	08/11/1993	263	2.5	105.2	2.5	1.75	1.25	30,138	42,193	71,500	130	232	325	550
		08/08/1994	328	2.5	131.2	2.5	1.75	1.25	37,586	52,620		130	289	405	
		07/03/1995	325	2.4	135.4	2.4	1.68	1.2	38,789	54,305		130	298	418	
		06/05/1996	334	2.7	123.7	2.7	1.89	1.35	35,437	49,612		130	273	382	
		05/12/1997	320	2.6	123.1	2.6	1.82	1.3	35,265	49,372		130	271	380	
		05/16/1997	320	2.6	123.1	2.6	1.82	1.3	35,265	49,372		130	271	380	
NLF	E9	04/11/1984	601	75.6	7.9	75.6	52.92	37.8	2,263	3,168	63,250	130	17	24	550
		05/20/1986	578	76.2	7.6	76.2	53.34	38.1	2,177	3,048		130	17	23	
		12/11/1986	1190	57.1	20.8	57.1	39.97	28.55	5,959	8,342		130	46	64	
		10/13/1987	1069	59.9	17.8	59.9	41.93	29.95	5,099	7,139		130	39	55	
		09/28/1988	894	61.2	14.6	61.2	42.84	30.6	4,183	5,856		130	32	45	
		07/11/1989	897	60	15	60	42	30	4,297	6,016		130	33	46	
		05/29/1990	876	60.3	14.5	60.3	42.21	30.15	4,154	5,816		130	32	45	
		04/18/1991	970	60.3	16.1	60.3	42.21	30.15	4,612	6,457		130	35	50	
		06/04/1992	897	62.4	14.4	62.4	43.68	31.2	4,125	5,775		130	32	44	
		07/22/1993	1021	55.6	18.4	55.6	38.92	27.8	5,271	7,380		130	41	57	
		07/19/1994	1053	52.1	20.2	52.1	36.47	26.05	5,787	8,102		130	45	62	
		07/03/1995	1058	51.5	20.5	51.5	36.05	25.75	5,873	8,222		130	45	63	
		05/23/1996	1073	49.7	21.6	49.7	34.79	24.85	6,188	8,663		130	48	67	
		04/23/1997	1050	50.1	21	50.1	35.07	25.05	6,016	8,422		130	46	65	
		06/03/1998	1021	50.8	20.1	50.8	35.56	25.4	5,758	8,061		130	44	62	
		05/04/1999	1107	39.8	27.8	39.8	27.86	19.9	7,964	11,150		130	61	86	
		04/21/2000	1117	29.6	37.7	29.6	20.72	14.8	10,800	15,120		130	83	116	
NLF	G45	04/16/1984	1590	31.2	51	31.2	21.84	15.6	14,610	20,455	63,250	115	127	178	550
		05/27/1986	1008	20.5	49.2	20.5	14.35	10.25	14,095	19,733		115	123	172	
		07/13/1989	1379	33.7	40.9	33.7	23.59	16.85	11,717	16,404		115	102	143	
		06/14/1990	1399	32.3	43.3	32.3	22.61	16.15	12,405	17,366		115	108	151	
		05/30/1991	1456	37.8	38.5	37.8	26.46	18.9	11,029	15,441		115	96	134	
		06/10/1992	1434	36.7	39.1	36.7	25.69	18.35	11,201	15,682		115	97	136	
		07/29/1993	1172	24.9	47.1	24.9	17.43	12.45	13,493	18,890		115	117	164	
		08/08/1994	1325	29.7	44.6	29.7	20.79	14.85	12,777	17,888		115	111	156	
		07/19/1995	1140	25.6	44.5	25.6	17.92	12.8	12,748	17,848		115	111	155	
		05/23/1996	1130	25.3	44.7	25.3	17.71	12.65	12,806	17,928		115	111	156	
		05/07/1997	1162	25.9	44.9	25.9	18.13	12.95	12,863	18,008		115	112	157	
		06/04/1998	1396	41.4	33.7	41.4	28.98	20.7	9,654	13,516		115	84	118	
		05/10/1999	1030	23	44.8	23	16.1	11.5	12,834	17,968		115	112	156	
		05/21/1999	1030	23	44.8	23	16.1	11.5	12,834	17,968		115	112	156	
		04/21/2000	1257	26.9	46.7	26.9	18.83	13.45	13,379	18,730		115	116	163	
NLF	X3	04/11/1984	802	41	19.6	41	28.7	20.5	5,615	7,861	63,250	115	49	68	550
		05/20/1986	505	53.4	9.5	53.4	37.38	26.7	2,722	3,810		115	24	33	
		10/13/1987	740	40.6	18.2	40.6	28.42	20.3	5,214	7,299		115	45	63	
		09/28/1988	477	45.5	10.5	45.5	31.85	22.75	3,008	4,211		115	26	37	
		07/11/1989	572	61.4	9.3	61.4	42.98	30.7	2,664	3,730		115	23	32	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/29/1990	444	47.5	9.3	47.5	33.25	23.75	2,664	3,730		115	23	32	
		04/18/1991	475	48.6	9.8	48.6	34.02	24.3	2,807	3,930		115	24	34	
		06/04/1992	587	46.1	12.7	46.1	32.27	23.05	3,638	5,094		115	32	44	
		07/22/1993	496	54	9.2	54	37.8	27	2,636	3,690		115	23	32	
		07/18/1994	465	52.2	8.9	52.2	36.54	26.1	2,550	3,570		115	22	31	
		07/03/1995	490	49.4	9.9	49.4	34.58	24.7	2,836	3,971		115	25	35	
		05/14/1996	449	53.9	8.3	53.9	37.73	26.95	2,378	3,329		115	21	29	
		04/23/1997	485	53.8	9	53.8	37.66	26.9	2,578	3,610		115	22	31	
		05/06/1998	531	47.9	11.1	47.9	33.53	23.95	3,180	4,452		115	28	39	
		05/04/1999	493	43.2	11.4	43.2	30.24	21.6	3,266	4,572		115	28	40	
		05/21/1999	493	43.2	11.4	43.2	30.24	21.6	3,266	4,572		115	28	40	
		04/21/2000	513	43.2	11.9	43.2	30.24	21.6	3,409	4,773		115	30	42	

Notes:

E = well efficiency

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-2

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Central Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	I	**05/23/1984**	**993**	**8.7**	**114.1**	**8.7**	**6.09**	**4.35**	**32,687**	**45,762**	**22,500**	**130**	**251**	**352**	**375**
		06/09/1986	**1058**	**9.6**	**110.2**	**9.6**	**6.72**	**4.8**	**31,570**	**44,198**	**22,500**	**130**	**243**	**340**	**375**
		02/03/1992	140	73	1.9	73	51.1	36.5	544	762		130	4	6	
		07/06/1994	129	86.2	1.5	86.2	60.34	43.1	430	602		130	3	5	
		08/01/1994	129	86.2	1.5	86.2	60.34	43.1	430	602		130	3	5	
VWC	K2	**01/29/1992**	**1563**	**7.1**	**220.1**	**7.1**	**4.97**	**3.55**	**63,054**	**88,275**	**54,375**	**145**	**435**	**609**	**375**
		05/13/1994	1365	7.1	192.3	7.1	4.97	3.55	55,090	77,126		145	380	532	
		04/17/1996	1650	8.6	191.9	8.6	6.02	4.3	54,975	76,965		145	379	531	
		07/11/1997	**1333**	**6.3**	**211.6**	**6.3**	**4.41**	**3.15**	**60,619**	**84,866**	**54,375**	**145**	**418**	**585**	**375**
		12/30/1998	1409	6.7	210.3	6.7	4.69	3.35	60,246	84,345		145	415	582	
VWC	L2	04/26/1984	2197	28.3	77.6	28.3	19.81	14.15	22,231	31,123	54,375	145	153	215	375
		11/21/1991	1400	19	73.7	19	13.3	9.5	21,113	29,559		145	146	204	
		01/29/1992	1466	26.1	56.2	26.1	18.27	13.05	16,100	22,540		145	111	155	
		05/13/1994	1256	32.8	38.3	32.8	22.96	16.4	10,972	15,361		145	76	106	
		04/17/1996	1210	29.6	40.9	29.6	20.72	14.8	11,717	16,404		145	81	113	
		07/14/1997	851	17.6	48.4	17.6	12.32	8.8	13,866	19,412		145	96	134	
		12/11/1998	931	24.5	38	24.5	17.15	12.25	10,886	15,241		145	75	105	
VWC	N	08/05/1969	1891	31.6	59.8	31.6	22.12	15.8	17,131	23,984	54,375	145	118	165	375
		08/27/1970	1787	27	66.2	27	18.9	13.5	18,965	26,551		145	131	183	
		07/21/1977	1427	15.2	93.9	15.2	10.64	7.6	26,900	37,660		145	186	260	
		05/23/1978	1448	14.6	99.2	14.6	10.22	7.3	28,419	39,786		145	196	274	
		11/05/1979	1427	15.4	92.7	15.4	10.78	7.7	26,557	37,179		145	183	256	
		11/17/1980	1450	21.8	66.5	21.8	15.26	10.9	19,051	26,671		145	131	184	
		10/26/1981	1427	26	54.9	26	18.2	13	15,728	22,019		145	108	152	
		06/10/1982	1427	24.1	59.2	24.1	16.87	12.05	16,960	23,743		145	117	164	
		02/04/1985	1562	22.9	68.2	22.9	16.03	11.45	19,538	27,353		145	135	189	
		08/07/1986	1450	23	63	23	16.1	11.5	18,048	25,267		145	124	174	
		04/25/1988	1404	23.3	60.3	23.3	16.31	11.65	17,275	24,184		145	119	167	
		02/01/1990	1380	22.5	61.3	22.5	15.75	11.25	17,561	24,586		145	121	170	
		05/30/1990	1350	21	64.3	21	14.7	10.5	18,421	25,789		145	127	178	
		11/21/1991	1320	19.5	67.7	19.5	13.65	9.75	19,395	27,152		145	134	187	
		01/30/1992	1378	20.8	66.3	20.8	14.56	10.4	18,994	26,591		145	131	183	
		05/13/1994	1328	16.9	78.6	16.9	11.83	8.45	22,517	31,524		145	155	217	
		04/18/1996	1320	16.8	78.6	16.8	11.76	8.4	22,517	31,524		145	155	217	
		07/11/1997	927	10.2	90.9	10.2	7.14	5.1	26,011	36,457		145	180	251	
		12/01/1998	1086	11.5	94.4	11.5	8.05	5.75	27,044	37,861		145	187	261	
VWC	N3	**11/21/1991**	**1550**	**8**	**193.8**	**8**	**5.6**	**4**	**55,519**	**77,727**	**79,750**	**145**	**383**	**536**	**550**
		05/12/1994	1520	11.3	134.5	11.3	7.91	5.65	38,531	53,944		145	266	372	
		04/18/1996	1294	7	184.9	7	4.9	3.5	52,970	74,158		145	365	511	
		07/14/1997	1121	6.5	172.5	6.5	4.55	3.25	49,417	69,184		145	341	477	
		12/11/1998	1319	8.5	155.2	8.5	5.95	4.25	44,461	62,246		145	307	429	
VWC	N4	**11/21/1991**	**1510**	**5.5**	**274.5**	**5.5**	**3.85**	**2.75**	**78,638**	**110,094**	**54,375**	**145**	**542**	**759**	**375**
		01/28/1992	1474	6.5	226.8	6.5	4.55	3.25	64,973	90,963		145	448	627	
		05/12/1994	1303	6.3	206.8	6.3	4.41	3.15	59,244	82,941		145	409	572	
		04/17/1996	1384	5.3	261.1	5.3	3.71	2.65	74,799	104,719		145	516	722	
		07/14/1997	1171	5	234.2	5	3.5	2.5	67,093	93,930		145	463	648	
		12/11/1998	1249	4.6	271.5	4.6	3.22	2.3	77,779	108,890		145	536	751	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	Q2	02/17/1955	2343	24.2	96.8	24.2	16.94	12.1	27,731	38,824		145	191	268	
		03/09/1955	2310	23.5	98.3	23.5	16.45	11.75	28,161	39,425		145	194	272	
		10/21/1955	2103	21.5	97.8	21.5	15.05	10.75	28,018	39,225		145	193	271	
		08/01/1957	1589	28.9	55	28.9	20.23	14.45	15,756	22,059		145	109	152	
		11/18/1958	1696	26.3	64.5	26.3	18.41	13.15	18,478	25,869		145	127	178	
		07/26/1960	1073	17.9	59.9	17.9	12.53	8.95	17,160	24,024		145	118	166	
		06/27/1962	1349	34.6	39	34.6	24.22	17.3	11,173	15,642		145	77	108	
		06/19/1963	1920	25.5	75.3	25.5	17.85	12.75	21,572	30,201		145	149	208	
		09/21/1964	1611	24.3	66.3	24.3	17.01	12.15	18,994	26,591		145	131	183	
		09/17/1965	1414	17.7	79.9	17.7	12.39	8.85	22,890	32,045		145	158	221	
		07/26/1967	1806	16	112.9	16	11.2	8	32,343	45,281		145	223	312	
		10/05/1970	1711	15.6	109.7	15.6	10.92	7.8	31,427	43,997		145	217	303	
		08/16/1971	1880	17.2	109.3	17.2	12.04	8.6	31,312	43,837		145	216	302	
		07/03/1974	2022	25.9	78.1	25.9	18.13	12.95	22,374	31,324		145	154	216	
		10/21/1975	1552	37.9	40.9	37.9	26.53	18.95	11,717	16,404		145	81	113	
		08/03/1976	1688	19.7	85.7	19.7	13.79	9.85	24,551	34,372		145	169	237	
		06/14/1977	1688	19.7	85.7	19.7	13.79	9.85	24,551	34,372		145	169	237	
		05/24/1978	1626	20.5	79.3	20.5	14.35	10.25	22,718	31,805		145	157	219	
		12/03/1979	1542	29.4	52.4	29.4	20.58	14.7	15,011	21,016		145	104	145	
		11/13/1980	1752	33.2	52.8	33.2	23.24	16.6	15,126	21,176		145	104	146	
		06/09/1982	1898	43.5	43.6	43.5	30.45	21.75	12,490	17,487		145	86	121	
		02/25/1985	1960	54.8	35.8	54.8	38.36	27.4	10,256	14,358		145	71	99	
		08/07/1986	1804	72.4	24.9	72.4	50.68	36.2	7,133	9,987		145	49	69	
		04/28/1988	**2297**	**18.4**	**124.8**	**18.4**	**12.88**	**9.2**	**35,752**	**50,053**	**79,750**	**145**	**247**	**345**	**550**
		02/01/1990	1965	19.5	100.8	19.5	13.65	9.75	28,877	40,428		145	199	279	
		05/29/1990	1890	18	105	18	12.6	9	30,080	42,112		145	207	290	
		03/19/1992	1874	19	98.6	19	13.3	9.5	28,247	39,545		145	195	273	
		05/24/1994	1637	15.3	107	15.3	10.71	7.65	30,653	42,914		145	211	296	
		04/05/1996	1466	15.9	92.2	15.9	11.13	7.95	26,413	36,979		145	182	255	
		07/23/1997	1206	14	86.1	14	9.8	7	24,666	34,532		145	170	238	
		12/17/1998	1225	19.1	64.1	19.1	13.37	9.55	18,363	25,709		145	127	177	
NLF	R2	07/23/1941	1730	29.5	58.6	29.5	20.65	14.75	16,788	23,503		90	187	261	
		06/21/1945	1520	8	190	8	5.6	4	54,431	76,203		90	605	847	
		12/18/1946	1352	6	225.3	6	4.2	3	64,544	90,361		90	717	1,004	
		10/29/1947	**1680**	**6.4**	**262.5**	**6.4**	**4.48**	**3.2**	**75,201**	**105,281**	**22,050**	**90**	**836**	**1,170**	**245**
		06/20/1949	**1672**	**9**	**185.8**	**9**	**6.3**	**4.5**	**53,228**	**74,519**	**22,050**	**90**	**591**	**828**	**245**
		05/23/1950	1152	45.5	25.3	45.5	31.85	22.75	7,248	10,147		90	81	113	
		10/16/1950	672	8.1	83	8.1	5.67	4.05	23,778	33,289		90	264	370	
		01/19/1951	1310	6	218.3	6	4.2	3	62,538	87,553		90	695	973	
		09/28/1951	328	4	82	4	2.8	2	23,491	32,888		90	261	365	
		06/06/1952	1200	11	109.1	11	7.7	5.5	31,255	43,757		90	347	486	
		01/15/1955	1010	19.5	51.8	19.5	13.65	9.75	14,840	20,775		90	165	231	
		03/03/1955	1119	19.1	58.6	19.1	13.37	9.55	16,788	23,503		90	187	261	
		10/18/1955	620	38.7	16	38.7	27.09	19.35	4,584	6,417		90	51	71	
		09/19/1956	588	22.4	26.3	22.4	15.68	11.2	7,534	10,548		90	84	117	
		08/01/1957	429	8.3	51.7	8.3	5.81	4.15	14,811	20,735		90	165	230	
		09/24/1957	600	28	21.4	28	19.6	14	6,131	8,583		90	68	95	
		08/18/1959	660	34.7	19	34.7	24.29	17.35	5,443	7,620		90	60	85	
		08/18/1960	538	32.4	16.6	32.4	22.68	16.2	4,756	6,658		90	53	74	
		09/11/1961	362	7.6	47.6	7.6	5.32	3.8	13,636	19,091		90	152	212	

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Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		06/13/1962	660	11.6	56.9	11.6	8.12	5.8	16,301	22,821		90	181	254	
		05/06/1963	880	14.6	60.3	14.6	10.22	7.3	17,275	24,184		90	192	269	
		09/21/1964	725	16.4	44.2	16.4	11.48	8.2	12,662	17,727		90	141	197	
		08/05/1965	491	12.1	40.6	12.1	8.47	6.05	11,631	16,283		90	129	181	
		10/12/1967	523	10.2	51.3	10.2	7.14	5.1	14,696	20,575		90	163	229	
		08/07/1968	588	8.5	69.2	8.5	5.95	4.25	19,824	27,754		90	220	308	
		08/16/1971	545	2.1	259.5	2.1	1.47	1.05	74,341	104,078		90	826	1,156	
		06/21/1972	548	1.9	288.4	1.9	1.33	0.95	82,620	115,668		90	918	1,285	
		10/20/1975	460	1.8	255.6	1.8	1.26	0.9	73,224	102,513		90	814	1,139	
		04/07/1977	714	3.4	210	3.4	2.38	1.7	60,160	84,225		90	668	936	
		09/30/1980	708	2.7	262.2	2.7	1.89	1.35	75,115	105,160		90	835	1,168	
NLF	S	08/25/1937	1220	15	81.3	15	10.5	7.5	23,291	32,607		145	161	225	
		08/01/1938	1113	10.9	102.1	10.9	7.63	5.45	29,249	40,949		145	202	282	
		08/03/1938	1195	12	99.6	12	8.4	6	28,533	39,947		145	197	275	
		07/17/1940	1052	11.3	93.1	11.3	7.91	5.65	26,671	37,340		145	184	258	
		09/25/1940	1173	13	90.2	13	9.1	6.5	25,840	36,176		145	178	249	
		07/23/1941	1278	12	106.5	12	8.4	6	30,510	42,714		145	210	295	
		06/28/1945	1183	14.5	81.6	14.5	10.15	7.25	23,377	32,727		145	161	226	
		07/01/1946	1135	23.5	48.3	23.5	16.45	11.75	13,837	19,372		145	95	134	
		12/18/1946	**1028**	**5**	**205.6**	**5**	**3.5**	**2.5**	**58,900**	**82,460**	**54,375**	**145**	**406**	**569**	**375**
		10/17/1947	1400	22.5	62.2	22.5	15.75	11.25	17,819	24,947		145	123	172	
		09/15/1948	1350	26	51.9	26	18.2	13	14,868	20,816		145	103	144	
		06/17/1949	1415	24	59	24	16.8	12	16,902	23,663		145	117	163	
		05/24/1950	1385	25	55.4	25	17.5	12.5	15,871	22,219		145	109	153	
		10/03/1950	1120	29.5	38	29.5	20.65	14.75	10,886	15,241		145	75	105	
		07/17/1952	1146	24.5	46.8	24.5	17.15	12.25	13,407	18,770		145	92	129	
		07/07/1953	913	13.5	67.6	13.5	9.45	6.75	19,366	27,112		145	134	187	
		05/14/1954	1320	24	55	24	16.8	12	15,756	22,059		145	109	152	
		02/23/1955	1101	20.8	52.9	20.8	14.56	10.4	15,155	21,217		145	105	146	
		03/07/1955	1293	21	61.6	21	14.7	10.5	17,647	24,706		145	122	170	
		11/14/1955	457	7.6	60.1	7.6	5.32	3.8	17,217	24,104		145	119	166	
		07/03/1958	1330	12	110.8	12	8.4	6	31,742	44,439		145	219	306	
		10/15/1958	726	7.5	96.8	7.5	5.25	3.75	27,731	38,824		145	191	268	
		07/23/1959	731	8.1	90.2	8.1	5.67	4.05	25,840	36,176		145	178	249	
		07/26/1960	695	7.8	89.1	7.8	5.46	3.9	25,525	35,735		145	176	246	
		08/17/1961	669	6.8	98.4	6.8	4.76	3.4	28,189	39,465		145	194	272	
		05/29/1962	721	6.2	116.3	6.2	4.34	3.1	33,317	46,644		145	230	322	
		04/22/1963	726	6.4	113.4	6.4	4.48	3.2	32,487	45,481		145	224	314	
		08/19/1964	658	6.4	102.8	6.4	4.48	3.2	29,450	41,230		145	203	284	
		08/18/1965	674	6.2	108.7	6.2	4.34	3.1	31,140	43,596		145	215	301	
		10/12/1967	638	5.6	113.9	5.6	3.92	2.8	32,630	45,682		145	225	315	
		08/06/1968	716	6.2	115.5	6.2	4.34	3.1	33,088	46,324		145	228	319	
		09/10/1968	721	6.4	112.7	6.4	4.48	3.2	32,286	45,201		145	223	312	
		08/06/1969	783	6.8	115.1	6.8	4.76	3.4	32,974	46,163		145	227	318	
		08/24/1970	1047	8.8	119	8.8	6.16	4.4	34,091	47,727		145	235	329	
		08/19/1971	1021	8.6	118.7	8.6	6.02	4.3	34,005	47,607		145	235	328	
		06/21/1972	1139	10.8	105.5	10.8	7.56	5.4	30,223	42,313		145	208	292	
		08/14/1973	**1169**	**9**	**129.9**	**9**	**6.3**	**4.5**	**37,214**	**52,099**	**54,375**	**145**	**257**	**359**	**375**
		01/14/1975	1082	9	120.2	9	6.3	4.5	34,435	48,209		145	237	332	
		05/13/1976	1115	44.2	25.2	44.2	30.94	22.1	7,219	10,107		145	50	70	

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Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		04/07/1977	1011	9.4	107.6	9.4	6.58	4.7	30,825	43,155		145	213	298	
		08/15/1978	1035	45.5	22.7	45.5	31.85	22.75	6,503	9,104		145	45	63	
		09/24/1981	937	11.4	82.2	11.4	7.98	5.7	23,549	32,968		145	162	227	
		08/19/1982	1078	9.5	113.5	9.5	6.65	4.75	32,515	45,521		145	224	314	
NLF	S2	09/20/1940	2630	26	101.2	26	18.2	13	28,992	40,588	54,375	145	200	280	375
		07/24/1941	3055	32.2	94.9	32.2	22.54	16.1	27,187	38,061		145	187	262	
		06/12/1945	2775	50.4	55.1	50.4	35.28	25.2	15,785	22,099		145	109	152	
		07/24/1946	2630	28	93.9	28	19.6	14	26,900	37,660		145	186	260	
		12/17/1946	2380	49.8	47.8	49.8	34.86	24.9	13,694	19,171		145	94	132	
		03/31/1947	2940	40	73.5	40	28	20	21,056	29,479		145	145	203	
		10/18/1947	2630	48	54.8	48	33.6	24	15,699	21,979		145	108	152	
		09/15/1948	2130	54	39.4	54	37.8	27	11,287	15,802		145	78	109	
		06/17/1949	2090	46	45.4	46	32.2	23	13,008	18,209		145	90	126	
		05/24/1950	1970	41	48	41	28.7	20.5	13,751	19,251		145	95	133	
		10/03/1950	1420	45.3	31.3	45.3	31.71	22.65	8,967	12,553		145	62	87	
		01/19/1951	2130	50	42.6	50	35	25	12,204	17,086		145	84	118	
		05/15/1954	2040	32.5	62.8	32.5	22.75	16.25	17,991	25,187		145	124	174	
		02/16/1955	1466	28.3	51.8	28.3	19.81	14.15	14,840	20,775		145	102	143	
		03/07/1955	1692	27.3	62	27.3	19.11	13.65	17,762	24,866		145	122	171	
		11/04/1955	1201	31	38.7	31	21.7	15.5	11,087	15,521		145	76	107	
		12/30/1955	1950	20	97.5	20	14	10	27,932	39,104		145	193	270	
		09/27/1956	1448	43.5	33.3	43.5	30.45	21.75	9,540	13,356		145	66	92	
		08/02/1957	1337	35.9	37.2	35.9	25.13	17.95	10,657	14,920		145	73	103	
		10/09/1957	1605	43	37.3	43	30.1	21.5	10,686	14,960		145	74	103	
		07/03/1958	1800	44	40.9	44	30.8	22	11,717	16,404		145	81	113	
		10/10/1958	1485	39.4	37.7	39.4	27.58	19.7	10,800	15,120		145	74	104	
		07/23/1959	1305	39.6	33	39.6	27.72	19.8	9,454	13,235		145	65	91	
		07/19/1960	1120	31	36.1	31	21.7	15.5	10,342	14,479		145	71	100	
		08/17/1961	1178	27	43.6	27	18.9	13.5	12,490	17,487		145	86	121	
		06/14/1962	1225	30.9	39.6	30.9	21.63	15.45	11,345	15,882		145	78	110	
		04/22/1963	1406	30	46.9	30	21	15	13,436	18,810		145	93	130	
		07/28/1964	1016	29	35	29	20.3	14.5	10,027	14,037		145	69	97	
		08/18/1965	1142	24.8	46	24.8	17.36	12.4	13,178	18,449		145	91	127	
		01/09/1967	1748	26	67.2	26	18.2	13	19,251	26,952		145	133	186	
		10/12/1967	1634	26	62.8	26	18.2	13	17,991	25,187		145	124	174	
		08/05/1968	1455	24.8	58.7	24.8	17.36	12.4	16,816	23,543		145	116	162	
		08/06/1969	1490	30.6	48.7	30.6	21.42	15.3	13,951	19,532		145	96	135	
		08/24/1970	2194	29.8	73.6	29.8	20.86	14.9	21,085	29,519		145	145	204	
		08/19/1971	2308	32.2	71.7	32.2	22.54	16.1	20,540	28,757		145	142	198	
		07/26/1972	2206	30.6	72.1	30.6	21.42	15.3	20,655	28,917		145	142	199	
		08/14/1973	1783	18	99.1	18	12.6	9	28,390	39,746		145	196	274	
		01/15/1975	2251	52.2	43.1	52.2	36.54	26.1	12,347	17,286		145	85	119	
		05/13/1976	1554	47.6	32.6	47.6	33.32	23.8	9,339	13,075		145	64	90	
		04/06/1977	2001	22	91	22	15.4	11	26,070	36,497		145	180	252	
		06/21/1978	2613	48	54.4	48	33.6	24	15,584	21,818		145	107	150	
		09/24/1981	1824	21.8	83.7	21.8	15.26	10.9	23,978	33,570		145	165	232	
		07/27/1982	1790	21.9	81.7	21.9	15.33	10.95	23,405	32,767		145	161	226	
		05/30/1984	1813	22.2	81.7	22.2	15.54	11.1	23,405	32,767		145	161	226	

TABLE B-2

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Central Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	S3	04/11/1951	939	57	16.5	57	39.9	28.5	4,727	6,618		145	33	46	
		07/07/1953	766	72.3	10.6	72.3	50.61	36.15	3,037	4,251		145	21	29	
		07/23/1954	844	57	14.8	57	39.9	28.5	4,240	5,936		145	29	41	
		03/03/1955	928	45.5	20.4	45.5	31.85	22.75	5,844	8,182		145	40	56	
		03/07/1955	871	45	19.4	45	31.5	22.5	5,558	7,781		145	38	54	
		11/04/1955	736	53.5	13.8	53.5	37.45	26.75	3,953	5,535		145	27	38	
		08/03/1956	700	60.5	11.6	60.5	42.35	30.25	3,323	4,652		145	23	32	
		07/24/1957	674	57.5	11.7	57.5	40.25	28.75	3,352	4,693		145	23	32	
		10/02/1957	594	82	7.2	82	57.4	41	2,063	2,888		145	14	20	
		08/16/1961	576	58.1	9.9	58.1	40.67	29.05	2,836	3,971		145	20	27	
		06/14/1962	695	50.8	13.7	50.8	35.56	25.4	3,925	5,495		145	27	38	
		06/06/1963	786	31.2	25.2	31.2	21.84	15.6	7,219	10,107		145	50	70	
		08/19/1964	716	36.5	19.6	36.5	25.55	18.25	5,615	7,861		145	39	54	
		08/18/1965	720	35.2	20.5	35.2	24.64	17.6	5,873	8,222		145	41	57	
		09/11/1968	**945**	**7.3**	**129.5**	**7.3**	**5.11**	**3.65**	**37,099**	**51,939**	**79,750**	**145**	**256**	**358**	**550**
		08/06/1969	1033	8.4	123	8.4	5.88	4.2	35,237	49,332		145	243	340	
		08/24/1970	1047	8.8	119	8.8	6.16	4.4	34,091	47,727		145	235	329	
		08/19/1971	1040	8.4	123.8	8.4	5.88	4.2	35,466	49,652		145	245	342	
		06/12/1972	1042	8.8	118.4	8.8	6.16	4.4	33,919	47,487		145	234	327	
		08/14/1973	1045	8.8	118.8	8.8	6.16	4.4	34,034	47,647		145	235	329	
		01/14/1975	**1016**	**7.9**	**128.6**	**7.9**	**5.53**	**3.95**	**36,841**	**51,578**	**79,750**	**145**	**254**	**356**	**550**
		04/14/1977	1007	8.6	117.1	8.6	6.02	4.3	33,547	46,965		145	231	324	
		06/21/1978	587	6.1	96.2	6.1	4.27	3.05	27,559	38,583		145	190	266	
		09/24/1981	632	6.8	92.9	6.8	4.76	3.4	26,614	37,259		145	184	257	
		07/26/1982	649	6	108.2	6	4.2	3	30,997	43,396		145	214	299	
		05/29/1984	649	6.9	94.1	6.9	4.83	3.45	26,958	37,741		145	186	260	
		05/22/1986	639	8	79.9	8	5.6	4	22,890	32,045		145	158	221	
		06/14/1990	433	5	86.6	5	3.5	2.5	24,809	34,733		145	171	240	
		06/04/1991	520	6.1	85.2	6.1	4.27	3.05	24,408	34,171		145	168	236	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-3

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Lower Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	Stadium	07/20/1965	812	8.3	97.8	8.3	5.81	4.15	28,018	39,225		90	311	436	
		06/06/1972	531	1.6	331.9	1.6	1.12	0.8	95,082	133,115		90	1,056	1,479	
		03/19/1974	**1046**	**2.8**	**373.6**	**2.8**	**1.96**	**1.4**	**107,028**	**149,840**	**63,250**	**90**	**1,189**	**1,665**	**550**
		04/10/1975	**965**	**2.8**	**344.6**	**2.8**	**1.96**	**1.4**	**98,720**	**138,209**	**63,250**	**90**	**1,097**	**1,536**	**550**
		04/12/1976	901	3.4	265	3.4	2.38	1.7	75,917	106,283		90	844	1,181	
		07/11/1977	836	4	209	4	2.8	2	59,874	83,824		90	665	931	
		05/10/1978	942	3.9	241.5	3.9	2.73	1.95	69,184	96,858		90	769	1,076	
		04/01/1979	930	3.1	300	3.1	2.17	1.55	85,943	120,321		90	955	1,337	
		09/01/1979	**937**	**3.1**	**302.3**	**3.1**	**2.17**	**1.55**	**86,602**	**121,243**	**63,250**	**90**	**962**	**1,347**	**550**
		09/22/1998	945	3.6	262.5	3.6	2.52	1.8	75,201	105,281		90	836	1,170	
VWC	U4	07/27/1967	1383	13.1	105.6	13.1	9.17	6.55	30,252	42,353		115	263	368	
		08/07/1968	1686	12.4	136	12.4	8.68	6.2	38,961	54,545		115	339	474	
		08/18/1969	**2621**	**10.2**	**257**	**10.2**	**7.14**	**5.1**	**73,625**	**103,075**	**63,250**	**115**	**640**	**896**	**550**
		08/13/1973	**2679**	**8**	**334.9**	**8**	**5.6**	**4**	**95,942**	**134,318**	**63,250**	**115**	**834**	**1,168**	**550**
		10/31/1979	1021	3.8	268.7	3.8	2.66	1.9	76,977	107,767		115	669	937	
		11/10/1980	1123	4.1	273.9	4.1	2.87	2.05	78,466	109,853		115	682	955	
		06/08/1982	1144	4.4	260	4.4	3.08	2.2	74,484	104,278		115	648	907	
		01/29/1985	962	3.8	253.2	3.8	2.66	1.9	72,536	101,551		115	631	883	
		08/18/1986	941	3.9	241.3	3.9	2.73	1.95	69,127	96,778		115	601	842	
		04/21/1988	1080	4.2	257.1	4.2	2.94	2.1	73,654	103,115		115	640	897	
		02/01/1990	1073	3.5	306.6	3.5	2.45	1.75	87,834	122,968		115	764	1,069	
		05/29/1990	1073	3.5	306.6	3.5	2.45	1.75	87,834	122,968		115	764	1,069	
		01/23/1992	978	4.5	217.3	4.5	3.15	2.25	62,252	87,152		115	541	758	
		06/14/1994	1057	4.2	251.7	4.2	2.94	2.1	72,107	100,949		115	627	878	
		04/04/1996	958	3.5	273.7	3.5	2.45	1.75	78,409	109,773		115	682	955	
		07/17/1997	919	3.3	278.5	3.3	2.31	1.65	79,784	111,698		115	694	971	
		12/29/1998	**1198**	**5.3**	**226**	**5.3**	**3.71**	**2.65**	**64,744**	**90,642**		**115**	**563**	**788**	
VWC	U3	07/27/1967	1389	9	154.3	9	6.3	4.5	44,204	61,885		115	384	538	
		08/07/1968	784	9	87.1	9	6.3	4.5	24,952	34,933		115	217	304	
		08/15/1973	**1997**	**4.7**	**424.9**	**4.7**	**3.29**	**2.35**	**121,725**	**170,414**	**63,250**	**115**	**1,058**	**1,482**	**550**
		10/21/1975	1087	3	362.3	3	2.1	1.5	103,791	145,307		115	903	1,264	
		08/02/1976	997	2.9	343.8	2.9	2.03	1.45	98,491	137,888		115	856	1,199	
		06/13/1977	907	4.1	221.2	4.1	2.87	2.05	63,369	88,717		115	551	771	
		05/31/1978	1074	4.3	249.8	4.3	3.01	2.15	71,562	100,187		115	622	871	
		10/31/1979	939	3.5	268.3	3.5	2.45	1.75	76,862	107,607		115	668	936	
		11/10/1980	898	3.4	264.1	3.4	2.38	1.7	75,659	105,922		115	658	921	
		06/08/1982	1181	4	295.3	4	2.8	2	84,597	118,436		115	736	1,030	
		01/28/1985	**1276**	**4**	**319**	**4**	**2.8**	**2**	**91,387**	**127,941**	**63,250**	**115**	**795**	**1,113**	**550**
		08/18/1986	961	3.2	300.3	3.2	2.24	1.6	86,029	120,441		115	748	1,047	
		04/21/1988	**1249**	**3.6**	**346.9**	**3.6**	**2.52**	**1.8**	**99,379**	**139,131**	**63,250**	**115**	**864**	**1,210**	**550**
		02/01/1990	**1253**	**3**	**417.7**	**3**	**2.1**	**1.5**	**119,662**	**167,527**	**63,250**	**115**	**1,041**	**1,457**	**550**
		05/29/1990	1162	3	387.3	3	2.1	1.5	110,953	155,334		115	965	1,351	
		01/24/1992	1078	5.2	207.3	5.2	3.64	2.6	59,387	83,142		115	516	723	
		07/18/1994	1217	3.9	312.1	3.9	2.73	1.95	89,410	125,174		115	777	1,088	
		04/04/1996	979	2.9	337.6	2.9	2.03	1.45	96,715	135,401		115	841	1,177	
		07/17/1997	861	2.6	331.2	2.6	1.82	1.3	94,882	132,834		115	825	1,155	
		01/18/1999	**1224**	**3.6**	**340**	**3.6**	**2.52**	**1.8**	**97,403**	**136,364**	**63,250**	**115**	**847**	**1,186**	**550**
SCWC	Honby	07/23/1965	613	26.4	23.2	26.4	18.48	13.2	6,646	9,305		90	74	103	
		06/02/1972	712	4	178	4	2.8	2	50,993	71,390		90	567	793	
		06/05/1972	781	14.4	54.2	14.4	10.08	7.2	15,527	21,738		90	173	242	
		04/02/1974	684	14.6	46.8	14.6	10.22	7.3	13,407	18,770		90	149	209	
		04/16/1975	654	14.2	46.1	14.2	9.94	7.1	13,207	18,489		90	147	205	

TABLE B-3

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Lower Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		04/13/1976	623	3.5	178	3.5	2.45	1.75	50,993	71,390		90	567	793	
		05/03/1976	674	13.8	48.8	13.8	9.66	6.9	13,980	19,572		90	155	217	
		07/28/1977	801	16.5	48.5	16.5	11.55	8.25	13,894	19,452		90	154	216	
		08/25/1977	702	7.2	97.5	7.2	5.04	3.6	27,932	39,104		90	310	434	
		05/11/1978	**970**	**8.2**	**118.3**	**8.2**	**5.74**	**4.1**	**33,890**	**47,447**	**49,500**	**90**	**377**	**527**	**550**
		05/25/1978	835	18.4	45.4	18.4	12.88	9.2	13,006	18,209		90	145	202	
		04/01/1979	1065	13.7	77.7	13.7	9.59	6.85	22,259	31,163		90	247	346	
		09/01/1979	**1080**	**8.9**	**121.3**	**8.9**	**6.23**	**4.45**	**34,750**	**48,650**	**49,500**	**90**	**386**	**541**	**550**
		08/19/1980	**1178**	**12**	**98.2**	**12**	**8.4**	**6**	**28,132**	**39,385**	**49,500**	**90**	**313**	**438**	**550**
		08/22/1980	914	29.6	30.9	29.6	20.72	14.8	8,852	12,393		90	98	138	
		11/18/1981	919	48	19.1	48	33.6	24	5,472	7,660		90	61	85	
		12/01/1981	1277	13.4	95.3	13.4	9.38	6.7	27,301	38,222		90	303	425	
		03/14/1983	868	35	24.8	35	24.5	17.5	7,105	9,947		90	79	111	
		08/24/1983	1287	16.7	77.1	16.7	11.69	8.35	22,087	30,922		90	245	344	
		07/24/1984	832	48.1	17.3	48.1	33.67	24.05	4,956	6,939		90	55	77	
		08/02/1984	1232	14.5	85	14.5	10.15	7.25	24,351	34,091		90	271	379	
		10/22/1985	756	46.2	16.4	46.2	32.34	23.1	4,698	6,578		90	52	73	
		10/24/1985	1217	15.1	80.6	15.1	10.57	7.55	23,090	32,326		90	257	359	
		09/22/1998	904	10.2	88.6	10.2	7.14	5.1	25,382	35,535		90	282	395	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-4

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Upper Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	N. Oaks West	06/05/1972	1245	17.8	69.9	17.8	12.46	8.9	20,025	28,035		90	222	311	
		08/05/1972	1527	18.6	82.1	18.6	13.02	9.3	23,520	32,928		90	261	366	
		03/20/1974	1578	17.8	88.7	17.8	12.46	8.9	25,411	35,575		90	282	395	
		04/07/1975	1407	12.6	111.7	12.6	8.82	6.3	32,000	44,799		90	356	498	
		04/15/1976	1232	10.6	116.2	10.6	7.42	5.3	33,289	46,604		90	370	518	
		08/24/1977	578	7.2	80.3	7.2	5.04	3.6	23,004	32,206		90	256	358	
		06/07/1978	1392	12	116	12	8.4	6	33,231	46,524		90	369	517	
		04/01/1979	1298	10.8	120.2	10.8	7.56	5.4	34,435	48,209		90	383	536	
		09/01/1979	1185	9.7	122.2	9.7	6.79	4.85	35,008	49,011		90	389	545	
		08/02/1980	1317	11.4	115.5	11.4	7.98	5.7	33,088	46,324		90	368	515	
		12/01/1981	1598	13.4	119.3	13.4	9.38	6.7	34,177	47,848		90	380	532	
		03/07/1983	**1598**	**12.5**	**127.8**	**12.5**	**8.75**	**6.25**	**36,612**	**51,257**	**49,500**	**90**	**407**	**570**	**550**
		07/31/1984	**1558**	**12**	**129.8**	**12**	**8.4**	**6**	**37,185**	**52,059**	**49,500**	**90**	**413**	**578**	**550**
		10/23/1985	**1538**	**11.4**	**134.9**	**11.4**	**7.98**	**5.7**	**38,646**	**54,104**	**49,500**	**90**	**429**	**601**	**550**
		09/17/1998	1405	11.7	120.1	11.7	8.19	5.85	34,406	48,168		90	382	535	
SCWC	N. Oaks Central	03/26/1974	989	3.8	260.3	3.8	2.66	1.9	74,570	104,398		90	829	1,160	
		04/07/1975	823	3	274.3	3	2.1	1.5	78,581	110,013		90	873	1,222	
		04/13/1976	861	3.3	260.9	3.3	2.31	1.65	74,742	104,639		90	830	1,163	
		07/14/1977	759	4.5	168.7	4.5	3.15	2.25	48,329	67,660		90	537	752	
		05/18/1978	1023	3.6	284.2	3.6	2.52	1.8	81,417	113,984		90	905	1,266	
		04/01/1979	953	3.7	257.6	3.7	2.59	1.85	73,797	103,316		90	820	1,148	
		09/01/1979	930	1.3	715.4	1.3	0.91	0.65	204,947	286,925		90	2,277	3,188	
		08/27/1980	1021	3.5	291.7	3.5	2.45	1.75	83,566	116,992		90	929	1,300	
		11/19/1981	1078	3.8	283.7	3.8	2.66	1.9	81,274	113,783		90	903	1,264	
		03/07/1983	1139	3.4	335	3.4	2.38	1.7	95,970	134,358		90	1,066	1,493	
		07/26/1984	1164	3.5	332.6	3.5	2.45	1.75	95,283	133,396		90	1,059	1,482	
		10/23/1985	1087	3	362.3	3	2.1	1.5	103,791	145,307		90	1,153	1,615	
		09/17/1998	**1450**	**4.8**	**302.1**	**4.8**	**3.36**	**2.4**	**86,545**	**121,163**	**49,500**	**90**	**962**	**1,346**	**550**
SCWC	N. Oaks East	11/27/1963	1099	8.9	123.5	8.9	6.23	4.45	35,380	49,532		90	393	550	
		08/24/1965	707	42.1	16.8	42.1	29.47	21.05	4,813	6,738		90	53	75	
		06/02/1972	1169	8.5	137.5	8.5	5.95	4.25	39,391	55,147		90	438	613	
		03/20/1974	1016	6.5	156.3	6.5	4.55	3.25	44,777	62,687		90	498	697	
		04/15/1975	842	4.8	175.4	4.8	3.36	2.4	50,248	70,348		90	558	782	
		04/13/1976	873	5.3	164.7	5.3	3.71	2.65	47,183	66,056		90	524	734	
		07/14/1977	699	6.3	111	6.3	4.41	3.15	31,799	44,519		90	353	495	
		06/07/1978	750	4.4	170.5	4.4	3.08	2.2	48,845	68,382		90	543	760	
		04/01/1979	578	3.1	186.5	3.1	2.17	1.55	53,428	74,799		90	594	831	
		09/01/1979	510	2.2	231.8	2.2	1.54	1.1	66,406	92,968		90	738	1,033	
		08/25/1980	531	3.2	165.9	3.2	2.24	1.6	47,527	66,537		90	528	739	
		11/19/1981	1312	10.6	123.8	10.6	7.42	5.3	35,466	49,652		90	394	552	
		03/23/1983	**1312**	**7.6**	**172.6**	**7.6**	**5.32**	**3.8**	**49,446**	**69,225**	**49,500**	**90**	**549**	**769**	**550**
		07/30/1984	1261	8	157.6	8	5.6	4	45,149	63,209		90	502	702	
		11/18/1985	1143	7.3	156.6	7.3	5.11	3.65	44,862	62,807		90	498	698	
		09/17/1998	1091	18.4	59.3	18.4	12.88	9.2	16,988	23,783		90	189	264	

TABLE B-4

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Upper Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	Sierra	**03/20/1974**	**1679**	**5.7**	**294.6**	**5.7**	**3.99**	**2.85**	**84,396**	**118,155**	**49,500**	**90**	**938**	**1,313**	**550**
		04/08/1975	1425	5.3	268.9	5.3	3.71	2.65	77,034	107,848		90	856	1,198	
		04/14/1976	1418	5.8	244.5	5.8	4.06	2.9	70,044	98,061		90	778	1,090	
		07/12/1977	1291	8.9	145.1	8.9	6.23	4.45	41,568	58,195		90	462	647	
		05/16/1978	**1574**	**5.4**	**291.5**	**5.4**	**3.78**	**2.7**	**83,508**	**116,912**	**49,500**	**90**	**928**	**1,299**	**550**
		04/01/1979	1538	4.9	313.9	4.9	3.43	2.45	89,926	125,896		90	999	1,399	
		09/01/1979	1507	5.5	274	5.5	3.85	2.75	78,495	109,893		90	872	1,221	
		08/25/1980	1558	4.6	338.7	4.6	3.22	2.3	97,030	135,842		90	1,078	1,509	
		11/30/1981	1448	4.2	344.8	4.2	2.94	2.1	98,778	138,289		90	1,098	1,537	
		03/15/1983	**1950**	**5.5**	**354.5**	**5.5**	**3.85**	**2.75**	**101,557**	**142,179**	**49,500**	**90**	**1,128**	**1,580**	**550**
		07/26/1984	1860	16.8	110.7	16.8	11.76	8.4	31,713	44,398		90	352	493	
		10/29/1985	**1840**	**6.4**	**287.5**	**6.4**	**4.48**	**3.2**	**82,362**	**115,307**	**49,500**	**90**	**915**	**1,281**	**550**
		09/16/1998	851	3.3	257.9	3.3	2.31	1.65	73,883	103,436		90	821	1,149	
SCWC	Mitchell	07/19/1965	536	11.4	47	11.4	7.98	5.7	13,464	18,850		90	150	209	
		08/07/1972	1250	6.5	192.3	6.5	4.55	3.25	55,090	77,126		90	612	857	
		03/26/1974	627	2.8	223.9	2.8	1.96	1.4	64,142	89,799		90	713	998	
		04/08/1975	529	2.6	203.5	2.6	1.82	1.3	58,298	81,618		90	648	907	
		08/25/1977	**709**	**5**	**141.8**	**5**	**3.5**	**2.5**	**40,623**	**56,872**	**49,500**	**90**	**451**	**632**	**550**
		07/25/1978	613	7.7	79.6	7.7	5.39	3.85	22,804	31,925		90	253	355	
		04/01/1979	653	8.7	75.1	8.7	6.09	4.35	21,515	30,120		90	239	335	
		09/01/1979	660	9	73.3	9	6.3	4.5	20,999	29,398		90	233	327	
		08/25/1980	602	9.8	61.4	9.8	6.86	4.9	17,590	24,626		90	195	274	
		11/23/1981	664	11	60.4	11	7.7	5.5	17,303	24,225		90	192	269	
		05/23/1983	674	12.3	54.8	12.3	8.61	6.15	15,699	21,979		90	174	244	
		08/02/1984	689	25.8	26.7	25.8	18.06	12.9	7,649	10,709		90	85	119	
		10/24/1985	694	39	17.8	39	27.3	19.5	5,099	7,139		90	57	79	
		09/22/1998	593	14.3	41.5	14.3	10.01	7.15	11,889	16,644		90	132	185	
SCWC	Lost Canyon 2	04/01/1979	743	17.3	42.9	17.3	12.11	8.65	12,290	17,206	36,000	90	137	191	400
		09/01/1979	885	28	31.6	28	19.6	14	9,053	12,674		90	101	141	
		09/16/1998	799	22.1	36.2	22.1	15.47	11.05	10,371	14,519		90	115	161	
SCWC	Lost Canyon 2A	10/29/1997	834	12.4	67.3	12.4	8.68	6.2	19,280	26,992	36,000	90	214	300	400
SCWC	Sand Canyon	07/02/1975	648	2.7	240	2.7	1.89	1.35	68,755	96,257		90	764	1,070	
		04/01/1979	540	2.5	216	2.5	1.75	1.25	61,879	86,631		90	688	963	
		09/01/1979	**825**	**2.6**	**317.3**	**2.6**	**1.82**	**1.3**	**90,900**	**127,259**	**36,000**	**90**	**1,010**	**1,414**	**400**
		08/22/1980	709	3.2	221.6	3.2	2.24	1.6	63,484	88,877		90	705	988	
		11/18/1981	684	3.4	201.2	3.4	2.38	1.7	57,639	80,695		90	640	897	
		05/23/1983	714	3.2	223.1	3.2	2.24	1.6	63,913	89,479		90	710	994	
		07/24/1984	**774**	**4.2**	**184.3**	**4.2**	**2.94**	**2.1**	**52,798**	**73,917**	**36,000**	**90**	**587**	**821**	**400**
		10/22/1985	658	3.3	199.4	3.3	2.31	1.65	57,124	79,973		90	635	889	
		09/16/1998	**1147**	**9.3**	**123.3**	**9.3**	**6.51**	**4.65**	**35,323**	**49,452**	**36,000**	**90**	**392**	**549**	**400**
NCWD	Pinetree1	04/02/1999	297	13.7	21.7	13.7	9.59	6.85	6,217	8,703	31,500	90	69	97	350
NCWD	Pinetree3	**04/02/1999**	**554**	**4.7**	**117.9**	**4.7**	**3.29**	**2.35**	**33,776**	**47,286**	**31,500**	**90**	**375**	**525**	**350**
NCWD	Pinetree4	**04/02/1999**	**497**	**4.8**	**103.5**	**4.8**	**3.36**	**2.4**	**29,650**	**41,511**	**31,500**	**90**	**329**	**461**	**350**

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	D	05/29/1984	503	6	83.8	6	4.2	3	24,007	33,610		100	240	336	
		04/27/1988	**1171**	**10.1**	**115.9**	**10.1**	**7.07**	**5.05**	**33,203**	**46,484**	**35,000**	**100**	**332**	**465**	**350**
		05/29/1990	990	9.5	104.2	9.5	6.65	4.75	29,851	41,791		100	299	418	
		07/06/1994	**1119**	**9.6**	**116.6**	**9.6**	**6.72**	**4.8**	**33,403**	**46,765**	**35,000**	**100**	**334**	**468**	**350**
		04/29/1996	1105	9.8	112.8	9.8	6.86	4.9	32,315	45,241		100	323	452	
		09/15/1997	1135	9.7	117	9.7	6.79	4.85	33,518	46,925		100	335	469	
		11/03/1998	**1086**	**9.6**	**113.1**	**9.6**	**6.72**	**4.8**	**32,401**	**45,361**	**35,000**	**100**	**324**	**454**	**350**
		11/13/1998	1086	9.6	113.1	9.6	6.72	4.8	32,401	45,361		100	324	454	
NLF	E	**04/10/1984**	**1726**	**7.8**	**221.3**	**7.8**	**5.46**	**3.9**	**63,398**	**88,757**	**35,000**	**100**	**634**	**888**	**350**
		05/21/1986	1613	7.1	227.2	7.1	4.97	3.55	65,088	91,123		100	651	911	
		10/14/1987	1151	15.6	73.8	15.6	10.92	7.8	21,142	29,599		100	211	296	
		10/05/1988	766	11	69.6	11	7.7	5.5	19,939	27,914		100	199	279	
		07/11/1989	877	8.2	107	8.2	5.74	4.1	30,653	42,914		100	307	429	
		05/30/1990	1291	13.9	92.9	13.9	9.73	6.95	26,614	37,259		100	266	373	
		04/17/1991	1187	15.8	75.1	15.8	11.06	7.9	21,515	30,120		100	215	301	
		06/03/1992	**1732**	**7.9**	**219.2**	**7.9**	**5.53**	**3.95**	**62,796**	**87,914**	**35,000**	**100**	**628**	**879**	**350**
		07/20/1993	1613	7.4	218	7.4	5.18	3.7	62,452	87,433		100	625	874	
		07/20/1994	1603	7.6	210.9	7.6	5.32	3.8	60,418	84,586		100	604	846	
		07/12/1995	1644	7.4	222.2	7.4	5.18	3.7	63,655	89,118		100	637	891	
		05/14/1996	1613	7.9	204.2	7.9	5.53	3.95	58,499	81,898		100	585	819	
		04/23/1997	1583	9.9	159.9	9.9	6.93	4.95	45,808	64,131		100	458	641	
		05/06/1998	1501	6.8	220.7	6.8	4.76	3.4	63,226	88,516		100	632	885	
		05/04/1999	1501	6.9	217.5	6.9	4.83	3.45	62,309	87,233		100	623	872	
		05/21/1999	1501	6.9	217.5	6.9	4.83	3.45	62,309	87,233		100	623	872	
		04/21/2000	1378	11.4	120.9	11.4	7.98	5.7	34,635	48,489		100	346	485	
NLF	E2	07/29/1938	1921	20.7	92.8	20.7	14.49	10.35	26,585	37,219		100	266	372	
		08/05/1938	1625	18.5	87.8	18.5	12.95	9.25	25,153	35,214		100	252	352	
		08/11/1938	1630	18.2	89.6	18.2	12.74	9.1	25,668	35,936		100	257	359	
		07/25/1939	1530	15.7	97.5	15.7	10.99	7.85	27,932	39,104		100	279	391	
		08/01/1939	1846	19.1	96.6	19.1	13.37	9.55	27,674	38,743		100	277	387	
		06/13/1941	1905	13.2	144.3	13.2	9.24	6.6	41,339	57,874		100	413	579	
		07/16/1945	**1635**	**9.9**	**165.2**	**9.9**	**6.93**	**4.95**	**47,326**	**66,257**	**35,000**	**100**	**473**	**663**	**350**
		12/18/1946	**1819**	**10**	**181.9**	**10**	**7**	**5**	**52,110**	**72,955**	**35,000**	**100**	**521**	**730**	**350**
		10/28/1947	1760	16.2	108.6	16.2	11.34	8.1	31,112	43,556		100	311	436	
		06/23/1949	1225	12.5	98	12.5	8.75	6.25	28,076	39,305		100	281	393	
		06/07/1950	1070	11	97.3	11	7.7	5.5	27,874	39,024		100	279	390	
		04/11/1951	1095	37.7	29	37.7	26.39	18.85	8,308	11,631		100	83	116	
		08/07/1953	1103	22.4	49.2	22.4	15.68	11.2	14,095	19,733		100	141	197	
		02/10/1955	1481	14.9	99.4	14.9	10.43	7.45	28,476	39,866		100	285	399	
		08/12/1955	1103	22.4	49.2	22.4	15.68	11.2	14,095	19,733		100	141	197	
		09/20/1956	998	28.2	35.4	28.2	19.74	14.1	10,141	14,198		100	101	142	
		07/16/1957	938	29.2	32.1	29.2	20.44	14.6	9,196	12,874		100	92	129	
		10/09/1957	828	11	75.3	11	7.7	5.5	21,572	30,201		100	216	302	
		07/25/1958	1582	12.5	126.6	12.5	8.75	6.25	36,268	50,775		100	363	508	
		10/24/1958	1532	16.6	92.3	16.6	11.62	8.3	26,442	37,019		100	264	370	
		09/03/1959	1329	24.8	53.6	24.8	17.36	12.4	15,355	21,497		100	154	215	
		07/29/1960	1084	39.2	27.7	39.2	27.44	19.6	7,935	11,110		100	79	111	
		08/03/1961	888	20.2	44	20.2	14.14	10.1	12,605	17,647		100	126	176	
		07/17/1962	1503	18.5	81.2	18.5	12.95	9.25	23,262	32,567		100	233	326	
		05/07/1963	1487	16.2	91.8	16.2	11.34	8.1	26,299	36,818		100	263	368	

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		07/16/1964	759	47.8	15.9	47.8	33.46	23.9	4,555	6,377		100	46	64	
		08/05/1965	652	34.2	19.1	34.2	23.94	17.1	5,472	7,660		100	55	77	
		11/01/1966	536	60.1	8.9	60.1	42.07	30.05	2,550	3,570		100	25	36	
		08/10/1967	842	9.6	87.7	9.6	6.72	4.8	25,124	35,174		100	251	352	
		09/26/1968	1161	62.5	18.6	62.5	43.75	31.25	5,328	7,460		100	53	75	
		06/23/1972	1345	12.8	105.1	12.8	8.96	6.4	30,109	42,152		100	301	422	
		07/08/1974	1287	17.3	74.4	17.3	12.11	8.65	21,314	29,840		100	213	298	
		05/06/1976	1065	25.5	41.8	25.5	17.85	12.75	11,975	16,765		100	120	168	
		03/14/1977	1056	43.7	24.2	43.7	30.59	21.85	6,933	9,706		100	69	97	
		08/10/1978	725	4.8	151	4.8	3.36	2.4	43,258	60,561		100	433	606	
		12/21/1989	1086	34.6	31.4	34.6	24.22	17.3	8,995	12,594		100	90	126	
		05/30/1990	1205	36.1	33.4	36.1	25.27	18.05	9,568	13,396		100	96	134	
		04/17/1991	1056	48.5	21.8	48.5	33.95	24.25	6,245	8,743		100	62	87	
		06/03/1992	1235	22.9	53.9	22.9	16.03	11.45	15,441	21,618		100	154	216	
		07/20/1993	**1312**	**8.3**	**158.1**	**8.3**	**5.81**	**4.15**	**45,292**	**63,409**	**35,000**	**100**	**453**	**634**	**350**
		07/21/1994	**1305**	**6.3**	**207.1**	**6.3**	**4.41**	**3.15**	**59,330**	**83,061**	**35,000**	**100**	**593**	**831**	**350**
		07/12/1995	**1395**	**6.2**	**225**	**6.2**	**4.34**	**3.1**	**64,458**	**90,241**	**35,000**	**100**	**645**	**902**	**350**
		06/05/1996	**1473**	**5.8**	**254**	**5.8**	**4.06**	**2.9**	**72,765**	**101,872**	**35,000**	**100**	**728**	**1,019**	**350**
		04/23/1997	1087	6.4	169.8	6.4	4.48	3.2	48,644	68,102		100	486	681	
		06/26/1998	1055	8.3	127.1	8.3	5.81	4.15	36,411	50,976		100	364	510	
		05/04/1999	1079	6.6	163.5	6.6	4.62	3.3	46,839	65,575		100	468	656	
		05/21/1999	1079	6.6	163.5	6.6	4.62	3.3	46,839	65,575		100	468	656	
		04/21/2000	1052	6.7	157	6.7	4.69	3.35	44,977	62,968		100	450	630	
WHR	8	04/10/1969	849	5.8	146.4	5.8	4.06	2.9	41,940	58,717	35,000	100	419	587	350
WHR	16	10/06/1955	1205	8.3	145.2	8.3	5.81	4.15	41,597	58,235		100	416	582	
		11/13/1957	1052	7.6	138.4	7.6	5.32	3.8	39,649	55,508		100	396	555	
		05/28/1959	810	6.3	128.6	6.3	4.41	3.15	36,841	51,578		100	368	516	
		06/19/1959	**1436**	**9.9**	**145.1**	**9.9**	**6.93**	**4.95**	**41,568**	**58,195**	**35,000**	**100**	**416**	**582**	**350**
		06/26/1962	**1150**	**7**	**164.3**	**7**	**4.9**	**3.5**	**47,068**	**65,896**	**35,000**	**100**	**471**	**659**	**350**
		12/04/1963	1073	6.9	155.5	6.9	4.83	3.45	44,547	62,366		100	445	624	
WHR	11	11/10/1954	1401	10.9	128.5	10.9	7.63	5.45	36,812	51,537		100	368	515	
		10/06/1955	**1444**	**10.4**	**138.8**	**10.4**	**7.28**	**5.2**	**39,763**	**55,668**	**35,000**	**100**	**398**	**557**	**350**
		03/07/1962	1125	8.5	132.4	8.5	5.95	4.25	37,930	53,102		100	379	531	
		10/31/1962	1288	10.6	121.5	10.6	7.42	5.3	34,807	48,730		100	348	487	
		12/04/1963	1172	8.2	142.9	8.2	5.74	4.1	40,938	57,313		100	409	573	
WHR	18	01/27/1959	1244	9	138.2	9	6.3	4.5	39,591	55,428		100	396	554	
		05/28/1959	**1369**	**9.3**	**147.2**	**9.3**	**6.51**	**4.65**	**42,170**	**59,037**	**35,000**	**100**	**422**	**590**	**350**
		06/26/1962	1262	8	157.8	8	5.6	4	45,206	63,289		100	452	633	
		12/04/1963	940	6	156.7	6	4.2	3	44,891	62,848		100	449	628	
WHR	17	**10/06/1955**	**576**	**3.2**	**180**	**3.2**	**2.24**	**1.6**	**51,566**	**72,193**	**35,000**	**100**	**516**	**722**	**350**
		03/06/1962	539	3.3	163.3	3.3	2.31	1.65	46,782	65,495		100	468	655	
		10/31/1962	536	3.2	167.5	3.2	2.24	1.6	47,985	67,179		100	480	672	
		12/04/1963	**595**	**3.3**	**180.3**	**3.3**	**2.31**	**1.65**	**51,652**	**72,313**	**35,000**	**100**	**517**	**723**	**350**
WHR	10	10/06/1955	442	18.5	23.9	18.5	12.95	9.25	6,847	9,586	35,000	100	68	96	350
		03/06/1962	452	11.1	40.7	11.1	7.77	5.55	11,660	16,324		100	117	163	
		10/31/1962	480	15	32	15	10.5	7.5	9,167	12,834		100	92	128	
		12/03/1963	508	23.6	21.5	23.6	16.52	11.8	6,159	8,623		100	62	86	
		11/13/1964	467	27.1	17.2	27.1	18.97	13.55	4,927	6,898		100	49	69	

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
WHR	15	10/06/1955	815	3.6	226.4	3.6	2.52	1.8	64,859	90,802		100	649	908	
		11/13/1957	1231	6.6	186.5	6.6	4.62	3.3	53,428	74,799		100	534	748	
		06/18/1958	1353	6.8	199	6.8	4.76	3.4	57,009	79,813		100	570	798	
		05/28/1959	**1655**	**9.6**	**172.4**	**9.6**	**6.72**	**4.8**	**49,389**	**69,144**	**35,000**	**100**	**494**	**691**	**350**
		06/18/1958	1353	6.8	199	6.8	4.76	3.4	57,009	79,813		100	570	798	
		06/26/1962	1260	6	210	6	4.2	3	60,160	84,225		100	602	842	
		12/05/1963	1180	7.6	155.3	7.6	5.32	3.8	44,490	62,286		100	445	623	
WHR	5	03/06/1962	684	9.7	70.5	9.7	6.79	4.85	20,197	28,275	35,000	100	202	283	350
		12/03/1963	693	8.8	78.8	8.8	6.16	4.4	22,574	31,604		100	226	316	
NCWD	Castaic1	03/31/1986	580	51.6	11.2	51.6	36.12	25.8	3,209	4,492	25,200	100	32	45	315
		04/23/1999	644	55.2	11.7	55.2	38.64	27.6	3,352	4,693		100	34	47	
NCWD	Castaic4	04/23/1999	271	87.6	3.1	87.6	61.32	43.8	888	1,243	25,200	100	9	12	315
NCWD	Castaic3	04/23/1999	470	41.3	11.4	41.3	28.91	20.65	3,266	4,572	25,200	100	33	46	315
NCWD	Castaic2	04/01/1986	428	37.9	11.3	37.9	26.53	18.95	3,237	4,532	25,200	100	32	45	315

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-6

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer In Tributary Canyons, Santa Clarita Valley, CA

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	W4	02/05/1992	592	9.4	63	9.4	6.58	4.7	18,048	25,267		100	180	253	
		08/12/1994	**957**	**10.8**	**88.6**	**10.8**	**7.56**	**5.4**	**25,382**	**35,535**	**10,500**	**100**	**254**	**355**	**105**
VWC	W6	11/22/1991	720	36	20	36	25.2	18	5,730	8,021		100	57	80	
		01/27/1992	636	40.5	15.7	40.5	28.35	20.25	4,498	6,297		100	45	63	
		05/11/1994	504	75	6.7	75	52.5	37.5	1,919	2,687		100	19	27	
		04/23/1996	531	71.3	7.4	71.3	49.91	35.65	2,120	2,968		100	21	30	
		07/15/1997	539	69.5	7.8	69.5	48.65	34.75	2,235	3,128		100	22	31	
		12/28/1998	468	83.2	5.6	83.2	58.24	41.6	1,604	2,246		100	16	22	
VWC	W9	04/23/1996	946	10.1	93.7	10.1	7.07	5.05	26,843	37,580		100	268	376	
		07/15/1997	958	10.5	91.2	10.5	7.35	5.25	26,127	36,578		100	261	366	
		12/28/1998	**990**	**10.2**	**97.1**	**10.2**	**7.14**	**5.1**	**27,817**	**38,944**	**10,500**	**100**	**278**	**389**	**105**
SCWC	Guida	**03/18/1974**	**1016**	**6.4**	**158.8**	**6.4**	**4.48**	**3.2**	**45,493**	**63,690**	**12,600**	**90**	**505**	**708**	**140**
		04/17/1975	990	6.2	159.7	6.2	4.34	3.1	45,751	64,051		90	508	712	
		04/19/1976	940	5.6	167.9	5.6	3.92	2.8	48,100	67,340		90	534	748	
		07/06/1977	890.7	5.2	171.3	5.2	3.64	2.6	49,074	68,703		90	545	763	
		05/09/1978	915	5.5	166.4	5.5	3.85	2.75	47,670	66,738		90	530	742	
		04/01/1979	990	6.5	152.3	6.5	4.55	3.25	43,631	61,083		90	485	679	
		09/01/1979	990	3.6	275	3.6	2.52	1.8	78,782	110,294		90	875	1,225	
		08/20/1980	1000	7	142.9	7	4.9	3.5	40,938	57,313		90	455	637	
		11/24/1981	1009	7.2	140.1	7.2	5.04	3.6	40,136	56,190		90	446	624	
		03/15/1983	1024	6.9	148.4	6.9	4.83	3.45	42,513	59,519		90	472	661	
		07/25/1984	**1014**	**6.4**	**158.4**	**6.4**	**4.48**	**3.2**	**45,378**	**63,529**	**12,600**	**90**	**504**	**706**	**140**
		10/28/1985	1044	7.8	133.8	7.8	5.46	3.9	38,331	53,663		90	426	596	
		09/23/1998	1066	9.4	113.4	9.4	6.58	4.7	32,487	45,481		90	361	505	
SCWC	Clark	**06/06/1972**	**814**	**4**	**203.5**	**4**	**2.8**	**2**	**58,298**	**81,618**	**22,050**	**90**	**648**	**907**	**245**
		03/18/1974	587	3.8	154.5	3.8	2.66	1.9	44,261	61,965		90	492	689	
		05/27/1975	541	3.7	146.2	3.7	2.59	1.85	41,883	58,636		90	465	652	
		04/12/1976	490	3.3	148.5	3.3	2.31	1.65	42,542	59,559		90	473	662	
		07/06/1977	500.3	3	166.8	3	2.1	1.5	47,785	66,898		90	531	743	
		05/08/1978	488	3.1	157.4	3.1	2.17	1.55	45,092	63,128		90	501	701	
		04/01/1979	600	3	200	3	2.1	1.5	57,296	80,214		90	637	891	
		09/01/1979	600	2.6	230.8	2.6	1.82	1.3	66,119	92,567		90	735	1,029	
		08/20/1980	573	2.9	197.6	2.9	2.03	1.45	56,608	79,251		90	629	881	
		11/24/1981	602	2.7	223	2.7	1.89	1.35	63,885	89,439		90	710	994	
		03/08/1983	608	2.6	233.8	2.6	1.82	1.3	66,979	93,770		90	744	1,042	
		07/25/1984	608	2.3	264.3	2.3	1.61	1.15	75,716	106,003		90	841	1,178	
		09/23/1998	677	4.4	153.9	4.4	3.08	2.2	44,089	61,725		90	490	686	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

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APPENDIX C

Surface Water Routing Model

A Surface Water Routing Model (SWRM) was developed to support groundwater flow modeling efforts in the Santa Clarita Valley of Southern California. The SWRM was developed as a pre- and post-processor for the Santa Clarita Valley Groundwater Model (hereafter called the Regional Model), which was constructed by the Upper Basin Water Purveyors. The Regional Model will be briefly described in this appendix; however, the reader should refer to the main body of this report for a more detailed description of the Regional Model.

C.1 Introduction

The Regional Model simulates monthly groundwater conditions from 1980 through 1999 over a 120 square mile (mi^2) area within a portion of the Santa Clara River Valley East Groundwater Subbasin. This subbasin lies within the Upper Santa Clara River Hydrologic Area, which is a watershed of approximately 460 mi^2 that lies in northwest Los Angeles County and a small portion of eastern Ventura County (Figure C-1).

The outer limits of the Regional Model correspond to the outer limits of the Santa Clarita Valley's groundwater systems, which consist of the Alluvial Aquifer and the Saugus Formation. These aquifers lie in the south-central portion of the hydrologic area, and the watershed extends upstream beyond the outer limits of the groundwater systems. Geologic formations located within the watershed, but outside of the Regional Model area, consist of bedrock and do not transmit significant quantities of groundwater flow due to their low permeability. However, an understanding of the availability of surface water runoff and infiltration within and upstream of the Regional Model area is critical to accurately simulate the water budget through time within the Regional Model area. Therefore, a surface water routing tool was developed to estimate, on a monthly basis, the location, magnitude, and timing of surface water infiltration to groundwater within the Regional Model boundary.

The SWRM was written in the Visual Basic Editor within Microsoft® Excel 97. The remainder of this appendix is organized as follows:

a. A list of the sources of recharge that are evaluated by the SWRM

b. The design of the SWRM

c. Detailed discussions of the calculations of magnitudes of each surface water source and its associated infiltration rate to groundwater

C.2 Sources of Recharge

The sources of recharge to the groundwater system in the Santa Clarita Valley are:

a. Infiltration of applied water for urban and industrial outdoor uses and for irrigating golf courses. Sources of urban and golf course irrigation water are groundwater pumping from the Alluvial Aquifer and the Saugus Formation, and import of water from the State Water Project (SWP).

b. Infiltration of water that is used for agricultural irrigation within the Regional Model area. This source of water consists exclusively of groundwater pumping from the Alluvial Aquifer.

c. Infiltration of direct precipitation within the Regional Model area, which is derived from precipitation data.

d. Infiltration of stormwater and anthropogenic streamflows. These sources include the following:

    1. Surface water runoff and infiltration from portions of the Upper Santa Clara River Hydrologic Area located outside of the Regional Model boundary

    2. Santa Clara River flows that enter the valley from the east

    3. Water released from Castaic Lagoon into Castaic Creek by the California Department of Water Resources

    4. Treated water discharged into the Santa Clara River from two Los Angeles County Sanitation District (LACSD) water reclamation plants (WRP)

C.3 SWRM Design

At every node in the grid that forms the Regional Model domain, the SWRM estimates groundwater recharge terms using the following three basic steps:

1. Calculate the monthly volume of surface water from each water source within and upstream of the Regional Model area.

2. Calculate the monthly volume of water in a stream that leaks through the streambed and collects on the water table, based on an assigned streambed leakage rate at each Regional Model stream node.

3. Calculate the monthly volume of water in a stream that does not infiltrate because of gaining stream conditions (i.e., rejected stream leakage). Rejected stream leakage remains as surface water as it passes the mouth of the stream and flows into the next stream system. For the Santa Clara River, rejected stream leakage eventually exits the Regional Model area at the west end of the valley, at the County Line stream gage.

Flow volumes in streams and rates of infiltration to groundwater from all water sources vary both geographically and over time based on sets of rules programmed into the SWRM. One of the most significant rules in the SWRM is that the infiltration rates to groundwater are not allowed to exceed the total amount of water generated by all surface water sources

in a given month. The magnitude of each potential source of groundwater recharge is based on local hydrologic measurements that have been recorded over time.

Following are discussions of the data and methods that were used to estimate the source water volumes and the amount of infiltration from each of these sources.

C.4 Infiltration of Applied Water (Urban Use, Excluding Golf Courses)

A significant portion of water that is used outdoors goes to plant uptake and direct evaporation, and a smaller portion infiltrates to the underlying aquifer system. The magnitude of infiltration was estimated using recent water use and land use data (Figure C-2) for developed areas within the Santa Clarita Valley.

The average annual water demand provided by the Upper Basin Water Purveyors was approximately 49,000 acre-feet per year (AF/yr) from 1994 through 1998. On a long-term basis, outdoor water use in urbanized areas is approximately 66 percent of the total annual water demand, as indicated by records of total water demands and WRP flows (see Table C-1). Within urbanized areas that are industrial and retail land uses, the outdoor water use is estimated to be approximately 30 percent of the total water use. For all urbanized areas excluding golf courses, it was assumed that 10 percent of the applied water in areas of urban development could potentially recharge groundwater. This assumption means that a total of 90 percent of the applied water goes to evapotranspiration (ET) demands, surface runoff, and return flow to surface water.

Aerial photographs of the valley taken in 1999 were used to identify land uses in developed areas, and a geographic information system (GIS) was used to determine the acreage of each land use type. Table C-2 summarizes the derivation of estimated values of infiltration for urban irrigation water from land use and water use data. The table shows the average annual water use volumes, the land use acreage, and the calculated depths of annual infiltration to groundwater. As shown in the table, infiltration of urban irrigation water is estimated to be approximately 1 inch per year (in/yr) for retail and industrial land uses, and 2.2 in/yr for suburban residential land use and recreational land use (parks). These values were used as direct specified input to the SWRM and were not varied during calibration of the Regional Model.

An attempt was made to vary over time, the locations at which urban applied water was specified in the Regional Model. However, electronic records of historical land use data were unavailable. Consequently, to ensure that the total infiltration volume in urbanized areas reflected the increase in development and water use that occurred throughout the 1980s and 1990s, this infiltration was applied to the 1999 urbanized area, but at rates that were adjusted upward or downward in a given year according to the difference between water uses in that year and in 1999. Tables C-3 and C-4 show the actual rates that were applied to the 1999 urbanized area to account for the gradual increase in water use from 1980 through 1999.

C.5 Infiltration of Applied Water (Golf Course Irrigation)

From 1994 through 1998, the average annual water use for golf course irrigation was approximately 500 AF/yr. The majority of this water use was for irrigation and was specified in the SWRM as 100 percent of the total water use for the golf course.

The amount of return flow to groundwater resulting from golf course irrigation was estimated to be 30 percent of applied water, which is three times higher than the assumed rate for other urbanized areas. This estimate was based on information suggesting that golf courses irrigate beyond the water demand requirements of grassy areas to maintain the quality of the greens. As shown in Table C-2, this resulted in an estimated annual average infiltration rate of 4.6 in/yr. As with urban irrigation, the golf course irrigation was increased gradually from 1980 through 1999 to account for the increased population growth and urban water use in the urbanized Santa Clarita Valley (see Table C-5).

C.6 Infiltration of Applied Water (Agricultural)

Aerial photographs of the valley taken in 1999 indicate that approximately 877 acres are currently irrigated for agricultural uses in the model study area. Approximately 90 percent of these irrigated lands are underlain by the Alluvial Aquifer, while the remaining 10 percent lie on the terrace deposits or in areas where the Saugus Formation is exposed at the ground surface. The total area of irrigated agriculture has diminished substantially since the 1960s as a result of development in the area.

Agricultural land in the Santa Clarita Valley is used primarily to grow row crops. A review was performed of detailed records of agricultural pumping, crop types, the acreage of each crop type, and the water use requirements for each crop type (as listed in the California Irrigation Management Information System). This review was performed for the period 1996 through 2000 to estimate the amount of applied irrigation water that infiltrates to groundwater beneath irrigated agricultural lands. Figure C-3 shows the analysis, which compares crop water use requirements with applied water volumes and identifies the difference as being equal to the infiltration volume to groundwater. For the period 1996 through 2000, Figure C-3 shows the following:

a. The average applied water volume was 7,038 AF/yr

b. The average amount of water that was not consumptively used (and which therefore infiltrated to groundwater) was 2,583 AF/yr, which is approximately 37 percent of the applied water volume

c. The equivalent average infiltration rate over the 877-acre area was 2.9 AF/acre/yr (which is equivalent to 2.9 ft/yr)

The infiltration rate of 2.9 ft/yr corresponds to the 7,038 AF/yr average water use during 1996 through 2000. A higher infiltration rate would be expected during years of higher water use and lower rate during years of reduced water use. Table C-6 shows the corresponding infiltration rates for each year, based on the water use each year. The 500-foot spacing of the Regional Model grid resulted in slight over-estimation of the acreage within

the model (1,205 acres) compared with the actual irrigated acreage (877 acres). This adjustment is also shown in Table C-6.

C.7 Infiltration of Direct Precipitation

As water falls onto the land surface or onto a body of water, it follows the three following natural pathways:

1. **Evapotranspiration.** This is the process by which water passes from a liquid to a vapor state via direct evaporation and through transpiration by plants (crops, urban landscaping, and native vegetation).
2. **Surface water runoff.** This represents water occurring as overland flow or water flowing in a stream.
3. **Infiltration.** This is the process by which water moves from the land surface downward through the upper soil layers. The process of infiltration increases the soil moisture content. If the soil moisture content reaches its field capacity, then any additional infiltration that takes place displaces water in the vadose zone and collects on the water table as groundwater recharge (deep percolation of precipitation). For the sake of clarity, references to infiltration in the rest of Appendix C will be synonymous with deep percolation of precipitation.

To estimate the infiltration rate, an understanding of the spatial pattern of precipitation must first be developed. To estimate the total volume of precipitation that falls onto the watershed, one would ideally like to have long-term precipitation data from several active rain gages located on a fairly consistent spacing throughout the watershed. However, due to the expense and maintenance required to operate a rain gage, such an extensive network of rain gages within a single watershed is typically not available for an extended period in most watersheds, as is the case for the Santa Clarita Valley.

C.7.1 Precipitation Data

The SWRM used precipitation data from the rain gage at the Newhall County Water District (NCWD) office, which is located south of Newhall Creek, approximately 1.3 miles south of the Newhall-Soledad rain gage (Figure C-4). Table C-7 lists the monthly precipitation at the NCWD gage from 1980 through 1999.

Because data from a single rain gage is not ideal for estimating the total volume of precipitation that falls within the entire watershed area, an isohyet map of California was also used. Figure C-4 shows contours of long-term average annual rainfall (isohyets) based on data compiled by the U.S. Geological Survey (USGS), the California Department of Water Resources, the California Geologic Survey (formerly the California Division of Mines and Geology), and where available, county and/or other local agencies. The source maps that were used to create the isohyet map are based primarily on U.S. Weather Service data from approximately 800 precipitation stations statewide. The U.S. Weather Service data were supplemented with county and local agency precipitation data in the Los Angeles area. The precipitation data were collected by these agencies over a sixty-year period from 1900 to

1960. Further information on the source of the isohyet data is available at the California Spatial Information Library.[1]

Because these isohyet data represent long-term hydrologic conditions from 1900 to 1960, a methodology was developed to estimate monthly precipitation throughout the Upper Santa Clara River Hydrologic Area using the NCWD gage data and the isohyets. For each month during the 1980 through 1999 Regional Model calibration period, this was done both within the Regional Model area and in the portions of the watershed lying outside the Regional Model area. The long-term average annual precipitation distribution shown in Figure C-4 was electronically draped over the nodes that comprise the Regional Model grid using the ESRI® ArcMap™/ArcInfo™ 8.3 GIS software. The annual precipitation rates at the NCWD rain gage from 1980 through 1999 were computed and compared with the value presented on the 1900 to 1960 isohyet map at that same location. The percent difference between the annual precipitation value and the isohyet value was computed for the NCWD rain gage location and applied to all isohyet values assigned to the Regional Model nodes, to estimate the average spatial distribution of precipitation for that particular calendar year. For example, the 1900-1960 isohyet value at the NCWD rain gage was 20.50 inches, but the 1980 annual precipitation data indicate 31.95 inches fell that year. Therefore, the adjustment factor for the isohyet values at all Regional Model nodes for 1980 was 31.95 divided by 20.50 or 1.559. This adjustment factor was then multiplied by the isohyet values at all Regional Model node locations to estimate the spatial distribution of annual precipitation during 1980.

The derivation of infiltration rates from direct precipitation within the Regional Model boundary is described in Section C.7.2. The derivation of streamflow rates from precipitation occurring outside the regional model boundary is discussed in Section C.8.1.

C.7.2 Infiltration Within the Regional Model Area

Because the Regional Model is a groundwater flow model, it does not directly input precipitation data. Instead, the monthly component of infiltration is estimated by the SWRM and used as input for the Regional Model. The infiltration rate is computed by the SWRM, within the Regional Model area, as described in the following paragraphs.

Annual precipitation infiltration volumes within the Regional Model domain were estimated from annual precipitation data using a variation of the Turner (1986) method. Turner empirically derived a power-function equation that described the relationship between annual rainfall and ET rates, based on the measured yields from 68 different watersheds located throughout California. Rainfall that does not go to ET is available for surface water runoff and infiltration to groundwater. During the largest storm events, some of this water leaves the basin before it has a chance to infiltrate to groundwater. However, during all but the largest storm events, precipitation that is not consumed by ET eventually infiltrates to groundwater, as defined by the following equation (Turner, 1986):

$$\text{Infiltration} + \text{Runoff} = \text{Precipitation} - 2.32(\text{Precipitation})^{0.66} \qquad \text{(C-1)}$$

[1] http://gis.ca.gov/meta.epl?oid=286

Equation C-1 is plotted on Figure C-5 for a range of annual precipitation values expressed in units of inches. Because this expression was empirically derived based on a best-fit to data from 68 watersheds throughout California, it is not necessarily representative of the conditions in an individual watershed. Therefore, the two power-function coefficients were adjusted during the process of calibrating the Regional Model. A final set of power-function coefficients for the Regional Model produced the following relationship for the Santa Clarita Valley:

$$\text{Infiltration} + \text{Runoff} = \text{Precipitation} - 6.20(\text{Precipitation})^{0.33} \qquad \text{(C-2)}$$

Equation C-2 (Figure C-5) was then applied to the annual precipitation-adjusted isohyet values to estimate the annual rate of infiltration from 1980 through 1999. Finally, based on the percentage of annual precipitation that fell each month during that calendar year at the NCWD rain gage, the annual infiltration rates were converted into monthly rates for every node in the Regional Model.

C.8 Infiltration From Streams

The natural sources of water to streams within the Santa Clarita Valley are surface water runoff from portions of the Upper Santa Clara River Hydrologic Area watershed that lie outside of the Regional Model boundary, and flow in the Santa Clara River where it enters the valley. Additionally, DWR releases water into Castaic Creek from Castaic Lagoon in some years, and treated water is discharged into the river from two WRPs on a continual basis. Following are discussions of the volumes of these water sources and the method used to determine infiltration rates in stream beds, based on the magnitude of flow in each stream.

C.8.1 Surface Water Runoff Volume Outside the Regional Model Area

For the Regional Model to honor the water budget for the entire watershed, a method was developed to estimate the monthly availability of surface water runoff and subsurface inflow from areas that are tributary to the Regional Model boundary. To do this, GIS software was used to provide specific input data to the SWRM as follows:

a. First, GIS software was used to delineate the extents of selected subwatersheds within the Upper Santa Clara River Hydrologic Area, using 30-meter digital elevation model data obtained from the USGS. Figure C-6 depicts the extents of these subwatersheds. The extents of the subwatersheds were important to delineate because precipitation rates vary spatially (see Figure C-4); therefore, at any given time, each sub-watershed receives different magnitudes of precipitation, and yields different quantities of surface water runoff and subsurface inflow into the Regional Model area.

b. Once the selected subwatersheds were delineated, the spatial areas were computed by GIS software for the entire subwatershed and for the portion of the subwatershed lying outside the Regional Model boundary. The GIS software also computed the mean of the 1900 to 1960 precipitation (isohyet) distribution within each subwatershed. The areas and the 1900 to 1960 mean precipitation values for each subwatershed are listed in Table C-8. The means of the 1900-1960 precipitation data were then multiplied by the precipitation adjustment factor (discussed in Section C.7.1) for each calendar year to

estimate the average magnitude of precipitation that fell within each sub-watershed during that calendar year.

c. Equation C-2 was then applied to the adjusted annual precipitation values for each sub-watershed to estimate the annual rate of surface water runoff from 1980 through 1999. This provided an estimate of the annual volume of water from subwatersheds that is then available as potential groundwater recharge within the stream reach that lies within the Regional Model domain. These annual estimates were then converted to monthly estimates by multiplying by the monthly percentage of precipitation that fell at the Newhall County Water District rain gage.

C.8.2 Santa Clara River Streamflow at Eastern Regional Model Boundary

The eastern point of the Regional Model, the location at which the Santa Clara River enters the model area, marks the approximate location of the Lang gage (Figure C-6). Streamflow was measured at this gage by the USGS and Los Angeles County for a discontinuous period of 36 years starting in 1949. The gaging station was removed from service in October 1989. Because the Santa Clara River flow into the model domain is a critical boundary condition for the Regional Model, it was necessary to estimate this streamflow beginning in October 1989.

The following paragraphs describe the method used to estimate the monthly streamflow at the Lang gage. This process used the Lang gage data through September 1989 and monthly precipitation data from a rain gage in the Acton groundwater basin, which is immediately east and upgradient of the Regional Model area. Using a multiple linear regression method described below, a good correlation between monthly precipitation data from the U.S Forest Service's Acton rain gage and the Lang stream gage was achieved. The resulting regression equation was used to generate estimates of streamflow during the period that streamflow data were unavailable (October 1989 through December 1999).

C.8.2.1 Data Sources

Monthly precipitation data for 1949 to 2001 were obtained for the Acton, California rain gage maintained by the U.S. Forest Service from the Western Regional Climate Data Center. This gage was determined to be the closest rain gage to the center of the Acton watershed with a long enough period of record to complete the regression analysis. Average rainfall at the Acton rain gage was 10.3 inches during the period of record, which is approximately 58 percent of the 17.83-inch average measured from 1883 through 2000 at the Newhall-Soledad gage.

C.8.2.2 Streamflow Estimation Method

The streamflow estimation procedure for the Lang gage site assumed that a predictable relationship exists between streamflows at the Lang gage and precipitation at the Acton rain gage. This assumption was used to develop a multiple linear regression relationship and to test the quality of that relationship using historical data. A simple mathematical model was established in which the streamflow at the Lang gage during a given month was estimated from the precipitation during the prior month. A Microsoft® Excel spreadsheet was used to perform the multiple linear regression calculations and to determine the regression coefficients for each monthly rainfall value.

The regression model was calibrated using monthly streamflow data for the Lang gage during water years 1949 to 1956. The calibration was verified using streamflow and precipitation data for water years 1957 to 1989. Numerous iterations using different rainfall periods and durations were attempted before achieving a good correlation. The final regression model bases the streamflow estimates on the previous six monthly rainfall values to predict each monthly streamflow value at the Lang gage.

The final regression equation was of the form:

$$\text{Streamflow at the Lang gage} = C1*Rain_{month1} + C2*Rain_{month2} + \ldots + C6*Rain_{month6} \quad \text{(C-3)}$$

where C1, C2, ...C6 are the regression constants.

C.8.2.3 Accuracy of Streamflow Estimates

Once a regression equation is developed and its predictions are verified, streamflows are commonly estimated by applying the equation to any set of precipitation data that are similar in magnitude to those which were used to develop the regression relationship (in this case, the historic values at the Acton rain gage). To verify that the regression equations produced accurate streamflow predictions, streamflow rates calculated from the regression equations were plotted and compared against measured streamflow rates for the period of record at the Lang gage. Figure C-7 shows a comparison plot using the results of this analysis, along with the final regression equation. The plotted data indicate that the regression equation produced streamflow estimates that closely matched measured streamflows. Where differences are apparent between computed and measured streamflows, this results from one or more of the following influences:

a. **System Operation.** The effects of streamflow diversions, pump stations, and wet weather bypasses are not consistent from storm to storm, and can result in irregular streamflows under similar precipitation events.

b. **Rainfall Distribution.** The regression equations were generated from the rain gage that was thought to best represent the precipitation distributed over the entire Acton basin. However, variability of rainfall volume and intensity is normal across basins, resulting in differences in streamflow volume and timing.

c. **Gage Data.** It is common to have intermittent problems with streamflow measurement devices, particularly because of changes in the depth-versus-streamflow relationship at the gaging station over time. The regression equation was produced from storm events during periods where the Acton precipitation data appeared to be the most reliable. These data are reasonable and appropriate for the uses of this study.

d. **Antecedent Conditions.** Streamflow predicted by the regression equation will be most accurate when applied to periods when storm intensity, duration, and antecedent conditions are similar to those used to generate the regression equations. If the antecedent conditions differ significantly from those present in the historical record, then the ability to forecast streamflow characteristics may be hindered.

As Figure C-7 shows, the relationship between monthly precipitation at the Acton rain gage and streamflow at the Lang gage is fairly predictable and has been consistent over time. This

mathematical relationship would be expected to remain consistent unless significant changes occur within the basin to affect streamflows, such as major land use changes.

The Acton rain gage was removed from service at the end of August 2000, therefore streamflow predictions cannot be made beyond this date using the calibrated regression model parameters described above. Table C-9 lists the combined set of measured and computed monthly streamflow values for the Lang gage from 1980 through 1999.

The monthly availability of streamflows at the Lang gage were input into the SWRM and allowed to infiltrate based on the specified maximum stream leakage rate, as Section C.8.5 of this appendix will discuss.

C.8.3 Releases from Castaic Lake

As described in Section 2.6.3.4 in the main body of this report, Castaic Creek occasionally receives surface water releases from Castaic Lagoon (i.e., Castaic Lake). The SWRM treats this surface water as it would any other available surface water in a stream. Based on the volume of available water during each monthly stress period, that water is allowed to infiltrate the Castaic Creek streambed and recharge the underlying groundwater system at a rate equal to or less than the streambed infiltration capacity (see Section C.8.5). Table C-10 lists the monthly releases of state surface water into Castaic Creek.

C.8.4 Treated Wastewater

Another anthropogenic source of recharge to the groundwater system is treated wastewater from the two LACSD WRPs in the valley, Plant No. 32 near Valencia, known as the Valencia WRP, and Plant No. 26 near Bouquet Canyon known, as the Saugus WRP. Tables C-11 and C-12 list the monthly volumes of treated wastewater that are discharged to the Santa Clara River from the Valencia WRP and the Saugus WRP, respectively.

The SWRM treats this surface water component as it would any other available surface water in a simulated stream. The volume of available treated wastewater during each monthly stress period is simulated to infiltrate the Santa Clara River streambed and recharge the groundwater system at a rate equal to or less than the streambed infiltration capacity (see Section C.8.5).

C.8.5 Assignment of Stream Leakage

Once the monthly streamflows were established for the Santa Clara River and each of its selected tributaries, a method had to be developed to determine the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system. The following paragraphs describe this method.

C.8.5.1 Stream Connectivity and Ranking System

For the SWRM to assign stream leakage rates accurately, a stream ranking convention was adopted (Figure C-8) as follows:

1. Santa Clara River
2. All modeled streams that merge with the Santa Clara River (2nd order streams)

3. All modeled streams that merge with the 2nd order streams (3rd order streams)
4. All modeled streams that merge with the 3rd order streams (4th order streams)
5. All modeled streams that merge with the 4th order streams (5th order streams)

For the entire model domain, the SWRM processes the assignment of stream leakage beginning with the highest ranking stream nodes and progressing sequentially downstream to the lowest ranking stream nodes for each subwatershed. This ensures a correct accounting of available stream leakage throughout the stream network in the Regional Model domain. Within a given stream, the connectivity relationships between each Regional Model grid node in that stream were established by ordering the Regional Model stream node number from upgradient nodes to downgradient nodes (Figure C-8). Additionally, the last stream node of a given stream was assigned a "next node number," which indicated the nearest node for the next downstream (lower ranking) stream that could receive any surface flows that remained in the higher ranking stream. This "next node number" attribute allowed the SWRM to simulate continued surface water infiltration in the lower ranking streams as long as the total volume of available recharge water was not consumed in upstream reaches of the simulated stream.

C.8.5.2 Stream Geometry at Each Node

Another necessary input for specifying infiltration rates from streams was the geometry of each individual stream node, specifically, the length, width, and area of each stream node (Figure C-8). This was required because the groundwater recharge module that was used within the Regional Model requires input in units of feet per day, then internally computes the volumetric groundwater recharge rate (in cubic feet per day) using the nodal area (in square feet). Thus, the SWRM requires input of simulated stream geometry assumptions to ensure that the correct volume of water is being recharged through the simulated streambeds.

C.8.5.3 Streambed Infiltration Capacity at Each Node

The streambed infiltration capacity was specified at each stream node in the SWRM. The streambed infiltration capacity is the maximum volume of water that can infiltrate through streambed sediments, assuming a sufficient volume of water in the stream. The streambed infiltration capacity is measured in cubic feet per second per stream mile and is a function of streambed sediment permeability and wetted width of the stream at any given time.

The wetted width of a stream at any given time will vary as a function of the amount of flow in the stream and will be less than the nodal width for all but the highest streamflows. Additionally, permeability of the streambed sediments will vary spatially and can even vary over time at any given location because of the scouring and deposition that occur during high flow events. Consequently, the streambed infiltration capacity of a stream at any given location can vary over time. For this reason, and because stream widths can vary in the field but not in the Regional Model, streambed infiltration capacity was allowed to vary over time in the SWRM.

A post-processor was written into the SWRM code to aid in the selection of time-varying streambed infiltration rates. The post-processor became a part of the calibration process of the Regional Model, in that differences between measured and simulated groundwater

elevations were used to help determine whether the streambed infiltration capacity of a given stream reach needed to be raised or lowered during any given month. Because this process required groundwater elevation data in the underlying groundwater system (in this case, the Alluvial Aquifer), the post-processor could only be applied along the Santa Clara River and Castaic Creek. Few, if any, records of groundwater elevations exist for the Alluvial Aquifer along the other streams, so streambed infiltration capacities were not varied over time along those streams. A complete description of the Regional Model calibration process and results can be found in Sections 4 and 5 in the main body of this report.

The monthly adjustment of the assumed streambed infiltration capacities during calibration of the Regional Model was performed in an iterative manner, using the following steps (which are also shown in Figure C-9):

1. Initial estimates of the maximum stream leakage rate were specified in the SWRM, which then generated monthly sets of groundwater recharge rates at each Regional Model node along the Santa Clara River and Castaic Creek during the 20-year simulation period.

2. The Regional Model was then run, and simulated groundwater elevations were recorded over time at selected calibration well locations along the Santa Clara River and Castaic Creek.

3. Simulated groundwater elevations were compared with measured elevations at each calibration well, and the differences (head residuals) were used to compute the surplus or deficit of water calculated by the Regional Model. For example, if a set of calibration wells in a particular area along the Santa Clara River indicated that simulated groundwater levels were 10 feet too high during a monthly stress period, then the computation would proceed as follows:

    a. Multiply the head residuals by the specific yield and the adjacent stream node area in the stream reach where the calibration well is located, to obtain the volume of surplus recharge water in the model.

    b. Reduce the assumed maximum stream leakage rate so that the calculated surplus recharge volume of water would not infiltrate in the stream reach associated with the calibration well during that particular monthly stress period. In other words, at a location where the model simulates too much stream leakage, the post-processor computes the volume of surplus recharge that, if eliminated, would allow the simulated groundwater elevations to better match the measured groundwater elevations. In this example, streamflow would be infiltrating the simulated streambed at a slower rate, thereby persisting as streamflow for a longer downstream reach of the stream channel.

4. Using the new values of streambed infiltration capacity, the SWRM was then run again to provide new groundwater recharge rates each month at the nodes where the post-processor was applied. The Regional Model was then run again with the new groundwater recharge rates, and this entire process was repeated until the assumed maximum stream leakage rate and/or the simulated groundwater elevations showed little to no change from one simulation to the next.

The streambed infiltration capacity that is assigned by the SWRM for each month is not necessarily the rate that surface water leaks into the Regional Model at any given location. The specified infiltration capacity simply allows stream leakage to occur as long as streamflows are available. For example, if the selected calibration wells are simulating groundwater elevations too low in comparison with measured groundwater elevations during a drought period, then the post-processor function within the SWRM would try to increase the assumed maximum stream leakage rate. However, during a drought, the availability of surface water is diminished. Therefore, even though the SWRM might increase the streambed infiltration capacity, there would be reaches where streamflows would be too low to allow water to infiltrate at a rate as high as the streambed infiltration capacity. The SWRM can only infiltrate the surface water if it is available, based on the complete water balance within the watershed. This rule allows the SWRM and the Regional Model to honor the watershed water budget.

C.9 Rejected Stream Leakage

As previously mentioned, the SWRM also tracks the volume of surface water in each simulated stream that does not infiltrate during each monthly stress period because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage remains as surface water in the Santa Clara River and eventually exits the Regional Model at the west end of the valley at the County Line stream gage. The monthly volumes of rejected stream leakage (calculated by the SWRM) and groundwater discharges to the river (calculated by the Regional Model) were used during the calibration process to compare these combined flow rates with streamflows measured at the County Line stream gage. This is discussed in detail in Sections 4.4.2 and 5.2.3 of the report.

Table C-13 lists the monthly streamflow measured from 1980 through 1999 at the County Line gage, which is located on the Santa Clara River at the western (downstream) end of the Santa Clarita Valley. Until October 1996, this gage was located just downstream of the Los Angeles-Ventura County line and just upstream of Blue Cut.[2] This gage continued operation through October 21, 1996, at which time it was permanently taken out of service. A new gage (USGS Gage No. 11109000) was put into service beginning on October 1, 1996 approximately 2.5 miles downstream, near Piru Junction, at the Las Brisas Bridge.

[2] Blue Cut is an area where the valley becomes substantially narrower in width and the river begins to bend toward the southern side of the valley. See Figure C-1 for this location.

C.10 References

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Tables

Table C-1

Comparison of WRP Discharges with Urban Water Demands

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	WRP Discharges to the Santa Clara River (AF/yr)	Urban Water Demands (AF/yr)	Percentage of Urban Demand Used Indoors (Routed to WRPs)	Percentage of Urban Demand Used Outdoors
1980	7,374	22,319	33.0	67.0
1981	7,950	24,822	32.0	68.0
1982	8,438	21,912	38.5	61.5
1983	9,422	21,386	44.1	55.9
1984	9,514	27,386	34.7	65.3
1985	9,616	28,482	33.8	66.2
1986	6,020	31,152	19.3	80.7
1987	11,843	33,877	35.0	65.0
1988	12,363	37,634	32.9	67.1
1989	13,560	42,813	31.7	68.3
1990	14,006	43,066	32.5	67.5
1991	14,108	39,793	35.5	64.5
1992	15,702	41,266	38.1	61.9
1993	17,178	43,352	39.6	60.4
1994	16,946	45,988	36.8	63.2
1995	17,823	45,673	39.0	61.0
1996	16,827	50,147	33.6	66.4
1997	15,775	54,173	29.1	70.9
1998	17,691	48,858	36.2	63.8
1999	17,847	57,250	31.2	68.8
1999	17,847	57,250	31.2	68.8
Statistics for 1980 through 1999				
Minimum	**6,020**	**21,386**	**19.3**	**55.9**
Maximum	**17,847**	**57,250**	**44.1**	**80.7**
Average	**13,231**	**38,981**	**34.2**	**65.8**
Median	**14,006**	**41,266**	**33.8**	**66.2**
Statistics for 1980 through 1999, Excluding 1986				
Minimum	**7,374**	**21,386**	**29.1**	**55.9**
Maximum	**17,847**	**57,250**	**44.1**	**70.9**
Average	**13,592**	**39,372**	**34.9**	**65.1**
Median	**14,057**	**42,040**	**34.3**	**65.7**

TABLE C-2
Calculation of Outdoor Irrigation Infiltration Rates to Groundwater for Non-Agricultural Water Uses
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Term	Value	Units	Reference or Calculation Method	Comment
NCWD Annual Water Use, 5-Year Average 1994 through 1998	8,150	AF/yr	Table III-6 in *1999 Annual Basin Report* (Luhdorff and Scalmanini Consulting Engineers, 2000)	16 percent of retailer-supplied water.
SCWD Annual Water Use, 5-Year Average 1994 through 1998	20,920	AF/yr		42 percent of retailer-supplied water.
VWC Total Annual Use, 5-Year Average 1994 through 1998	19,330	AF/yr		40 percent of retailer-supplied water.
LA County 36 Annual Water Use, 5-Year Average 1994 through 1998	570	AF/yr		1 percent of retailer-supplied water.
Valencia Country Club (VCC) Annual Water Use, 5-Year Average 1994 through 1998	490	AF/yr		1 percent of retailer-supplied water.
Annual Water Use, 5-Year Average 1994 through 1998	**49,460**	**AF/yr**		
Area of Water Use (excluding agriculture and undeveloped)	17,691	acres	Aerial photography (1999).	Area where retailer-supplied water is used.
Alluvial Aquifer Area of Water Use (excluding agriculture and undeveloped)	8,000	acres		Alluvial area where retailer-supplied water is used.
Saugus Area of Water Use (excluding agriculture and undeveloped)	9,691	acres		Saugus area where retailer-supplied water is used.
Alluvial Aquifer Lands – Suburban Residential Area	4,765	acres	Aerial photography (1999) and geologic mapping.	60 percent of alluvium area receiving applied water.
Alluvial Aquifer Lands – Retail – Office – Industrial Area	2,900	acres		36 percent of alluvium area receiving applied water.
Alluvial Aquifer Lands – Recreational Area	0	acres		No recreational areas were identified as overlying alluvium.
Alluvial Aquifer Lands – Golf Course Area	335	acres		4 percent of alluvium area receiving applied water.
Saugus Lands – Suburban Residential Area	8,192	acres		85 percent of Saugus area receiving applied water.
Saugus Lands – Retail - Office – Industrial Area	1,411	acres		15 percent of Saugus area receiving applied water.
Saugus Lands – Recreational Area	46	acres		Less than 1 percent of Saugus area receiving applied water.
Saugus Lands -- Golf Course Area	42	acres		Less than 1 percent of Saugus area receiving applied water.
Percent Annual Water Consumption for Outdoor Use -- Suburban Residential	65		Comparison of historical water use records and WRP flow records. See Table C-1.	
Percent Annual Water Consumption for Outdoor Use -- Retail/Office/Industrial	30			
Percent Annual Water Consumption for Outdoor Use -- Recreational	65			
Percent Annual Water Consumption for Outdoor Use -- Golf Course	100			
Percent Applied Water Going to Deep Percolation -- Suburban Residential	10		Assumed irrigation efficiency is 10 percent for all urban land uses where irrigation occurs.	
Percent Applied Water Going to Deep Percolation -- Retail/Office/Industrial	10			
Percent Applied Water Going to Deep Percolation -- Recreational	10			
Percent Applied Water Going to Deep Percolation -- Golf Course	30			
Percent Total Water Use Going to Deep Percolation -- Suburban Residential	6.5		Calculated.	Equals 65 percent times 10 percent.
Percent Total Water Use Going to Deep Percolation -- Retail/Office/Industrial	3.0			Equals 30 percent times 10 percent.
Percent Total Water Use Going to Deep Percolation -- Recreational	6.5			Equals 65 percent times 10 percent
Percent Total Water Use Going to Deep Percolation -- Golf Course	30.0			Equals 100 percent times 30 percent.
Alluvial Aquifer Annual Deep Percolation – Suburban Residential	866	AF/yr	Calculated from total water use (49,460 AF/yr), the area overlying the alluvium for each land use category, and the percentage of total water use going to recharge.	Equals 49,460 AF/yr * (4765 acres / 17691 acres) * 6.5 percent.
Alluvial Aquifer Annual Deep Percolation -- Retail/Office/Industrial	243	AF/yr		Equals 49,460 AF/yr * (2900 acres / 17691 acres) * 3.0 percent.
Alluvial Aquifer Annual Deep Percolation – Recreational	0	AF/yr		No recreational areas overlie alluvium.
Alluvium Annual Deep Percolation -- Golf Course	130	AF/yr		Equals 490 AF/yr * (335 acres / (335+42 acres)) * 30.0 percent.
Alluvial Aquifer Annual Deep Percolation	**1,239**	**AF/yr**		
Alluvial Aquifer 5-Year Deep Percolation (1994 through 1998)	**6,195**	**AF**		
Saugus Annual Deep Percolation – Suburban Residential	1,489	AF/yr	Calculated from total water use (49,460 AF/yr), the area overlying the Saugus for each land use category, and the percentage of total water use going to recharge.	Equals 49,460 AF/yr * (8192 acres / 17691 acres) * 6.5 percent.
Saugus Annual Deep Percolation – Retail/Office/Industrial	118	AF/yr		Equals 49,460 AF/yr * (1411 acres / 17691 acres) * 3.0 percent.
Saugus Annual Deep Percolation – Recreational	8	AF/yr		Equals 49,460 AF/yr * (46 acres / 17691 acres) * 6.5 percent.
Saugus Annual Deep Percolation – Golf Course	16	AF/yr		Equals 490 AF/yr * (42 acres / (335+42 acres) * 30.0 percent.
Saugus Annual Deep Percolation	**1,631**	**AF/yr**		
Saugus 5-Year Deep Percolation (1994 through 1998)	**8,155**	**AF**		
Average Area-Wide Deep Percolation -- Suburban Residential	2.2	in/yr	Calculated from applied water volumes in Alluvial and Saugus samples, as well as combined area in alluvium and Saugus occupied by each land use category.	Equals (12 in/ft)* (866+1,489 AF/yr) / (4,765+8,192 acres).
Average Area-Wide Deep Percolation -- Retail/Office/Industrial	1.0	in/yr		Equals (12 in/ft)* (243+118 AF/yr) / (2,900+1411 acres).
Average Area-Wide Deep Percolation -- Recreational	2.2	in/yr		Equals (12 in/ft)* (0+8 AF/yr) / (0+46 acres).
Average Area-Wide Deep Percolation -- Golf Course	4.6	in/yr		Equals (12 in/ft)* (130+16 AF/yr) / (335+42 acres).

Notes:

Applied water recharge to Saugus includes areas where terrace deposits are present at the ground surface.
in/ft = inches per foot

Table C-3

Irrigation Infiltration Rates over 1999 Suburban Residential Area

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Suburban Residential Area (in/yr)	Ratio Compared with 1999
1980	22,319	0.86	0.391
1981	24,822	0.95	0.432
1982	21,912	0.84	0.382
1983	21,386	0.82	0.373
1984	27,386	1.05	0.477
1985	28,482	1.09	0.495
1986	31,152	1.2	0.545
1987	33,877	1.3	0.591
1988	37,634	1.45	0.659
1989	42,813	1.65	0.75
1990	43,066	1.65	0.75
1991	39,793	1.53	0.695
1992	41,266	1.59	0.723
1993	43,352	1.67	0.759
1994	45,988	1.77	0.805
1995	45,673	1.76	0.8
1996	50,147	1.93	0.877
1997	54,173	2.08	0.945
1998	48,858	1.88	0.855
1999	57,250	2.2	1
2000	60,988	2.34	1.064

Note:

Eq. = equivalent

Table C-4

Irrigation Infiltration Rates over 1999 Retail and Industrial Area

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Retail/Industrial Area (in/yr)	Ratio Compared with 1999
1980	22,319	0.39	0.39
1981	24,822	0.43	0.43
1982	21,912	0.38	0.38
1983	21,386	0.37	0.37
1984	27,386	0.48	0.48
1985	28,482	0.5	0.5
1986	31,152	0.54	0.54
1987	33,877	0.59	0.59
1988	37,634	0.66	0.66
1989	42,813	0.75	0.75
1990	43,066	0.75	0.75
1991	39,793	0.7	0.7
1992	41,266	0.72	0.72
1993	43,352	0.76	0.76
1994	45,988	0.8	0.8
1995	45,673	0.8	0.8
1996	50,147	0.88	0.88
1997	54,173	0.95	0.95
1998	48,858	0.85	0.85
1999	57,250	1	1

Table C-5

Irrigation Infiltration Rates over 1999 Golf Course Areas

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Golf Courses Area (in/yr)	Ratio Compared with 1999
1980	22,319	1.79	0.389
1981	24,822	1.99	0.433
1982	21,912	1.76	0.383
1983	21,386	1.72	0.374
1984	27,386	2.2	0.478
1985	28,482	2.29	0.498
1986	31,152	2.5	0.543
1987	33,877	2.72	0.591
1988	37,634	3.02	0.657
1989	42,813	3.44	0.748
1990	43,066	3.46	0.752
1991	39,793	3.2	0.696
1992	41,266	3.32	0.722
1993	43,352	3.48	0.757
1994	45,988	3.7	0.804
1995	45,673	3.67	0.798
1996	50,147	4.03	0.876
1997	54,173	4.35	0.946
1998	48,858	3.93	0.854
1999	57,250	4.6	1

Table C-6
Irrigation Infiltration Rates for Agricultural Lands
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Agricultural Applied Water Volume (AF/yr)	Infiltration Rate (ft/yr)	Infiltration Rate for Modeled Acreage (ft/yr)	Percentage of 1996 through 2000 Average
1980	6,364	2.7	1.9	90
1981	7,433	3.1	2.2	106
1982	5,441	2.3	1.6	77
1983	4,487	1.9	1.3	64
1984	6,311	2.6	1.9	90
1985	5,241	2.2	1.5	74
1986	4,657	1.9	1.4	66
1987	3,662	1.5	1.1	52
1988	3,348	1.4	1.0	48
1989	3,511	1.5	1.0	50
1990	4,623	1.9	1.4	66
1991	3,958	1.7	1.2	56
1992	5,022	2.1	1.5	71
1993	4,508	1.9	1.3	64
1994	5,958	2.5	1.8	85
1995	6,276	2.6	1.8	89
1996	6,728	3.2	2.2	108
1997	7,528	3.0	2.1	102
1998	5,980	2.7	1.9	93
1999	7,479	2.9	2.1	99
2000	7,476	2.9	2.0	98
Average (1996 through 2000)	**7,038**	**2.9**	**2.1**	100

Note:
Actual acreage is 877 acres; modeled acreage is 1,205 acres.

TABLE C-7
Monthly Precipitation Measured at the Newhall County Water District Rain Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
1981	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
1982	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
1983	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
1984	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
1985	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
1986	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
1987	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
1988	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
1989	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
1990	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
1991	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
1992	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
1993	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
1994	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
1995	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
1996	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
1997	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
1998	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
1999	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05

Note:

All precipitation values are measured in inches.

TABLE C-8
Spatial Areas and Means of 1900 to 1960 Precipitation for Subwatersheds
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Canyon/Stream	Subwatershed Area (acres)	Contributing Area to Regional Model (acres)	Mean of Precipitation 1900 to 1960 within Each Contributing Area (in/yr)
Bee Canyon	1,163.38	970.06	11.41
Bouquet Canyon	11,995.90	9,100.66	14.09
Bouquet Canyon Tributary 1	409.84	291.36	12.81
Bouquet Canyon Tributary 2	683.75	577.67	13.25
Bouquet Canyon Tributary 3	459.20	393.53	13.18
Lower Castaic Creek	13,109.20	4,205.12	14.73
Upper Castaic Creek	98,417.60	98,417.60	19.62
Charlie Canyon	6,323.41	5,418.33	15.55
Dry Canyon	4,883.13	2,900.08	14.20
Gavin Canyon	3,608.62	2,913.39	21.32
Haskell Canyon	7,608.26	5,976.49	14.01
Hasley Canyon	5,609.59	385.96	14.25
Iron Canyon	1,734.63	1,401.94	18.92
Marple Canyon	6,031.13	4,980.94	17.09
Mint Canyon	5,711.30	4,155.07	12.45
Mint Canyon Tributary 1	615.56	367.82	12.14
Mint Canyon Tributary 2	1,697.89	1,438.90	12.22
Mint Canyon Tributary 3	304.45	296.87	12.61
Mint Canyon Tributary 4	234.88	231.90	12.93
Mint Canyon Tributary 5	118.01	114.80	13.01
Newhall Canyon	3,191.67	1,625.11	18.98
Oak Spring Canyon	3,628.60	2,721.91	16.21
Pico Canyon	4,404.42	2,853.93	19.47
Placerita Canyon	6,117.92	2,490.47	18.20
Plum Canyon	2,085.00	753.09	13.25
Pole Canyon	1,744.04	1,614.78	15.95
Potrero Canyon	2,865.18	1,074.76	15.88
Railroad Aqueduct Canyon	865.82	198.83	20.27

TABLE C-8
Spatial Areas and Means of 1900 to 1960 Precipitation for Subwatersheds
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Canyon/Stream	Subwatershed Area (acres)	Contributing Area to Regional Model (acres)	Mean of Precipitation 1900 to 1960 within Each Contributing Area (in/yr)
San Francisquito Canyon	31,388.60	26,878.10	16.51
San Martinez Canyon	2,117.60	1,384.49	13.67
Sand Canyon	5,489.51	4,191.58	19.39
Sand Canyon Road Tributary	554.03	508.56	13.12
Sand Canyon Tributary 1	644.26	251.41	15.97
Sand Canyon Tributary 2	338.66	221.79	16.99
Santa Clara River East	12,696.90	2,562.57	14.16
Santa Clara River West	17,105.90	3,169.86	13.76
Santa Clara River Tributary 1	1,278.18	927.13	16.97
Santa Clara River Tributary 2	277.82	264.96	13.64
Santa Clara River Tributary 3	219.50	189.19	13.65
Santa Clara River Tributary 4	101.25	91.84	13.54
Santa Clara River Tributary 5	114.80	106.31	13.44
South Fork Santa Clara River	5,491.11	655.74	17.62
Tapie Canyon	1,260.27	1,235.25	11.39
Texas Canyon	6,956.88	6,659.55	13.59
Tick Canyon	3,662.58	3,428.16	11.57
Tick Canyon Tributary	175.19	154.75	12.09
Towsley Canyon	3,681.64	3,606.56	21.43
Vasquer Canyon	2,743.26	2,151.81	12.66
Whitney Canyon	1,321.58	1,104.38	18.95
Area Totals	**293,241.89**	**217,615.36**	

TABLE C-9
Monthly Streamflows Measured in the Santa Clara River at the Lang Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
1981	594	98	339	240	107	18	18	12	338	321	258	394	2,739
1982	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
1983	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
1984	0	596	405	240	143	166	228	411	154	220	904	578	4,044
1985	483	461	274	215	77	0	0	0	12	179	221	301	2,224
1986	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
1987	117	117	65	31	12	0	0	0	0	0	258	516	1,116
1988	222	209	506	117	77	68	0	0	0	0	12	25	1,236
1989	50	111	60	25	6	0	0	0	102	94	34	18	499
1990	212	276	230	46	46	5	0	0	0	27	36	147	1,025
1991	162	775	879	736	145	142	14	0	45	69	62	263	3,291
1992	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
1993	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
1994	388	493	497	319	163	80	20	7	37	102	193	941	3,239
1995	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
1996	666	896	730	315	151	46	7	0	54	154	307	510	3,836
1997	517	346	140	85	33	5	4	50	66	240	566	809	2,859
1998	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
1999	92	85	204	224	197	107	80	46	52	54	31	80	1,252

Note:

All monthly streamflows are measured in acre-feet.

TABLE C-10
Monthly Releases of Water from Castaic Lagoon to Castaic Creek
Regional Groundwater Flow Model Report for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
1981	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1982	0	0	0	0	0	667	842	735	0	0	0	0	2,244
1983	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1987	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
1988	0	0	809	341	900	0	0	0	0	0	0	0	2,050
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	66	66
1992	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
1993	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
1994	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
1995	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
1996	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
1997	0	0	8701	873	0	0	0	0	0	0	0	310	9,884
1998	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
1999	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830

Note:

All monthly releases are measured in acre-feet.

TABLE C-11
Monthly Treated Wastewater Discharge Measured at the Valencia Water Reclamation Plant
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	266	258	257	239	247	212	219	219	212	228	239	247	2,844
1981	248	220	249	235	244	237	253	255	248	263	285	270	3,006
1982	275	247	284	271	277	269	275	268	254	266	271	284	3,241
1983	286	261	301	288	296	277	287	296	282	286	276	295	3,432
1984	303	281	304	294	321	315	320	317	314	322	315	319	3,723
1985	309	283	316	316	333	331	354	359	348	361	357	341	4,006
1986	350	341	374	359	377	380	415	454	446	440	421	445	4,801
1987	455	415	472	489	550	567	603	594	579	633	600	624	6,582
1988	622	557	588	587	603	537	575	606	587	608	600	602	7,072
1989	622	593	695	666	671	708	714	731	668	678	673	676	8,095
1990	698	644	725	695	666	693	725	714	692	700	658	680	8,290
1991	715	662	702	627	668	646	647	691	709	743	717	748	8,276
1992	777	777	819	813	824	800	853	869	818	828	811	786	9,775
1993	778	733	863	858	869	925	910	846	816	834	818	858	10,107
1994	722	729	809	776	802	761	771	764	739	763	735	760	9,132
1995	889	777	935	887	884	848	853	814	826	834	823	855	10,225
1996	893	838	935	890	902	876	903	891	886	817	810	816	10,456
1997	815	713	866	829	852	879	860	851	824	826	778	775	9,867
1998	778	787	955	955	984	965	1,136	1,139	1,020	993	911	906	11,529
1999	930	868	962	953	985	968	1,003	1,018	961	1,020	1,040	987	11,695

Note:

All monthly releases are measured in acre-feet.

TABLE C-12
Monthly Treated Wastewater Discharge Measured at the Saugus Water Reclamation Plant
Regional Groundwater Flow Model Report for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	362	365	419	414	419	387	362	362	350	362	359	371	4,529
1981	382	337	390	398	444	412	417	429	431	434	412	460	4,945
1982	445	399	456	444	446	434	434	421	415	434	431	438	5,196
1983	460	421	514	541	562	545	520	477	458	481	477	534	5,990
1984	558	505	499	485	476	443	458	456	451	467	474	519	5,791
1985	503	461	505	458	448	444	452	459	452	470	460	498	5,610
1986	498	475	528	501	499	483	481	476	500	511	518	552	6,023
1987	524	475	542	487	425	383	391	403	395	397	411	430	5,264
1988	443	411	439	434	440	430	445	457	435	464	436	460	5,294
1989	462	410	441	450	464	436	476	479	462	471	451	466	5,468
1990	463	403	432	426	483	492	513	504	489	493	508	512	5,718
1991	495	423	479	427	491	516	557	525	486	474	470	493	5,835
1992	488	507	530	472	489	476	493	521	492	498	452	514	5,931
1993	595	534	616	581	615	587	622	604	578	609	567	567	7,075
1994	601	606	694	677	687	644	642	645	619	663	655	685	7,817
1995	657	578	676	705	699	631	641	635	617	613	568	581	7,602
1996	532	504	525	501	517	506	511	525	532	579	558	583	6,375
1997	564	516	515	461	469	417	442	474	475	503	521	553	5,911
1998	529	541	544	511	617	587	426	399	457	501	521	533	6,166
1999	542	485	551	391	544	512	547	532	521	527	487	514	6,153

Note:

All monthly discharges are measured in acre-feet.

TABLE C-13
Monthly Streamflows Measured in the Santa Clara River at the County Line Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	8,428	43,565	18,125	8,551	3,792	3,963	1,202	1,111	1,668	1,470	1,452	1,884	95,211
1981	3,376	1,533	5,415	1,815	1,662	1,279	942	906	1,139	1,488	2,138	2,539	24,232
1982	2,826	2,358	5,572	7,091	3,909	1,749	1,694	1,392	1,597	1,621	3,449	3,229	36,488
1983	7,787	9,122	67,712	11,240	10,320	3,828	2,102	2,678	2,053	3,443	5,040	5,911	131,236
1984	5,691	3,931	4,084	4,530	2,309	1,607	1,224	1,511	1,464	1,624	3,237	8,067	39,279
1985	3,116	2,561	2,852	1,974	1,694	1,365	1,178	1,365	1,551	1,880	2,102	2,828	24,466
1986	3,955	13,991	10,616	3,328	2,612	1,622	1,454	1,482	1,870	1,896	2,606	2,590	48,024
1987	2,485	2,325	2,575	1,841	1,908	1,710	1,650	1,470	1,412	2,309	2,057	4,457	26,198
1988	3,421	2,981	3,025	3,172	2,636	2,231	1,734	1,494	1,605	1,904	2,027	10,381	36,611
1989	2,644	3,340	2,584	2,055	1,740	1,920	1,732	1,345	1,535	2,146	1,964	1,795	24,799
1990	2,709	3,247	2,269	1,898	1,730	1,545	1,478	1,751	1,668	1,660	1,924	1,593	23,472
1991	2,051	3,219	15,981	1,837	1,519	1,113	1,144	831	912	948	1,014	4,332	34,901
1992	3,737	37,636	9,576	4,439	1,964	1,533	1,377	1,085	1,129	1,329	1,496	3,277	68,577
1993	47,199	44,749	25,738	9,459	4,860	3,324	2,797	2,771	2,949	3,005	2,686	3,247	152,783
1994	3,281	3,437	3,501	3,533	3,519	2,200	1,640	1,400	1,192	1,855	2,263	4,219	32,039
1995	31,125	3,828	19,662	8,452	3,901	2,527	1,843	2,192	1,855	1,716	2,075	3,235	82,409
1996	3,604	10,669	7,678	6,073	3,584	1,678	1,640	1,579	1,509	2,625	1,590	5,701	47,930
1997	5,375	3,913	7,884	3,370	1,680	1,240	1,571	1,371	1,230	1,662	2,636	4,848	36,780
1998	5,875	104,388	25,377	9,378	34,992	5,312	3,935	3,537	2,579	2,450	2,890	4,427	205,139
1999	4,328	4,128	4,322	6,526	4,760	3,590	1,125	1,439	2,164	1,888	2,243	2,434	32,382

Note:

All monthly streamflows are measured in acre-feet.

Figures

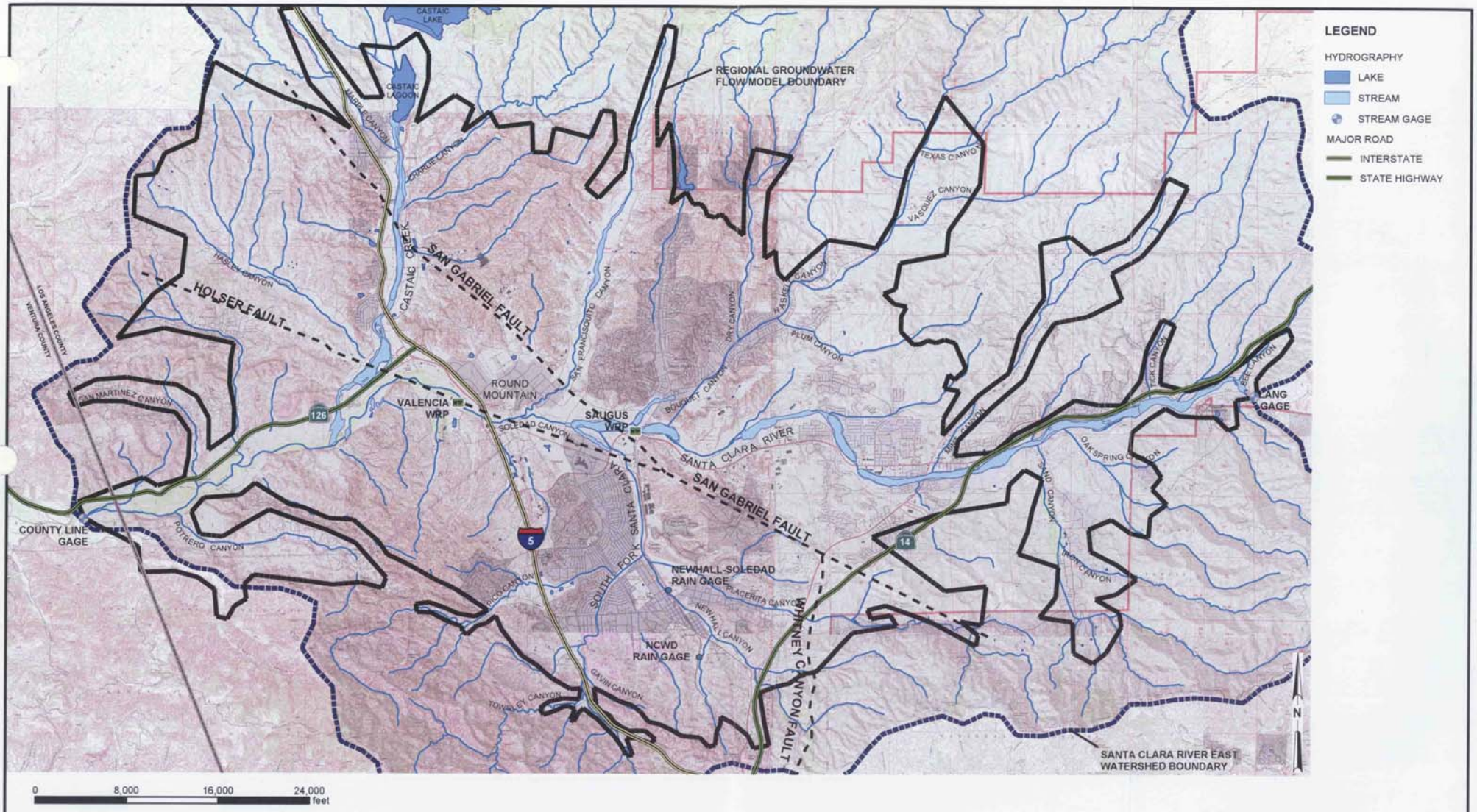

FIGURE C-1
MAP OF STUDY AREA
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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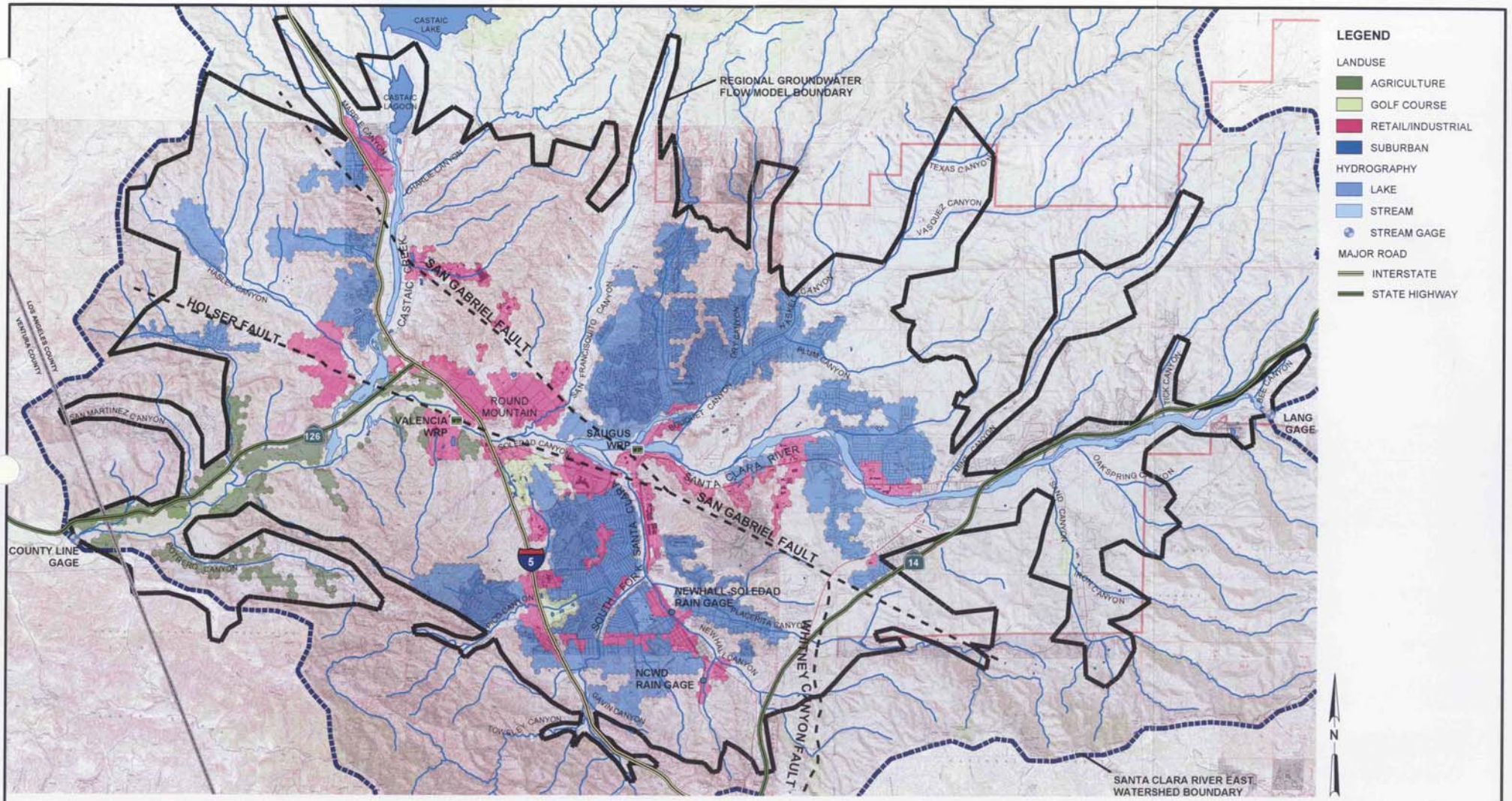

FIGURE C-2
LAND USE MAP
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIGC-06.MXD FIGC-02.PDF 02/03/2004 09:36:51

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Year	Acres				Acreage %		
	Alfalfa	Sudan	Vegetables	Total	Alfalfa	Sudan	Vegetables
1996	105	170	537	812	12.9%	20.9%	66.1%
1997	160	103	663	926	17.3%	11.1%	71.6%
1998	115	100	590	805	14.3%	12.4%	73.3%
1999	55	150	709	914	6.0%	16.4%	77.6%
2000	55	150	722	927	5.9%	16.2%	77.9%
Average	**98**	**134.6**	**644.2**	**876.8**	**11.3%**	**15.4%**	**73.3%**

Year	CIMIS AF/yr		
	Alfalfa	Sudan	Vegetables
1996	10.21	10.21	7.3
1997	10.22	10.22	7.3
1998	9.4	9.4	6.71
1999	10.51	10.51	7.51
2000	10.37	10.37	7.41
Average	**10.142**	**10.142**	**7.246**

Year	Water Use (AF/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	1,072	1,736	3,920	6,728
1997	1,635	1,053	4,840	7,528
1998	1,081	940	3,959	5,980
1999	578	1,577	5,325	7,479
2000	570	1,556	5,350	7,476
Average	**987**	**1,372**	**4,679**	**7,038**

Data Source: Appendix 2.5(m) of
Draft Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant, Final Environmental Impact Report
Impact Sciences, Inc., April 2001)

Crop Efficiency		
Alfalfa	Sudan	Vegetables
50%	50%	70%

Year	Estimated Infiltration (AF/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	536	868	1,176	2,580
1997	818	526	1,452	2,796
1998	541	470	1,188	2,198
1999	289	788	1,597	2,675
2000	285	778	1,605	2,668
Average	**494**	**686**	**1,404**	**2,583**

Year	Estimated Infiltration (AF/acre/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	5.1	5.1	2.2	3.2
1997	5.1	5.1	2.2	3.0
1998	4.7	4.7	2.0	2.7
1999	5.3	5.3	2.3	2.9
2000	5.2	5.2	2.2	2.9
Average	**5.1**	**5.1**	**2.2**	**2.9**

This represents the average deep percolation on irrigated acreage during the past 5 years, consistent with the water application of an average 7,038 AF/yr during this period. Values are in AF/acre/year, which is equivalent to feet/year.

FIGURE C-3
ANALYSIS OF AGRICULTURAL WATER USE AND ASSOCIATED INFILTRATION TO GROUNDWATER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-409.xls\FigureC-3

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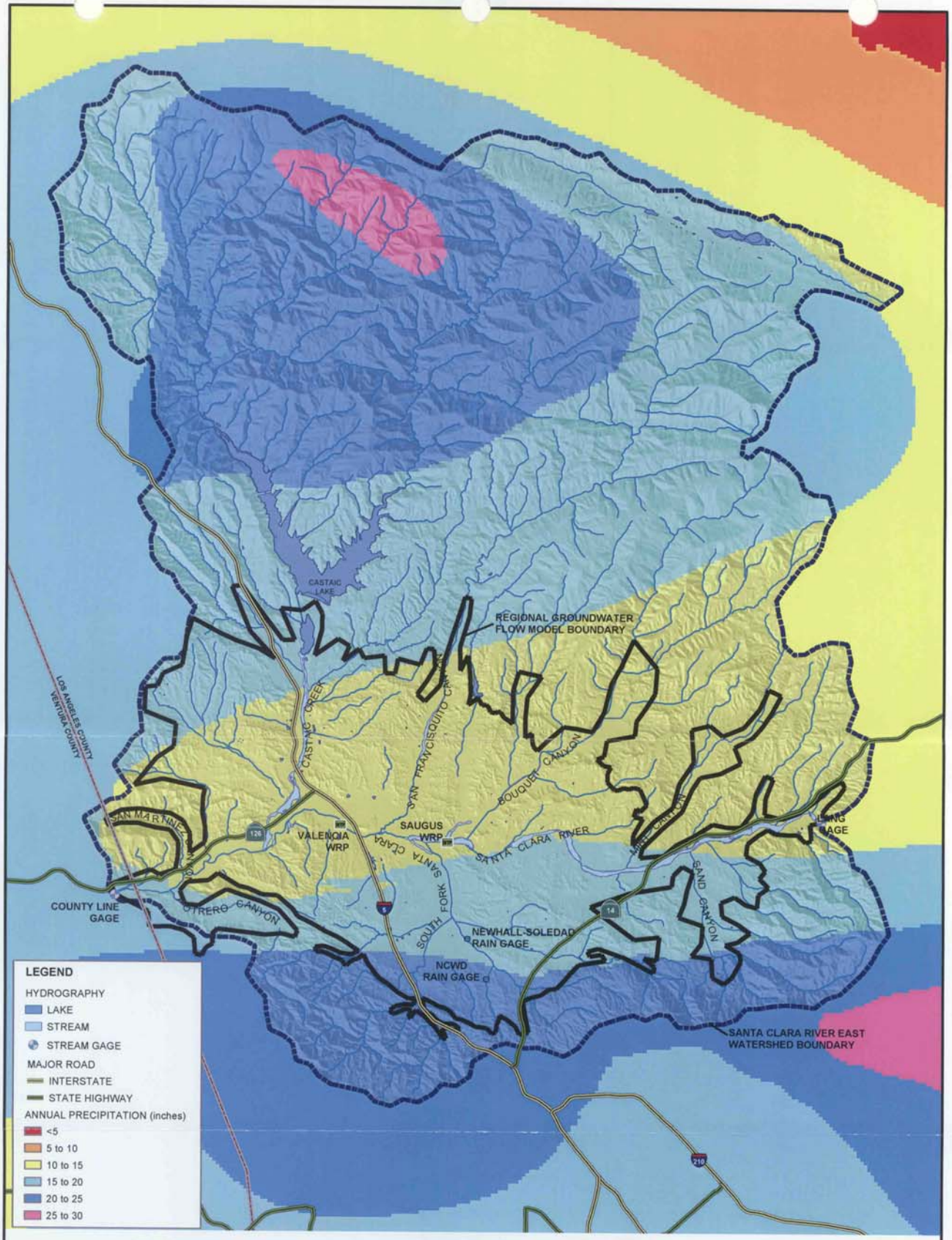

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

N

0 2.5 5 miles

FIGURE C-4
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ\255\SANTACLARITA_MOU\FIGURES\MXD\FIGC-07.MXD FIGC-07.PDF

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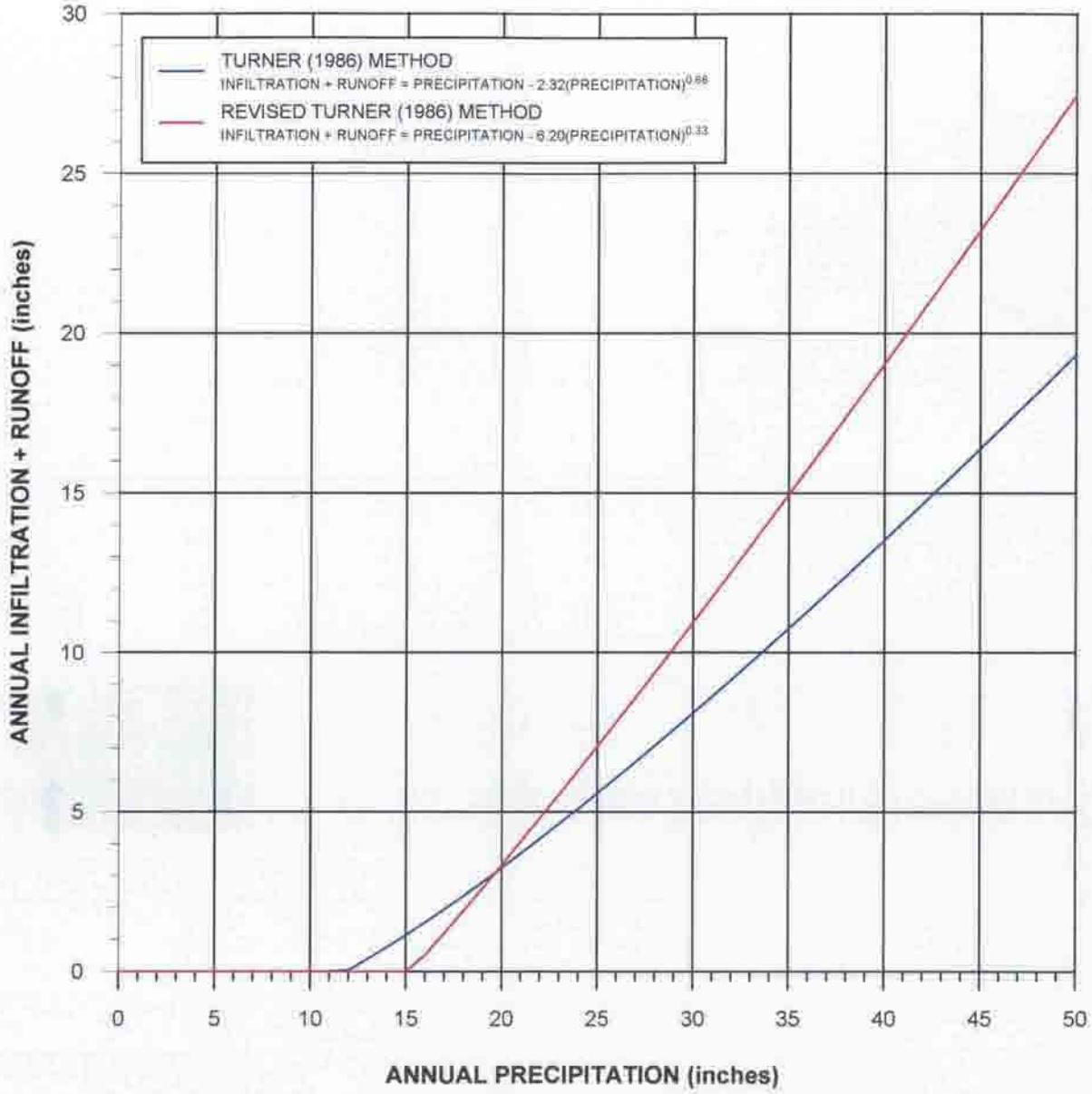

SOURCE:

TURNER, K.M. 1986. WATER LOSS FROM FOREST AND RANGE LANDS IN CALIFORNIA. *IN* PROCEEDINGS OF THE CHAPPARRAL ECOSYSTEMS CONFERENCE, SANTA BARBARA, CALIFORNIA, MAY 16-17, 1986, J. DEVRIES (EDITOR). WATER RESOURCES CENTER, REPORT 62, UNIVERSITY OF CALIFORNIA-DAVIS, CALIFORNIA, PP. 63-66.

FIGURE C-5
INFILTRATION AND RUNOFF AS A FUNCTION OF PRECIPITATION
REGIONAL GROUNDWATER MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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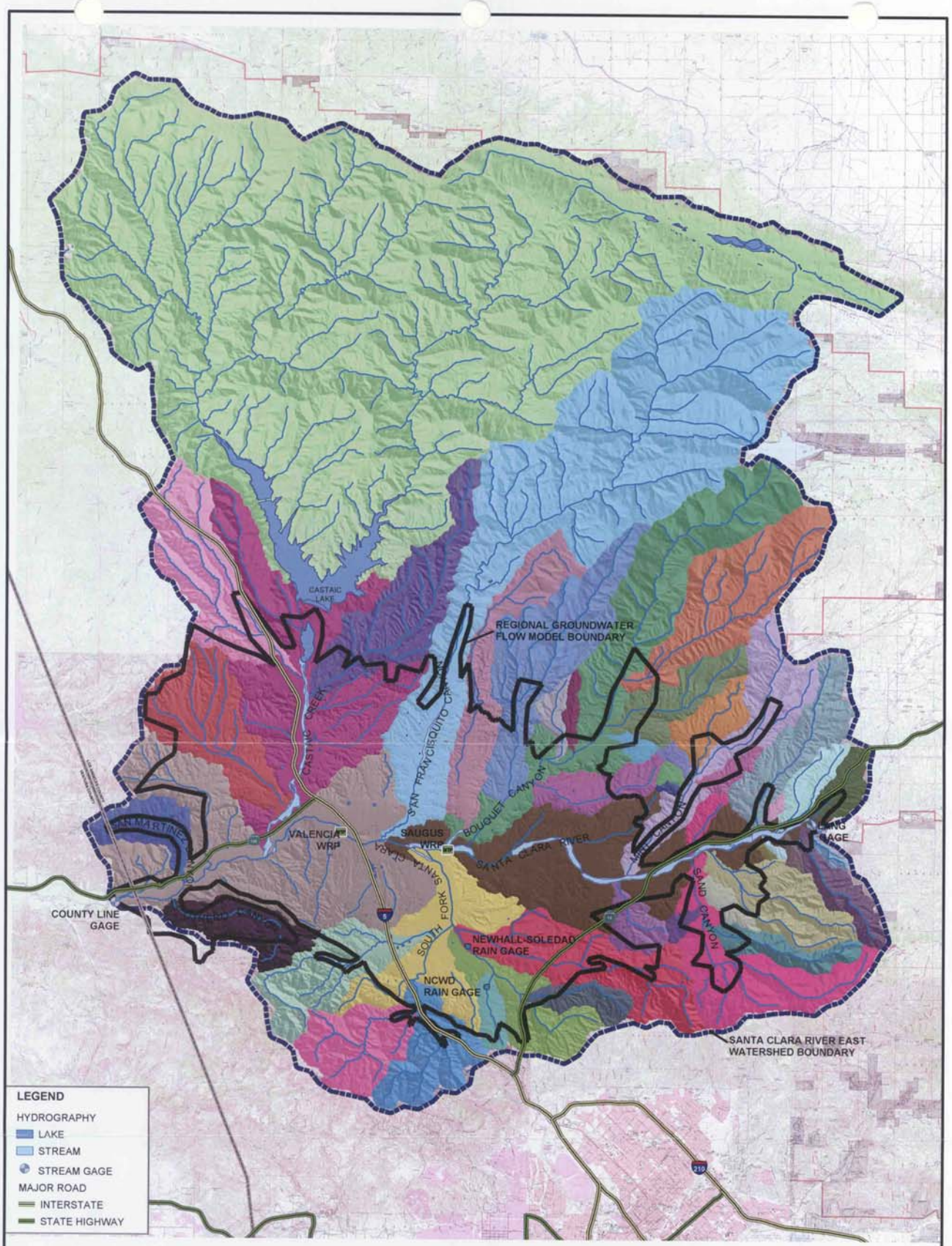

FIGURE C-6
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\RCD31\0025405\SANTACLARITA_MOU\FIGURES\MXD\FIGC-06.MXD FIGC-06.PDF 01/22/2004 08:19:58

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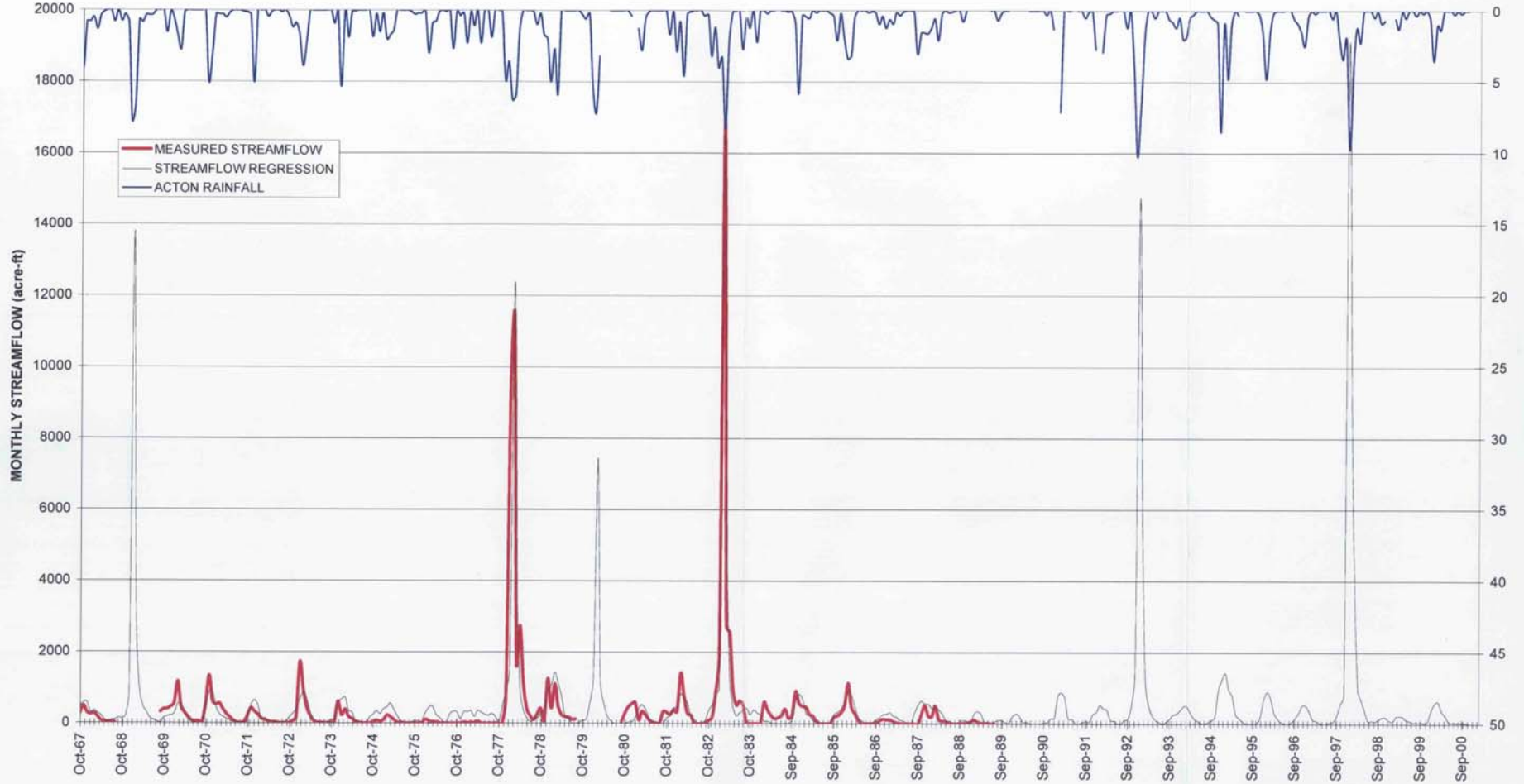

REGRESSION EQUATION:
MONTHLY STREAMFLOW AT LANG = 90.00*1 mo + 120.00*2 mo + 100.00*3 mo + 20.00*4 mo + 20.00*5 mo + 2.00*6 mo

FIGURE C-7
SANTA CLARA RIVER STREAMFLOW REGRESSION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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178973-408.xls/FIG C-7

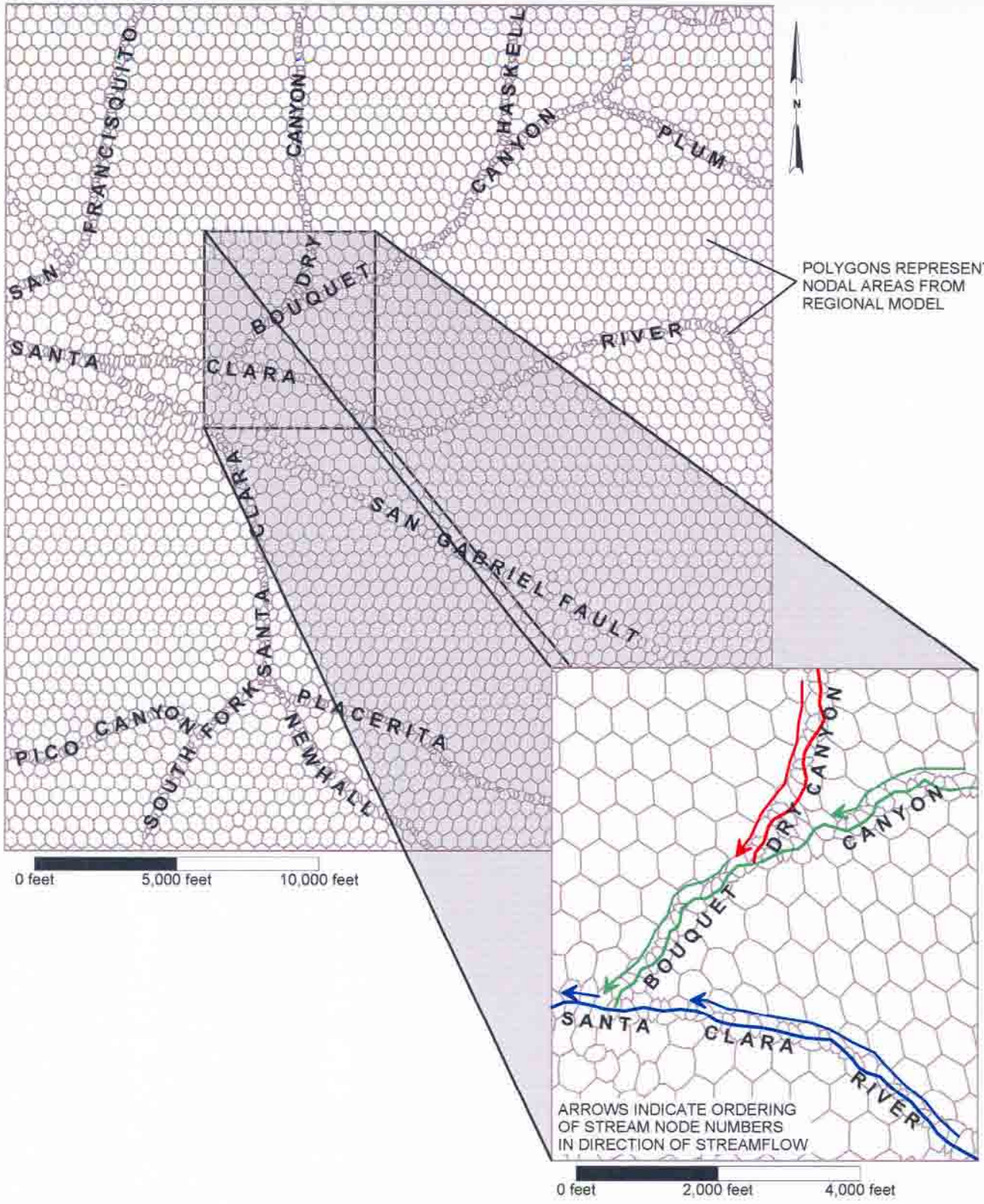

FIGURE C-8
MAP SHOWING EXAMPLE OF STREAM RANKING
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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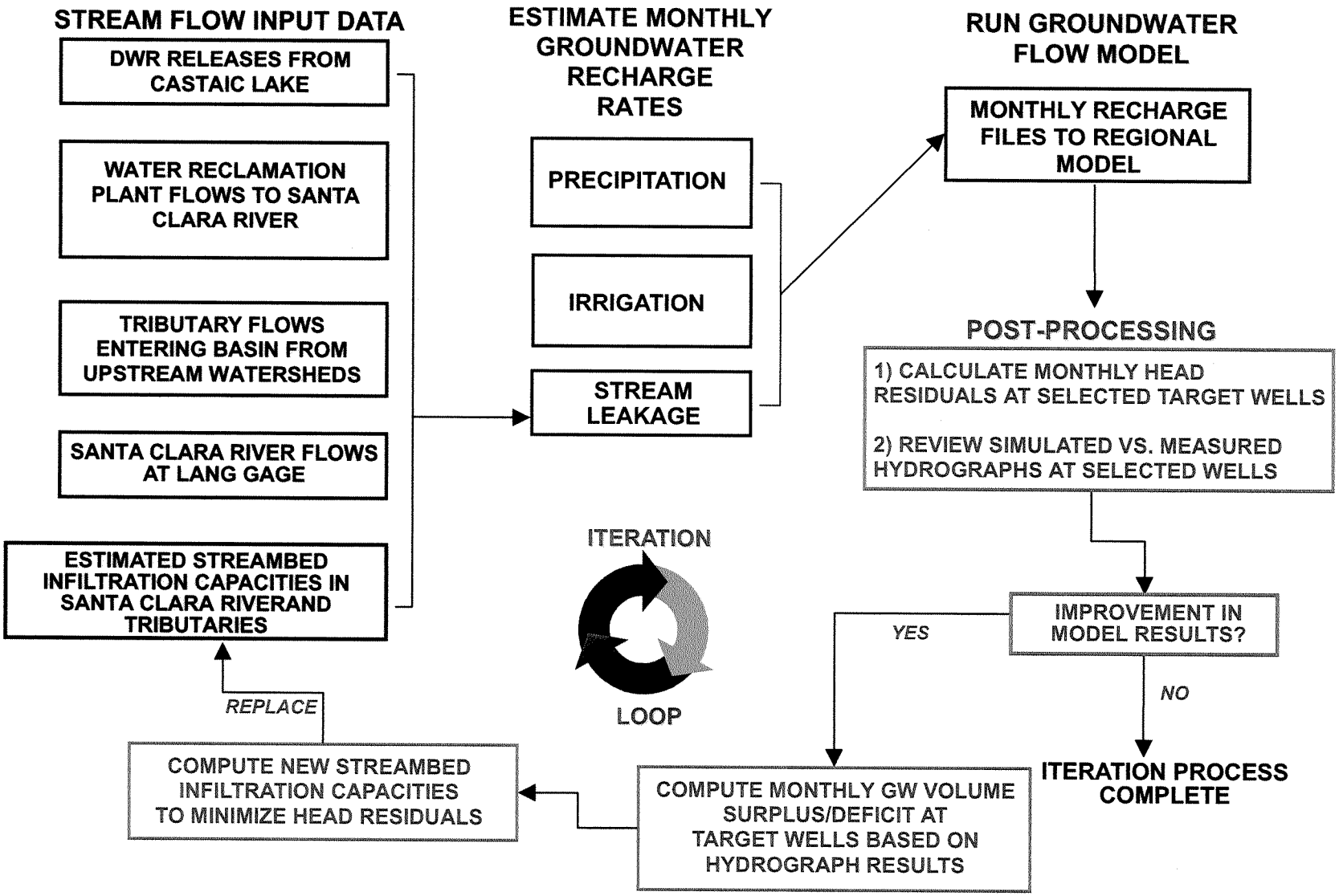

FIGURE C-9
FLOW CHART SHOWING ITERATIVE PROCESS USED TO VARY STREAMBED INFILTRATION CAPACITIES DURING MODEL CALIBRATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-002.FH9

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Final Report

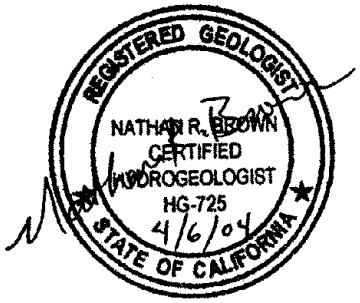
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Development and Calibration

Prepared for

Upper Basin Water Purveyors:

Castaic Lake Water Agency (CLWA)
Newhall County Water District
Santa Clarita Water Division of CLWA
Valencia Water District



April 2004

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Executive Summary

The water purveyors in the Santa Clarita Valley of Southern California have constructed a regional-scale numerical groundwater flow model of the valley. The model, which is called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. Figure ES-1 shows the study area, including the Regional Model's boundaries. Figure ES-2 shows the extent of the watershed that the valley occupies, and shows the sub-watersheds that drain into the study area covered by the Regional Model.

The Regional Model has been developed as part of the work scope contained in a Memorandum of Understanding (MOU) that was entered into in August 2001 by the Upper Basin Water Purveyors in the Santa Clarita Valley and the United Water Conservation District in Ventura County. This report documents the construction and calibration of the Regional Model, including presenting the conceptual hydrogeologic model on which the Regional Model is based.

ES.1 Model Development Objectives and Approach

The Regional Model is intended to become an evolving tool for managing the local groundwater resource. Specific objectives that are identified for the model are:

a. To be able to evaluate the long-term sustainability (yield) of the two aquifer systems that are present in the valley, the Alluvial Aquifer and the Saugus Formation, under a range of existing and potential future water resource management conditions

b. To be able to evaluate artificial recharge to increase the long-term sustainability of the aquifer system, particularly in conjunction with the availability of imported surface water supplies

c. To evaluate the influences of future water management plans and alternatives on groundwater conditions within the valley and on the flows of water into the downstream basins in Ventura County

d. To facilitate general management of water quantity and water quality issues

The approach to developing the Regional Model included the following steps:

1. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system

2. Creating a variety of data sets to conduct steady-state and transient calibrations

3. Constructing the Regional Model using the MicroFEM® finite-element groundwater flow code, and also using the available database and geographic information system (GIS) for the Santa Clarita Valley

4. Calibrating the Regional Model
5. Performing sensitivity tests on the Regional Model

ES.2 Hydrogeology of the Santa Clarita Valley

Section 2 of the report describes the hydrogeology of the Santa Clarita Valley, including the geologic system; groundwater occurrence; groundwater recharge and discharge mechanisms; the relationship of surface hydrology to the valley's groundwater resources; historical trends in the valley's hydrology; the role of the State Water Project (SWP) in the valley's water resources and water supply; and key findings from prior studies conducted in the valley. This section of the report focuses particularly on information of specific relevance to development of the Regional Model. Figure ES-3 is a schematic representation of the regional-scale geology and hydrologic cycle in the Santa Clarita Valley. Figure ES-4 is a geologic map.

ES.2.1 Geology

The geology of the valley is defined in part by the non-water-bearing bedrock that underlies and surrounds the valley's aquifer systems. This bedrock forms a bowl-shaped aquifer system, which is thickest at the center of the valley and progressively thins outwards towards the margins of the valley. The deeper of the two aquifer systems is contained in the Saugus Formation, which consists of lenticular and interfingered beds of poorly- to well-consolidated sandstone, conglomerate, and siltstone that are at least 7,500 feet thick in the deepest part of the basin. The most productive portion of the Saugus Formation is thought to be the area southwest of the San Gabriel Fault. The deeper and older portion of the Saugus Formation, the Sunshine Ranch Member, was deposited in a marine environment and consists of fine-grained, low-permeability siltstone and sandstone that preclude development of municipal water supplies. Evidence from geophysical logs also indicates that the groundwater in much of the Sunshine Ranch Member may be somewhat brackish in quality.

Overlying the Saugus Formation is the Alluvial Aquifer, which consists of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable amounts of cobbles and boulders. In general, alluvium in the main river valley ranges from medium-grained sand to sandy gravel and cobbles. Due to its unconsolidated to poorly consolidated condition, and its lack of cementation, the alluvium has relatively high permeability and porosity.

ES.2.2 Groundwater Recharge

Average annual rainfall in the Santa Clarita Valley is approximately 18 inches per year, and higher (up to 30 inches per year or more) in the surrounding mountains. Natural groundwater recharge occurs from direct precipitation and from stormwater flowing in the Santa Clara River and its tributaries. Each of these streams have their headwaters in areas lying upstream of the Alluvial Aquifer and Saugus Formation. Consequently, stormwater that is generated in these upstream watersheds flows into the valley and is an important source of groundwater recharge. Because the climate is semi-arid, rainfall and stormwater runoff occur primarily between November and March and can vary considerably in

magnitude from year to year. The direct precipitation in the valley and the recharge of stormwater generated in upstream watersheds together provide approximately 94 percent of the total groundwater recharge to the valley's groundwater resources. Irrigation on agricultural and urban lands represents another 4 percent, and underflow beneath Castaic Dam into the adjoining Alluvial Aquifer is estimated to represent approximately 2 percent of the total basinwide groundwater recharge.

ES.2.3 Groundwater Discharge

Groundwater discharge from the Alluvial Aquifer occurs primarily as discharge to the Santa Clara River and evapotranspiration (ET) by the riparian vegetation growing along the river corridor. The Alluvial Aquifer also discharges as subsurface outflow into the Piru Basin at Blue Cut, which is located just downstream of the Los Angeles-Ventura County line. Groundwater pumping occurs from both the Alluvial Aquifer and the Saugus Formation, and Saugus Formation groundwater also discharges to the Alluvial Aquifer.

ES.2.4 Aquifer Physical Properties

Specific capacity data from Alluvial Aquifer production wells indicates that the horizontal hydraulic conductivity is approximately 300 to 700 feet per day, and possibly higher, along the Santa Clara River. In the tributaries, the horizontal hydraulic conductivity is approximately 100 to 600 feet per day. The horizontal hydraulic conductivity in the Saugus Formation has been estimated to be approximately 6.5 feet per day, based on pumping and injection tests conducted on production wells with long screen intervals.

ES.2.5 Basin Hydrology

Long-term records of groundwater elevations and pumping exist for the Alluvial Aquifer throughout the valley. These records indicate that groundwater elevations can fluctuate significantly from year to year in the eastern part of the valley, in response to patterns of droughts and above-normal rainfall. In the western part of the valley, groundwater levels are stable, as this is the regional groundwater discharge area. Despite the variations in groundwater elevations in the eastern valley and the variations in pumping throughout the valley during the past five decades, groundwater elevations in the Alluvial Aquifer have shown no permanent long-term declines. In addition, the availability of SWP water has allowed the valley to become increasingly urbanized, and the resulting gradual increase in urbanization and SWP water imports have resulted in a gradual increase in flows in the Santa Clara River.

Similar conditions are seen in the Saugus Formation. From the late 1980s through the early to mid-1990s, groundwater elevations declined in response to drought conditions and increased pumping. However, starting in the mid-1990s, Saugus groundwater elevations increased notably as pumping decreased and rainfall increased. As with the Alluvial Aquifer, the Saugus Formation showed groundwater elevation recovery to levels seen prior to the drought.

ES.2.6 Water Supply

The Santa Clarita Valley obtains its water supply from local groundwater sources and from SWP water that is delivered to the Castaic Lake Water Agency by the California Department

of Water Resources (DWR) via the California Aqueduct. Water use includes municipal and agricultural uses.

Before 1970, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during the 1950s and early 1960s ranged from 35,000 to 44,000 acre-feet per year (AF/yr). Pumping from the Alluvial Aquifer dropped gradually from 40,000 AF/yr in 1967 to less than 30,000 AF/yr by 1983, and did not rise above 30,000 AF/yr until 1993. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. In response to statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available. The water management practices of the purveyors call for maximizing the use of Alluvial Aquifer and SWP water. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. Consequently, since 1995, Saugus pumping has ranged between approximately 4,000 and 8,500 AF/yr.

The Castaic Lake Water Agency (CLWA) has a contract amount of SWP Table A water of 95,200 AF/yr. Modeling by DWR has indicated that actual SWP water imports, based on the current CLWA Table A contract amount, will be 66,300 AF/yr in wet years, 56,800 AF/yr in average years, and 37,900 AF/yr in multiple dry years. The occurrences of drought years in the SWP system is based on the hydrology of Northern California, and hence only occasionally coincides with the occurrence of drought locally. In addition to the above entitlements, DWR occasionally releases flood flows into Castaic Creek from Castaic Dam. These flows averaged 15,700 AF/yr during the 24-year period of water years 1977 through 2000. However, no flood flows were stored or delivered in five of those years, and the median flow was 2,800 AF/yr (only 18 percent of the average flow).

ES.3 Model Construction

The Regional Model was constructed using the three-dimensional finite-element groundwater modeling software called MicroFEM® (Hemker and de Boer, 2003). The Regional Model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. The model area largely coincides with the Santa Clara River Valley East Groundwater Subbasin, extending from the Lang stream gage at the eastern end of the valley to the County Line gage area in the west. The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. The upper model layer simulates the Alluvial Aquifer, or the upper portion of the Saugus Formation wherever the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and the Sunshine Ranch Member.

The boundary conditions in the model consist of specified flux boundaries for precipitation; irrigation; recharge from ephemeral streams; pumping; and underflow from beneath Castaic Dam. Head-dependent flux boundaries are used in the perennial reach of the Santa Clara River, and to model any residual drainage of groundwater that might occur in the

ephemeral reach under high water table conditions. A head-dependent flux boundary is also used for ET. A constant-head boundary was used in the Alluvial Aquifer at the downgradient (western) end of the valley, at the County Line gage.

Groundwater recharge rates were estimated using precipitation records; streamflow records; watershed maps; topographic maps; and aerial photography. These recharge rates were calculated using a detailed Surface Water Routing Model that was written specifically for the construction and calibration of the Regional Model. Pumping rates and pumping depths were defined from groundwater pumping and well construction records.

ES.4 Model Calibration Process

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation. The steady-state calibration was performed for calendar years 1980 through 1985, and the transient calibration was performed for calendar years 1980 through 1999. The goals of the calibration process were generally to match groundwater flow directions, groundwater gradients, and groundwater elevations that were measured throughout the 20-year simulation period at wells across the valley. Figures ES-5 and ES-6 show the locations of wells that were used to evaluate calibration in the Alluvial Aquifer and the Saugus Formation, respectively. The figures also show how each aquifer was subdivided into zones to facilitate parameter selection and model calibration. An additional calibration goal was to match the patterns of total flow in the Santa Clara River and estimated groundwater discharge rates to the river. Model variables were adjusted in a manner that sought to honor independent estimates of parameter values while resulting in the best possible calibration.

ES.5 Model Calibration and Sensitivity

The Regional Model meets most of the qualitative and quantitative goals that were established for the calibration process. For the steady-state model, statistical goals for the head residuals, which are equal to the modeled minus measured groundwater elevations, were easily met for the Alluvial Aquifer and adequately met for the Saugus Formation. For the transient model, trends in groundwater elevations were generally well matched. However, during the mid- and late 1990s, the model tended to simulate too much decline in Alluvial Aquifer groundwater elevations in the eastern-most portion of the valley and water level fluctuations that were too variable in Castaic Creek. Groundwater discharges to the river were simulated well for both the steady-state and transient models.

The groundwater budget for the 20-year transient calibration period showed that recharge from precipitation and streamflows varied considerably from year to year, ranging from less than 15,000 AF/yr in the driest years to as much as 270,000 AF/yr in the wettest years (see Figure ES-7). In contrast, total groundwater discharges were less variable, ranging from approximately 61,000 AF/yr at the end of the late 1980s/early 1990s drought to 116,000 AF/yr during 1998 (see Figure ES-8). This variability in groundwater discharge did not follow the year-to-year pumping patterns, but instead was caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlated well with groundwater recharge patterns. During the 20-year transient

calibration period, changes in the volume of groundwater stored in the combined Alluvial-Saugus aquifer system varied primarily according to year-to-year variations in regional rainfall. No long-term decline in groundwater storage was observed in the field or simulated by the model (see Figure ES-9) during this period. As Section 2.6.2 of this report will discuss, available data dating back to the 1950s also show that no long-term water level declines have occurred in the valley, despite past periods of significant pumping (particularly during the 1950s) and drought cycles.

Sensitivity analyses were performed to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the Regional Model. Variables that were tested were the hydraulic properties (horizontal and vertical hydraulic conductivities and storage coefficients) for the Alluvial Aquifer and the Saugus Formation; the riverbed leakage terms for the Santa Clara River and Castaic Creek; and the ET parameters. The sensitivity analysis indicated that the model is calibrated well and that it is sensitive to the choices of horizontal hydraulic conductivity in both aquifers and vertical hydraulic conductivity in the Saugus Formation. The Regional Model was also sensitive to the riverbed leakage terms in both groundwater recharge and groundwater discharge areas. However, the model was insensitive to the choice of ET parameters.

The process of calibrating the Regional Model to a 20-year period of groundwater elevation and streamflow data has resulted in a model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary attributes of the model's calibration that makes this tool appropriate for its intended uses are:

a. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased SWP water imports (from outside the valley), and associated changes in land use and water use

b. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property)

c. Its use of an integrated model of the watershed, the Surface Water Routing Model, to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system

The calibration process has resulted in a Regional Model that closely simulates, on a monthly basis, total flows in the river and estimated volumes of groundwater discharging to the river. The calibration process has also resulted in a Regional Model that closely simulates the short-term and long-term time-varying trends in groundwater elevations throughout the valley, which is necessary for evaluating groundwater management strategies. The close calibration of the groundwater elevation trends and absolute groundwater elevations in both the Alluvial Aquifer and the Saugus Formation near the Whittaker-Bermite property also renders the Regional Model suitable for particle-tracking analyses, to support the design of a long-term pumping and groundwater treatment plan that will restore impaired water supplies while also preventing contamination in unimpacted portions of the aquifer.

ES.6 Model Use and Recommendations

The Regional Model is generally well-calibrated and therefore can be applied to meet the objectives for which it was developed. Nonetheless, because no model is perfect, it should be used with care, and all model results should be examined by qualified and experienced hydrogeologists and water resource managers. It is recommended that future applications of the model include sensitivity analyses on key variables and that the Regional Model and the Surface Water Routing Model be updated as water use conditions change in the future. Additionally, data gathering efforts should continue or resume, to facilitate updates of the Regional Model. In particular, controlled pumping tests should be conducted to provide quantitative estimates of aquifer properties at the locations of new Saugus Formation wells and streamflow monitoring should resume at the Lang gage, in order to better understand the magnitudes and timing of Santa Clara River flows into the valley.

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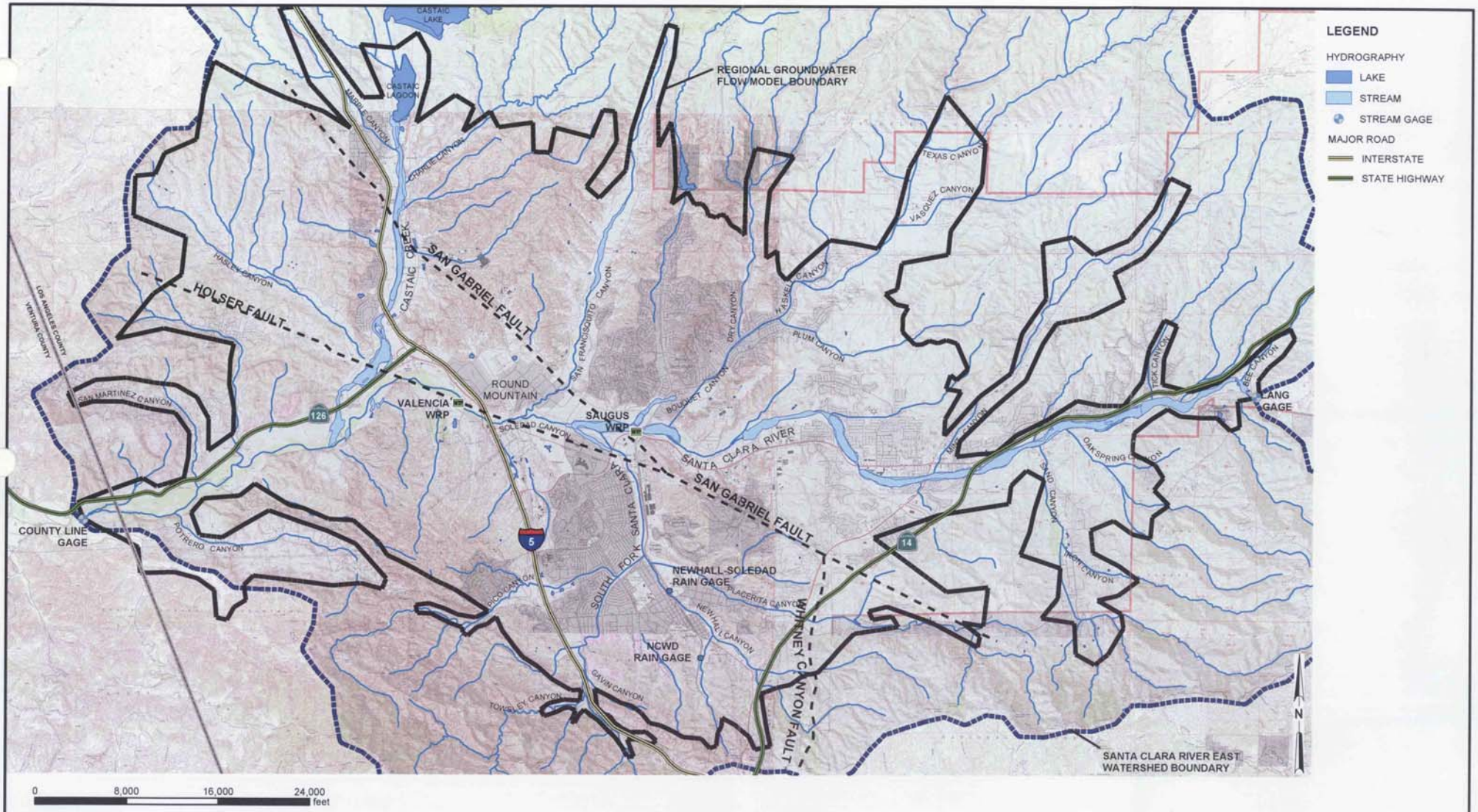

FIGURE ES-1
MAP OF STUDY AREA
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FOR THE SANTA CLARITA VALLEY
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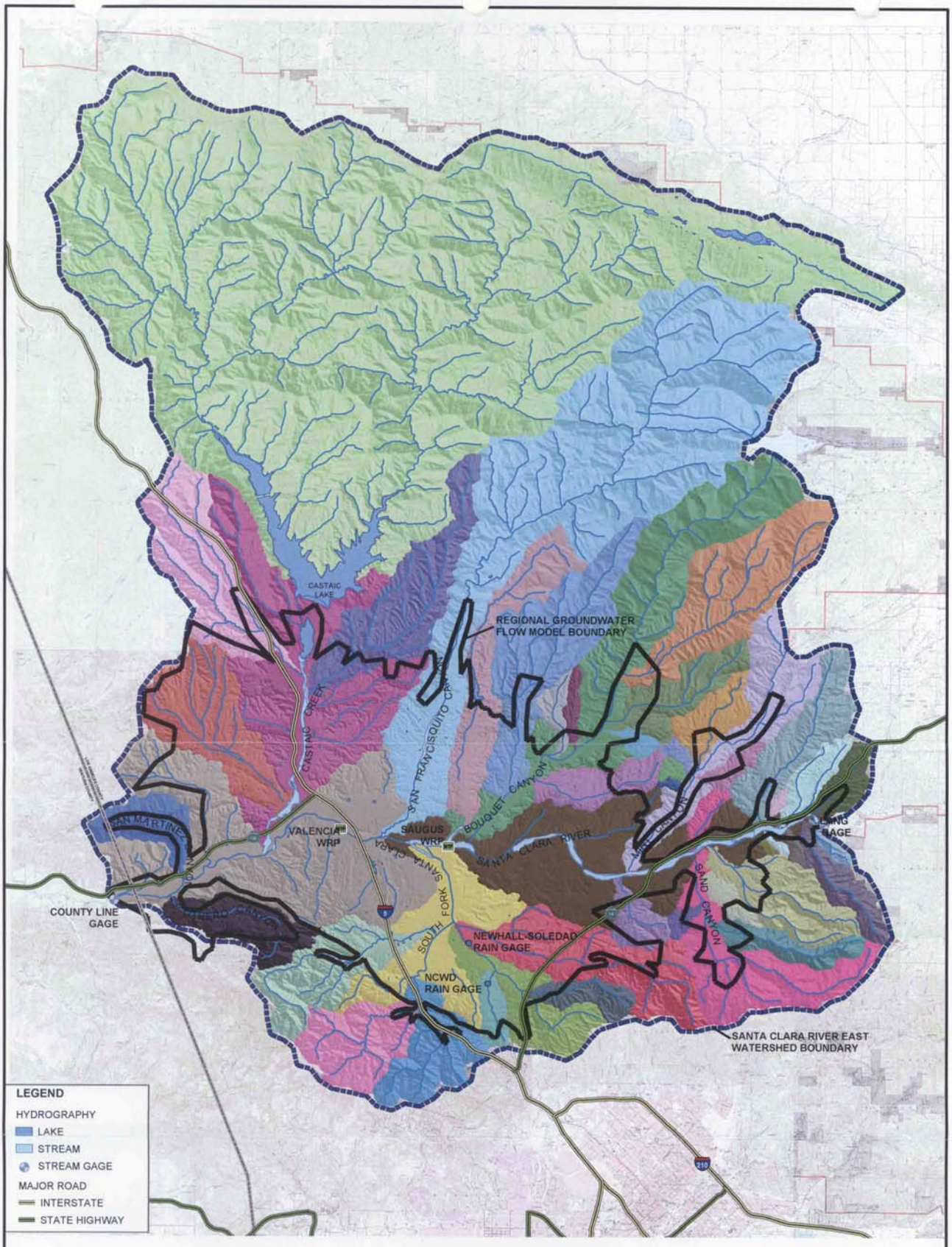

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SANTA CLARITA, CALIFORNIA

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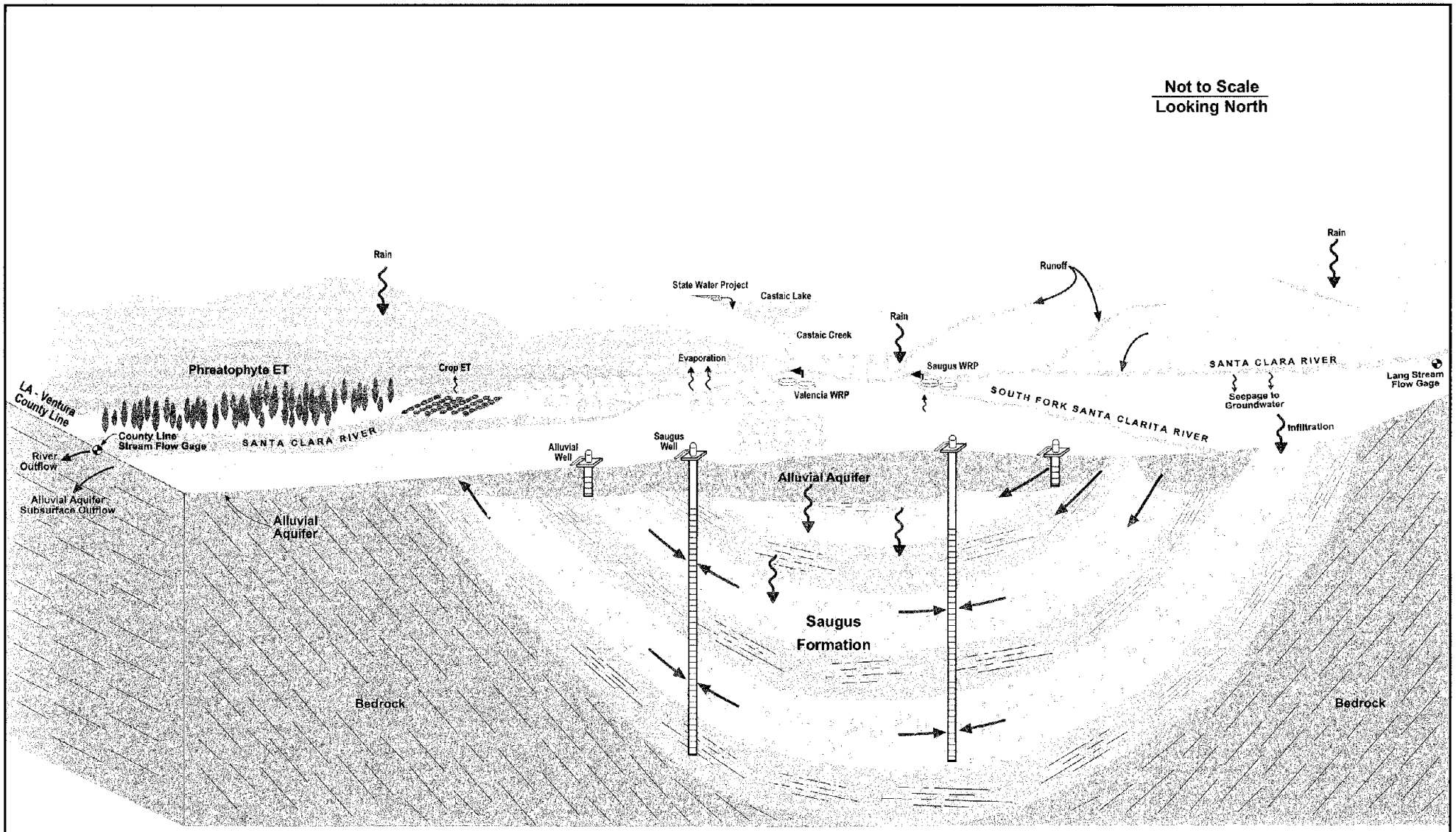

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SANTA CLARITA, CALIFORNIA

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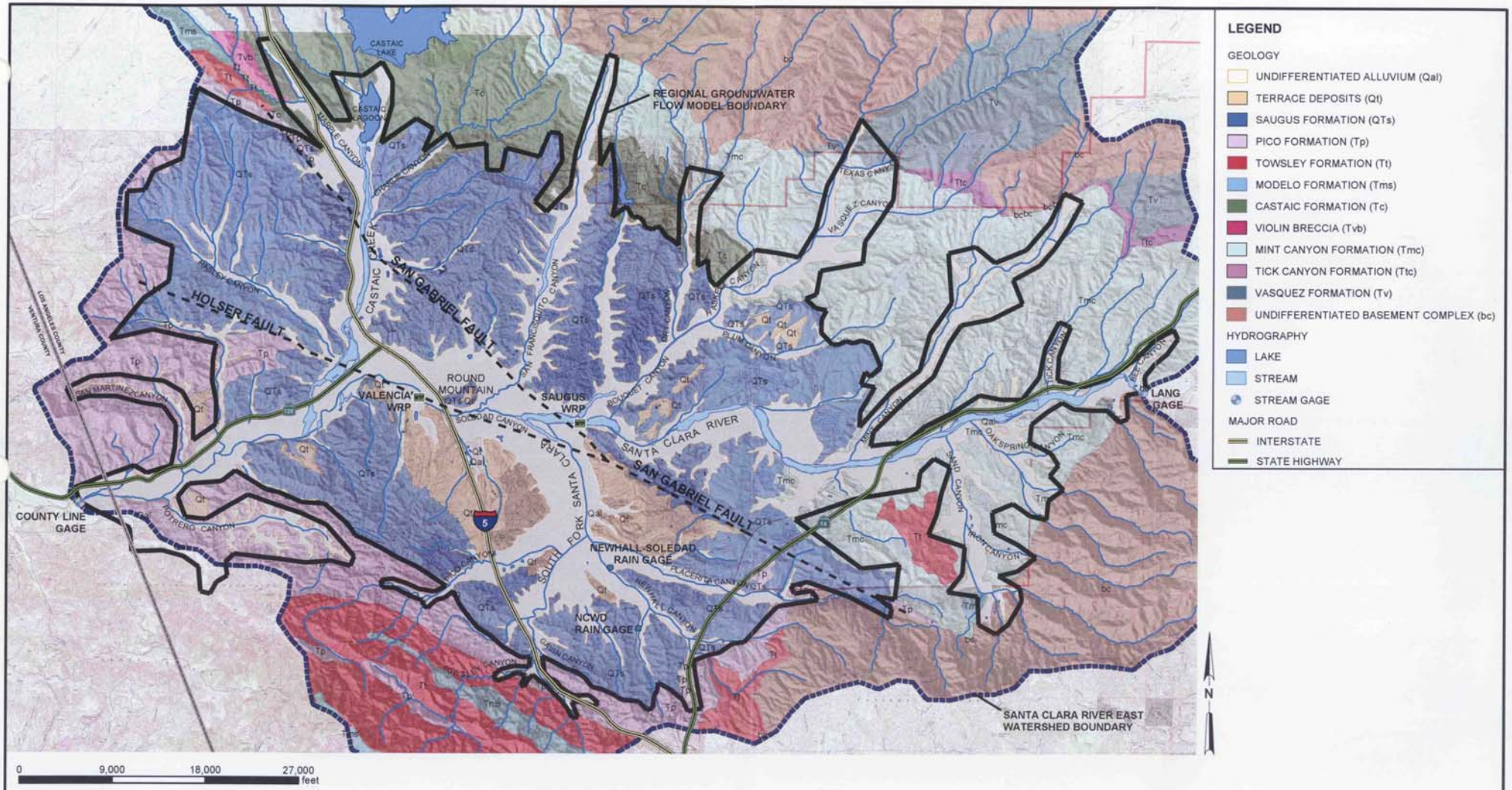

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SANTA CLARITA, CALIFORNIA

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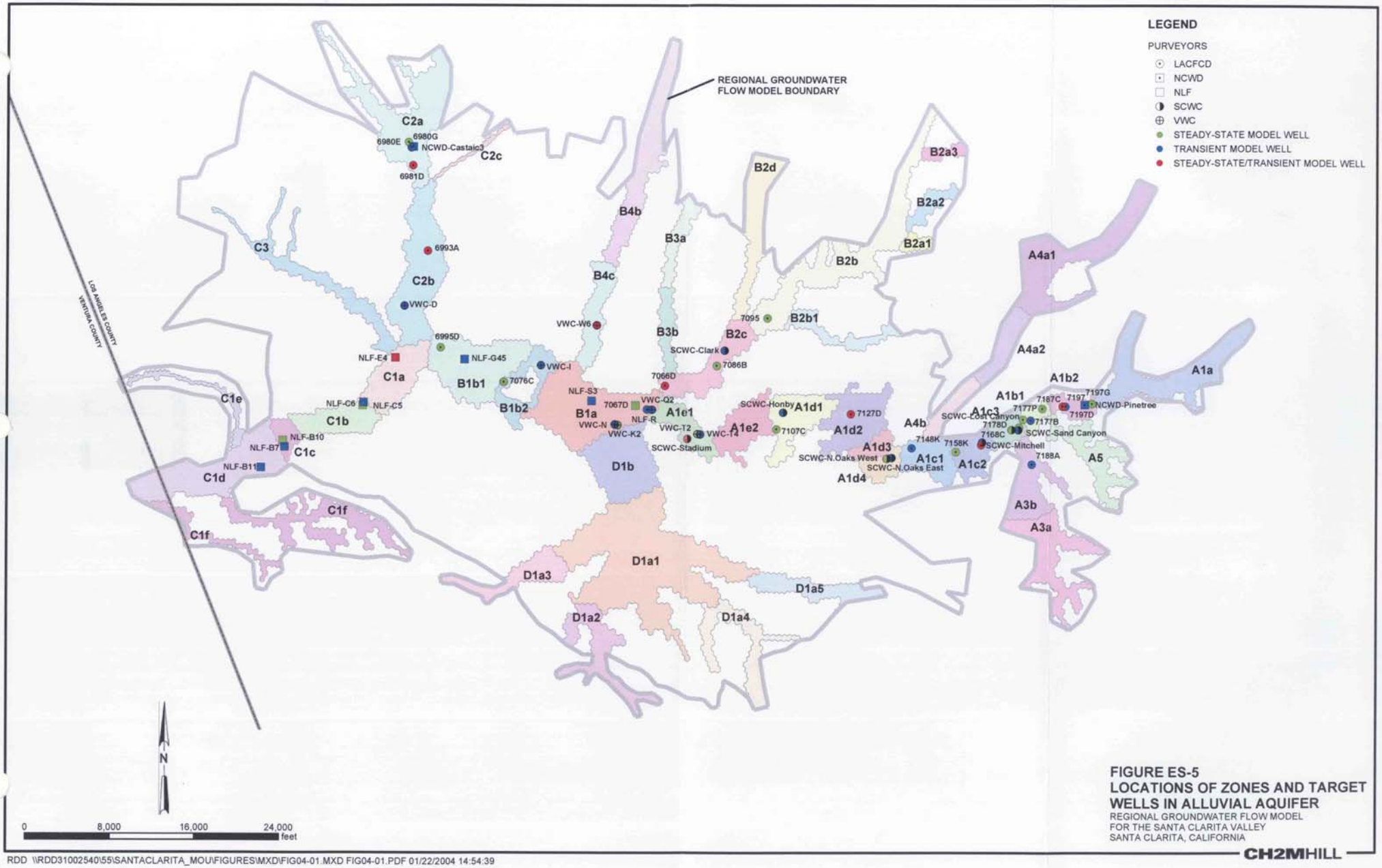

FIGURE ES-5
LOCATIONS OF ZONES AND TARGET WELLS IN ALLUVIAL AQUIFER
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FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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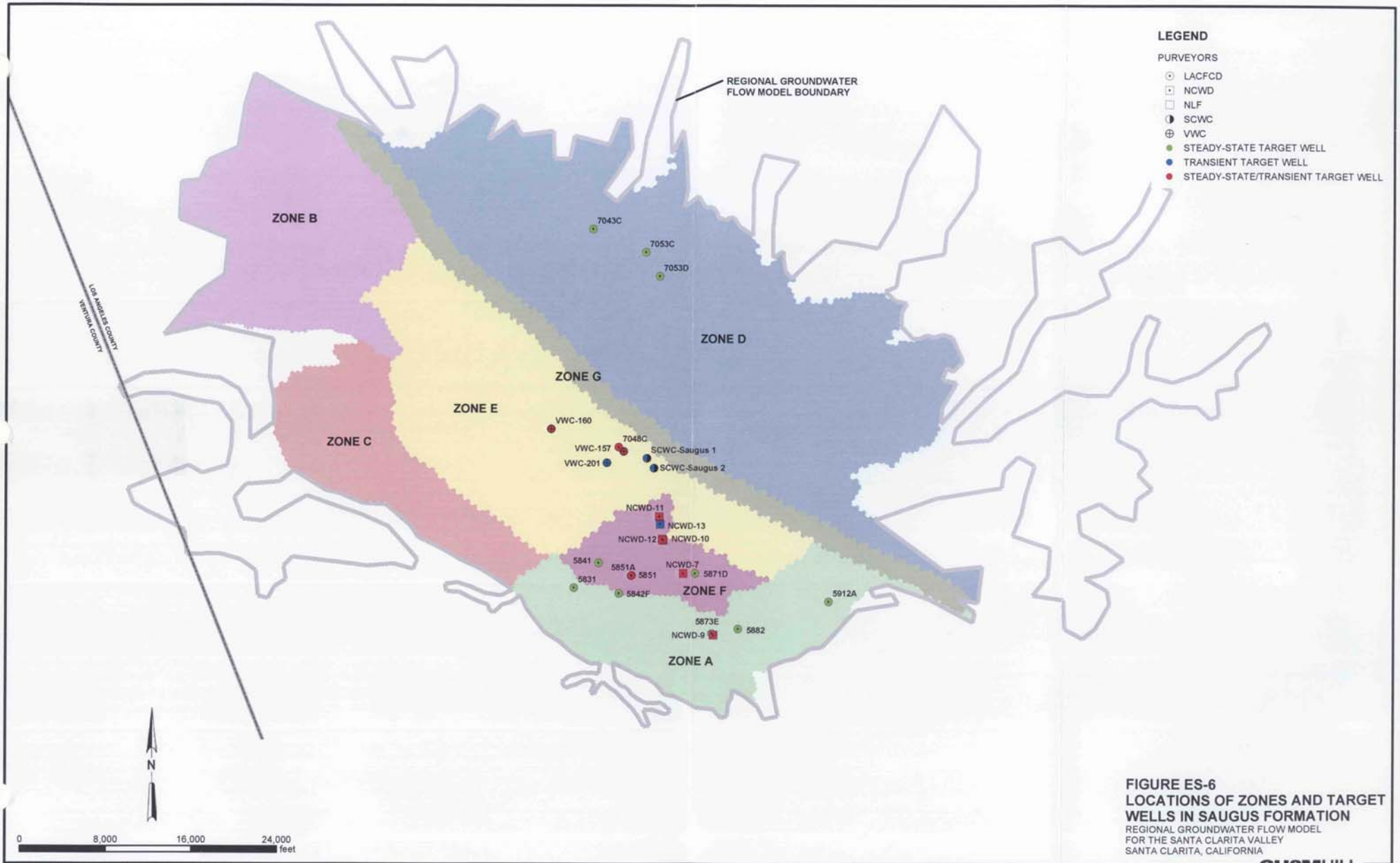

FIGURE ES-6
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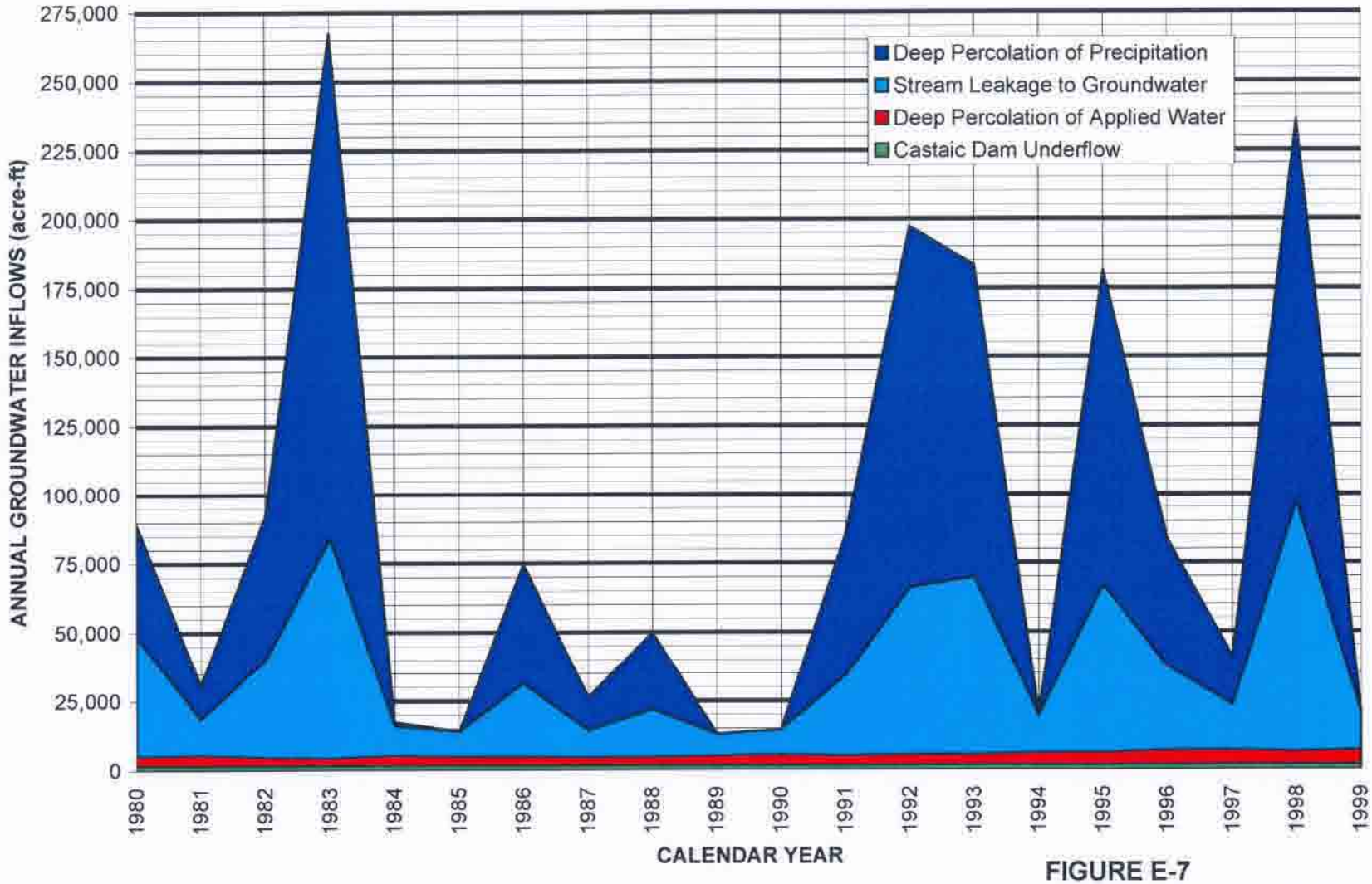

FIGURE E-7
ANNUAL GROUNDWATER INFLOWS
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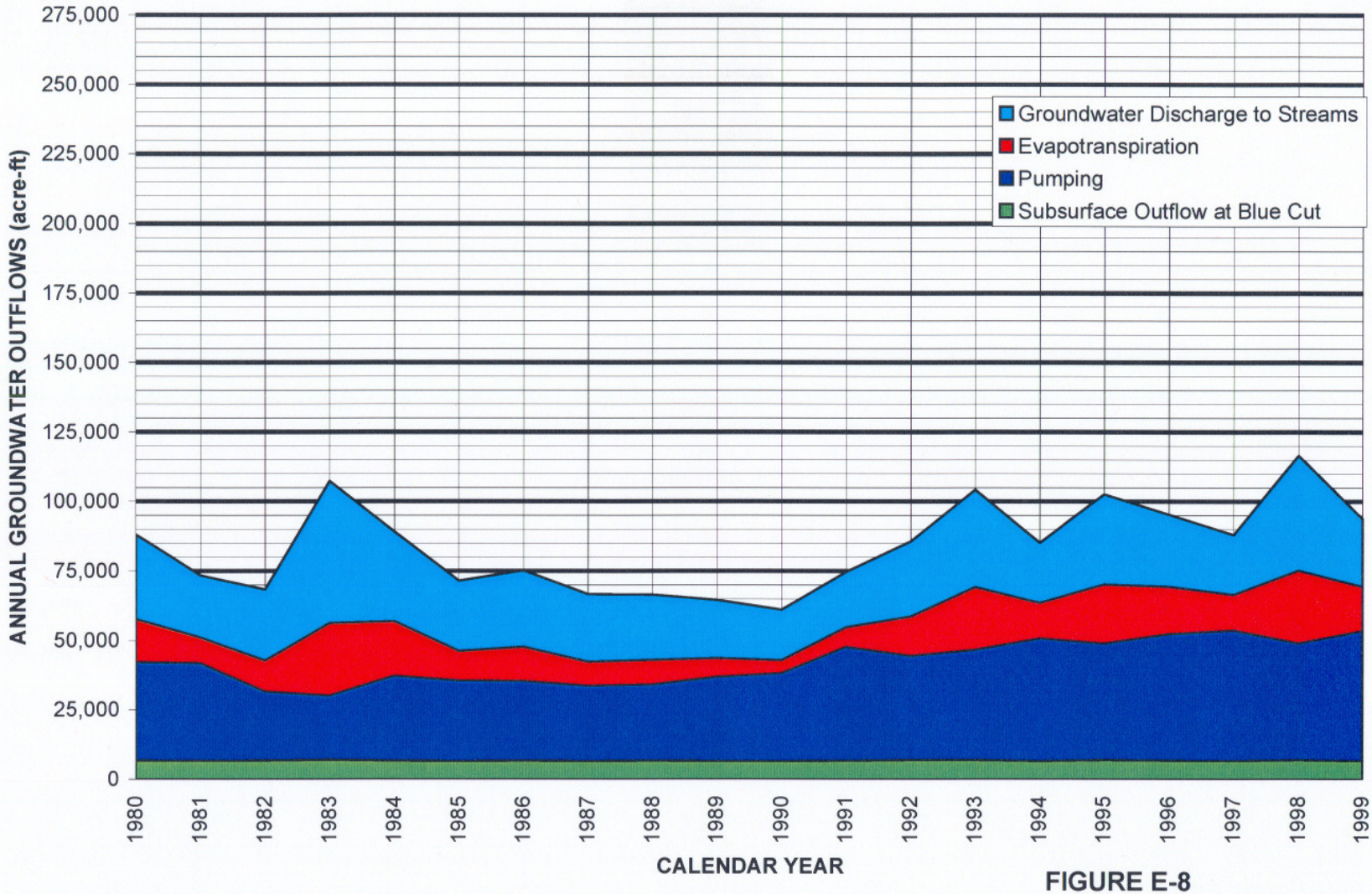

FIGURE E-8
ANNUAL GROUNDWATER OUTFLOWS
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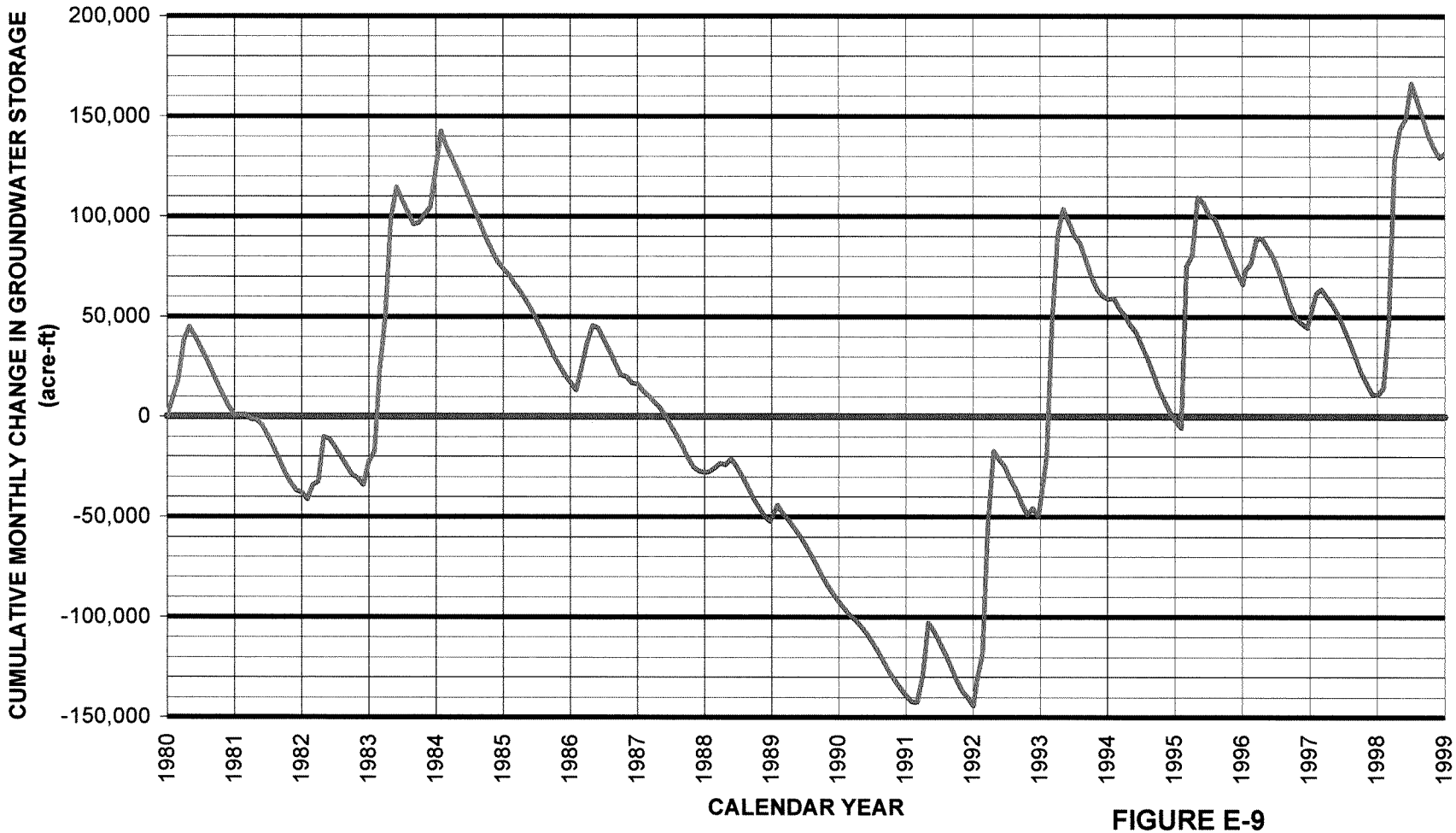

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Acronyms and Abbreviations

°F	degrees Fahrenheit
AF	acre-feet
AF/yr	acre-feet per year
ASR	aquifer storage and recovery
bgs	below ground surface
cfs	cubic feet per second
CLWA	Castaic Lake Water Agency
cm/sec	centimeters per second
county line	Los Angeles-Ventura County line
Downstream Water Users	Los Angeles County Waterworks District, Newhall Land & Farming Company, Newhall County Water District, and United Water Conservation District
DWR	California Department of Water Resources
ET	evapotranspiration
ft/day	feet per day
ft^2/day	square feet per day
ft/yr	feet per year
GIS	geographic information system
gpd	gallons per day
gpd/ft	gallons per day per foot
gpm	gallons per minute
gpm/ft	gallons per minute per foot
GPS	global positioning system
I-5	Interstate 5
in/yr	inches per year
K	hydraulic conductivity
Kh	horizontal hydraulic conductivity
Kv	vertical hydraulic conductivity
LACFCD	Los Angeles County Flood Control District
LACSD	Los Angeles County Sanitation District

LACWWD	Los Angeles County Waterworks District
LADPW	Los Angeles County Department of Public Works
MOU	Memorandum of Understanding
NCDC	National Climate Data Center
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
Purveyors	Upper Basin Water Purveyors
R	vertical anisotropy ratio (Kh:Kv)
RCS	Richard C. Slade and Associates, LLC
Regional Model	Santa Clarita Valley Groundwater Model
residual	residual error
RMS	root-mean-square
SCWC	Santa Clarita Water Company
SWP	State Water Project
SWRM	Surface Water Routing Model
Sy	aquifer specific yield
T	transmissivity
UWCD	United Water Conservation District
USGS	U.S. Geological Survey
VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WRP	water reclamation plant
WY	water year

SECTION 1

Introduction

This report describes the development of a regional groundwater flow model for the Santa Clarita Valley, located in northwestern Los Angeles County, California. The model, called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. It has been developed for the water purveyors in the valley as a tool for the analysis of groundwater management options in the context of future water demands and water supply conditions in the valley. Figure 1-1 is a map showing the study area.

1.1 Model Use Objectives

The Regional Model has been developed as part of the work scope contained in a Memorandum of Understanding (MOU) that was entered into in August 2001 by the water purveyors in the Santa Clarita Valley (the Purveyors) and the United Water Conservation District (UWCD), located downstream in Ventura County. The MOU, which is contained in Appendix A, is a commitment by the Purveyors to expand the analysis of groundwater conditions such that the adequacy of the local water supply is well understood and questions about surface water and groundwater resources can be more readily addressed. The MOU contained a number of technical components, including the development and calibration of a regional-scale groundwater flow model and the preparation of technical reports on topics such as groundwater model development. This report and the model described herein reflect the accomplishment of two of the MOU technical components.

The Regional Model is intended to become a tool for managing the local groundwater resource, including the relationship of surface water to groundwater in the valley. The model has been designed to be an evolving tool that will analyze groundwater development, natural and artificial recharge (particularly in conjunction with the availability of imported surface water supplies), and the resultant impacts of these activities on groundwater conditions within the valley and on the flows of water into the downstream basins in Ventura County. As discussed in the MOU, one use will be to evaluate the long-term sustainability, or operational yield, of the shallow Alluvial Aquifer and the deeper groundwater resources that are present in the underlying Saugus Formation. Specifically, this assessment will look at basin operations over a multi-year wet/dry cycle, with operational yield defined as a basin operating plan that allows continued pumping from these aquifers while assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. The parties to the MOU agreed to use the Regional Model for this assessment because (1) data show no long-term lowering of the water table or degradation of water quality has occurred during the 50 to 60 years of historical groundwater development in the valley, and (2) current planning places future pumping of the Alluvial Aquifer in the same range as historical pumping. At this time, the primary question of interest to the MOU parties is the effect of pumping the Saugus Formation during short-term dry periods at rates that are higher than have been historically pumped from that formation. An additional

planned application of the model will be to evaluate the restoration of pumping capacity that has been impacted by perchlorate contamination in the vicinity of the Whittaker-Bermite property in the central part of the valley.

Based on these objectives, the MOU specified that a model would be constructed that covers the entire area within the Santa Clarita Valley where Alluvial and Saugus groundwater resources are present, and that the model should be subjected to a transient calibration.

1.2 Model Development

The approach to developing the model included:

a. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system.

b. Creating a variety of data sets to conduct steady-state and transient calibrations.

c. Constructing the groundwater flow model using the MicroFEM® finite-element groundwater flow code, and also using the available database and geographic information system (GIS) for the Santa Clarita Valley.

d. Calibrating the flow model.

e. Performing sensitivity tests on the flow model.

This project was conducted for the parties to the MOU, who are the United Water Conservation District (UCWD) in Ventura County and the Upper Basin Water Purveyors, the water providers in the Santa Clarita Valley. The Upper Basin Water Purveyors consist of four retail purveyors of municipal water and the Castaic Lake Water Agency (CLWA), which has a contract with the State of California to obtain water from the State Water Project (SWP), and which furnishes SWP water to the four retail purveyors. The four retail purveyors are Los Angeles County Waterworks District (LACWWD) No. 36, the Newhall County Water District (NCWD), Santa Clarita Water Company (SCWC, a division of CLWA), and the Valencia Water Company (VWC).

1.3 Previous Studies

There are several previous studies of the groundwater system in the Santa Clarita Valley that were used to help develop the conceptual and numerical models of the hydrogeologic system. These studies include reports on the regional geology and hydrogeology, and a previous modeling analysis of the feasibility of constructing an aquifer storage and recovery (ASR) system. These studies are listed below and are described in more detail in Section 2.7 of this report.

a. *Hydrogeologic Investigation: Perennial Yield and Artificial Recharge Potential of the Alluvial Sediments in the Santa Clarita River Valley of Los Angeles County, California* (Richard C. Slade and Associates, LLC [RCS], 1986). This report was the first comprehensive study of the geology and hydrology of the Alluvial Aquifer.

b. *Hydrogeologic Assessment of the Saugus Formation in the Santa Clara Valley of Los Angeles County, California* (RCS, 1988). This report was the first comprehensive study of the geology and hydrology of the Saugus Formation.

c. *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001). This report documented the results of ASR field tests in the Saugus Formation that evaluated the feasibility of injecting water into, and recovering water from, deep Saugus Formation wells.

d. *2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems* (RCS, 2002). This report was a summary and update of the 1986 and 1988 RCS reports.

e. *Newhall Ranch ASR Impact Evaluation* (CH2M HILL, 2001). This document evaluated the longer-term basinwide influences that would occur for an ASR program that was proposed as part of the water supply for the planned Newhall Ranch community.

f. *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002). This document updated the ASR impact evaluation, including analyzing the effects of all aspects of the Newhall Ranch community (not just ASR) on the valley's water resources.

1.4 Report Organization

The remainder of this report is organized as follows:

Section 2 describes the hydrogeology of the Santa Clarita Valley, including the geologic system; groundwater occurrence; groundwater recharge and discharge mechanisms; the relationship of surface hydrology to the valley's groundwater resources; historical trends in the valley's hydrology; the role of the SWP on the valley's water resources and water supply; and key findings from prior studies conducted in the valley. This section of the report (along with Appendix B) focuses on information of specific relevance to development of the regional flow model.

Section 3 discusses the construction of the model, including the modeling software; the grid design; the layer-by-layer representation of the aquifers; the boundary conditions; the estimation of groundwater recharge rates; and the assignment of pumping rates in the model. Appendix C describes the design, operation, and data for a surface water routing model that was developed to provide the Regional Model with recharge rates from urban irrigation, agricultural irrigation, direct precipitation, streamflows entering the model domain, and discharges from water reclamation plants (WRP).

Section 4 describes the calibration conditions; the calibration goals; the model variables that were adjusted during calibration; the calibration procedure; and the measured (target) data that were used to evaluate calibration quality.

Section 5 presents quantitative and semi-quantitative evaluations of the calibration results, with a focus on the assessment of the model's calibration quality compared with the calibration goals presented in Section 4. Section 5 then concludes with a sensitivity analysis that further evaluates calibration quality and demonstrates the sensitivity of simulated groundwater elevations and water budget terms to changes in model parameter values.

Section 6 summarizes the applicability of the model for use in managing local groundwater resources, including the key attributes of the model and recommendations for further data collection and future model updates.

Section 7 is the reference list.

Figures

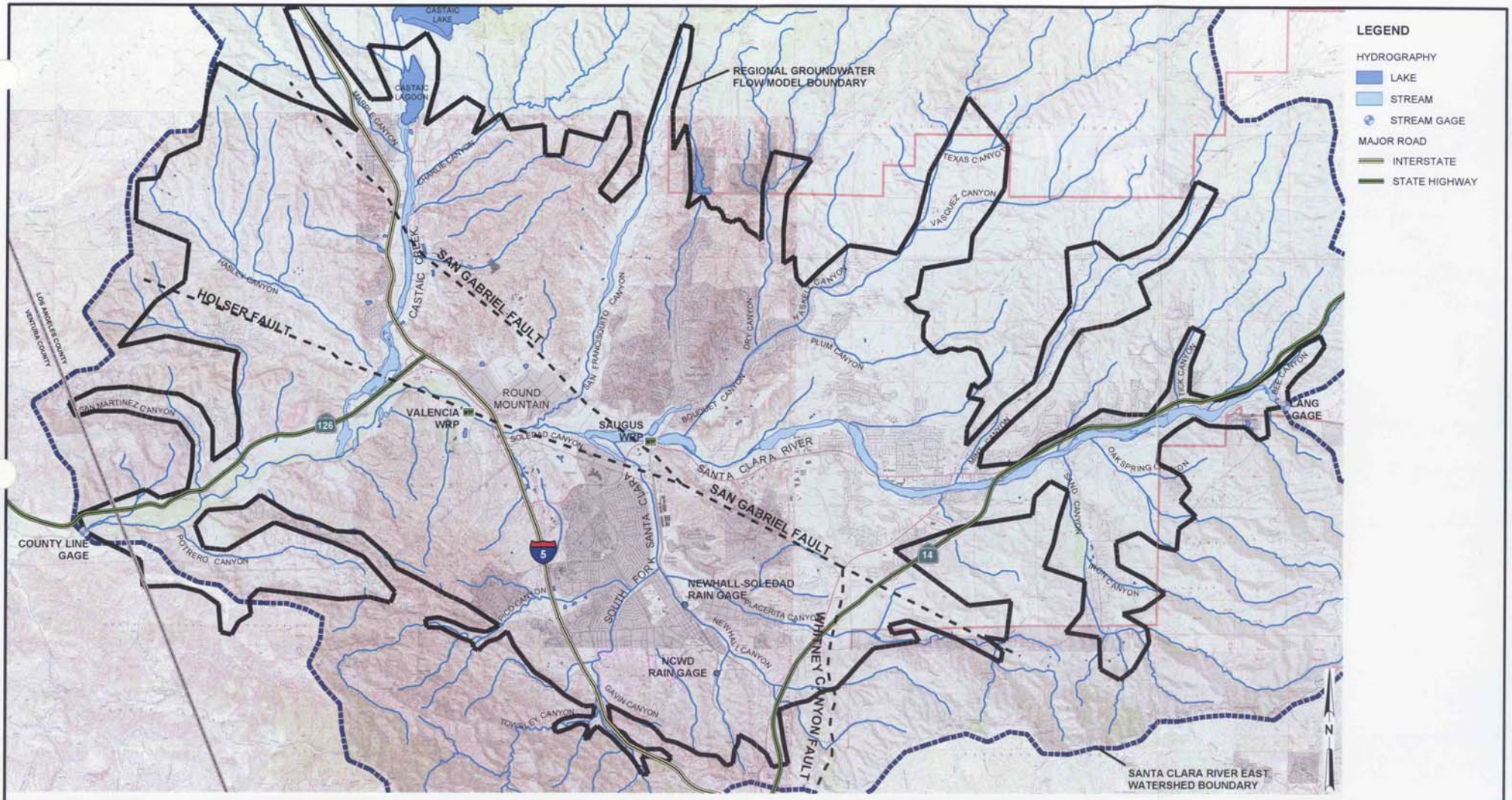

FIGURE 1-1
MAP OF STUDY AREA
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 2

Hydrogeology of the Santa Clarita Valley

The geology and hydrogeology of the Santa Clarita Valley are described in this section, which is derived primarily from the reports described in Section 1.3 and Section 2.7. Figure 2-1 is a schematic representation of the regional scale geology and hydrologic cycle in the Santa Clarita Valley. As shown on Figure 2-1, the two aquifer systems in the Santa Clarita Valley are the Alluvial Aquifer and the Saugus Formation. Groundwater is exchanged between these two units. Additionally, the aquifer systems are affected by direct rainfall; streamflows in the Santa Clara River and its tributaries; evapotranspiration (ET) by riparian vegetation along portions of the river; and human influences which consist of pumping, agricultural and urban irrigation, discharge of treated water into the Santa Clara River from two water reclamation plants, and occasional releases of water into Castaic Creek from Castaic Lake and Castaic Lagoon.

Figure 2-2 shows the location of the Santa Clarita Valley groundwater basin. This groundwater basin is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley East Groundwater Subbasin and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Figure 2-3 is a map of the Santa Clarita Valley, showing the locations of production wells completed in the Alluvial Aquifer and Saugus Formation.

2.1 Setting

The study area comprises the relatively flat-lying Santa Clarita Valley and portions of the surrounding hills and mountains. The study area extends from approximately the Los Angeles-Ventura County line (county line) on the west to the community of Lang on the east, and from the southern end of Castaic Lake on the north to the intersection of the Golden State Freeway (Interstate 5 [I-5]) and the Antelope Valley Freeway (State Highway 14) on the south. The mountains that surround the Santa Clarita Valley include the Santa Susana and San Gabriel Mountains to the south and the Sierra Pelona and Leibre-Sawmill Mountains to the north. Elevations range from approximately 800 feet on the valley floor to approximately 6,500 feet in the San Gabriel Mountains. The headwaters of the Santa Clara River are at an elevation of approximately 3,200 feet at the topographic divide separating the Upper Santa Clara River Hydrologic Area from the Mojave Desert.

The largest community in the study area is the City of Santa Clarita, which was formed in 1987 through the amalgamation of the communities of Newhall, Valencia, Saugus, and Canyon Country. Other smaller unincorporated communities in the study area include Stevenson Ranch and Val Verde in the west, Castaic in the northwest, and Lang in the east. The population of the City of Santa Clarita was estimated to be approximately 151,260 in the 2000 U.S. Census. In 2001, the Southern California Association of Governments estimated the population of the surrounding unincorporated Santa Clarita Valley at 48,237. Hence, the total current population of the Santa Clarita Valley is approximately 200,000 (RCS, 2002).

Prior to the 1960s, the predominant land use in the Santa Clarita Valley was agricultural, with much of the valley undeveloped. Urbanization began gradually in the 1960s, with a rapid increase beginning in the late 1970s and early 1980s and continuing to the present. Accompanying the rapid population increase has been a gradual change in valley land use patterns, from largely agricultural to urban and suburban developments. Nevertheless, a considerable portion of the hills and low mountains bordering the main river valley remain in a natural, undeveloped condition (RCS, 2002).

2.2 Climate

The study area has a semi-arid Mediterranean-type climate, characterized by long, dry summers and relatively short, wet winters. Temperatures in the Santa Clarita Valley range from a minimum of 20 degrees Fahrenheit (°F) to 30°F in the winter to a maximum of approximately 100 to 110°F during the summer. Mean monthly temperatures range between approximately 48°F in the winter and 77°F in the summer.

Rainfall data have been recorded since 1883 at the Newhall-Soledad gage (Station No. FC32CE), located at the Los Angeles County Department of Public Works (LADPW) Newhall-Soledad Division Headquarters office, on San Fernando Road in the community of Newhall. The average rainfall at this gage was 17.95 inches from 1883 through 2000 and 17.84 inches from 1950 through 2000.[1] A second rain gage is located approximately 1.3 miles to the south, at the NCWD office. Figure 2-4 shows the annual rainfall at the Newhall-Soledad and NCWD gages for calendar years 1950 through 2000. As shown in the figure, annual rainfall is highly variable from year to year. During this period, the highest calendar-year rainfall was 42.17 inches in 1978 at the Newhall-Soledad gage, and 48.33 inches in 1983 at the NCWD gage. The lowest amount of annual rainfall from 1950 through 2000 was 4.15 inches in 1972 at the Newhall-Soledad gage, and 8.47 inches in 1989 at the NCWD gage. Average annual rainfall from 1979 through 2000 was 18.67 inches at the Newhall-Soledad gage and 22.88 inches at the NCWD gage. Rainfall at the NCWD gage is usually greater than at the Newhall-Soledad gage, because the NCWD gage is located closer to the hills that form the southern boundary of the watershed and receive a greater amount of orographic precipitation.

Rainfall is not only variable on an annual basis, but is also highly seasonal. Approximately 80 percent of the annual precipitation in the Santa Clarita Valley falls between November and March. Most of the precipitation comes from winter storms that last only a few days and are separated by relatively long periods of clear weather.

As shown by the difference in rainfall values between the Newhall-Soledad and NCWD rain gages, rainfall varies across the basin according to elevation differences and the locations of surrounding mountain ranges. Figure 2-5 shows lines of equal precipitation (rainfall isohyets), based on long-term mean annual precipitation data compiled from the U.S. Geological Survey (USGS), DWR, and California Division of Mines maps and data. The source maps consist primarily of U.S. Weather Service data for approximately 800 precipitation stations, but in the Los Angeles and San Francisco Bay areas the

[1] Annual rainfall values for the Newhall-Soledad gage are based on monthly records reported by the National Climate Data Center (NCDC) and LADPW.

U.S. Weather Service data have been supplemented by county and local agency precipitation data. The precipitation isohyets shown on Figure 2-5 display the average annual rainfall during the period from 1900 through 1960. (See the internet site http://gis.ca.gov/meta.epl?oid=286 for more information.)

2.3 Geology

Figure 2-6 presents a geologic map of the Santa Clarita Valley, as reported by RCS (2002). The geologic units shown on the map include water-bearing sediments and non-water-bearing bedrock.

The Santa Clarita Valley is underlain and bounded by non-water-bearing bedrock units that are Miocene, Oligocene, and pre-Tertiary in geologic age. These units yield little water and are not considered viable for groundwater development.

Where the bedrock units are not exposed at the ground surface, they are overlain by younger geologic units. The Pliocene-age to Pleistocene-age Saugus Formation (map symbol, QTs) overlies the bedrock in much of the basin. At the far western and eastern ends of the basin, and in the upper reaches of some of the canyons, the Saugus Formation is absent and the bedrock units are overlain by a blanket of unconsolidated alluvium of Quaternary geologic age (map symbol, Qal). Where present, the alluvium overlies the Saugus Formation within much of the Santa Clarita Valley. In some areas where the alluvium is absent, the Saugus Formation is overlain by scattered outcrops of Quaternary-age Terrace deposits (map symbol, Qt). Groundwater is present in much of the alluvium and the Saugus Formation. However, the terrace deposits do not contain significant water resources because they are typically situated at elevations above the regional water table.

2.3.1 Non-Water-Bearing Bedrock

Underlying the water-bearing sediments in the Santa Clarita Valley are a series of consolidated, older, cemented sedimentary and crystalline rocks of Tertiary geologic age or older. For the most part, the sedimentary rocks are exposed along the flanks of the hills and mountains that border the Santa Clarita Valley, while the geologically older crystalline metamorphic and igneous rocks crop out in the upper watershed areas of the Sierra Pelona and San Gabriel Mountains.

Geologically older sedimentary rocks underlie the base of the Saugus Formation and are exposed in the hills beyond the exterior boundary line for the mapped surface limits of the Saugus Formation. The older rocks lying immediately below the Saugus Formation are: (1) the Pico Formation, composed of siltstone and shale, which underlies the Saugus Formation in the region southwest of the San Gabriel fault; and (2) the Castaic Formation and the Mint Canyon Formation, mainly siltstone and shale, which underlie the Saugus Formation in areas northeast of the San Gabriel fault. These sedimentary rock formations are generally fine grained, have low permeability, and do not yield substantial quantities of water to wells. In the project area, these rocks are considered barriers to groundwater flow.

2.3.2 Water-Bearing Sediments

Water-bearing sediments in the Santa Clarita Valley consist of:

a. Alluvial and valley fill deposits that underlie the Santa Clara River and its tributaries

b. Partially consolidated, older sediments of the Saugus Formation, including the Sunshine Ranch Member, that underlie the alluvium and are also exposed in the hillsides surrounding the main portion of the valley

2.3.2.1 Alluvium

The alluvial sediments are composed of extensively interlayered and interfingered mixtures of gravel, sand, silt, and clay, with variable amounts of cobbles and boulders. In general, alluvium in the main river valley ranges from medium-grained sand to sandy gravel and cobbles. Drillers' logs indicate the presence of discrete sand zones and discrete gravel zones in many areas of the alluvium. Due to its unconsolidated to poorly consolidated condition, and its lack of cementation, the alluvium has relatively high permeability and porosity.

The alluvial sediments lie within and along the course of the Santa Clara River and its main tributaries. The maximum thickness of the alluvium varies along the Santa Clara River, but generally is considered to be 200 feet. Typically, the alluvium tends to be thickest near the central portion of the river, and thins or pinches out near the flanks of the adjoining hills.

The alluvium overlies the Saugus Formation in much of the valley. However, in the eastern part of Soledad Canyon, the Saugus Formation is absent, and instead the alluvium overlies Miocene-age terrestrial sediments of the Tick Canyon and Mint Canyon Formations. In the upper reaches of some tributaries to the Santa Clara River, the alluvium overlies these or other Miocene-age sediments, such as the Pico and Castaic Formations. At the west end of the valley, the alluvium overlies the Pico Formation.

2.3.2.2 Saugus Formation

The Saugus Formation is present throughout the main portion of the Santa Clarita Valley and extends to the surrounding foothills. The Saugus Formation contains lenticular and interfingered beds of poorly- to well-consolidated sandstone, conglomerate, and siltstone that are at least 7,500 feet thick in the deepest part of the basin. These terrestrial sediments were deposited in stream channels, floodplains, and alluvial fans by the ancestral drainage system in the valley. The coarser-grained materials in the Saugus Formation were deposited in the main channels of the ancestral drainage system, and the locations of these channels changed throughout the approximately 3-million-year period of deposition of the Saugus Formation. Recent interpretations of geophysical electric log data indicate that the coarse-grained channel deposits (the primary water-bearing strata) are thicker and more numerous in some areas than in other locations in the valley. Although the Saugus Formation displays a considerable amount of lateral variability in lithology and grain size, some thicker stratigraphic packages can be traced through portions of the valley, primarily on the west (downthrown) side of the San Gabriel Fault (RCS, 2002).

The deeper and older portion of the Saugus Formation, the Sunshine Ranch Member, was deposited in a marine environment and consists of fine-grained, low-permeability siltstone and sandstone. The Sunshine Ranch Member has a maximum thickness of approximately 3,500 feet in the central part of the valley. It is present at or very close to ground surface at the margins of the valley. Geophysical (electric) logging indicates that the groundwater in

much of the Sunshine Ranch Member may be somewhat brackish in quality and is not useful for municipal water supply purposes.

2.3.3 Geologic Structure

Faulting and folding of the rocks in the region have caused the sedimentary rocks, including the Saugus Formation, to form a bowl-shaped structure. The Saugus Formation and the underlying bedrock dip generally toward the center of the "bowl" from all locations along the bottom (basal) contact of the Saugus Formation.

Dominating the geologic structure in the valley is the southeast-northwest-trending San Gabriel fault. The fault is a northeast-dipping reverse fault. The vertical displacement of the Saugus Formation on each side of the fault varies along the length of the fault and ranges from 100 feet to 2,600 feet within the valley (RCS, 1988). The Saugus Formation is thickest south of the fault, and this is the area where all significant Saugus production wells are located. North of the San Gabriel fault, the Saugus Formation is older, thinner, and finer grained than south of the fault. Little groundwater development has occurred north of the San Gabriel Fault.

A spur from this fault, referred to as the Holser fault, trends west through the valley. Cross sections prepared by RCS (1988, 2002) show that marker beds are offset by approximately 100 to 200 feet across the Holser Fault, which is substantially less than the offset across the San Gabriel Fault. Another spur fault called the Whitney Canyon fault extends south from the San Gabriel Fault in the southeastern corner of the valley.

2.4 Groundwater Occurrence, Recharge, and Discharge

Groundwater is present in the alluvium under generally unconfined conditions. Saugus Formation groundwater is thought to be present under unconfined conditions in the shallowest water-bearing zones where the Alluvial Aquifer is absent, and under semi-confined and confined conditions at greater depths. Figure 2-1 is a schematic cross-sectional representation of the groundwater flow patterns in the Santa Clarita Valley, including the predominant recharge and discharge mechanisms for the two aquifer systems. These are discussed in detail below.

2.4.1 Alluvium

Natural sources of recharge to the alluvium include deep percolation (infiltration) of direct precipitation within the valley; percolation of stream runoff flowing into the valley along the Santa Clara River and its tributaries; subsurface inflow from the adjoining (upgradient) portions of the Alluvial Aquifer to the north and east of the valley; and discharge of groundwater from the Saugus Formation to the Alluvial Aquifer, primarily on the west side of the Santa Clarita Valley.

Manmade sources of recharge to the Alluvial Aquifer include infiltration of irrigation water; infiltration of stormwater runoff from urban areas; infiltration of surface flow and underflow from Castaic Dam within the Castaic Creek area; infiltration of water released by the Los Angeles Department of Water and Power from its reservoir facilities in upper San Francisquito Canyon and upper Bouquet Canyon; and infiltration of water reclamation

plant (WRP) discharges to the Santa Clara River from two Los Angeles County Sanitation District (LACSD) WRPs in the valley (Plant No. 26 near Bouquet Canyon and Plant No. 32 near Valencia).

Groundwater discharge is significant in the western portion of the Alluvial Aquifer, where it occurs primarily as discharge to the Santa Clara River and ET by the riparian vegetation growing along the river corridor. Groundwater discharge from the west end of the basin also occurs as subsurface outflow through the Alluvial Aquifer to the downstream Piru Basin. Other groundwater discharge mechanisms in the Santa Clarita Valley are pumping for agricultural and municipal uses and seepage to underlying permeable portions of the Saugus Formation, particularly in the eastern portion of the basin.

According to RCS (1986), groundwater present within the Alluvial Aquifer flows from east to west roughly coincident with the direction of surface water flow. Figure 2-7 displays a groundwater elevation contour map for the Alluvial Aquifer, using water level data collected during the spring of 2000.

RCS (2002) estimated that the amount of groundwater in storage in the Alluvial Aquifer has historically fluctuated between approximately 100,000 and 200,000 acre-feet. Table 2-1 summarizes the well-by-well historical annual groundwater pumping from the Alluvial Aquifer from 1980 through 2000. Historical groundwater production rates during this period averaged 29,700 acre-feet per year (AF/yr) and ranged from approximately 20,300 to 43,500 AF/yr. As discussed later in Section 2.6.2, these pumping rates are at or below pumping rates during the 1950s and 1960s, when groundwater was used primarily for agricultural purposes.

2.4.2 Saugus Formation

The Saugus Formation is recharged by two principal sources: (1) infiltration of precipitation in the exposed portions of the Saugus in the highlands surrounding the valley, and (2) seepage from the Alluvial Aquifer along the Santa Clara River and its tributaries, particularly in the eastern and central portions of the Santa Clarita Valley. Minor recharge may also occur in limited areas through irrigation seepage, where the land overlying the Saugus is cultivated. In the eastern part of the Santa Clarita Valley, the Saugus Formation is underlain by older rocks of the Castaic Formation and Mint Canyon Formation, which surround the bowl-shaped Saugus structure. Little, if any, groundwater exchange occurs between these formations and the Saugus Formation.

Discharge from the Saugus Formation occurs in part as groundwater pumping from wells as deep as 2,000 feet. Discharge from the Saugus Formation also occurs at the west end of the valley, west of the I-5 bridge, where Saugus groundwater is thought to discharge to the Alluvial Aquifer. The older and relatively impermeable rocks of the Pico Formation, that underlie and form the western boundary of the Saugus Formation, form a barrier to groundwater flow and force Saugus groundwater to discharge upwards into the Alluvial Aquifer in the area extending between two miles and six miles upstream of the county line (refer to Figure 2-1). The Saugus is not present at Blue Cut, which is approximately three miles downstream of the Saugus/Pico Formation contact and approximately one mile downstream of the county line.

Because the Saugus Formation and underlying bedrock units tilt downward from the edges of the valley to the center of the valley, the permeable sand layers within the Saugus Formation near the margins of the valley are thought to be oriented so that they are in direct connection with the overlying Alluvial Aquifer. Consequently, recharge to the Saugus Formation from the Alluvial Aquifer is thought to be greatest in these areas, particularly on the east side of the valley. Also, discharge from the Saugus Formation to the Alluvial Aquifer is thought to be enhanced where permeable sand layers of the Saugus are contacting the Alluvial Aquifer on the western end of the valley where the Saugus Formation discharges.

The available water level data, which are concentrated in localized areas, indicate that the direction of groundwater flow in the Saugus is toward the center of the valley from the highlands. The data indicate that Saugus groundwater flows toward the western end of the Santa Clara Valley where it discharges naturally into the Alluvial Aquifer. Figure 2-8 displays a groundwater elevation contour map for the Saugus Formation, using water level data collected during the fall of 2000 (RCS, 2002).

Although few wells have been drilled into the Saugus Formation at or north/northeast of the San Gabriel fault, there is evidence of limited Saugus groundwater flow across the fault. Data that suggest this limited hydraulic connection between the two fault blocks are as follows:

a. Geologic and geophysical logging of former exploratory oil wells indicates that the Saugus Formation is much thinner north of the San Gabriel Fault than south of it (see geologic cross section E-E′ in RCS, 1988). Preliminary interpretations of recent geologic and geophysical logging at multi-port monitoring wells on the Whittaker-Bermite property also suggest the Sunshine Ranch Member is present at much shallower depths on the upthrown fault block, north/northeast of the fault, than on the downthrown block, south/southwest of the fault. Together, these data indicate that the older and fine-grained Sunshine Ranch Member of the Saugus Formation predominates in the area north of the fault.

b. Water level monitoring on the Whittaker-Bermite property shows groundwater elevations in multi-port monitoring well MP-3, on the upthrown side of the fault, are approximately 100 to 150 feet higher than in the other multi-port wells, which are on the downthrown side of the fault. Additionally, the three monitoring wells on the downthrown side (MP-1, MP-2, and MP-4) that have been monitored since January 2003, show responses to seasonal pumping of nearby water supply wells, whereas the monitoring well on the upthrown side (MP-3) shows no such response. (See Figure 2-3 for the locations of these wells, and Figure 2-9 for plots of groundwater elevations over time at each of these wells.)

In contrast, recent drilling, well construction, and pump testing work has indicated that the Holser Fault does not act as a barrier to groundwater flow. In early 2003, well MP-5 was installed in the Saugus Formation, located just north of the fault. This is a multi-port monitoring well that measures water levels at four discrete depths as great as 965 feet in the Saugus Formation. During March 2004, a deep Saugus production well south of the Holser Fault (VWC-205, located 4,700 feet away) was pumped for 72 hours under controlled conditions that included allowing no pumping to occur from other Saugus wells in the area.

The test was performed in part to evaluate the Holser Fault's hydraulic influence in the Saugus Formation. During pumping at VWC-205, measurable drawdown was observed at the two deepest ports at MP-5, which are situated at depths (795 feet and 965 feet) that correspond with the depths of the upper portion of the screen of VWC-205. Water level recovery monitoring conducted when VWC-205 was shut down showed rising water levels in these same two ports at MP-5. These observations are consistent with previous indications that the Holser Fault is not a significant barrier to groundwater flow in the Saugus Formation.

RCS (2002) estimated that the amount of groundwater in storage in the freshwater-portion of the Saugus Formation is approximately 1.65 million acre-feet. Historical groundwater production rates since 1980 have ranged from approximately 3,000 to nearly 15,000 AF/yr. Table 2-2 summarizes the well-by-well historical annual groundwater pumping from the Saugus Formation from 1980 through 2000.

2.5 Aquifer Physical Properties

2.5.1 Alluvium

Available groundwater elevation data and aquifer test data from Alluvial wells indicate that the Alluvial Aquifer is unconfined (i.e., is under water table conditions). Transmissivity values range from 4,700 square feet per day (ft^2/day), or 35,000 gallons per day (gpd) per foot (gpd/ft) to over 100,000 ft^2/day, or 750,000 gpd/ft. Specific yield values range from approximately 0.09 to 0.16 (RCS, 1986, 2002).

The transmissivity values are estimated (indirectly calculated) from pumping plant efficiency (specific capacity) tests conducted on a number of alluvial water wells over the years by the Southern California Edison Company. The transmissivity estimates that are calculated from these tests vary widely over short distances, and in some cases they vary substantially over time at individual wells. This is because the drawdown data that are collected during these tests are solely from the pumping wells themselves. Consequently, the use of water level drawdown data from pumping wells may provide transmissivity estimates that are strongly influenced (potentially biased low) by the condition of the well's screen or perforations and the gravel pack, particularly in the case of older wells. Nonetheless, these estimates can be useful for identifying substantial spatial variations in aquifer permeability if one selects the highest transmissivity values that are calculated for each given well (those values least impacted by well structure or well-related issues). Table 2-3 summarizes the results of the interpretations of the specific capacity data. Appendix B contains detailed tables of the testing data and the calculations of transmissivity and hydraulic conductivity, along with a comparison of these values to parameter values used in the regional model.

2.5.2 Saugus Formation

Available aquifer test data from Saugus wells located near the center of the valley where the Saugus is thickest indicate that the Saugus is semi-confined to confined (under pressure). In areas where the Saugus crops out, the uppermost saturated zones are partially unconfined because the permeable beds are folded upwards. In the highlands, the Saugus beds are

exposed at the ground surface, and in the valley the Saugus beds are in contact with the Alluvial Aquifer.

Transmissivity values range from approximately 400 to 25,000 ft^2/day (3,000 to 180,000 gpd/ft), but are typically between 5,500 and 11,000 ft^2/day (40,000 and 80,000 gpd/ft). Storativity values are on the order of 10^{-3} to 10^{-4}. These aquifer parameter values have been estimated from well performance tests and from the Saugus Formation ASR study conducted in 2000 (RCS, 2001, 2002). Table 2-4 summarizes this parameter data.

The ASR study consisted of a three-phase field test:

a. Phase 1: Injection of approximately 24 million gallons of treated drinking water into well VWC-205 at three injection rates (500, 800, and 1,100 gallons per minute [gpm]). Injection at each rate was performed for 7 days, for a total injection period of 21 days.

b. Phase 2: Recovery of 33 million gallons of water by pumping well VWC-205 at an average rate of 2,300 gpm for a period of 10 days. This pumping began 13 days after injection had ended.

c. Phase 3: Pumping 35 million gallons of water from nearby well VWC-201 at an average rate of 2,400 gpm for a period of 10 days. This pumping began 24 days after pumping had stopped at well VWC-205.

Water levels were monitored in nearby non-pumping Saugus Formation wells, including a Saugus monitoring well located 35 feet from well VWC-205, and in a newly installed Alluvial Aquifer monitoring well located 40 feet from well VWC-201. Monitoring began 22 days prior to Phase 1 and continued 3 days beyond the completion of Phase 3. Testing and monitoring details are provided in the report titled *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001). The ASR test indicated that it is hydrogeologically feasible to inject and recover significant volumes of water from a well completed in the Saugus Formation. The data also indicated that there was no measurable effect on water levels at the alluvial monitoring well during the monitoring period.

The ASR testing data also indicated that wells VWC-201 and VWC-205 have specific capacities between 10 and 20 gpm per foot (gpm/ft), which is intermediate in value between those of nearby wells. NCWD's wells to the south have specific capacities ranging from approximately 2 to 10 gpm/ft. To the north, wells that are owned by VWC and SCWC show specific capacities ranging from approximately 25 to 50 gpm/ft. Although these data suggest the possible existence of slightly more permeable zones in the center of the basin than along the southern edge, the apparent difference may also be caused by differences in well construction and well efficiency. Analyses of the ASR test data, including numerical model calibration runs, indicate that the bulk permeability of the Saugus Formation at wells VWC-201 and VWC-205 is approximately 6.5 feet per day (ft/day) (CH2M HILL, 2001).

2.6 General Hydrology and Hydrologic Cycle

The major sources of surface water in the Santa Clarita Valley include precipitation, return flows of urban and agricultural irrigation water, and treatment plant discharges to the Santa Clara River from two WRPs which were built in 1962 and 1967. Another significant source

of surface water is the increased importing of SWP water, which is stored in Castaic Lake and Castaic Lagoon, then treated and delivered by CLWA to the retail water purveyors in the Santa Clarita Valley. In some years, DWR releases flood flows from Castaic Dam/ Lagoon into Castaic Creek during the winter or spring months. Further details regarding the operation of the SWP system and its effect on the valley's hydrology and water supply are provided in Section 2.6.3 below.

Before 1970, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during the 1950s and early 1960s ranged from 35,000 to 44,000 AF/yr. Pumping from the Alluvial Aquifer dropped gradually from 40,000 AF/yr in 1967 to less than 30,000 AF/yr by 1983, and did not rise above 30,000 AF/yr until 1993. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. In response to statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available. The water management practices of the purveyors call for maximizing the use of Alluvial Aquifer and SWP water. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. Consequently, since 1995, Saugus pumping has ranged between approximately 4,000 and 8,500 AF/yr.

The remainder of this section describes the hydrology of the Santa Clarita Valley, historical hydrologic trends, and the operation of the SWP system and its influence on local hydrology and water supplies.

2.6.1 Basin Hydrology

The natural surface water features in the basin are the Santa Clara River and the tributaries that flow into it from canyons lying north and south of the river (Figure 2-10). Flows in the tributary canyons, and in the reach of the Santa Clara River that lies upstream of San Francisquito Canyon, are ephemeral, or intermittent. In these ephemeral streams, flow is limited to short-term runoff periods during storm events. The reach of the Santa Clara River west of San Francisquito Canyon is a perennially flowing river that obtains its flow from natural discharge of Alluvial Aquifer groundwater and from discharge of treated water from two WRPs. The other significant surface water feature is Castaic Lake, an SWP reservoir that lies at the north end of Castaic Creek in the northwestern portion of the valley. Like other tributaries to the Santa Clara River, the flows in Castaic Creek are ephemeral.

Figure 2-1 is a schematic diagram showing the hydrologic cycle for the Santa Clarita Valley. Table 2-5 lists the components of the hydrologic cycle for the basin. The components are classified in the table as one or more of the following:

a. Surface water recharge
b. Surface water discharge

c. Groundwater recharge
d. Groundwater discharge

These four elements of the hydrologic cycle have an important influence on the availability of surface water and groundwater resources in the basin. Time-series plots were constructed to show the relative magnitudes and trends of the various components of the hydrologic cycle in recent years. The time-series plots also illustrate the interrelationships of the hydrologic system components and their relationships to trends in groundwater levels in the Alluvial Aquifer and the Saugus Formation. The time-series analyses are discussed below.

2.6.2 Historical Hydrologic Trends

Long-term water level data have been collected over the years at purveyor-owned wells in the City of Santa Clarita and along the South Fork Santa Clara River. The data have been collected in pumping wells, and the hydrographs of these wells are steep at certain times, suggesting that some water levels are influenced by pumping at the well. Nonetheless, the data show some general trends over time and are useful for assessing general relationships between groundwater elevation trends and changes in groundwater recharge and pumping over time. Following are discussions of the observed hydrologic trends in the basin during the 50-year period from 1950 through 1999, as well as a comparison of hydrologic trends locally and in the SWP system.

2.6.2.1 Historical Trends in Rainfall

Figure 2-11 shows the annual precipitation along with the cumulative departure from the average annual precipitation since 1950. Cumulative departure refers to the cumulative amount of rainfall that is greater than or less than the long-term average rainfall. The slope of the cumulative departure plot shows the temporal trends in rainfall over successive years. The figure shows the following trends in precipitation within the Santa Clarita Valley:

a. 1950 through 1964: Dry conditions except for single wet years in 1952, 1957, 1958, and 1962 (a nearly continual decrease in cumulative departure values)

b. 1965 through 1970: Wet conditions (increase in cumulative departure values)

c. 1971 through 1977: Average to dry conditions (flat or declining cumulative departure values)

d. 1978 through 1983: Wet conditions (increase in cumulative departure values)

e. 1984 through 1991: Dry conditions (decrease in cumulative departure values)

f. 1992 through 1999: Highly variable conditions from year to year, but overall increase in cumulative departure values

2.6.2.2 Historical Trends in Alluvial Groundwater Elevations

Figure 2-12 shows trends in groundwater elevations in two Alluvial Aquifer wells located near the mouth of the South Fork Santa Clara River (VWC-N and NLF-S) and two Alluvial Aquifer wells near the western end of the basin (NLF-C5 and NLF-C7). The figure also shows trends in the following other components of the hydrologic cycle:

a. Precipitation at the Newhall-Soledad rain gage (plotted as the cumulative departure from the average precipitation)

b. Annual pumping volumes from the Alluvial Aquifer and the Saugus Formation

c. Total discharges from the WRPs to the Santa Clara River

d. Measured flow volume in the Santa Clara River during the lowest flow month of each year

Observations from Figure 2-12 are as follows:

a. Alluvial Aquifer groundwater elevations show greater variability over time within the basin interior (wells VWC-N and NLF-S) than near the basin outlet (wells NLF-C5 and NLF-C7). The range in water levels during the 50-year period of record is approximately 100 feet at the interior wells but only 20 to 30 feet in the two wells near the basin outlet.

b. The effect of reduced pumping from the Alluvial Aquifer from 1967 through 1989 was to minimize seasonal fluctuations in Alluvial Aquifer water levels near the aquifer's regional discharge zone at the western end of the valley. In this area, fluctuations in Alluvial pumping over time affected Alluvial groundwater elevations only seasonally; year-to-year variations in groundwater elevations were small. This indicates that water levels in this area are controlled less by pumping than by the discharge of Alluvial Aquifer groundwater to the Santa Clara River in the area downstream of I-5.

c. As with the western portion of the Alluvial Aquifer, the central portion of the Alluvial Aquifer has not shown long-term water level declines. During the 1950s and early 1960s, total pumping from the Alluvial Aquifer ranged between 35,000 AF/yr and 44,000 AF/yr during all but one year, and long-term (year-to-year) groundwater elevations were relatively stable (see the hydrographs for wells VWC-N, and NLF-S). When pumping from the Alluvial Aquifer decreased beginning in 1967, Alluvial groundwater elevations in this area quickly rose and have been relatively stable since about 1970, despite an increase in Alluvial Aquifer pumping during the 1990s. The hydrographs indicate that after an extended drought and high rates of pumping, Alluvial Aquifer groundwater elevations recover very quickly when normal or above normal rainfall patterns return.

d. The seasonal low flow in the Santa Clara River at the County Line gage has shown a long-term increase since the mid-1970s and, to some degree, during the late 1960s. The figure shows that this increase in flow coincides with increases in the annual discharges of treated water to the Santa Clara River from the two WRPs. Although Alluvial Aquifer pumping increased during the 1980s and 1990s, the seasonal low river flow did not show a long-term decrease during this period. The increases in WRP and Santa Clara River flows and the fluctuations in Alluvial Aquifer pumping have not caused long-term changes in Alluvial Aquifer groundwater elevations at the two wells near the basin outlet.

2.6.2.3 Historical Trends in Saugus Groundwater Elevations

Figures 2-13 and 2-14 compare groundwater elevation trends in the Saugus near the Santa Clara River, below the mouth of the South Fork Santa Clara River, with the same hydrologic

components displayed on Figure 2-12. Figure 2-13 shows this information for the period 1950 through 1999, and Figure 2-14 shows this information during the 1990s, when groundwater levels rose in the Saugus Formation. Figures 2-15 and 2-16 show the same information, but for groundwater elevations at Saugus Formation wells located farther away from the Santa Clara River, along the tributary valley containing the South Fork Santa Clara River.

In examining the four Saugus figures, it is difficult to distinguish between the influences of precipitation and pumping trends on changes in Saugus water levels. Although a slight rise in water levels may have occurred at VWC-157 and VWC-160 during the late 1960s and early 1970s, it appears to follow the trends in Saugus pumping volumes more closely than the precipitation trends. The data at VWC-157 also suggest that a succession of above-normal precipitation years (e.g., 1978 through 1983) or a year of precipitation that is substantially above normal (e.g., 1983) may have some influence on Saugus water levels. However, the data are limited, and the periods of increased precipitation tend to coincide with periods of decreased pumping, making it difficult to identify the effect of precipitation or pumping on Saugus water levels.

Another observation is that the rise in Saugus water levels in the late 1960s and early 1970s occurred despite an increase in annual pumping volumes from the Alluvial Aquifer. This indicates that Saugus water levels are controlled by precipitation and/or Saugus pumping trends, and not by Alluvial pumping trends.

2.6.2.4 Comparison of Historical Trends in Alluvial and Saugus Groundwater Elevations

Figure 2-17 compares groundwater elevations at Alluvial and Saugus wells located near each other along the Santa Clara River, just below the mouth of the South Fork Santa Clara River. At this location, the trends in Alluvial groundwater elevations show no clear relationship with the trends in Saugus groundwater elevations. A moderate overall increase in groundwater elevations is observed in both the Alluvial Aquifer and the Saugus Formation during the late 1960s. However, this similarity in the water level trends may be a coincidence arising from reduced pumping in both aquifers. During the early 1970s, water levels in Saugus well VWC-157 decreased while water levels in the nearby Alluvial Aquifer well (VWC-N) generally increased. During the 1990s, the Alluvial Aquifer groundwater elevations at well VWC-N were generally stable despite (1) increased basinwide alluvial pumping and (2) a sharp decrease, then increase, in Saugus groundwater elevations, which correlated with the trends in Saugus pumping. In summary, although there may be a relationship between Alluvial and Saugus groundwater elevations near the margins of the Santa Clara Valley, where folding of Saugus beds has brought permeable zones in contact with the alluvium, Figure 2-17 indicates that there is general independence between the Alluvial and Saugus water level trends at this location, which is near the center of the bowl-shaped Saugus Formation structure discussed in Section 2.3.3.

2.6.2.5 Historical Trends in Santa Clara River Baseflow

Hydrograph separation techniques were applied to the daily streamflow data for the County Line gage to estimate historical groundwater discharges (baseflow) to the Santa Clara River within the Santa Clarita Valley. The hydrograph separation was performed for calendar years 1953 through 1999 using the following five steps:

1. For each day, the average daily flow at the County Line gage in cubic feet per second (cfs) was converted to acre-feet of volumetric flow for the day.

2. The daily flows from Castaic Dam and at the Castaic Creek South gage (located near the mouth of Castaic Creek) were subtracted from the flow at the County Line gage. These data reflect surface water flow from tributaries. Data from the Castaic Creek South gage were used through June 1977. Beginning in July 1977, operational data for Castaic Lagoon, presented in annual reports by DWR, were used to estimate surface flow contributions from Castaic Creek.

3. The discharges of treated effluent from WRPs owned by LACSD were subtracted. This was performed for calendar years 1975 and later, as 1975 was the first year that such records were available.

4. The resulting day-to-day trends in streamflows were scrutinized for days when notably elevated flows occurred suddenly. These days were assumed to be dominated by storm flow. In some cases, the elevated flows lasted for only 2 to 5 days. In other cases, flows remained elevated for several days but showed steady declines, indicating that only the beginning of the elevated-flow period was dominated by surface runoff.

5. On all other days, storm flow was considered to be minimal or zero, and the flow values calculated for days not dominated by storm flow were assumed to represent river base-flow (that is, groundwater discharge to the river). For each month, an average flow was calculated for these non-storm days. The average flow was then converted to a total flow for the month, and the monthly flow volumes were summed to come up with the total flow for each year.

Table 2-6 presents the annual calculations from the hydrograph separation analysis. Table 2-7 presents summary statistics for the entire 47-year period that was analyzed, as well as for shorter time frames. Tables 2-8 and 2-9 show dry-year, normal-year, and wet-year statistics for the entire period of record and the shorter time frames. The shorter time frames are:

a. Calendar years 1953 through 1965, which were years of primarily agricultural water use prior to urbanization and construction of WRPs. This 13-year period was also characterized by 5 years of below-normal rainfall.

b. Calendar years 1975 through 1999, which represent 25 years of significant urbanization, including SWP water importation and WRP operations. This 25-year period was characterized by 6 years of below-normal rainfall, though rainfall volumes in general were somewhat higher (19.4 inches per year [in/yr] average, versus 15.5 in/yr average for 1953 through 1965).

c. Calendar years 1953 through 1999, but excluding 8 years (1966 through 1974) when WRP discharges occurred but were not recorded.

The daily streamflow data and the hydrograph separation technique indicate the following:

a. Summary statistics in Table 2-7 for all types of rainfall years (dry, normal, and wet) show that average groundwater discharges to the river from 1953 through 1965 were approximately 2,500 AF/yr (3.5 cfs). Groundwater discharges to the river were typically

14,000 to 22,000 AF/yr (19 to 31 cfs) from 1975 through 1999 because of more rainfall, increasing urbanization, and increasing importation of water from outside the valley.

b. For normal rainfall years only, median and average groundwater discharges to the river were approximately 12,500 and 14,300 AF/yr (17 and 20 cfs), respectively, during 1975 through 1999 (Table 2-8); approximately 8,600 and 10,000 AF/yr (12 and 14 cfs), respectively, for the entire historical record (Table 2-9); and approximately 4,000 and 3,600 AF/yr (5.5 and 5.0 cfs), respectively, from 1953 through 1965 (Table 2-8).

c. For drought years only, Table 2-8 shows that groundwater discharges to the river ranged from 400 to 4,900 AF/yr (0.5 to 7 cfs) between 1953 and 1965, and from 5,200 to 14,500 AF/yr (7 to 20 cfs) between 1975 and 1999. Table 2-8 also shows that median and average groundwater discharges to the river during drought years were 600 and 1,700 AF/yr (1 and 2 cfs), respectively, from 1953 through 1965, and typically 9,600 and 10,200 AF/yr (13 and 14 cfs), respectively, from 1975 through 1999.

2.6.3 State Water Project Operations and Hydrology

The import of SWP water is an important aspect of the local hydrologic system, particularly for water supplies. Following is a summary of the SWP system's operations and history in the Santa Clarita Valley, the amount of SWP water available to the valley, and a comparison of the timing of wet-dry rainfall cycles in the SWP system and in the Santa Clarita Valley.

2.6.3.1 State Water Project Operations and History

SWP water is transported to the Santa Clarita Valley by the California Aqueduct and is stored in Castaic Lake prior to use. Castaic Lake is one of several facilities that store SWP water that is transported to Southern California by the California Aqueduct and other aqueducts. The designated uses of Castaic Lake are recreation and storage of SWP water intended for eventual municipal use.

The stored SWP water is delivered by CLWA, which was formed in 1962 to provide a supplemental supply of imported water to the retail water purveyors in the valley. CLWA treats this water at two facilities, the Earl Schmidt Filtration Plant and the Rio Vista Water Treatment Plant, then wholesales this water to each of the retail water purveyors through an extensive transmission pipeline system. The CLWA service area covers approximately 195 square miles (124,800 acres), including the City of Santa Clarita and the surrounding unincorporated communities.

In 1966, CLWA signed a contract with DWR that established a contract amount of 41,500 acre-feet of SWP water. CLWA subsequently purchased 12,700 AF/yr from a Kern County water district during the 1980s, and recently purchased an additional 41,000 AF/yr from a member agency of the Kern County Water Agency, for a current total of 95,200 AF/yr of Table A SWP water. From 1980, when SWP water was first imported into the Santa Clarita Valley, through 1999, the total amount of SWP water delivered to the CLWA service area was approximately 298,972 acre-feet.

The SWP water is combined with local groundwater to meet both residential and non-residential interior and exterior water demands. Ultimately, a substantial portion of the municipal water supply reaches the local existing WRPs in the valley. Historically, the

treated water has been discharged from these WRPs to the Santa Clara River, where it contributes significantly to the natural surface water and groundwater flows reaching Ventura County. As discussed previously, stream gage data at the county line (USGS Gage No. 11108500)[2] demonstrate an increase in annual flow since the import of SWP water and the operation of the WRPs began, even during dry years. This is expected to continue in the future because increased urbanization will increase CLWA water deliveries, which in turn will increase inflows and outflows at LACSD's two WRPs (LACSD, 1998; CH2M HILL, 2002). However, over time, a portion (up to 17,000 AF/yr) of the future increases in flows into the WRPs will become reclaimed water that is used for outdoor irrigation, rather than being discharged into the river.

2.6.3.2 State Water Project Water Availability

The current CLWA Table A contract amount of 95,200 AF/yr of SWP water is affected by a number of factors, including hydrologic conditions; the status of SWP facilities construction; environmental requirements; and evolving policies for water resources management in the San Francisco Bay and Sacramento Delta system, which help route SWP water. While several programs may improve the reliability of SWP water imports to Southern California, such as Interim Delta Improvements and future improvements called the Full Delta Fix and South of Delta Storage, water planning efforts in the Santa Clarita Valley have conservatively assumed that future SWP water supplies will be equal to the SWP supply available under existing conditions. (See the Urban Water Management Plan 2000 [S.A. Associates et al., 2000] for details.)

The DWR has created a model of the SWP system and its allocations. The results from the model, called the DWRSIM model, are used by water agencies in the Santa Clarita Valley as planning numbers for SWP deliveries. The planning numbers for annual SWP water imports to the Santa Clarita Valley, based on CLWA's current Table A contract amount, are as follows:

a. Average years = 56,800 AF/yr (59.7 percent of the 95,200 AF/yr Table A contract amount)

b. Wet years = 66,300 AF/yr (69.6 percent of the 95,200 AF/yr Table A contract amount)

c. Multiple dry years = 37,900 AF/yr (39.8 percent of the 95,200 AF/yr Table A contract amount)

d. Multiple critical years = 19,000 AF/yr (20.0 percent of the 95,200 AF/yr Table A contract amount)

The DWRSIM model also indicates that a dry year allocation occurs, on average, once every 10 years, and that 3 consecutive years of drought occur, on average, once every 20 years. A separate DWR study (Roos, 1992) also concluded that droughts in excess of 3 years are rare in Northern California. Consequently, because of the availability of storage in the SWP

[2] Until October 1996, this gage was located just downstream of the county line at Blue Cut, an area where the valley becomes substantially narrower in width and the river begins to bend toward the southern side of the valley. See Figure 1-1 for this location. This gage continued operation through October 21, 1996, at which time it was permanently taken out of service. A new gage (USGS Gage No. 11109000) was put into service beginning on October 1, 1996 approximately 2.5 miles downstream, near Piru Junction, at the Las Brisas Bridge.

system, DWR and the water agencies in the Santa Clarita Valley use the dry year allocation of 37,900 AF/yr to plan for single dry years, and also for droughts lasting up to 3 years.

2.6.3.3 Local and State Water Project Historical Hydrology

Table 2-10 compares the historical hydrologic pattern for the SWP system with the local basin hydrology since 1944. The SWP hydrologic pattern is affected by the hydrology of Northern and Central California and is specifically mentioned in the Sacramento Four Rivers Unimpaired Runoff Index in Volume 1 of *Bulletin 160-98: The California Water Plan Update* (DWR, 1998). This index provides a general indication of SWP water delivery patterns, though it only describes runoff into the SWP system and does not account for system storage and other factors that affect actual SWP deliveries. The local hydrologic pattern shown in Table 2-10 is based on the long-term rainfall record at the Newhall-Soledad rain gage. Table 2-10 shows the following:

a. Critically low runoff years occurred in the SWP system during the 2-year period 1976 through 1977; during 1988; during the 3-year period 1990 through 1992; and again during 1994.

b. The period 1980 through 1999 shows primarily extreme hydrologic conditions (wet, dry, or critical), with moderate hydrologic conditions occurring only twice, above-normal years in 1980 and 1993.

c. Hydrologic conditions in the SWP system are often different from local hydrologic conditions. Below-normal years in the SWP system often do not coincide with local droughts, and only some critical SWP years, 1990 and 1994, coincide with local drought. Likewise, historical SWP hydrology has varied considerably during years of local droughts.

The Regional Model was calibrated to time-varying hydrologic conditions for the historical time period 1980 through 1999 (see Section 4 for more details on Regional Model calibration). Table 2-11 compares SWP hydrology, SWP allocations, and local hydrology for the period 1980 through 1999. Based on the historical cycle and the goals listed above, the hydrologic cycle relating to the availability of SWP water during that period was as follows:

a. Years 1 through 5 (water years [WY] 1980 through 1984): normal or above-normal availability

b. Year 6 (WY 1985): 1-year drought (below-normal availability)

c. Years 7 through 10 (WYs 1986 through 1989): normal or above-normal availability

d. Years 11 through 13 (WYs 1990 through 1992): 3-year drought (below-normal availability)

e. Year 14 (WY 1993): normal or above-normal availability

f. Year 15 (WY 1994): 1-year drought (below-normal availability)

g. Years 16 through 20 (WYs 1995 through 1999): normal or above-normal availability

Although SWP hydrology was dry or critical during water years 1987 through 1989, the DWRSIM model indicates that the storage volume in the SWP would have provided normal water deliveries to the Santa Clarita Valley (S.A. Associates et al., 2000).

2.6.3.4 Availability of Castaic Creek Flood Flows

As provided through agreement with DWR, CLWA has access to approximately 4,700 acre-feet of storage in Castaic Lake. This water is stormwater that flows into Castaic Lake from its upstream watersheds. Prior to completion of Castaic Dam in 1972, the LACWWD, Newhall Land & Farming Company (NLF), NCWD, and UWCD, which together constitute the Downstream Water Users, had certain rights to the stormwater flowing in Castaic Creek. On October 24, 1978, DWR entered into agreements with the Downstream Water Users regarding their rights to this water. Under the terms of the agreement, DWR would release the first 100 cfs of inflow. At the time of the agreement, flows in excess of 100 cfs were believed to be wasted to the ocean. When the local inflow to Castaic Reservoir exceeds 100 cfs, the excess of 100 cfs inflow is retained in the reservoir. Until May 1 of each year, the Downstream Water Users can receive 75 percent of this retained water by paying specified storage charges. If the Downstream Water Users request this water, it is delivered by releasing water into Castaic Lagoon, and then Castaic Creek. These releases are called Castaic Creek Flood Flows. If the Downstream Water Users do not request this water on or before May 1, any retained water becomes the property of DWR.

The allocation of stored water among the Downstream Water Users is specified in a separate agreement. Under that agreement, UWCD receives 48 percent of the delivered flood flows, while the three Santa Clarita Valley entities, NLF, NCWD, and LACWWD, together receive 52 percent.

The Castaic Creek flood flows available to the group of four Downstream Water Users averaged 15,700 AF/yr during water years 1977 through 2000. (See Table 2-12.) However, the magnitudes of these flows varied greatly from year to year, as shown on Figure 2-18. No flood flows were stored or delivered in 5 of these years, and the median flow was 2,800 AF/yr (only 18 percent of the average flow). The highest flood flow was 67,400 AF/yr, in water year 1978, and the flood flow exceeded the average flow in only 7 of these 24 years. The Regional Model simulated these historical flows, as described in Appendix C.

2.7 Previous Studies

Several prior studies have been important in developing a general understanding of the valley's geology and hydrology and in developing and calibrating the Regional Model.

2.7.1 1986 Alluvial Aquifer Study

In 1986, RCS studied the alluvial sediments in the Santa Clarita Valley to estimate the amount of groundwater in storage and the amount of recharge that occurs over the long-term, and also to evaluate the feasibility of artificially recharging these sediments (RCS, 1986). This was the first published report detailing the hydrogeologic characteristics of the Alluvial Aquifer system, water well construction and testing information, and magnitudes and changes in groundwater elevation and groundwater quality. Prior studies in the Santa Clarita Valley focused on oil development, and therefore evaluated the regional geology

with an emphasis on the subsurface geologic conditions in the hills and mountains surrounding the valley.

The 1986 study identified 650 water wells that had been drilled in the valley up to that time, all but 22 of which were drilled in the alluvium to depths less than 250 feet. The study examined geologic logs, well testing (specific capacity) records, long-term water level data, and water quality records. The study concluded that the coarse-grained, permeable sediments comprising this aquifer system are subjected to seasonal and year-to-year variations in water levels and groundwater in storage due to highly variable rainfall and streamflow patterns. In addition to describing the hydrogeology of the Alluvial Aquifer, the study mapped and identified the watersheds contributing to streamflows in the Santa Clara River and its tributaries, and estimated the amount of runoff from these watersheds that is potentially available as recharge to the Alluvial Aquifer. The study also concluded that it would be feasible to artificially recharge portions of the Alluvial Aquifer using spreading basins, primarily along the Santa Clara River in the area east of the mouth of Bouquet Canyon.

2.7.2 1988 Saugus Aquifer Study

In 1988, RCS conducted a study of the Saugus Formation that was similar in scope to the 1986 study of the Alluvial Aquifer (RCS, 1988). The scope of work included conducting 24-hour, constant discharge aquifer tests in five different Saugus Formation wells, including monitoring water level recovery rates. Six regional geologic cross-sections were also constructed from geologic and geophysical logs that had been compiled prior to this study at water wells and numerous oil wells within and around the Santa Clarita Valley.

The study concluded that the Saugus Formation is discretely layered, with groundwater production occurring from discrete sand and gravel zones that exist throughout much of the total thickness of the formation. The study also concluded that it is hydrogeologically feasible to develop additional groundwater supplies from the Saugus Formation as long as wells are properly sited and constructed, and that the groundwater-yielding capability of the Saugus Formation is likely greater south of the San Gabriel fault than north of the fault.

2.7.3 2002 Aquifer Study Update

In 2002, RCS updated the 1986 and 1988 studies with more recent data and prepared a report for both the Alluvial and Saugus Formation aquifers (RCS, 2002). As part of this work, a GIS and digital database were constructed. Field activities conducted during the study included surveying water well locations and elevations using a global positioning system (GPS) survey and water level data collected at Alluvial and Saugus wells.

The report concluded that groundwater levels in the Alluvial Aquifer and Saugus Formation have fluctuated over time, but have shown no long-term progressive declines in the amount of groundwater storage that could be considered indicative of overdraft conditions. From the long-term pumping and water level data, the report concluded that the Alluvial Aquifer can be pumped at rates between 30,000 and 40,000 AF/yr over the long-term, and suggested that pumping be between 30,000 and 35,000 AF/yr during dry years. For the Saugus Formation, the study concluded that pumping can occur at rates between 7,500 and 15,000 AF/yr on a long-term basis, with short-term increases to as much as

35,000 AF/yr during the end of a multi-year drought period. These pumping rates for the Alluvial and Saugus aquifer systems were referred to in the 2002 study as the operational yields of both aquifers.[3]

2.7.4 Newhall Ranch ASR Impact Evaluation

The Newhall Ranch Company performed analyses of potential impacts resulting from development of the proposed Newhall Ranch Specific Plan, including implementation of an ASR program. Findings were documented in the following reports:

a. *Assessment of the Hydrogeologic Feasibility of Aquifer Storage and Recovery, Saugus Formation, Santa Clarita Valley, California* (RCS, 2001).

b. *Newhall Ranch ASR Impact Evaluation* (CH2M HILL, 2001).

c. *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002).

The study consisted of the following work:

a. An ASR field test was conducted by RCS in the Saugus Formation at VWC-205 in July 2000. The objective of the test was to determine the feasibility of injecting water into the Saugus Formation and later extracting the stored water. Approximately 24 million gallons of treated drinking water were injected into the well at a rate of up to 1,100 gpm for 21 days (RCS, 2001). The stored water was then recovered at a rate of 2,300 gpm for 10 days. Water levels were monitored in nearby Saugus Formation wells and in a newly installed Alluvial Aquifer monitoring well. This test demonstrated that ASR is indeed feasible in the Saugus Formation. Also, there was no measurable effect on water levels during the injection or pumping phase at the Alluvial monitoring well.

b. A pumping test was conducted by RCS in the Saugus Formation at VWC-201 to further demonstrate the limited hydraulic connection between the Saugus Formation and the Alluvial Aquifer. Well VWC-201 was pumped at 2,400 gpm for 10 days and water levels were monitored at an Alluvial Aquifer well located less than 50 feet away. Again, no response to Saugus Formation pumping was discernible at the Alluvial monitoring well.

While the ASR field test demonstrated that ASR is feasible in the Saugus Formation and that there is limited effect on the Alluvial Aquifer, it was necessary to conduct additional

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[3] The concept of operational yield was described in the RCS report as follows (RCS, 2002):

"One of the disadvantages of utilizing perennial yield as a basis for managing the pumpage from an aquifer system is that it represents a long-term average value for annual yield. There is a potential for the perennial yield value to be interpreted as a "not-to-exceed" volume, with a related potential for pumping above the perennial yield value in any give year to be incorrectly interpreted as "overdraft." A recently advanced concept intended to deal with such misinterpretations is that of operational yield. Operational yield can be defined as a fluctuating value of pumpage that may be above or below the perennial (or average) yield in any given year, and that varies as a function of the availability of other water supplies. The basic intent of the operational yield value is that it should not exceed the perennial yield of the groundwater basin over multi-year wet and dry cycles."

"The operational yield concept includes flexibility of groundwater use by allowing increased pumping during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is available in wet/normal rainfall periods. The operational yield protects the aquifer by helping to assure that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. In the Valley, historical groundwater data demonstrate that the alluvium has been, and continues to be, developed within its long-term sustainability (i.e., no continuous lowering of water levels, no notable trend toward degradation of groundwater quality, etc.)"

analysis to extrapolate the results of RCS's well field testing to a full-scale, long-term ASR operation. This additional analysis was designed to address the following questions:

a. Can 4,500 AF/yr of water be stored in the Saugus Formation for withdrawal during drought years?

b. Will storage of water in the Saugus Formation increase the rate of natural groundwater discharge to the Alluvial Aquifer and to the Santa Clara River, and, if so, by how much?

c. Will pumping Saugus Formation ASR wells during a drought period reduce groundwater elevations in the Alluvial Aquifer and, subsequently, flows in the Santa Clara River?

d. Will the ASR program result in water quality changes within the Saugus Formation, the Alluvial Aquifer, and the Santa Clara River?

e. Will the ASR program cause spreading of perchlorate that is present in the Saugus Formation?

To answer these questions, CH2M HILL prepared a numerical groundwater flow model of the western and central portions of the Santa Clarita Valley. The model simulated the groundwater flow in the Saugus Formation and the Alluvial Aquifer, accounting for the inflows and outflows to and from the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River under historical conditions. The model was also used to simulate the changes in the groundwater flow system that would arise from operation of the ASR system. Of particular interest was the model's simulation of changes in subsurface groundwater flow out of the valley and changes in groundwater discharge into the Santa Clara River that would arise from ASR operations under a historical climatic cycle (wet and dry hydrologic conditions) observed during the 1980s and 1990s. These two groundwater discharge mechanisms were evaluated in detail with the model to estimate the potential changes in flow to Ventura County from the ASR system. The western limit of the model was placed at the county line, and the eastern limit of the Saugus Formation was established as the eastern limit of the model domain.

The primary findings from the analysis were:

a. On the basis of the historical timing of drought years, the proposed ASR system would provide long-term benefits to the river and the groundwater system. ASR pumping cycles would cause small (less than 1 foot) declines during drought years, and long-term operation of the ASR system would not cause long-term groundwater elevation declines in the Alluvial Aquifer, where riparian habitat is present along the river.

b. The combined influence of the proposed ASR program and the other water resource attributes[4] of Newhall Ranch would result in an overall increase in river flows over the long term.

c. The continued increase in water supplies to meet the water demands arising from a combination of growth outside Newhall Ranch and development of the Newhall Ranch

[4] Direct discharges of treated effluent into the river from the Newhall Ranch WRP, and the redistribution of irrigation demands (rates and locations) associated with conversion of water use from agricultural to municipal demands.

project would further enhance the long-term flows to the river, compared with present conditions. The occurrence of increased annual river flows during drought and nondrought years alike, compared with present conditions, is consistent with historical records, showing that continued urbanization and associated importation of water from areas outside the valley would increase river flows gradually over time.

Tables

TABLE 2-1

Annual Groundwater Pumping from the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NCWD	Castaic1	244	257	253	189	251	274	295	450	520	478	444	561	515	458	496	401	385	535	166	426	118
	Castaic2	124	48	0	0	0	0	380	535	324	678	0	0	0	477	518	380	327	268	257	331	289
	Castaic3	0	108	136	172	240	301	0	0	324	0	660	532	488	0	0	0	0	0	0	0	0
	Castaic4	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	95	57	6	7
	Pinetree1	346	326	355	242	148	273	8	0	2	152	0	47	16	247	154	79	64	89	227	403	245
	Pinetree2	58	84	209	112	154	113	206	309	351	348	31	0	283	326	218	165	70	0	0	0	0
	Pinetree3	398	527	225	432	753	655	719	756	758	672	801	724	682	450	607	595	624	812	716	505	494
	Pinetree4	0	0	0	0	3	28	234	77	4	0	0	0	10	19	232	55	333	510	338	5	355
NLF	161	317	370	271	223	314	220	170	0	0	0	120	82	401	753	791	0	0	0	0	123	106
	B10	0	0	0	0	0	0	0	0	0	0	0	291	1,225	452	1,406	894	1,045	930	1,244	1,155	990
	B11	186	217	159	133	184	138	60	0	0	127	445	311	0	136	51	127	151	30	250	212	182
	B5	1,218	1,423	1,041	858	1,208	772	1,178	1,002	1,481	1,928	1,893	1,880	860	989	1,950	1,921	1,649	1,756	1,273	1,748	1,500
	B6	858	1,002	733	604	850	543	946	788	165	96	137	263	615	283	808	1,359	1,421	1,602	1,572	2,133	1,830
	B7	0	0	0	0	0	0	60	0	0	127	0	0	400	180	581	373	56	286	176	444	381
	C	723	845	618	510	717	575	660	387	418	557	338	226	756	1,024	417	1,324	715	1,126	598	716	614
	C3	196	229	168	138	195	140	254	63	130	71	134	48	197	259	582	333	397	355	378	619	531
	C4	260	304	222	183	258	196	137	25	30	7	213	225	166	12	108	150	293	483	609	819	703
	C5	459	536	392	323	455	359	328	191	198	154	147	250	428	414	394	472	676	894	628	685	588
	C6	203	237	174	143	201	166	161	103	117	77	59	123	0	0	0	360	229	226	128	154	132
	C7	575	671	491	405	570	354	195	192	318	337	339	220	427	279	625	778	582	779	779	1,167	1,001
	C8	0	0	0	0	0	0	0	0	0	0	0	0	126	254	166	199	458	432	179	236	202
	E	2,067	2,416	1,767	1,457	2,051	3,342	1,842	1,180	812	624	965	498	1,325	1,513	1,022	1,366	2,542	1,949	1,522	2,506	2,150
	E2	174	203	149	123	173	138	103	0	0	251	1,284	830	560	584	555	115	669	525	426	138	118
	E3	0	0	0	0	0	0	0	0	0	0	0	0	0	15	138	0	0	0	0	0	0
	E4	1,011	1,181	864	712	1,003	639	716	83	566	392	553	284	376	16	0	381	140	339	80	281	241
	E5	0	0	0	0	0	0	0	0	0	0	0	0	65	274	0	142	514	598	42	0	0
	E7	0	0	0	0	0	0	0	0	0	0	0	0	116	80	105	88	79	2	0	0	0
	E9	96	113	82	68	96	78	117	288	476	411	339	596	252	187	435	319	12	142	170	42	36
	G45	324	378	277	228	321	179	153	98	123	99	143	146	165	82	144	137	159	180	144	231	198
	Q	441	515	377	311	438	159	360	382	312	185	15	0	0	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	205	0	0	0	0	0	0	0	0	0	0	0	0	0
	R2	159	186	136	112	158	71	104	47	0	0	0	87	0	0	0	0	0	0	0	0	0
	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S2	293	342	250	206	290	95	0	958	0	0	503	0	0	0	0	0	0	0	0	276	237
	S3	655	765	560	461	649	327	124	0	0	0	29	37	52	99	87	109	97	55	10	3	0
	Topco 1	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0
	Topco 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	W4	303	354	259	213	300	138	60	1	0	300	157	252	1	0	36	5	128	29	20	3	3
	W5	553	646	472	389	548	191	315	205	308	192	0	175	0	0	0	0	0	0	0	21	18
	X3	260	304	222	183	258	508	244	314	497	308	412	215	350	135	205	222	8	108	22	112	96
SCWC	Clark	303	228	131	137	194	200	208	342	248	301	407	542	662	635	572	662	1,027	873	697	878	747
	Guida	1,058	795	457	477	677	698	221	569	158	530	676	801	978	895	942	744	1,252	1,479	1,274	1,556	853
	Honby	594	447	257	268	381	392	193	391	462	216	930	893	731	1,393	476	553	352	814	532	1,162	815
	Lost Canyon 2	1,083	814	468	489	693	714	765	923	787	588	601	404	465	692	669	773	678	792	757	946	708
	Lost Canyon 2A	0	0	0	0	0	0	0	0	0	0	293	832	1,284	1,080	1,383	1,230	1,370	1,055	973	890	998
	Methodist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mitchell	1,189	893	515	537	761	785	444	582	485	435	264	3	474	663	564	610	598	633	482	913	439
	N.Oaks Central	488	367	211	220	313	322	304	361	153	329	525	704	701	1,403	1,313	965	851	870	1,490	1,682	1,145
	N.Oaks East	601	451	260	271	385	396	863	972	776	914	454	194	588	1,233	1,473	1,295	900	1,033	1,407	695	1,483
	N.Oaks West	643	483	278	290	412	424	874	465	842	413	275	78	634	866	972	795	663	952	934	1,894	1,663
	Sand Canyon	721	542	312	325	461	477	514	466	498	1,115	458	49	661	918	781	842	1,211	1,533	1,622	1,629	1,317
	Sierra	2,780	2,089	1,202	1,255	1,780	1,834	856	220	459	730	772	719	1,050	1,413	1,433	1,092	1,034	597	814	1,158	640
	Stadium	0	0	0	0	0	0	167	291	211	214	328	374	60	825	418	656	509	637	444	338	721

TABLE 2-1

Annual Groundwater Pumping from the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
VWC	D	289	269	164	163	240	41	0	305	588	614	510	680	239	173	494	403	454	1,134	1,209	921	880
	I	214	200	122	121	177	181	95	0	91	132	73	108	1	0	1	0	0	0	0	0	0
	K2	0	0	0	0	0	0	0	0	0	0	0	982	1,134	1,708	2,089	1,155	1,305	1,076	1,489	1,420	861
	L2	9	8	5	5	7	91	0	0	0	0	0	838	526	996	1,236	818	961	308	190	532	494
	N	1,475	1,376	840	833	1,223	1,093	1,472	1,420	1,473	1,177	792	976	697	66	0	24	263	808	768	1,036	935
	N3	0	0	0	0	0	0	0	0	0	0	0	10	999	1,536	29	943	1,325	1,034	1,093	1,057	778
	N4	5	5	3	3	4	65	0	0	0	0	0	847	248	133	911	1,329	1,328	1,185	772	894	710
	Q2	440	411	251	248	367	461	838	893	512	1,483	1,398	1,783	335	548	1,348	1,126	1,385	1,462	1,655	1,288	1,387
	S6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515
	S7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111
	S8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79
	T2	621	580	354	351	515	704	894	913	1,007	1,030	643	662	379	0	3	280	733	837	941	726	984
	T4	160	150	91	91	133	54	167	0	0	0	0	163	687	3	1	975	1,258	804	523	892	625
	U3	1,476	1,378	841	834	1,225	1,278	1,033	638	323	823	1,254	1,199	369	1	2	765	987	851	560	702	1,126
	U4	1,306	1,220	744	738	1,084	665	668	606	696	567	551	584	42	3	2	7	742	789	529	828	1,073
	W6	0	0	0	0	0	0	0	146	145	0	0	217	260	204	224	365	615	493	355	416	445
	W9	0	0	0	0	0	0	0	0	0	0	11	902	699	444	507	508	1,077	915	627	1,111	1,176
WHR	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,229	1,376	772	1,104	1,204	1,352	760	614	1,229	1,131	1,010
	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	137	137	137	137	137	137	137	137	137	137	91	102	57	82	89	100	56	46	91	84	75
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	680	762	427	612	666	748	421	340	680	627	559
	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Pumping (NCWD)		1,170	1,350	1,178	1,147	1,549	1,644	1,842	2,127	2,283	2,367	1,936	1,864	1,994	1,977	2,225	1,675	1,803	2,309	1,761	1,676	1,508
Total Pumping (NLF)		11,331	13,237	9,684	7,983	11,237	9,328	8,287	6,512	5,951	6,243	8,225	7,039	8,938	8,020	10,606	11,174	12,020	12,826	10,250	13,824	11,857
Total Pumping (SCWC)		9,460	7,109	4,091	4,269	6,057	6,242	5,409	5,582	5,079	5,785	5,983	5,693	8,288	12,016	10,996	10,217	10,445	11,268	11,426	13,741	11,529
Total Pumping (VWC)		5,995	5,597	3,415	3,387	4,975	4,633	5,167	4,921	4,835	5,826	5,232	9,951	6,615	5,815	6,847	8,698	12,433	11,696	10,711	11,823	12,179
Total Pumping (WHR)		3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	2,000	2,240	1,256	1,798	1,959	2,200	1,237	1,000	2,000	1,842	1,644
Total Pumping (All Purveyors)		30,956	30,293	21,368	19,786	26,818	24,847	23,705	22,142	21,148	23,221	23,376	26,687	27,091	29,626	32,633	33,964	37,938	39,099	36,148	42,906	38,717
Total Pumping (Others)		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	932	953	890
Total Alluvial Aquifer Pumping		31,456	30,793	21,868	20,286	27,318	25,347	24,205	22,642	21,648	23,721	23,876	27,187	27,591	30,126	33,133	34,464	38,438	39,599	37,080	43,859	39,607

Notes:

N. = north

WHR = Wayside Honor Rancho, owned by LACWWD

All pumping volumes are listed in acre-feet.

Data source: Luhdorff and Scalmanini, Consulting Engineers. April 2003. *Santa Clarita Valley Water Report 2002.* Prepared for the Castaic Lake Water Agency, Los Angeles County Waterworks District #36, Newhall County Water District, and Valencia Water Company.

TABLE 2-2

Annual Groundwater Pumping from the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
NCWD	7	404	396	350	348	355	384	271	260	332	242	242	274	180	268	321	364	332	288	280	172	0
	4	440	449	319	385	315	369	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9	0	0	0	0	119	227	115	138	1	0	5	1	1	0	4	1	1	0	1	0	0
	10	790	906	1,287	1,300	1,007	997	731	888	613	453	644	343	351	61	0	1	0	0	2	0	0
	11	729	870	716	754	1,159	1,278	2,209	2,371	1,265	1,280	1,252	1,034	428	730	614	522	353	81	14	0	0
	12	0	0	0	0	0	0	0	0	1,830	2,713	2,603	3,342	2,807	1,956	1,918	2,264	2,140	1,798	1,909	1,155	1,767
	13	0	0	0	0	0	0	0	0	0	0	0	0	1,393	2,053	2,248	1,623	2,045	3,001	2,351	1,295	419
NLF	156	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374
SCWC	Saugus1	0	0	0	0	0	0	0	0	31	0	0	1,690	437	1,226	1,333	0	410	451	0	0	0
	Saugus2	0	0	0	0	0	0	0	0	32	0	40	3,091	2,476	1,675	2,530	1,726	1,766	617	0	0	0
VWC	157	635	604	529	239	387	314	581	483	1,223	1,146	635	1,005	570	436	616	403	46	80	0	0	0
	159	0	0	0	0	0	0	0	0	0	0	3	63	65	74	147	68	3	0	0	0	0
	160	1,571	1,725	368	372	467	571	846	822	1,077	1,326	839	1,325	580	920	957	585	206	401	133	95	776
	201	0	0	0	0	0	0	0	0	0	57	2,039	2,249	1,170	752	845	530	71	35	16	11	172
	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	59
Total Pumping (NCWD)		2363	2621	2672	2787	2955	3255	3548	3657	4041	4688	4746	4994	5160	5068	5103	4775	4871	5168	4557	2622	2186
Total Pumping (NLF)		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374
Total Pumping (SCWC)		0	0	0	0	0	0	0	0	63	0	40	4781	2913	2901	3863	1726	2176	1068	0	0	0
Total Pumping (VWC)		2206	2329	897	611	854	885	1427	1305	2300	2529	3516	4642	2385	2182	2565	1586	326	516	149	106	1007
Total Pumping (All Purveyors)		4,589	4,970	3,589	3,418	3,829	4,160	4,995	4,982	6,424	7,237	8,322	14,437	10,478	10,171	11,551	8,107	7,639	7,197	5,132	3,207	3,567
Total Pumping (Others)		0	0	501	434	620	555	490	579	504	522	539	480	446	439	474	453	547	548	423	509	513
Total Saugus Formation Pumping		4,589	4,970	4,090	3,852	4,449	4,715	5,485	5,561	6,928	7,759	8,861	14,917	10,924	10,610	12,025	8,560	8,186	7,745	5,555	3,716	4,080

Note:

All pumping volumes are listed in acre-feet.

Data source: Luhdorff and Scalmanini, 2003.

TABLE 2-3

Summary of Selected Tests and Estimated Parameter Values for the Alluvial Aquifer

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Area	Well Owner-Name	Estimated T (ft^2/day)	Model T (ft^2/day)	Estimated K (ft/day)	Model K (ft/day)	Model Zone
West of I-5	NLF-B5	80,000 to 150,000	60,500	750 to 1,400	550	C1c
	NLF-B6	40,000 to 70,000	60,500	100 to 600	550	C1c
	NLF-C4	20,000 to 35,000	60,500	100 to 300	550	C1b
	NLF-E5	40,000 to 55,000	71,500	100 to 400	550	C1a
Between I-5	VWC-I	30,000 to 45,000	22,500	250 to 350	375	B1b2
and Soledad	VWC-K2	60,000 to 90,000	54,375	400 to 600	375	B1a
Canyon	VWC-N3	55,000 to 80,000	79,750	375 to 550	550	B1a
	VWC-N4	75,000 to 100,000	54,375	500 to 750	375	B1a
	VWC-Q2	35,000 to 50,000	79,750	250 to 350	550	B1a
	NLF-R2	50,000 to 105,000	22,050	600 to 1,200	245	B1a
	NLF-S	35,000 to 85,000	54,375	250 to 600	375	B1a
	NLF-S3	35,000 to 55,000	79,750	250 to 350	550	B1a
Lower Soledad	SCWC-Stadium	85,000 to 150,000	63,250	950 to 1,650	550	A1e1
Canyon	VWC-U3	90,000 to 170,000	63,250	800 to 1,500	550	A1e2
	VWC-U4	65,000 to 135,000	63,250	550 to 1,200	550	A1e2
	SCWC-Honby	30,000 to 50,000	49,500	300 to 550	550	A1d1
Upper Soledad	SCWC-N.Oaks West	35,000 to 55,000	49,500	400 to 600	550	A1d4
Canyon	SCWC-N.Oaks Central	85,000 to 120,000	49,500	900 to 1,350	550	A1d4
	SCWC-N.Oaks East	50,000 to 70,000	49,500	500 to 800	550	A1d4
	SCWC-Sierra	80,000 to 145,000	49,500	900 to 1,600	550	A1c1
	SCWC-Mitchell	40,000 to 60,000	49,500	450 to 650	550	A1c2
	SCWC-Sand Canyon	35,000 to 125,000	36,000	400 to 1,400	400	A1c3
	NCWD-Pinetree 3 and 4	30,000 to 50,000	31,500	300 to 550	350	A1b1
Castaic Valley	VWC-D	30,000 to 50,000	35,000	300 to 500	350	C2b
	NLF-E	60,000 to 90,000	35,000	600 to 900	350	C2b
	NLF-E2	45,000 to 100,000	35,000	450 to 1,000	350	C2b
	WHR Wellfield	40,000 to 75,000	35,000	400 to 750	350	C2a and C2b
Northern Canyons	NLF-W4	25,000 to 35,000	10,500	250 to 350	105	B4c
	VWC-W6	25,000 to 40,000	10,500	250 to 400	105	B4c
	SCWC-Guida	45,000 to 65,000	12,600	500 to 700	140	B2b
	SCWC-Clark	55,000 to 80,000	22,050	650 to 900	245	B2c

Note:

See Section 4.3.1 for a discussion of the model zones.

TABLE 2-4

Summary of Selected Tests and Estimated Parameter Values for the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Name	Date	Type of Test	Pumping or Injection Rates (gpm)	Length of Test (minutes)	Well Monitored	Specific Capacity (gpm/ft)[a]	T (gpd/ft)	T (ft^2/day)	Storativity	Model Zone
NCWD-7	03/04/1987	Drawdown	341	1,440	NCWD-7	3.1	26,400	3,530		F
NCWD-7	03/05/1987	Recovery		1,500	NCWD-7		23,300	3,110		F
NCWD-10	03/11/1987	Drawdown	364	1,440	NCWD-10	8.3	28,500	3,810		F
NCWD-10	03/11/1987	Drawdown	364	1,440	NCWD-12 (160 feet away)		57,700	7,710	9.10E-04	F
NCWD-10	03/11/1987	Recovery		1,480	NCWD-10		38,400	5,130		F
NCWD-10	03/11/1987	Recovery		1,490	NCWD-12 (160 feet away)		61,500	8,220	7.60E-04	F
NCWD-9	03/17/1987	Drawdown	256	1,460	NCWD-9	1.9	3,700	490		A
NCWD-9	03/17/1987	Recovery		1,500	NCWD-9		3,000	400		A
VWC-160	03/24/1987	Drawdown	2,562	720	VWC-160	49.8	163,000	21,790		E
VWC-160	03/24/1987	Recovery		850	VWC-160		182,000	24,330		E
VWC-205	07/01/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-205M (40 feet)	12.2	41,370	5,530	8.88E-04	E
VWC-205	07/02/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-201 (2,400 feet)		50,450	6,740	7.56E-04	E
VWC-205	07/03/2000	Injection + Recovery	500-800-1,100	30,240 / 12,960	VWC-157 (4,100 feet)		54,880	7,340	6.45E-04	E
VWC-205	08/01/2000	Pumping	2,273	12,960 / 14,440	VWC-205	18.7				E
VWC-205	08/01/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-205M (40 feet)	18.7	78,910	10,550	9.48E-04	E
VWC-205	08/02/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-201 (2,400 feet)		76,410	10,220	1.37E-03	E
VWC-205	08/03/2000	Pumping + Recovery	2,273	12,960 / 14,440	VWC-157 (4,100 feet)		65,880	8,810	1.36E-03	E
VWC-201	10/01/2000	Pumping	2,439	14,440 / 2,880	VWC-201	30	65,100	8,700	5.75E-04	E
VWC -201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-157 (1,900 feet)		44,230	5,910	1.17E-03	E
VWC-201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-205M (2,360 feet)		57,210	7,650	8.49E-04	E
VWC-201	10/01/2000	Pumping + Recovery	2,439	14,440 / 2,880	VWC-205 (2,400 feet)		47,890	6,400	6.75E-04	E
SCWC-Saugus1	07/01/1988	Pumping	2,941	1,440	SCWC-Saugus1	30.2	69,300	9,260		E
SCWC-Saugus1	07/01/1988	Recovery	2,941	480	SCWC-Saugus1		59,700	7,980		E
SCWC-Saugus2	09/01/1988	Pumping	2,531	2,880	SCWC-Saugus2	24.1	53,500	7,150		E
SCWC-Saugus2	09/01/1988	Recovery	2,531	1,320	SCWC-Saugus2		55,700	7,450		E
SCWC-Saugus2	09/01/1988	Pumping	2,531	2,880	SCWC-Saugus1		71,500	9,560	3.60E-04	E
SCWC-Saugus3	09/01/1988	Recovery	2,531	1,320	SCWC-Saugus1		60,200	8,050		E

[a]gpm/ft of drawdown

Note:

See Section 4.3.1 for a discussion of the model zones.

Data source: RCS, 2002 (except model zones)

TABLE 2-5
Recharge and Discharge Components of the Hydrologic Cycle in the Upper Santa Clara River Basin
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Recharge	Discharge
Surface Water	
Direct runoff of precipitation	Evapotranspiration of precipitation
Precipitation runoff from upstream watershed areas	Santa Clara River flow to Ventura County
Castaic Lake/Lagoon releases into Castaic Creek	Streamflow seepage to the Alluvial Aquifer
WRP discharges into the Santa Clara River	Evapotranspiration of applied irrigation water
Groundwater seepage into the Santa Clara River	
Irrigation return flows (agricultural and urban)	
Groundwater	
Infiltration of precipitation	Pumping
Infiltration of outdoor applied water (agricultural and urban)	Evapotranspiration of Alluvial Aquifer groundwater by riparian vegetation
Alluvial Aquifer subsurface inflow (Castaic Dam)	Alluvial Aquifer subsurface outflow (western study area boundary)
Streamflow seepage to Alluvial aquifer	Groundwater seepage into the Santa Clara River

Notes:

The two sources of water for agricultural and municipal water uses in the basin are groundwater pumping and imported water from the SWP.

Because SWP water is stored in Castaic Lake, which is outside the limits of the Alluvial and Saugus aquifers, it is not considered to be a part of the valley's hydrologic cycle while it is still in storage. However, SWP water that is land-applied or that is discharged from a WRP qualifies as a component of the hydrologic cycle. In addition, subsurface groundwater flow occurs into the Santa Clarita Valley beneath Castaic Creek due to water seepage beneath Castaic Dam.

TABLE 2-6
Estimated Annual Groundwater Discharge to the Santa Clara River
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Total Gaged Flow at Mouth of Castaic Creek (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[a]	Local Rainfall Condition[b]
1953	0	4,986	4,943	0	4,943	4.88	Dry
1954	977	7,316	5,554	0	5,554	15.82	Normal
1955	134	4,795	4,122	0	4,122	13.91	Normal
1956	311	5,429	3,803	0	3,803	14.21	Normal
1957	559	4,782	2,410	0	2,410	22.85	Wet
1958	21,204	38,756	5,344	0	5,344	23.14	Wet
1959	473	3,277	2,206	0	2,206	9.81	Dry
1960	1	777	586	0	586	11.64	Dry
1961	79	804	410	0	410	8.82	Dry
1962	5,101	28,460	2,433	0	2,433	21.22	Wet
1963	32	1,884	1,058	0	1,058	12.79	Normal
1964	1	1,030	646	0	646	10.09	Dry
1965	3,702	35,614	996	0	996	32.28	Wet
1966	5,780	10,101	2,332	No data	---	14.57	Normal
1967	27,819	40,480	8,640	No data	---	23.23	Wet
1968	4,381	7,216	3,895	No data	---	6.90	Dry
1969	46,461	258,660	29,395	No data	---	32.42	Wet
1970	6,597	31,066	14,924	No data	---	23.19	Wet
1971	2,310	15,883	10,843	No data	---	13.75	Normal
1972	2,205	16,027	12,975	No data	---	4.15	Dry
1973	12,671	52,631	26,115	No data	---	19.79	Wet
1974	7,288	25,265	11,918	No data	---	18.04	Wet
1975	2,027	14,770	10,806	5,534	5,272	10.92	Dry
1976	156	10,162	9,754	6,095	3,659	14.02	Normal
1977	1,380	13,454	9,359	6,004	3,355	20.87	Wet
1978	35,378	129,187	60,955	6,982	53,973	42.17	Wet
1979	13,626	57,594	42,448	7,397	35,051	21.47	Wet
1980	16,785	95,211	57,593	7,372	50,221	27.00	Wet
1981	6,519	24,232	21,172	7,949	13,223	13.42	Normal
1982	9,102	36,488	32,531	8,436	24,095	20.20	Wet
1983	67,058	131,236	55,878	9,420	46,458	39.07	Wet
1984	13,787	39,279	35,215	9,512	25,703	12.86	Normal
1985	2,619	24,466	24,089	9,614	14,475	8.37	Dry
1986	4,945	48,024	31,327	10,822	20,505	18.02	Wet

TABLE 2-6
Estimated Annual Groundwater Discharge to the Santa Clara River
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Total Gaged Flow at Mouth of Castaic Creek (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[a]	Local Rainfall Condition[b]
1987	911	26,198	23,663	11,844	11,819	14.45	Normal
1988	2,415	36,611	24,934	12,363	12,571	16.92	Wet
1989	Unavailable	24,799	23,453	13,560	9,893	7.56	Dry
1990	0	23,472	21,772	14,006	7,766	6.98	Dry
1991	65	34,901	18,702	14,108	4,594	17.21	Wet
1992	4,450	68,577	23,601	15,703	7,898	32.03	Wet
1993	7,725	152,783	65,054	17,179	47,875	32.72	Wet
1994	Unavailable	32,039	31,239	16,946	14,293	10.27	Dry
1995	5,611	82,409	51,001	17,824	33,177	29.15	Wet
1996	5,632	47,930	36,366	16,831	19,535	15.88	Normal
1997	9,885	36,780	27,521	15,778	11,743	13.35	Normal
1998	47,803	205,139	81,744	17,695	64,049	30.73	Wet
1999	5,830	32,382	27,176	17,847	9,329	8.96	Dry

[a]Annual rainfall values are based on monthly records for this gage, as reported by NCDC and LADPW.

[b]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-7
Statistics on Annual Groundwater Discharge to the Santa Clara River, All Years
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	311	4,795	2,410	0	2,410	13.91
Average	2,506	10,608	2,655	0	2,655	15.50
Maximum	21,204	38,756	5,554	0	5,554	32.28
Statistics for 1975 through 1999						
Minimum	0	10,162	9,359	5,534	3,355	6.98
Median	5,632	36,611	27,521	11,844	14,293	16.92
Average	11,466	57,125	33,894	11,873	22,021	19.38
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	3,161	30,250	22,613	11,844	8,613	15.14
Average	8,230	41,211	23,207	11,873	15,396	18.05
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	4,450	28,460	18,702	11,844	8,613	15.82
Average	9,151	43,050	21,338	11,873	15,396	17.92
Maximum	67,058	258,660	81,744	17,847	64,049	42.17

TABLE 2-8
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1965 vs. 1975 through 1999
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 5 Dry Years during 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	1	1,030	646	0	646	9.81
Average	111	2,175	1,758	0	1,758	9.05
Maximum	473	4,986	4,943	0	4,943	11.64
Statistics for 4 Normal Years during 1953 through 1965						
Minimum	32	1,884	1,058	0	1,058	12.79
Median	222	5,112	3,963	0	3,963	14.06
Average	363	4,856	3,634	0	3,634	14.18
Maximum	977	7,316	5,554	0	5,554	15.82
Statistics for 4 Wet Years during 1953 through 1965						
Minimum	559	4,782	996	0	996	21.22
Median	4,402	32,037	2,421	0	2,421	23.00
Average	7,641	26,903	2,796	0	2,796	24.87
Maximum	21,204	38,756	5,344	0	5,344	32.28
Statistics for 6 Dry Years during 1975 through 1999						
Minimum	0	14,770	10,806	5,534	5,272	6.98
Median	2,323	24,633	23,771	13,783	9,611	8.67
Average	2,619	25,322	23,089	12,918	10,171	8.84
Maximum	5,830	32,382	31,239	17,847	14,475	10.92
Statistics for 6 Normal Years during 1975 through 1999						
Minimum	156	10,162	9,754	6,095	3,659	12.86
Median	6,076	31,489	25,592	10,678	12,521	13.72
Average	6,148	30,763	25,615	11,335	14,280	14.00
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 13 Wet Years during 1975 through 1999						
Minimum	65	13,454	9,359	6,004	3,355	16.92
Median	7,725	68,577	42,448	10,822	33,177	27.00
Average	16,642	83,970	42,702	11,639	31,063	26.74
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-9
Statistics on Annual Groundwater Discharge to the Santa Clara River, Including and Excluding 1966 through 1974
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 13 Dry Years during 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	473	14,770	10,806	13,783	5,272	8.82
Average	1,601	14,311	12,630	12,918	6,347	8.41
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 12 Normal Years during 1953 through 1999						
Minimum	0	7,316	2,433	6,004	2,433	13.35
Median	5,101	26,198	21,172	11,844	11,743	16.92
Average	5,238	27,883	16,963	10,788	8,671	17.10
Maximum	12,671	52,631	27,521	15,778	13,223	21.22
Statistics for 22 Wet Years during 1953 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	7,507	44,252	25,525	10,822	20,505	23.17
Average	15,807	73,060	29,877	11,639	24,412	25.62
Maximum	67,058	258,660	81,744	17,824	64,049	42.17
Statistics for 11 Dry Years during 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	79	14,770	10,806	13,783	5,272	8.96
Average	1,226	14,800	13,393	12,918	6,347	8.94
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 10 Normal Years during 1953 through 1965 and 1975 through 1999						
Minimum	32	1,884	1,058	6,095	1,058	12.79
Median	944	17,197	15,463	10,678	8,649	13.97
Average	3,834	20,400	16,823	11,335	10,022	14.07
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 17 Wet Years during 1953 through 1965 and 1975 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	5,611	48,024	31,327	10,822	20,505	23.14
Average	14,524	70,543	33,312	11,639	24,412	26.30
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-10
Historical Hydrology in Northern California and the Santa Clarita Valley
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Northern California Hydrology[a]	Local Hydrology[b]
1944	Dry	Wet
1945	Below Normal	Normal
1946	Below Normal	Wet
1947	Dry	Dry
1948	Below Normal	Dry
1949	Dry	Dry
1950	Below Normal	Dry
1951	Above Normal	Normal
1952	Wet	Wet
1953	Wet	Dry
1954	Above Normal	Normal
1955	Dry	Normal
1956	Wet	Normal
1957	Above Normal	Wet
1958	Wet	Wet
1959	Below Normal	Dry
1960	Dry	Dry
1961	Dry	Dry
1962	Below Normal	Wet
1963	Wet	Normal
1964	Dry	Dry
1965	Wet	Wet
1966	Below Normal	Normal
1967	Wet	Wet
1968	Below Normal	Dry
1969	Wet	Wet
1970	Wet	Wet
1971	Wet	Normal
1972	Below Normal	Dry
1973	Above Normal	Wet
1974	Wet	Wet
1975	Wet	Dry
1976	Critical	Normal
1977	Critical	Wet
1978	Above Normal	Wet
1979	Below Normal	Wet

TABLE 2-10
Historical Hydrology in Northern California and the Santa Clarita Valley
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Northern California Hydrology[a]	Local Hydrology[b]
1980	Above Normal	Wet
1981	Dry	Normal
1982	Wet	Wet
1983	Wet	Wet
1984	Wet	Normal
1985	Dry	Dry
1986	Wet	Wet
1987	Dry	Normal
1988	Critical	Wet
1989	Dry	Dry
1990	Critical	Dry
1991	Critical	Wet
1992	Critical	Wet
1993	Above Normal	Wet
1994	Critical	Dry
1995	Wet	Wet
1996	Wet	Normal
1997	Wet	Normal
1998	Wet	Wet
1999	Wet	Dry

[a]Defined by water year, using the Sacramento Four Rivers Index (Figure 3-4 in Bulletin 160-98; DWR, 1998): wet = wettest; critical = driest.

[b]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-11
Historical State Water Project Allocations and Local Hydrology, 1980 through 1999
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	SWP Hydrology[a]	SWP Allocations[b]	Local Hydrology[c]
1980	Above Normal	100%	Wet
1981	Dry	100%	Normal
1982	Wet	100%	Wet
1983	Wet	100%	Wet
1984	Wet	100%	Normal
1985	Dry	100%	Dry
1986	Wet	100%	Wet
1987	Dry	85%	Normal
1988	Critical	100%	Wet
1989	Dry	100%	Dry
1990	Critical	100%	Dry
1991	Critical	30%	Wet
1992	Critical	45%	Wet
1993	Above Normal	85%	Wet
1994	Critical	50%	Dry
1995	Wet	80%	Wet
1996	Wet	100%	Normal
1997	Wet	100%	Normal
1998	Wet	100%	Wet
1999	Wet	100%	Dry

[a]Defined by water year, using the Sacramento Four Rivers Index (Figure 3-4 in Bulletin 160-98; DWR, 1998): wet = wettest; critical = driest. SWP = State Water Project.

[b]Contractor demands, and therefore requests for water, have been increasing through the time period shown. Water allocations in the earlier part of the time period reflect that 100% of contractor requests were met. Those requests were for amounts of water less than the full SWP contract (i.e., Table A) amounts totaling 4.1 million acre-feet. In recent years, SWP contractors have been requesting nearly all of the 4.1 million acre-foot Table A amount contained in the 29 SWP contracts.

[c]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-12

Castaic Creek Flood Flows

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Water Year[a]	Natural Inflows	Flood Flows 10/1 - 4/30	Late Flood Flows[b] 5/1 - 9/30	Total Flood Flows	Net Flood Flows[c]	Flood Flow Shares				Total NLF/LACWWD/ NCWD Flood Flows
						UWCD 48%	NLF 44.867%	LACWWD 4.471%	NCWD 2.662%	
1977	752	0	0	0	0	0	0	0	0	0
1978	92,780	89,592	325	89,917	67,438	32,370	30,257	3,015	1,795	35,068
1979	31,440	19,641	0	19,641	14,731	7,071	6,609	659	392	7,660
1980	54,158	47,625	101	47,726	35,794	17,181	16,060	1,600	953	18,613
1981	6,186	628	0	628	471	226	211	21	13	245
1982	8,930	3,544	0	3,544	2,658	1,276	1,193	119	71	1,382
1983	78,010	74,287	3,020	77,307	57,981	27,831	26,014	2,592	1,543	30,150
1984	10,582	2,106	0	2,106	1,580	758	709	71	42	822
1985	3,361	0	0	0	0	0	0	0	0	0
1986	20,005	13,867	0	13,867	10,400	4,992	4,666	465	277	5,408
1987	1,212	0	0	0	0	0	0	0	0	0
1988	4,401	807	0	807	605	290	272	27	16	315
1989	919	0	0	0	0	0	0	0	0	0
1990	540	0	0	0	0	0	0	0	0	0
1991	6,719	4,375	0	4,375	3,281	1,575	1,472	147	87	1,706
1992	29,409	22,631	0	22,631	16,973	8,147	7,615	759	452	8,826
1993	81,264	77,722	0	77,722	58,291	27,980	26,154	2,606	1,552	30,312
1994	6,424	502	0	502	377	181	169	17	10	196
1995	57,914	53,363	0	53,363	40,022	19,211	17,957	1,789	1,065	20,812
1996	7,105	1,654	0	1,654	1,241	596	557	55	33	645
1997	9,028	3,918	0	3,918	2,938	1,410	1,318	131	78	1,528
1998	68,846	66,597	11,639	78,236	58,677	28,165	26,327	2,623	1,562	30,512
1999	7,793	238	0	238	179	86	80	8	5	93
2000	7,212	4,118	0	4,118	3,088	1,482	1,386	138	82	1,606
Totals	**594,990**	**487,215**	**15,085**	**502,300**	**376,725**	**180,828**	**169,025**	**16,843**	**10,028**	**195,897**
Average	**24,791**	**20,301**	**629**	**20,929**	**15,697**	**7,535**	**7,043**	**702**	**418**	**8,162**
Median	**8,362**	**3,731**	**0**	**3,731**	**2,798**	**1,343**	**1,255**	**125**	**74**	**1,455**

[a]A water year is from October 1 to September 30, but the flood flow water is generally available only from October 1 through April 30.

[b]Late flood flows are from May 1 through September 30.

[c]Net flood flows are 75% of total flood flows.

Note:

All flows are listed in acre-feet.

Figures

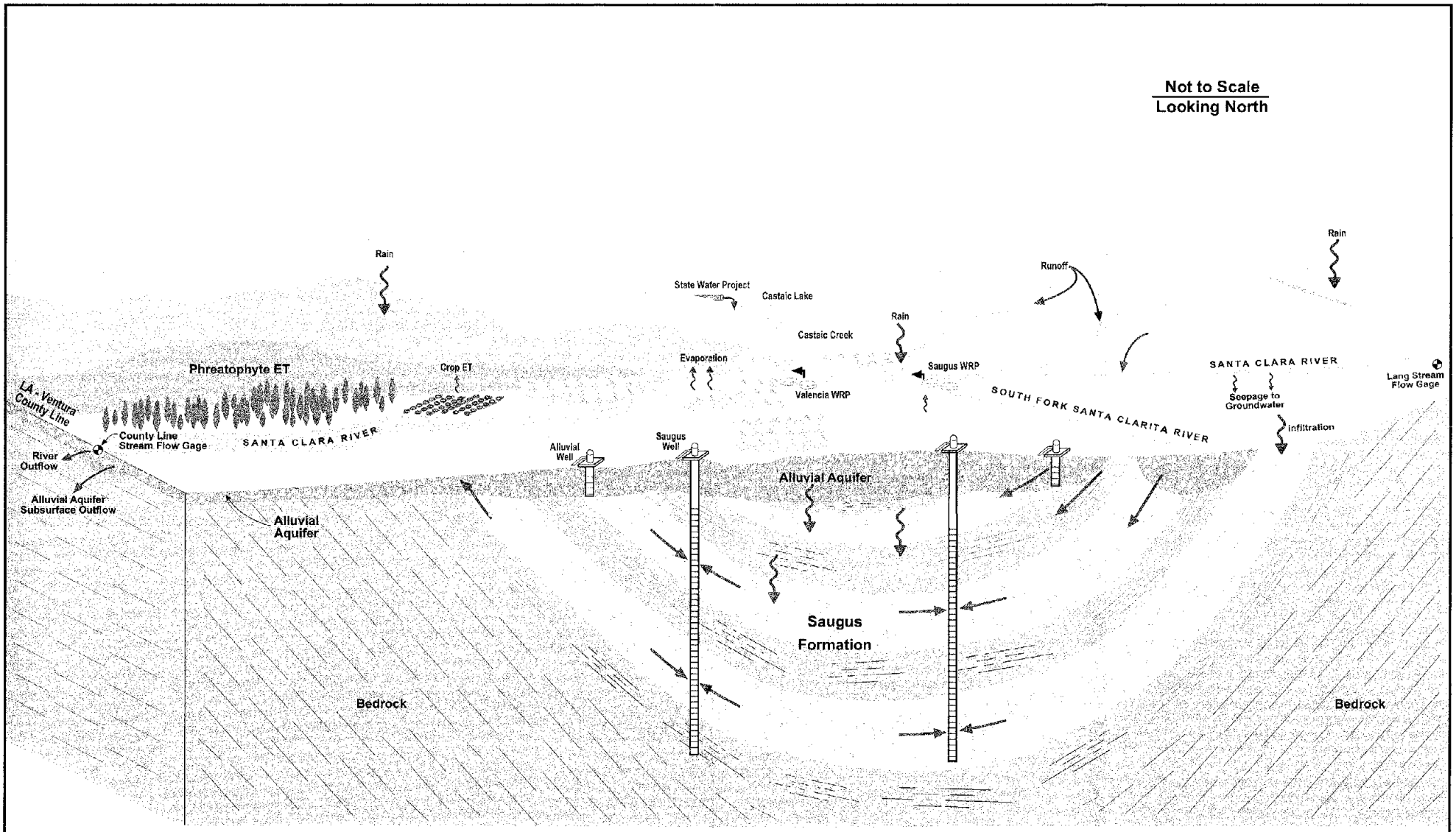

FIGURE 2-1
SANTA CLARITA VALLEY HYDROLOGY
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

E012004006RDD_01 (1/20/04)

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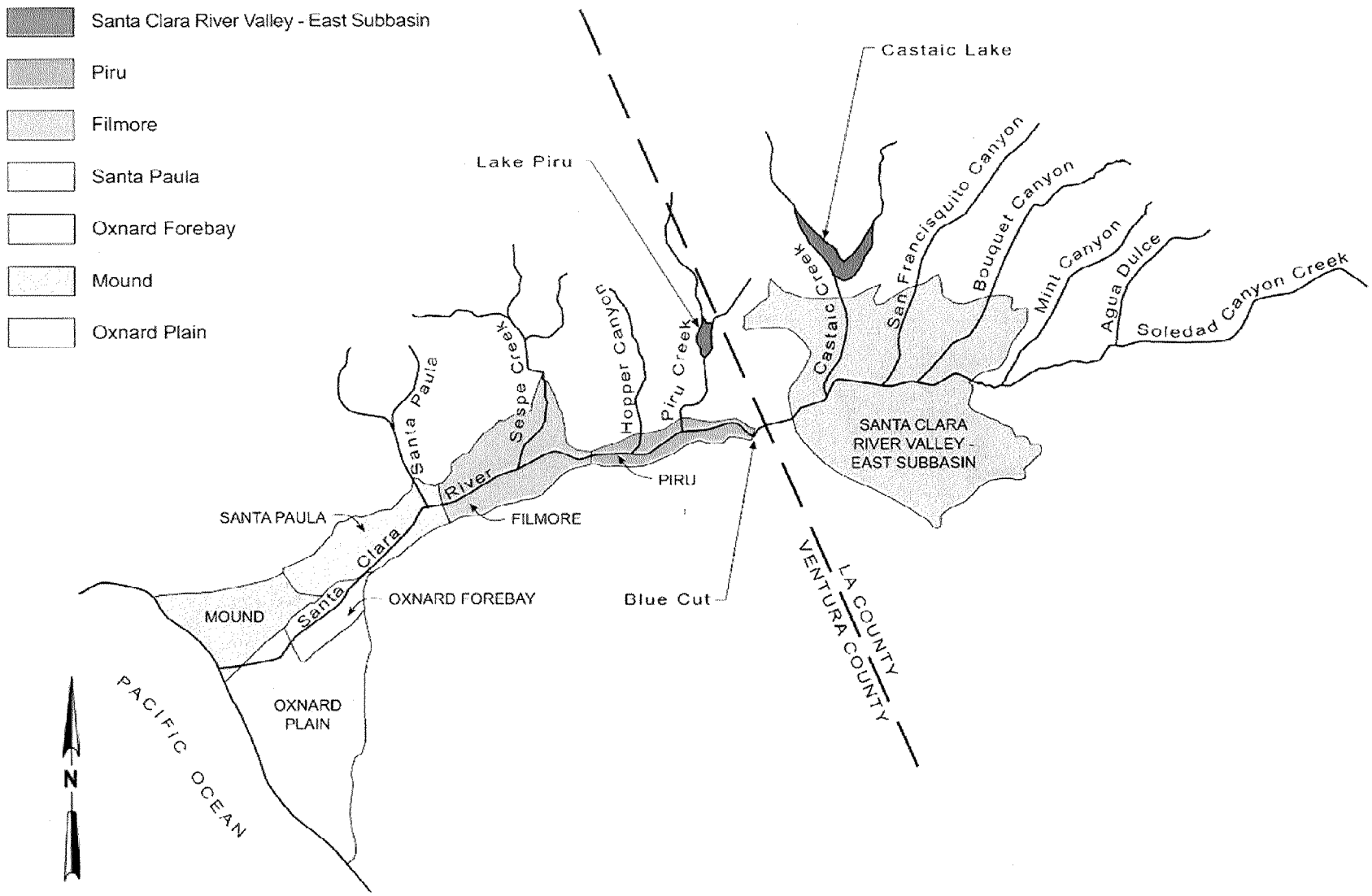

FIGURE 2-2
GROUNDWATER BASINS IN THE SANTA CLARA RIVER DRAINAGE
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-001.FH9

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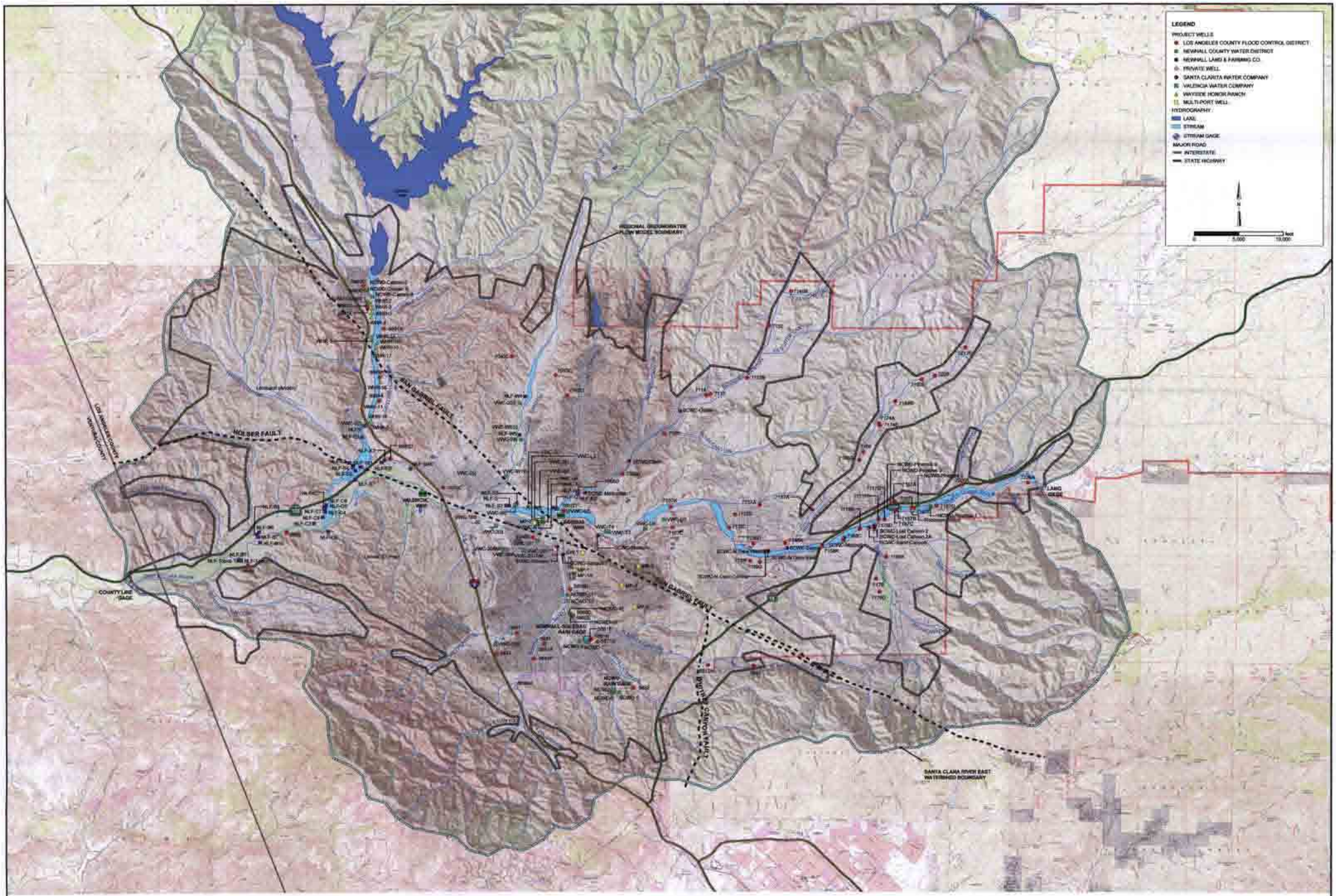

FIGURE 2-3
WELL LOCATIONS AND FEATURES MAP
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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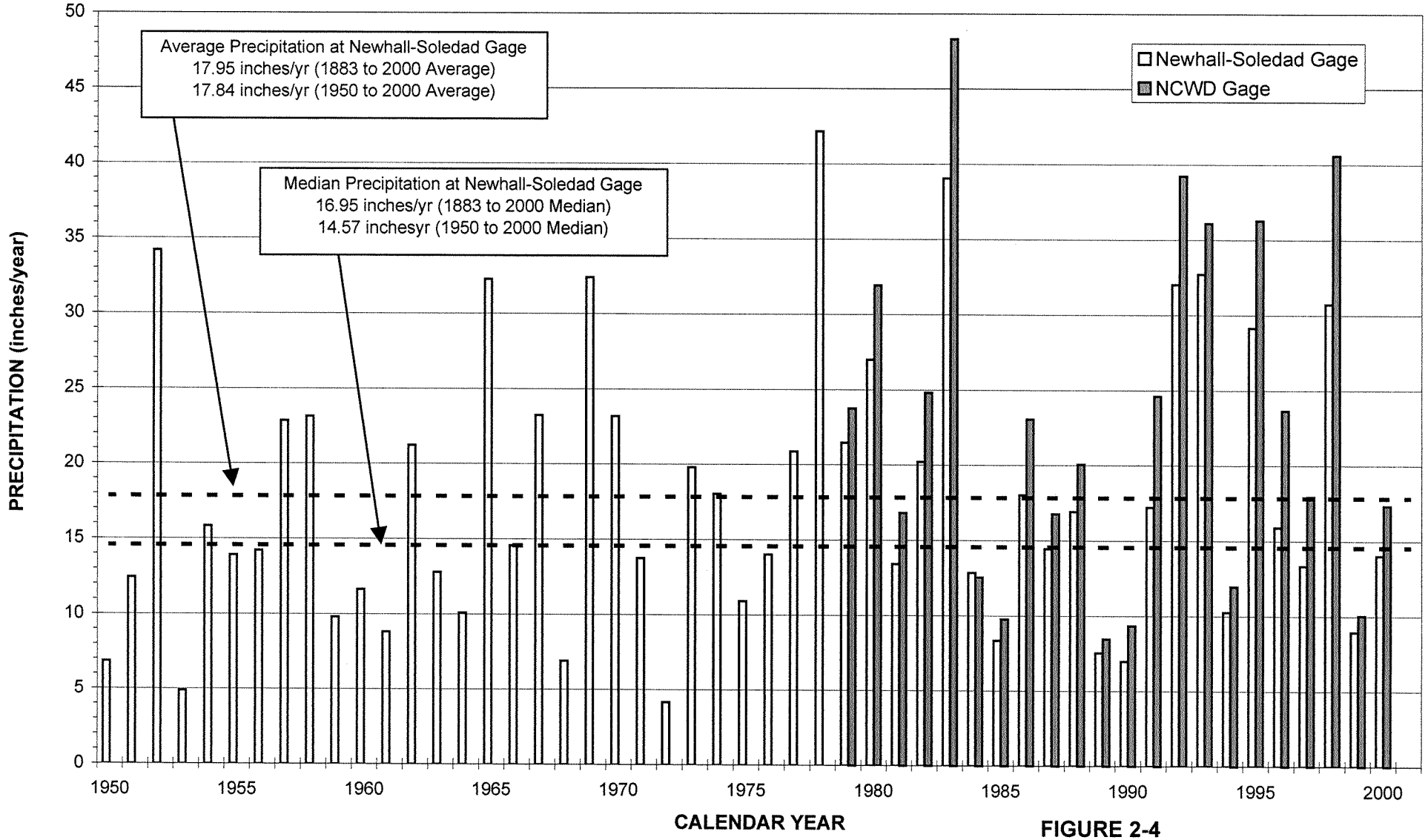

FIGURE 2-4
ANNUAL PRECIPITATION AT THE NEWHALL-SOLEDAD AND NCWD RAIN GAGES SINCE 1950
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-401.xls\Fig 2-4

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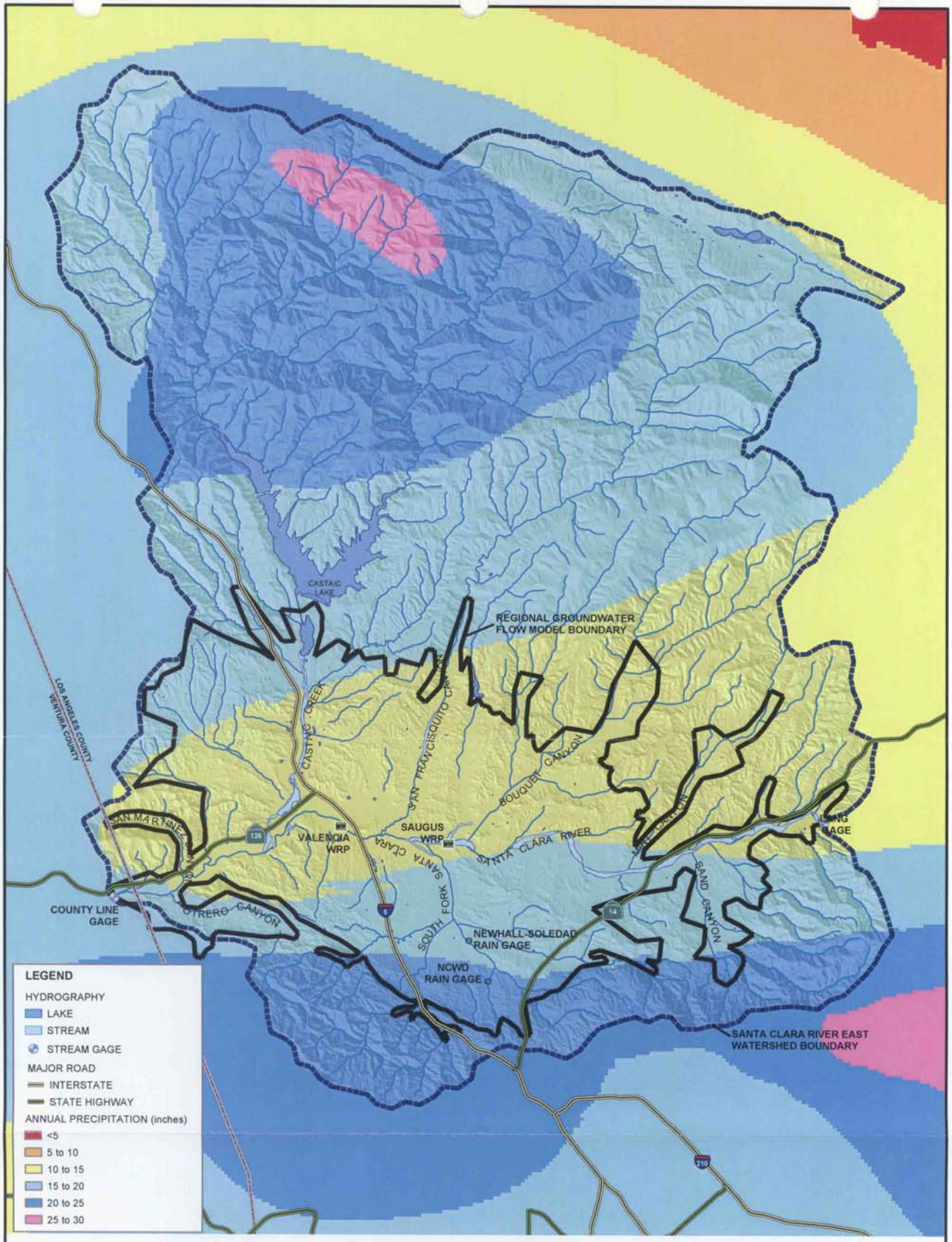

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

FIGURE 2-5
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0205.MXD FIG0205.PDF

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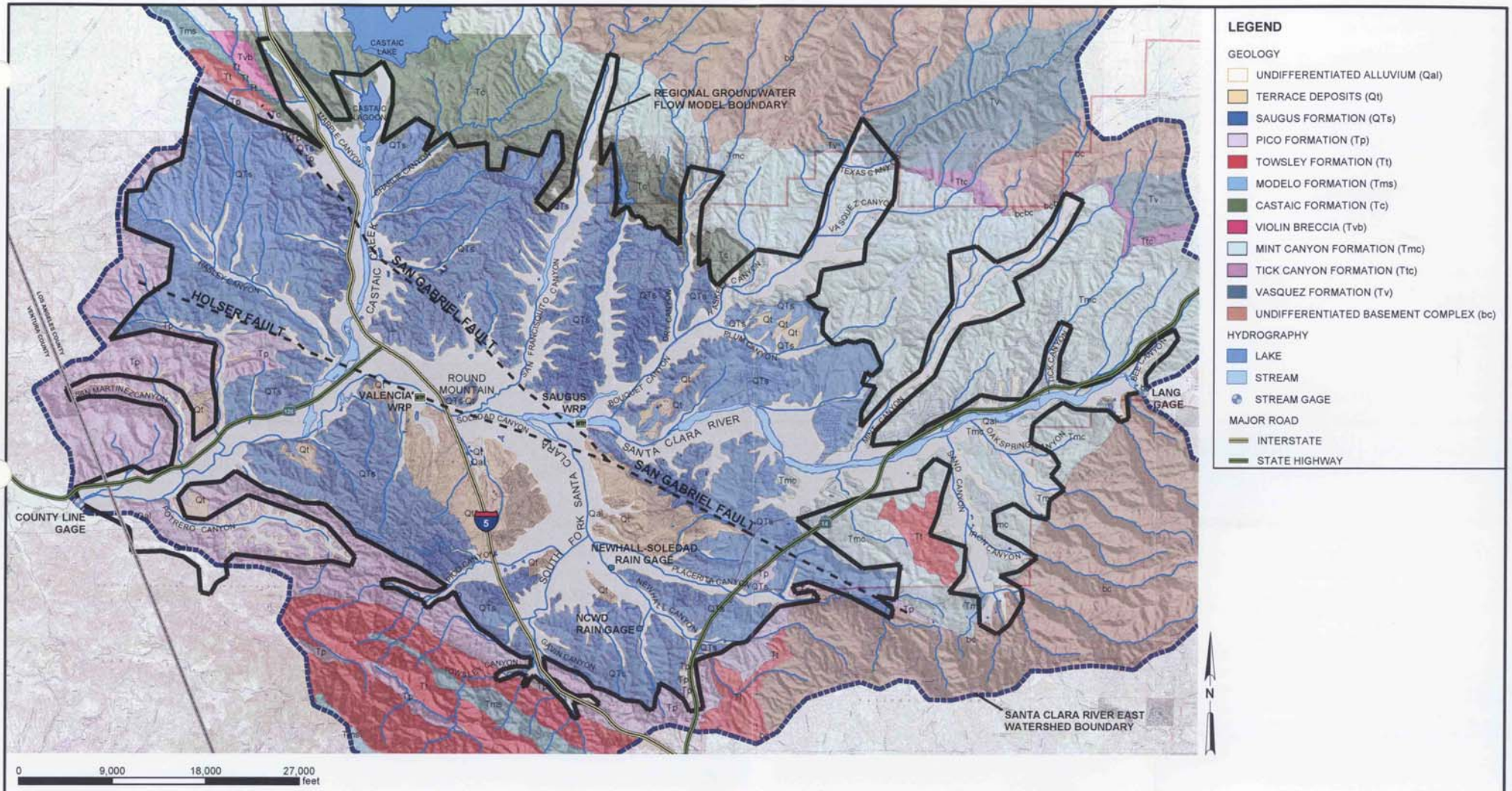
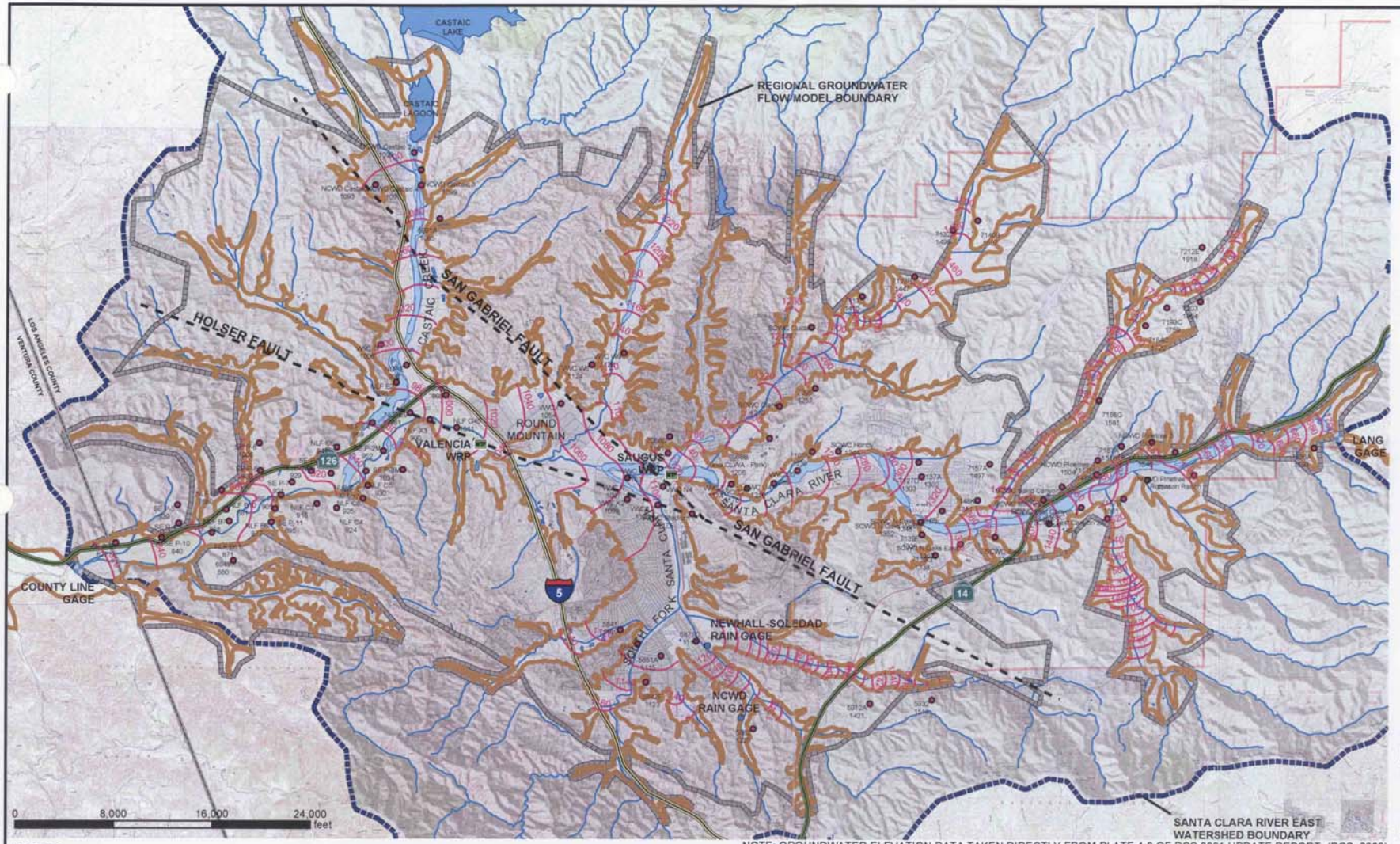


FIGURE 2-6
BASIN GEOLOGIC MAP
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\RDD31002540\SANTACLARITA\MXD\FIG0206.MXD FIG02-06.PDF 04/04/2004 17:54:36



NOTE: GROUNDWATER ELEVATION DATA TAKEN DIRECTLY FROM PLATE 4-3 OF RCS 2001 UPDATE REPORT. (RCS, 2002)

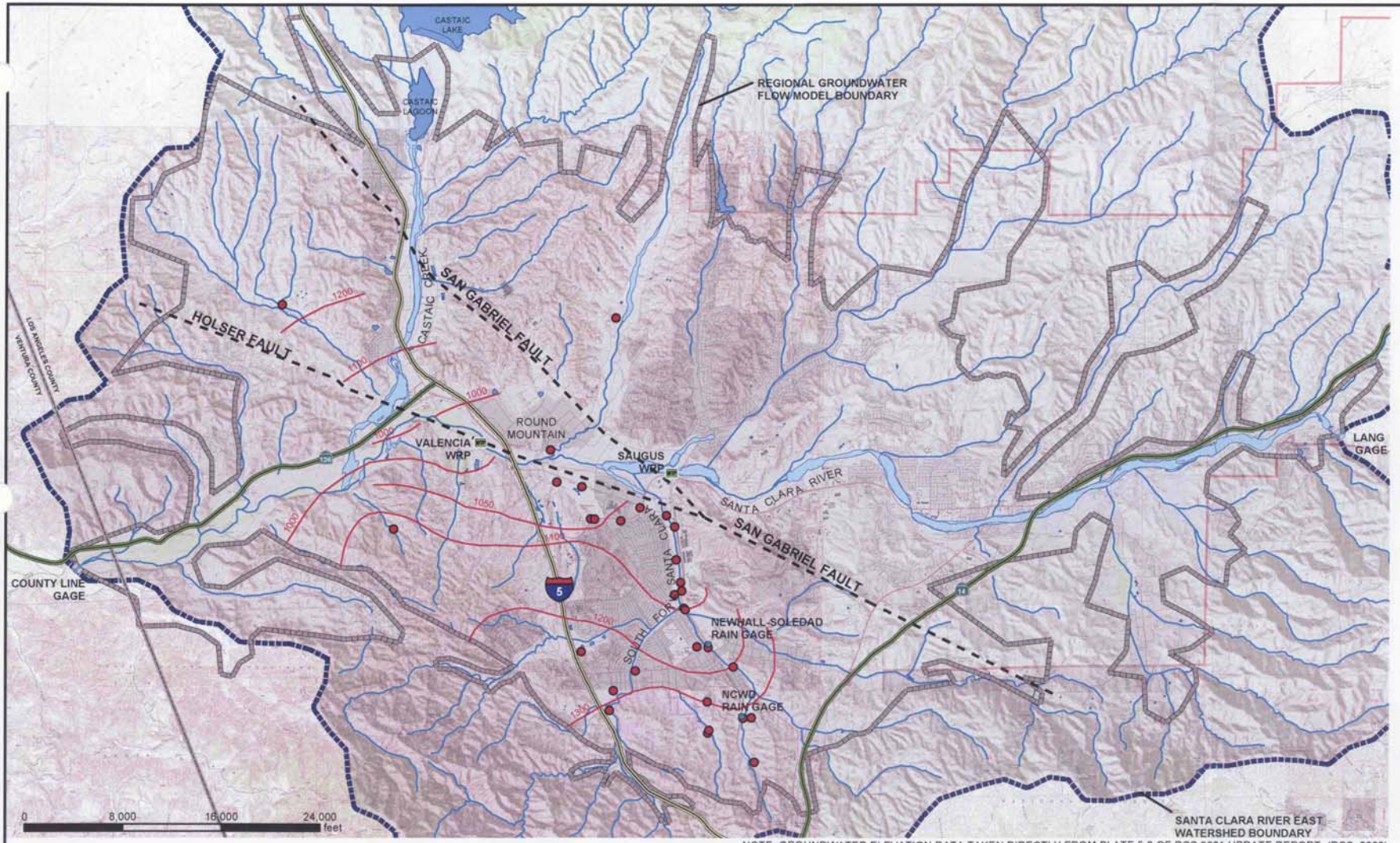
LEGEND

- CONTOUR OF SPRING 2000 GROUNDWATER ELEVATION (feet MSL)
- SPRING 2000 GROUNDWATER ELEVATION (feet MSL)
- EXTENT OF ALLUVIUM
- LAKE
- STREAM

FIGURE 2-7
GROUNDWATER ELEVATION CONTOUR MAP FOR THE ALLUVIUM – SPRING 2000
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0207.MXD FIG02-07.PDF 02/02/2004 12:27:27



NOTE: GROUNDWATER ELEVATION DATA TAKEN DIRECTLY FROM PLATE 5-3 OF RCS 2001 UPDATE REPORT. (RCS, 2002)

LEGEND

- SAUGUS WELLS
- CONTOUR OF FALL 2000 GR0UNDWATER ELEVATION (feet MSL)
- LAKE
- STREAM

FIGURE 2-8
GROUNDWATER ELEVATION CONTOUR MAP FOR THE SAUGUS – FALL 2000
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0208.MXD FIG02-08.PDF 02/04/2004 10:57:48

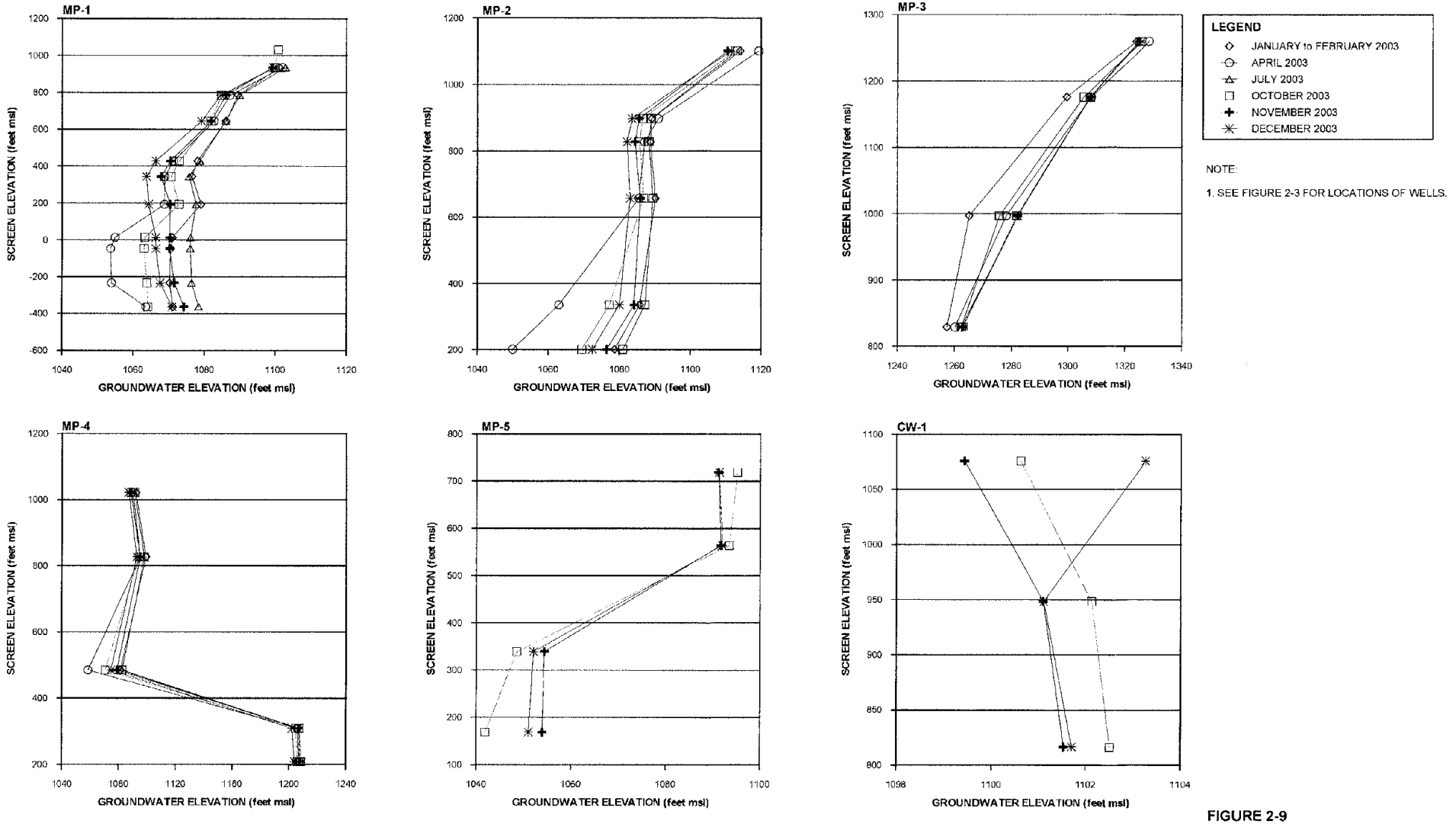

FIGURE 2-9
GROUNDWATER ELEVATIONS IN MULTI-PORT SAUGUS FORMATION MONITORING WELLS JANUARY 2003 THROUGH DECEMBER 2003
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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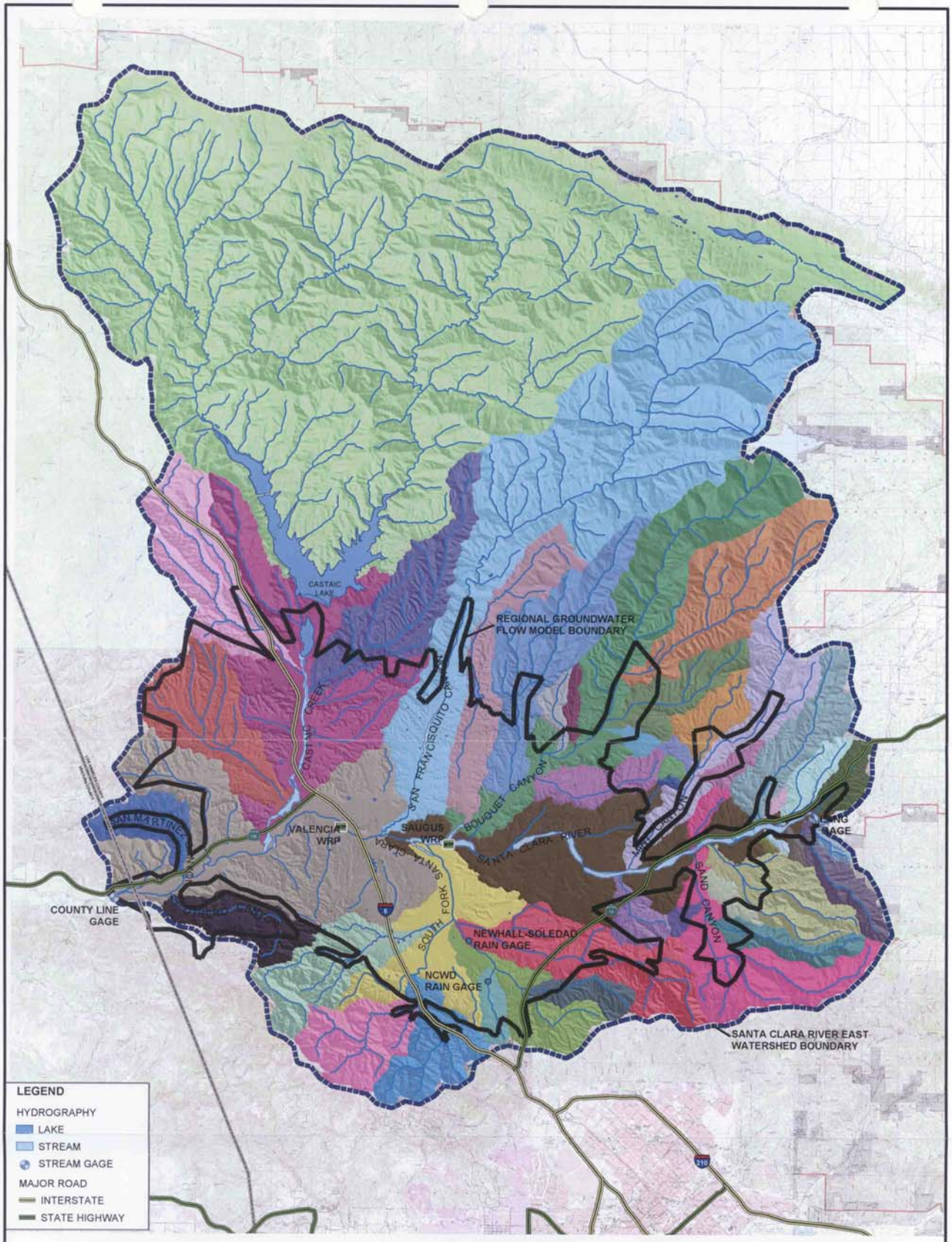

FIGURE 2-10
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

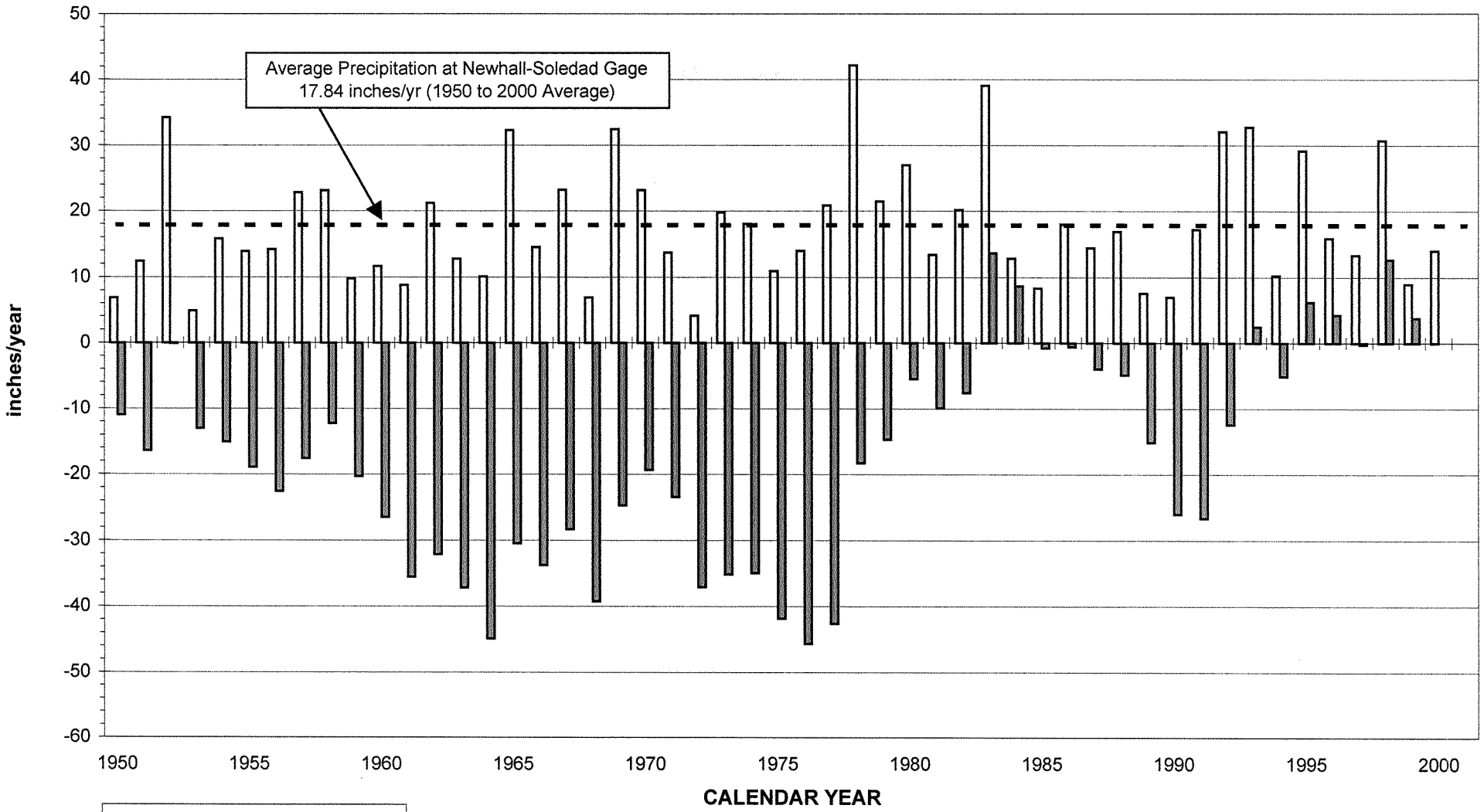

FIGURE 2-11
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 TO 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE SINCE 1950
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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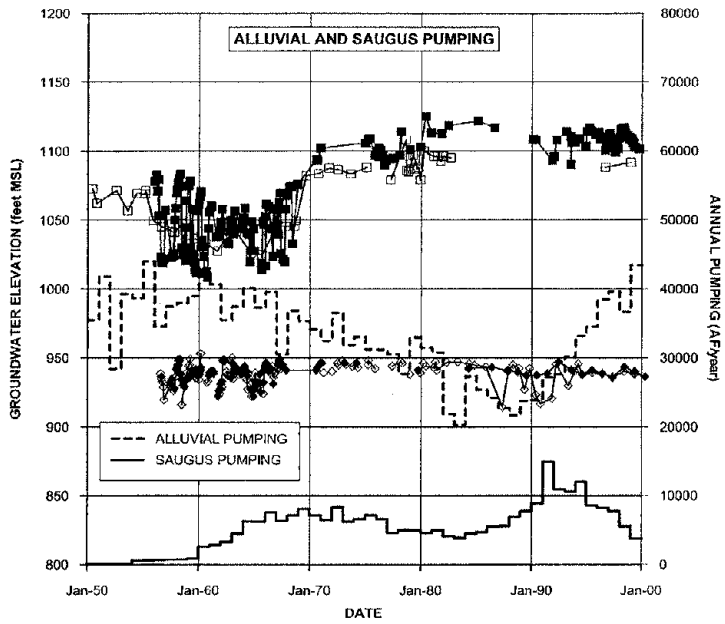

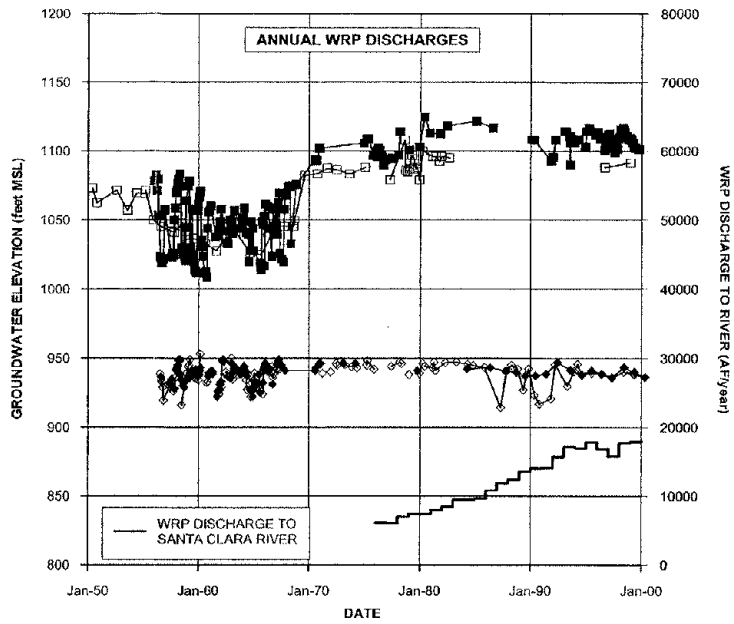

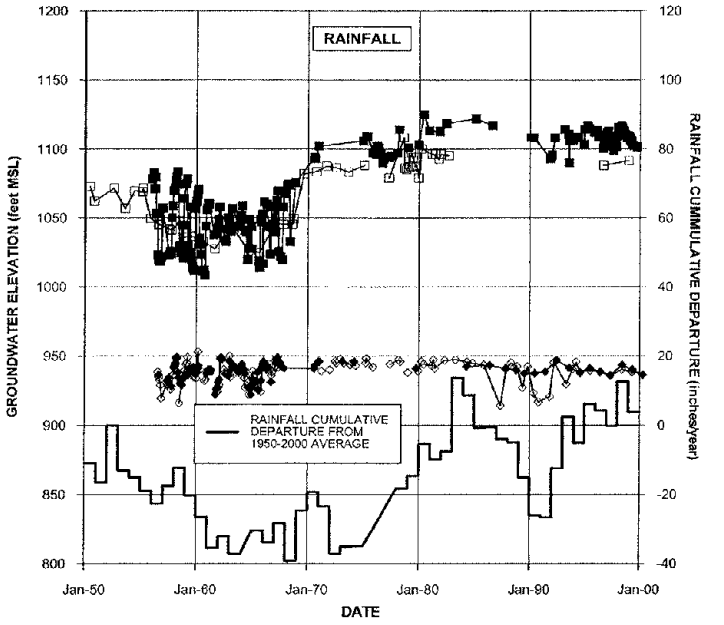

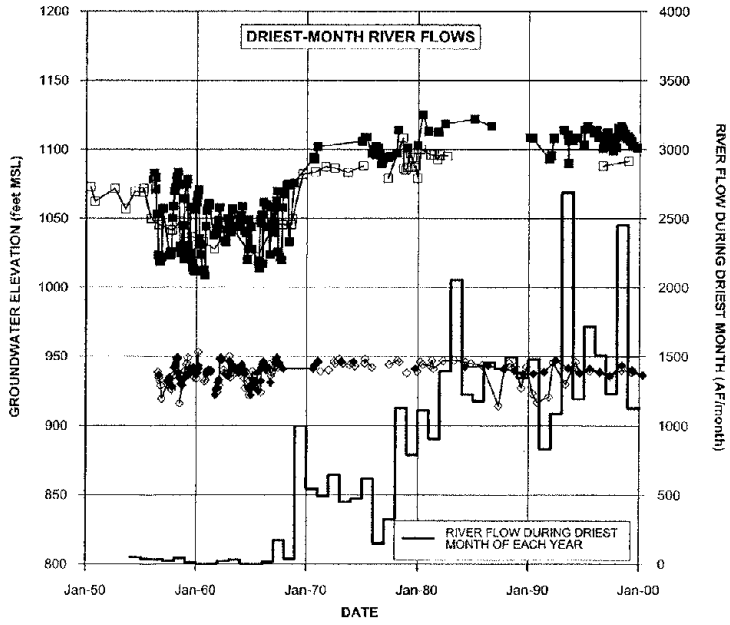

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N
- ELEVATION OF GROUNDWATER IN NLF-S
- ELEVATION OF GROUNDWATER IN NLF-C5
- ELEVATION OF GROUNDWATER IN NLF-C7

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-12
ALLUVIAL GROUNDWATER ELEVATIONS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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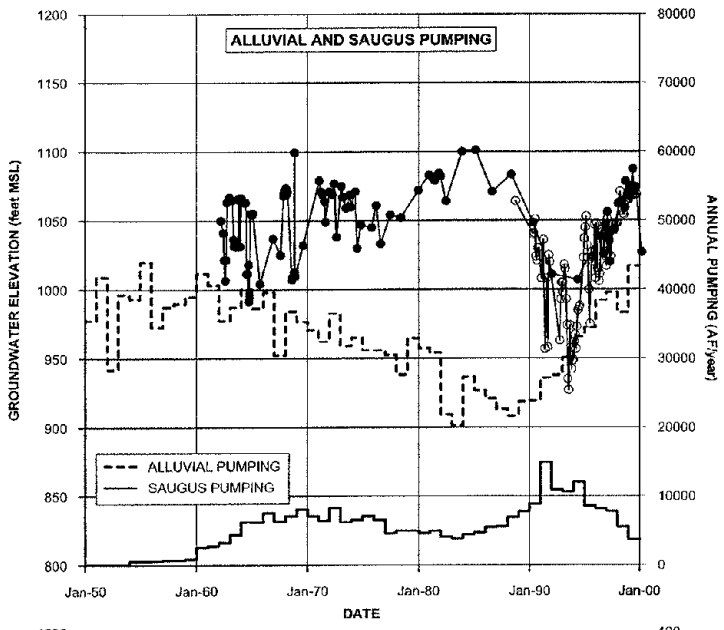

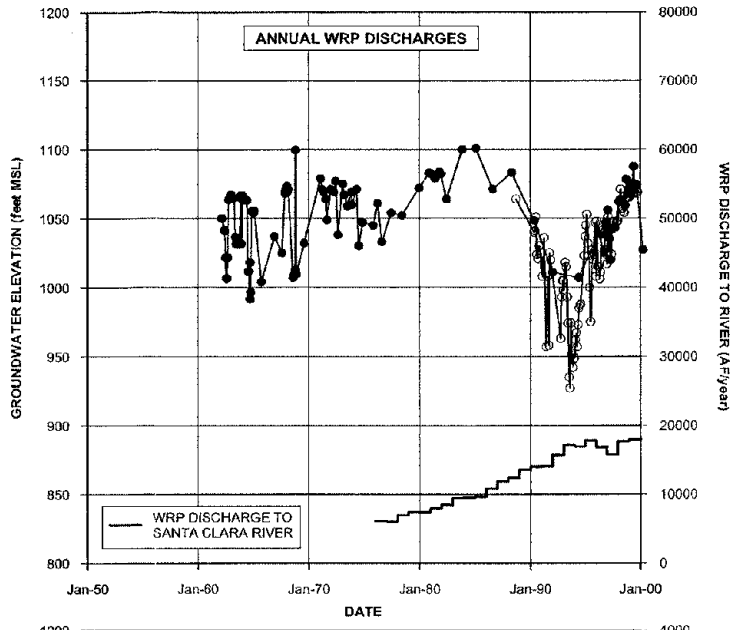

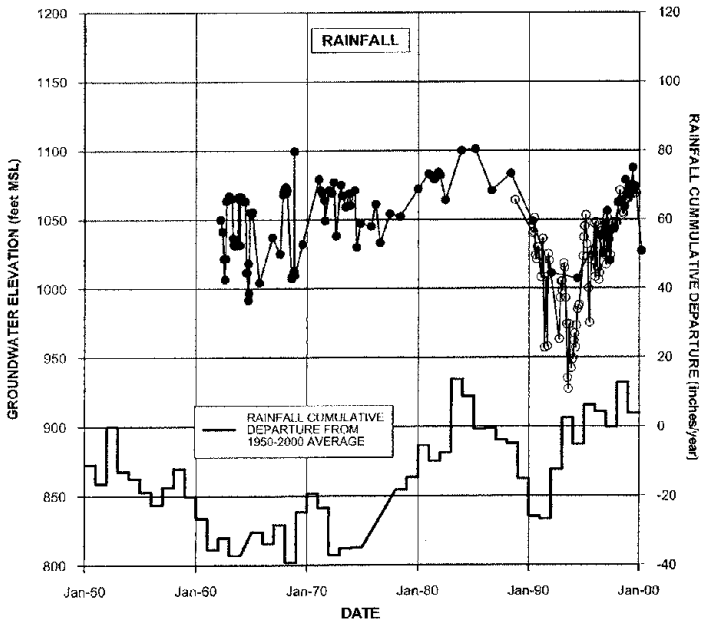

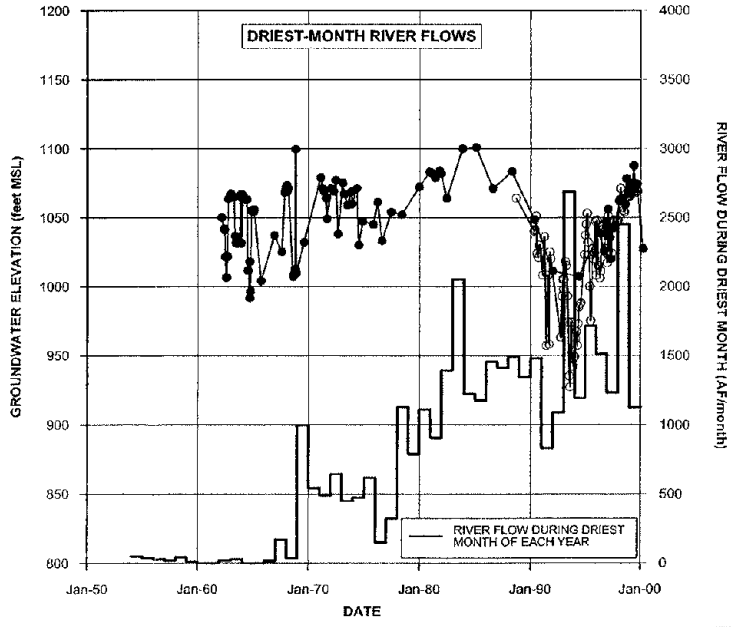

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157
- ELEVATION OF GROUNDWATER IN SCWC SAUGUS 2

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-13
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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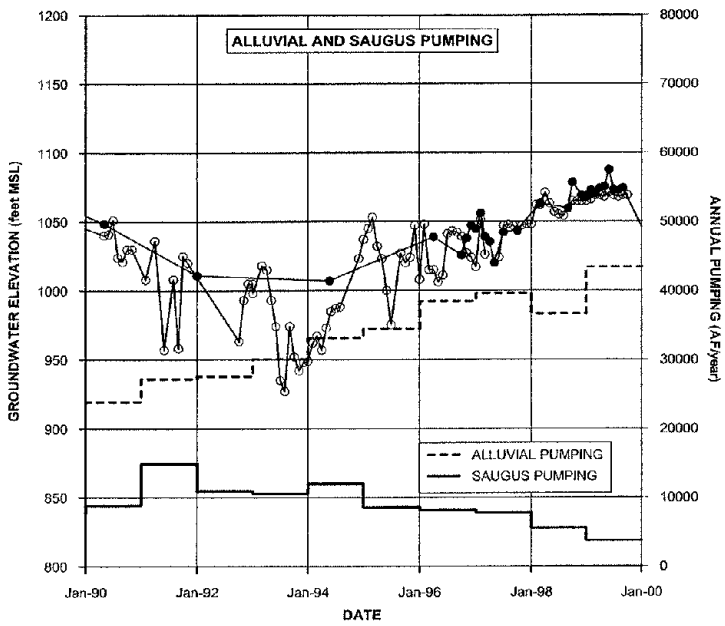

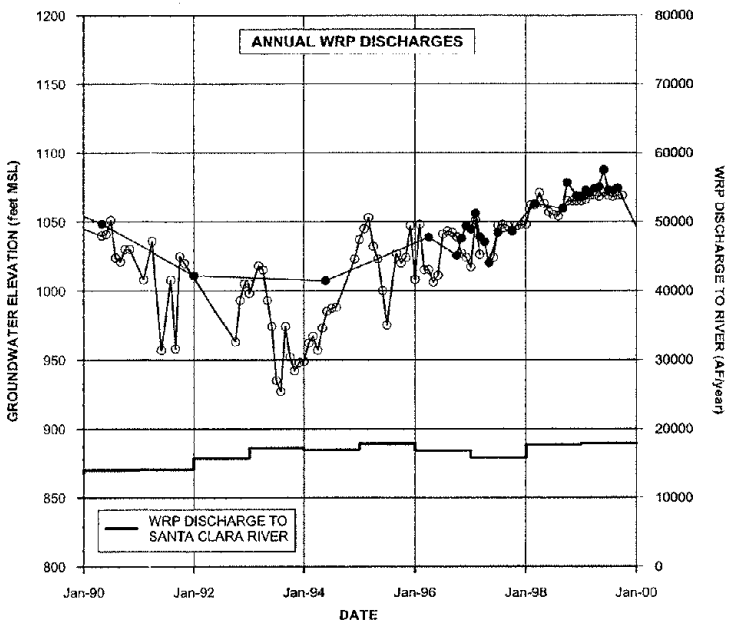

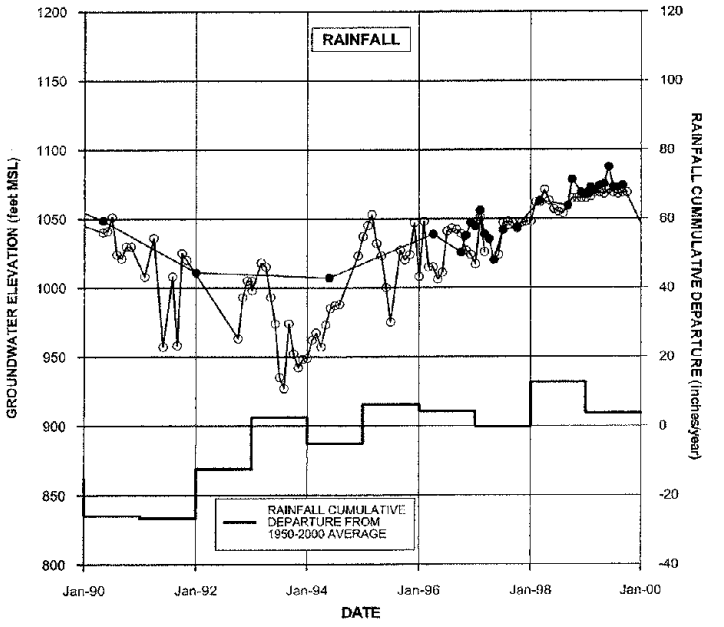

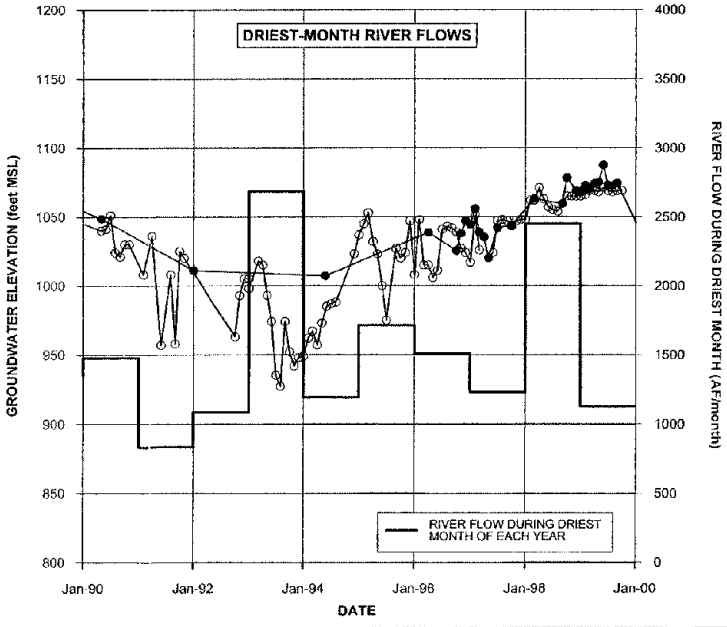

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157
- ELEVATION OF GROUNDWATER IN SCWC SAUGUS 2

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-14
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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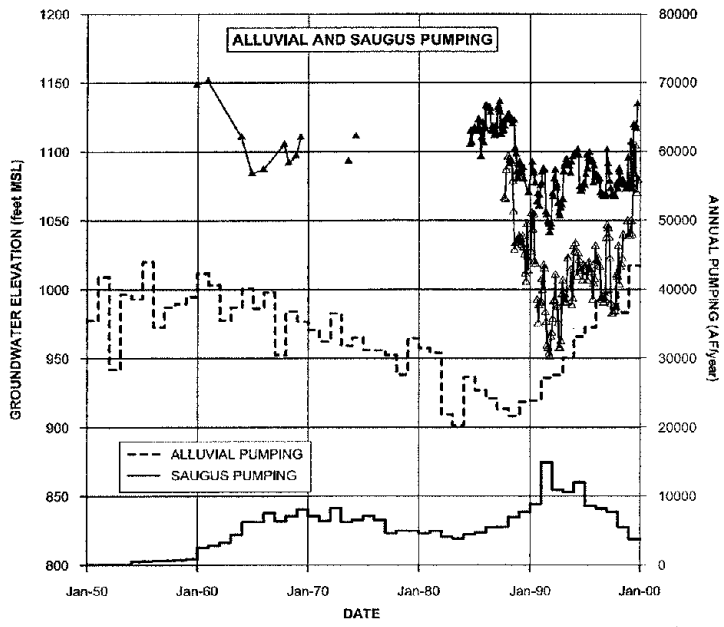

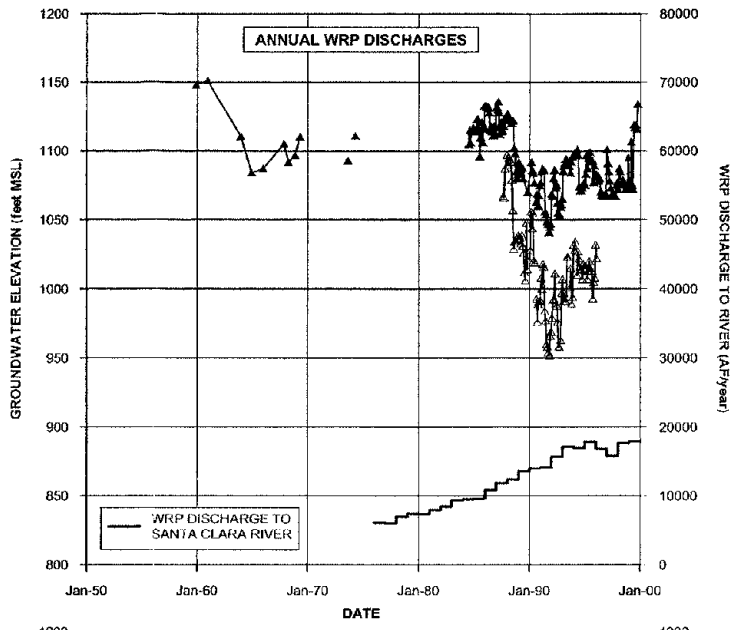

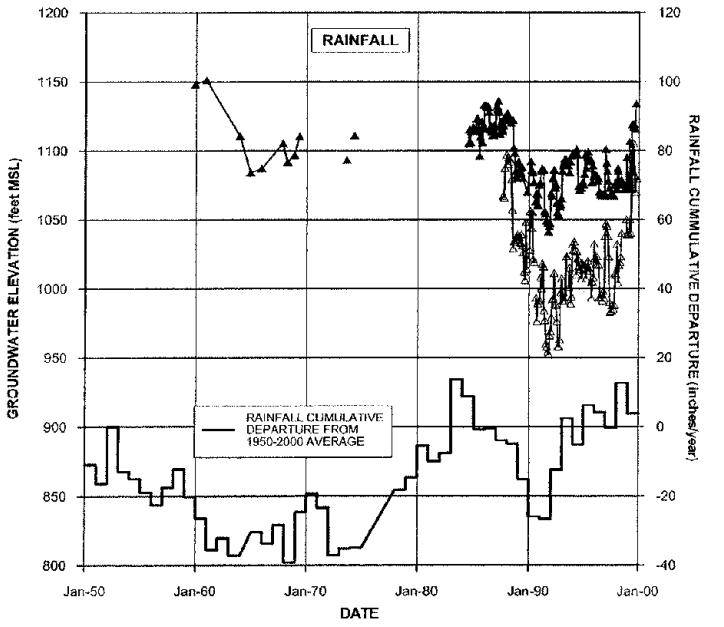

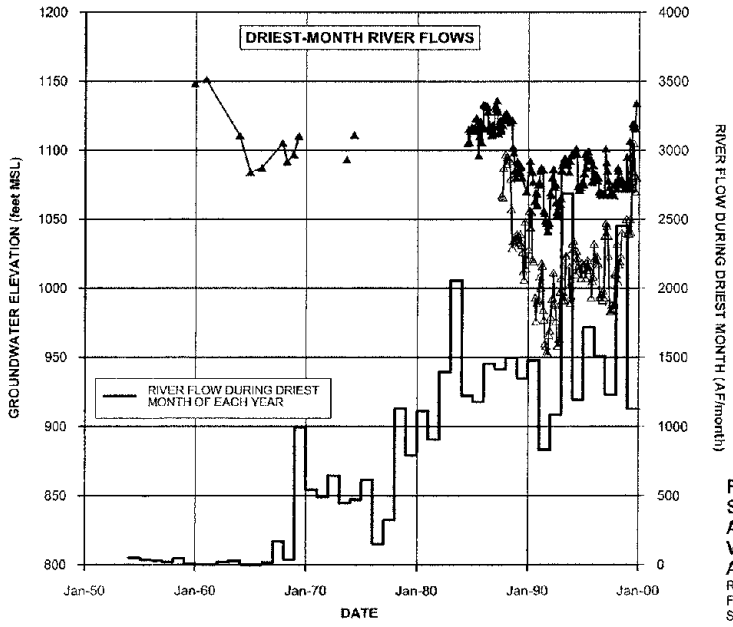

LEGEND

- ELEVATION OF GROUNDWATER IN NCWD-7
- ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-15
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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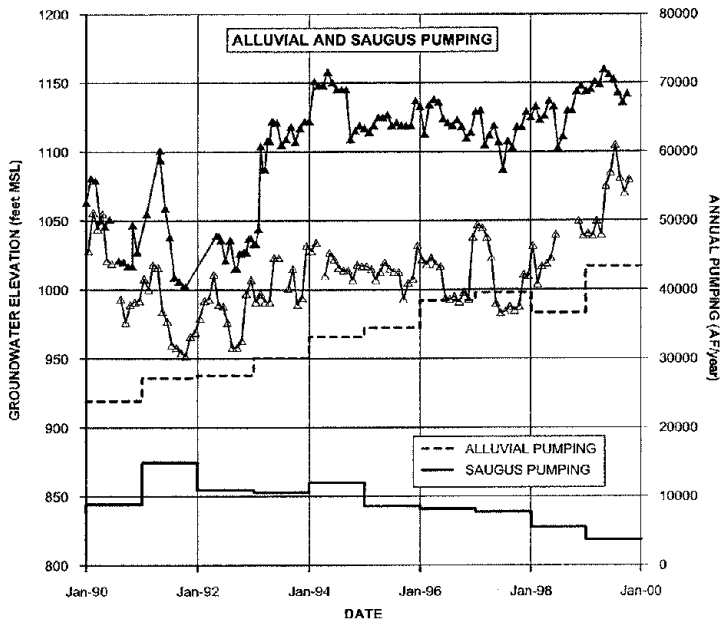

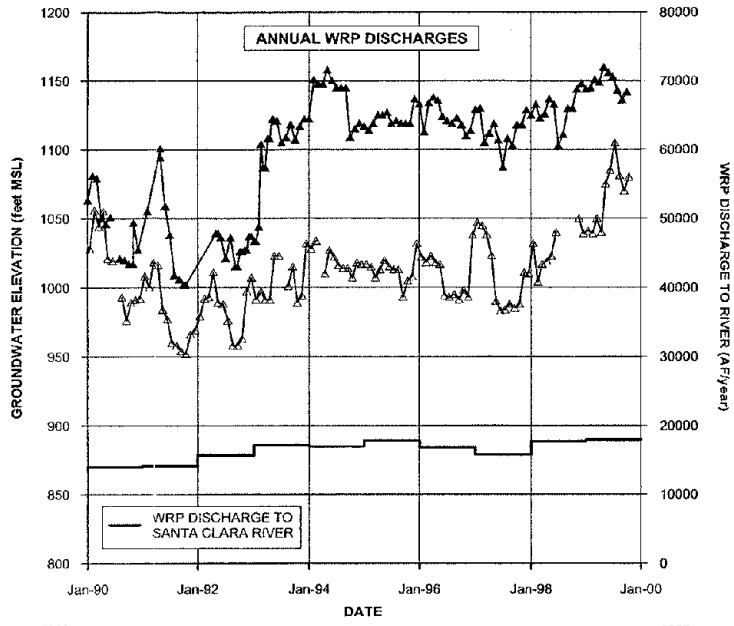

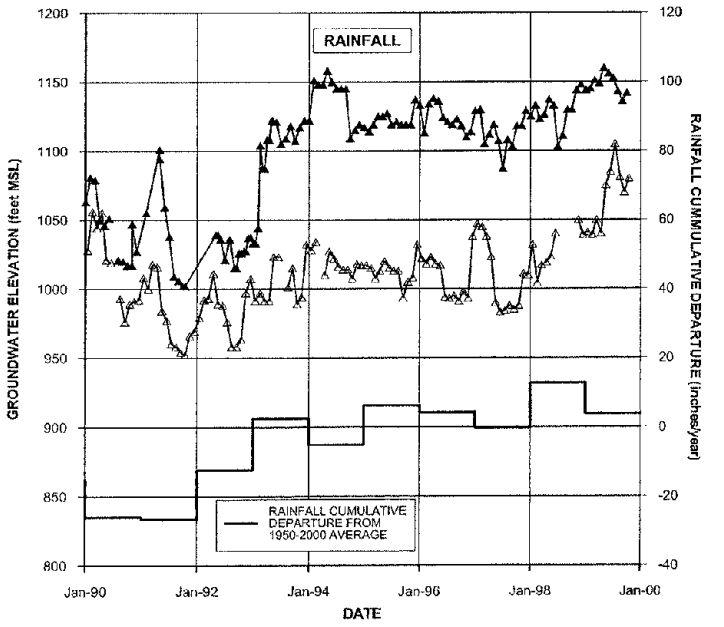

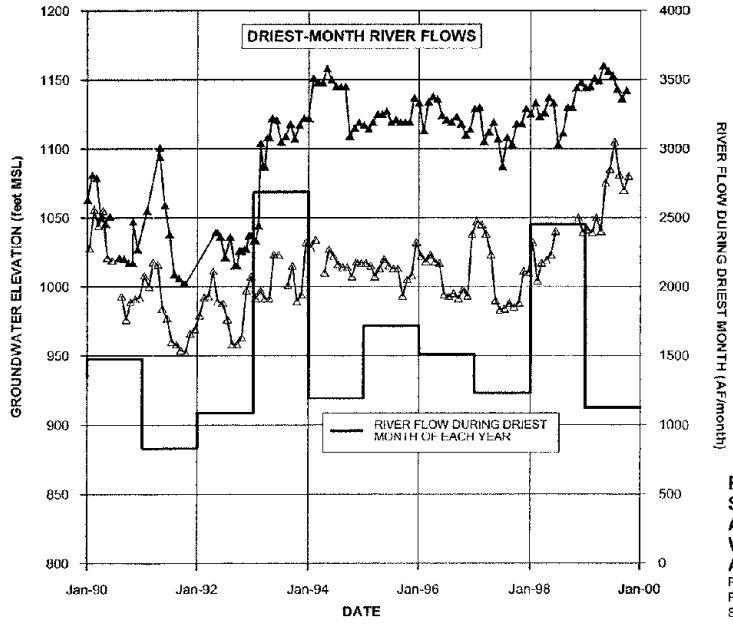

LEGEND

- ELEVATION OF GROUNDWATER IN NCW-10
- ELEVATION OF GROUNDWATER IN NCW-12

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-16
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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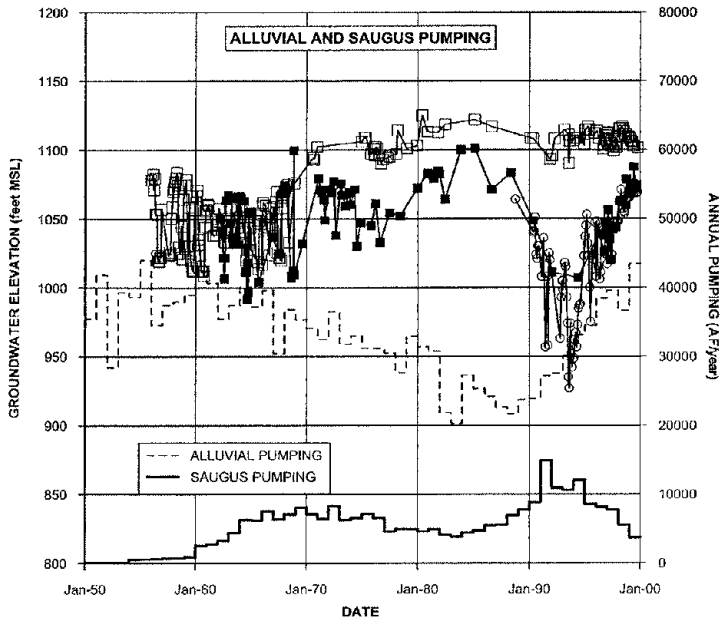

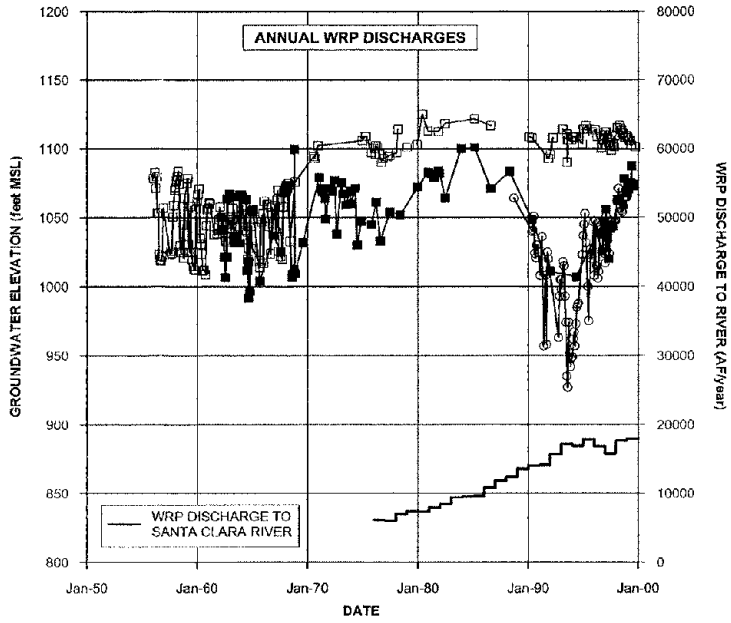

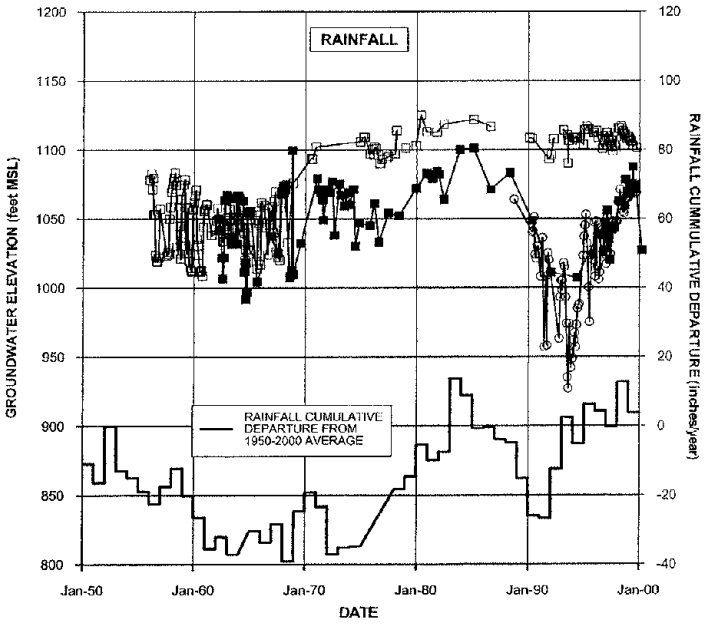

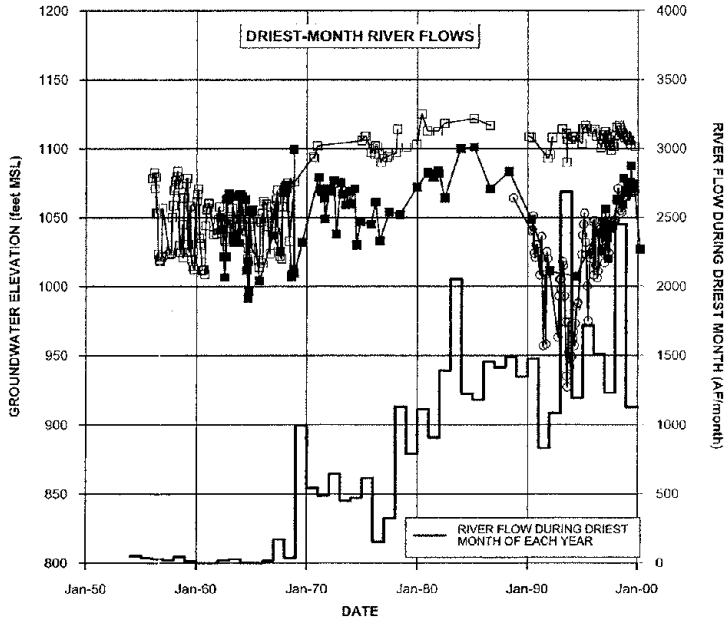

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N (ALLUVIUM)
- ELEVATION OF GROUNDWATER IN NVWC-157 (SAUGUS)
- ELEVATION OF GROUNDWATER IN SWC SAUGUS 2 (SAUGUS)

NOTES:

1. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-17
GROUNDWATER ELEVATIONS IN ADJACENT ALLUVIAL AND SAUGUS WELLS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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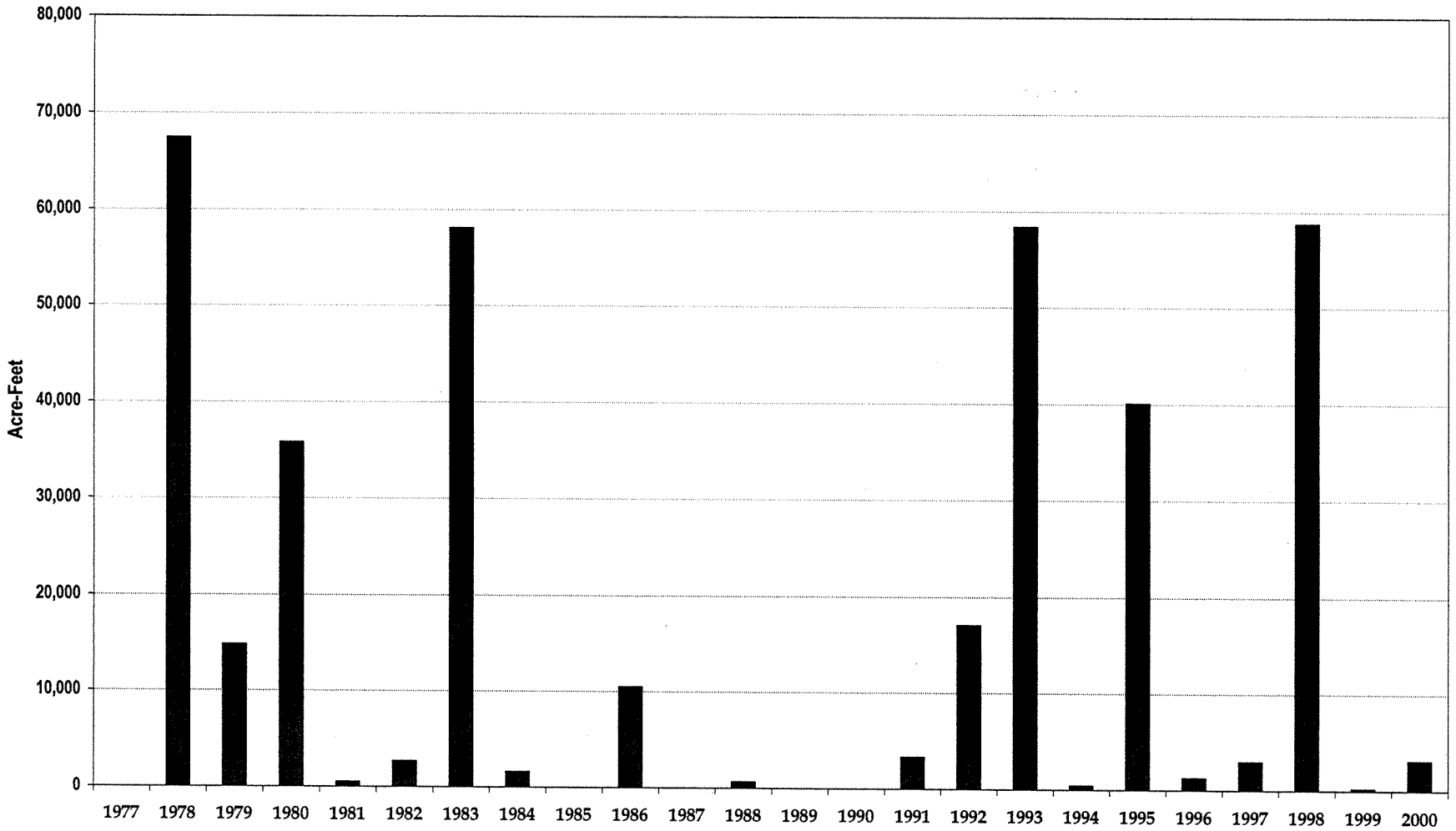

This chart shows the potential Flood Flows available during water years 1977 through 2000. Water Year 1977 is defined as October 1, 1976 through September 30, but the water is generally available only from October 1 through April 30.

FIGURE 2-18
NET CASTAIC CREEK FLOOD FLOWS AVAILABLE TO DOWNSTREAM USERS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

SECTION 3

Model Construction

The Regional Model is a three-dimensional numerical model of groundwater flow in the Alluvial Aquifer and the Saugus Formation. The model simulates changes in groundwater flow and storage during the recent 20-year period from 1980 through 1999. This section of the report presents the overall approach to the construction of the Regional Model including the model software; model domain; grid design; layering scheme; boundary conditions; designation of subareas within the model domain; and the process for estimating the magnitudes of groundwater recharge and pumping terms required by the model.

3.1 Modeling Software

The Regional Model was constructed using the three-dimensional finite-element groundwater modeling software called MicroFEM® (Hemker and de Boer, 2003). MicroFEM® operates in a Windows™ environment and can be used to solve groundwater flow problems for unconfined, semi-confined, or confined aquifer systems. This software simulates steady-state or transient flow conditions in up to a 20-layer aquifer system; the finite-element mesh may contain as many as 50,000 nodes in each model layer. The software contains several different methods for simulating groundwater/surface water interactions. MicroFEM® is based on software developed in the Netherlands during the 1980s for use in evaluating the effects of groundwater pumping in areas with complicated meandering rivers. Further details regarding this software's design, capabilities, and functionality can be found on the Internet at www.microfem.com and in two reviews of the software by Diodato (1997, 2000).

3.2 Extent of the Model Domain

A finite-element mesh was designed that covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. The model area largely coincides with the Santa Clara River Valley East Groundwater Subbasin, extending from the Lang stream gage at the eastern end of the valley to the County Line gage area in the west. The northern and southern edges of the model domain are defined by the geologic contacts mapped by RCS (2002) for the Alluvial Aquifer and the Saugus Formation. Figure 2-10 shows the model domain, along with its location relative to the upstream watersheds that contribute runoff into the model study area.

3.3 Model Grid

Figure 3-1 shows the spacing of the individual nodes that comprise the grid. The mesh contains 17,103 nodes in each model layer. The nodes are connected by segments, forming 32,496 triangular elements. Calculations of all flow components (recharge and discharge),

groundwater storage, and groundwater elevations are performed by the model for each node and segment.

The nodes are 500 feet apart in the majority of the modeled area. However, a finer node spacing (150 feet) was used along the Santa Clara River and its tributaries to allow a more exact simulation of surface water/groundwater exchanges. Additionally, specific nodes were placed within this regional grid at the locations of production and monitoring wells.

3.4 Layering

The groundwater system was represented in the Regional Model with seven layers. The layer representation is summarized schematically on Figure 3-2. The Alluvial Aquifer, where present, was modeled with a single layer, and the Saugus Formation was modeled with multiple layers to its total depth, which was defined as the base of the Sunshine Ranch Member of the Saugus Formation. Figures 3-3 through 3-9 show the assigned thicknesses in model layers 1 through 7. Figure 3-10 shows the total modeled saturated thickness of the Saugus Formation. Figures 3-11 through 3-17 show the elevations of the base of each model layer. Figure 3-18 shows the model layering in three cross-sectional views. Further details regarding model layering are presented below.

3.4.1 Alluvial Aquifer Layer

In 2002, RCS compiled and geographically grouped hydrogeologic data from Alluvial Aquifer wells to estimate the aquifer's saturated thickness during various historical periods. The saturated thickness was defined from the average base elevation of the aquifer and the water level elevations measured during the fall of 1985 and the spring of 2000, then typical saturated thicknesses for geographic subareas were defined. The spatial distribution of the Alluvial Aquifer's typical saturated thickness is shown on Figure 3-3. Along the Santa Clara River, the typical saturated thickness ranges between 110 and 130 feet west of I-5; is less than 100 feet near Round Mountain; ranges between 100 and 150 feet between Round Mountain and Soledad Canyon; and ranges between 80 and 90 feet in Soledad Canyon. The typical saturated thickness ranges between 80 and 100 feet in the Castaic Creek Valley and in the lower reach of Bouquet Canyon. Other tributary canyons to the Santa Clara River have typical saturated thicknesses of 60 feet or less, and the saturated thickness decreases significantly in the upstream direction within each canyon, particularly along the South Fork Santa Clara River, where all production wells are constructed in the Saugus Formation, rather than the alluvium (RCS, 2002).

3.4.2 Saugus Formation Layers

The Saugus Formation was simulated using 500-foot-thick model layers through the freshwater-bearing deposits, which are present in the basin at depths up to 2,500 feet (RCS, 1988, 2002). The model layers were specified at each node by importing digitized contours of the total thickness of the Saugus Formation's freshwater-bearing deposits (Plate 5 in RCS, 1988). Figure 3-4 is a contour fill map showing the total thickness of the Saugus Formation's freshwater-bearing deposits that was programmed into the model. As shown in the individual thickness maps for each model layer, the Saugus is present in the

model at progressively fewer nodes with depth, due to the bowl-shaped structure of the unit and the underlying bedrock.

3.5 Boundary Conditions

The boundary conditions used in the Regional Model were the following:

a. **Specified flux for precipitation within the model grid.** Deep percolation of precipitation was simulated using the precipitation top-system package contained in MicroFEM®.

b. **Specified flux for irrigation.** Deep percolation of agricultural irrigation and urban irrigation in developed areas was simulated using the precipitation top-system package contained in MicroFEM®.

c. **Specified flux and head-dependent flux along ephemeral streams.** With respect to groundwater discharges to streams, the Santa Clara River was modeled as an ephemeral, predominantly losing stream at and upstream of the mouth of San Francisquito Canyon, and as a perennial, predominantly gaining stream downstream of San Francisquito Canyon. Although flows in the river are currently perennial below the mouth of Bouquet Canyon, because of discharges from the Saugus WRP, the river was perennial only below the mouth of San Francisquito Canyon in the 1960s, prior to WRP operations. The tributaries to the Santa Clara River were modeled as ephemeral streams, using the precipitation top-system package to specify stream leakage to groundwater. Aerial photos and historical observations indicate that under high water table conditions, groundwater can locally discharge into Castaic Creek and the ephemeral reach of the Santa Clara River wherever Alluvial groundwater levels rise above the riverbed elevation. Consequently, the drain package in MicroFEM® was used in these streams to allow drainage of any groundwater that was calculated to be above the riverbed elevation at each river node.

d. **Specified flux and head-dependent flux along perennial Santa Clara River.** In the perennial reach of the Santa Clara River, the river was modeled using the wadi top-system package contained in MicroFEM®. The wadi package allows groundwater to discharge to the river whenever groundwater elevations are higher than the specified river stage. When groundwater levels are below the river stage, the river recharges the Alluvial Aquifer. The rate of recharge is proportional to the difference between the river stage elevation and the model-calculated groundwater elevation. However, once the groundwater elevation drops below the streambed sediments, the rate of leakage from the stream is constant (i.e., does not vary as the groundwater elevation fluctuates). For the Regional Model, each node along the perennial reach of the Santa Clara River was assigned a river stage 1 foot higher than the mapped bed elevation of the river. The riverbed permeability, or conductance, which helps control the model-calculated groundwater/surface water exchange rates, was adjusted during model calibration by calibrating to streamflow data collected at the county line. (See Section 4.3 for further details on the use of the streamflow data during model calibration.)

e. **Specified flux for pumping.** Pumping rates and locations for wells completed in the Alluvial Aquifer and the Saugus Formation were directly imported into the Regional

Model from the Upper Santa Clara River Groundwater Basin database. Further information on how pumping was specified in the model is contained in Section 3.7.

f. **Specified flux at upgradient Alluvial Aquifer boundaries.** Where there is Alluvial groundwater flow into the study area from beneath Castaic Dam, the magnitude of the specified flux was adjusted during the model calibration process, using groundwater elevations and gradients published by RCS (1986 and 2002).

g. **Specified groundwater elevation in the Alluvial Aquifer at the county line.** The groundwater elevation (805 feet) was obtained from water level contour maps for the Alluvial Aquifer prepared by RCS (1986, 2002). (See Figure 2-7 for groundwater elevation contours during Spring 2000, as mapped by RCS [2002].)

h. **Head-dependent flux for evapotranspiration.** ET from the water table by riparian vegetation was simulated using the evaporation top-system package contained in MicroFEM®. This package requires specification of the maximum rooting depth for the riparian vegetation, the maximum potential ET rate, and the ground surface elevation.

i. **No-flow.** In general, the outermost line of nodes that form the model boundary and the bottom of the model are no-flow boundaries. The exceptions are the western model boundary (specified head) and the specified-flux nodes representing underflow into the Alluvial Aquifer from beneath Castaic Dam. Also, all nodes on the model boundary are assigned specified fluxes due to precipitation and, in some cases, ephemeral streamflow.

3.6 Estimation of Groundwater Recharge Rates

The groundwater recharge rates required by the model were derived from the following information sources:

a. Precipitation records

b. Watershed maps and topographic maps

c. Aerial photography (to identify vegetation patterns and areas of agricultural and urban irrigation)

Groundwater recharge was defined on a month-to-month basis for the transient calibration process. Groundwater recharge rates were assigned at all model nodes using the GIS for the valley and a Surface Water Routing Model (SWRM), which was written specifically for the Regional Model using the Visual Basic Editor within Microsoft® Excel 97. For each month during the transient calibration period, the SWRM estimated the following:

a. The amount of water potentially available to recharge the aquifer, which consisted of:

   1. Infiltration of direct precipitation within the model grid area
   2. Infiltration of urban irrigation water
   3. Infiltration of agricultural irrigation water
   4. The amount of stormwater yielded by upstream watersheds in each tributary to the Santa Clara River
   5. The amount of water entering the valley in the Santa Clara River at the Lang gage

6. The amount of water released into Castaic Creek by DWR
7. The locations and volumes of flow discharged into the Santa Clara River from the two LACSD WRPs

b. The amount of water in each stream that actually infiltrates to the aquifer, based on an assigned streambed leakage rate at each model node

c. The amount of water in each stream that does not infiltrate and therefore remains as surface water in the Santa Clara River at the west end of the valley, at the County Line gage

During model calibration, the SWRM was used to adjust the streambed conductance terms for Castaic Creek and the ephemeral reach of the Santa Clara River. These adjustments were made by examining the differences between measured and modeled groundwater elevations at wells located in the valleys where these ephemeral streams are present. In addition, the streambed conductance terms were allowed to vary from month to month because the conductance implicitly incorporates the streambed area, which is large during high river flows and smaller during low-flow periods.

A detailed discussion of the SWRM's design, operations, and input data is contained in Appendix C.

3.7 Assignment of Pumping Rates

Pumping rates were assigned in the Regional Model using the following information:

a. Water use records maintained by the Purveyors and other agencies in the valley. These records were available in the form of AF/yr of water use at each well.

b. Estimates of monthly water demand for urban water use and agricultural water use.

c. Well construction records, which were needed to determine which model layers at each individual well should be assigned pumping.

Tables 2-1 and 2-2 summarize annual pumping rates at each well and for each year during the transient model calibration period. All production wells in the Alluvial Aquifer were assigned pumping rates in model layer 1. For each production well completed in the Saugus Formation, the pumping assignments in each model layer were based on the total pumping rate, the percentage of the model layer in which the well was open, and the thickness and hydraulic conductivity of each model layer. Table 3-1 summarizes this information and shows the percentage of the total well yield that was derived from each model layer.

Table 3-2 summarizes the monthly distribution of the annual pumping volumes. Separate distributions were used for agricultural demands, which are exclusively for outdoor uses, and for urban demands, which are for both indoor and outdoor uses. The monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining monthly flow records for the two LACSD WRPs and monthly demand distributions recorded by VWC during the past several years.

Tables

TABLE 3-1

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-7	3	520	974	454	2	908	100.0
NCWD-8	2	342	970	158	10	1,580	62.7
NCWD-8	3	342	970	470	2	940	37.3
NCWD-9	2	311	674	189	0.03371	6.37	59.4
NCWD-9	3	311	674	174	0.025	4.35	40.6
NCWD-10	3	780	1,544	220	2	440	28.8
NCWD-10	4	780	1,544	500	2	1,000	65.4
NCWD-10	5	780	1,544	44	2	88	5.8
NCWD-11	2	200	1,075	300	10	3,000	72.3
NCWD-11	3	200	1,075	500	2	1,000	24.1
NCWD-11	4	200	1,075	75	2	150	3.6
NCWD-12	2	485	1,280	15	10	150	8.8
NCWD-12	3	485	1,280	500	2	1,000	58.5
NCWD-12	4	485	1,280	280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
NCWD-13	3	420	750	250	2	500	38.5
NLF-156	2	320	1,800	180	10	1,800	21.8
NLF-156	3	320	1,800	500	6.5	3,250	39.4
NLF-156	4	320	1,800	500	4	2,000	24.2
NLF-156	5	320	1,800	300	4	1,200	14.5
SCWC-Saugus1	2	490	1,620	10	10	100	1.8
SCWC-Saugus1	3	490	1,620	500	6.5	3,250	59.9
SCWC-Saugus1	4	490	1,620	500	4	2,000	36.8
SCWC-Saugus1	5	490	1,620	20	4	80	1.5
SCWC-Saugus2	2	490	1,591	10	10	100	1.8
SCWC-Saugus2	3	490	1,591	500	6.5	3,250	56.9
SCWC-Saugus2	4	490	1,591	500	4	2,000	35.0
SCWC-Saugus2	5	490	1,591	91	4	364	6.4
VWC-157	3	586	2,008	414	6.5	2,691	40.2
VWC-157	4	586	2,008	500	4	2,000	29.9
VWC-157	5	586	2,008	500	4	2,000	29.9
VWC-159	3	662	1,900	338	0.025	8.45	27.3
VWC-159	4	662	1,900	500	0.025	12.5	40.4
VWC-159	5	662	1,900	400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.5
VWC-160	4	950	2,000	500	4	2,000	46.2
VWC-160	5	950	2,000	500	4	2,000	46.2

TABLE 3-1

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
VWC-201	3	540	1,670	460	6.5	2,990	52.7
VWC-201	4	540	1,670	500	4	2,000	35.3
VWC-201	5	540	1,670	170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
VWC-205	4	820	1,930	500	4	2,000	40.9
VWC-205	5	820	1,930	430	4	1,720	35.2

TABLE 3-2

Allocation of Pumping by Month for Agricultural and Urban Production Wells

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Month	% of Annual Water Use, Agricultural	% of Annual Water Use, Urban	% of May through October Water Use, Urban
January	3.8	5.2	
February	5.1	3.7	
March	6.6	5.2	
April	9.1	6.6	
May	10.6	8.7	13.2
June	11.4	10.4	15.8
July	14.1	13.0	19.7
August	12.9	13.6	20.6
September	10.2	10.9	16.5
October	7.5	9.3	14.1
November	5.0	7.1	
December	3.8	6.3	
Total	**100.0**	**100.0**	**100.0**

Figures

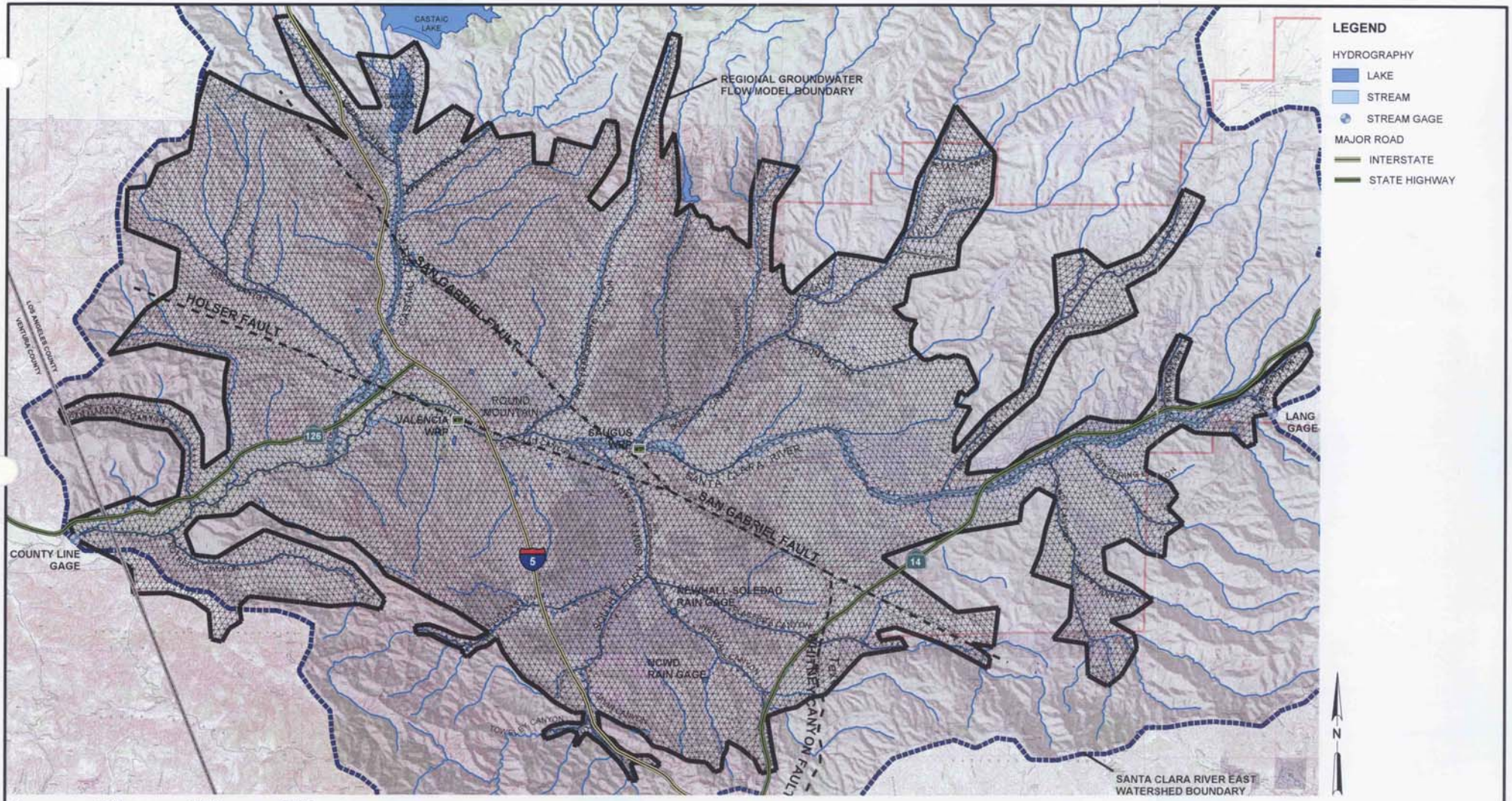

FIGURE 3-1
MODEL GRID
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG0301.MXD FIG03-01.PDF 02/03/2004 09:40:41

	Stratigraphy		Model Layer	Thickness (feet)
Saugus	Alluvium	Saugus	1	500
Saugus	Saugus	Saugus	2	
Saugus	Saugus	Saugus	3	500
Saugus	Saugus	Saugus	4	500
Saugus	Saugus	Saugus	5	500
Saugus	Saugus	Saugus	6	500
Sunshine	Sunshine	Sunshine	7	Variable

FIGURE 3-2
SHEMATIC DIAGRAM OF THE MODEL'S REPRESENTATION OF STRATIGRAPHY IN THE MIDDLE OF THE BASIN
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

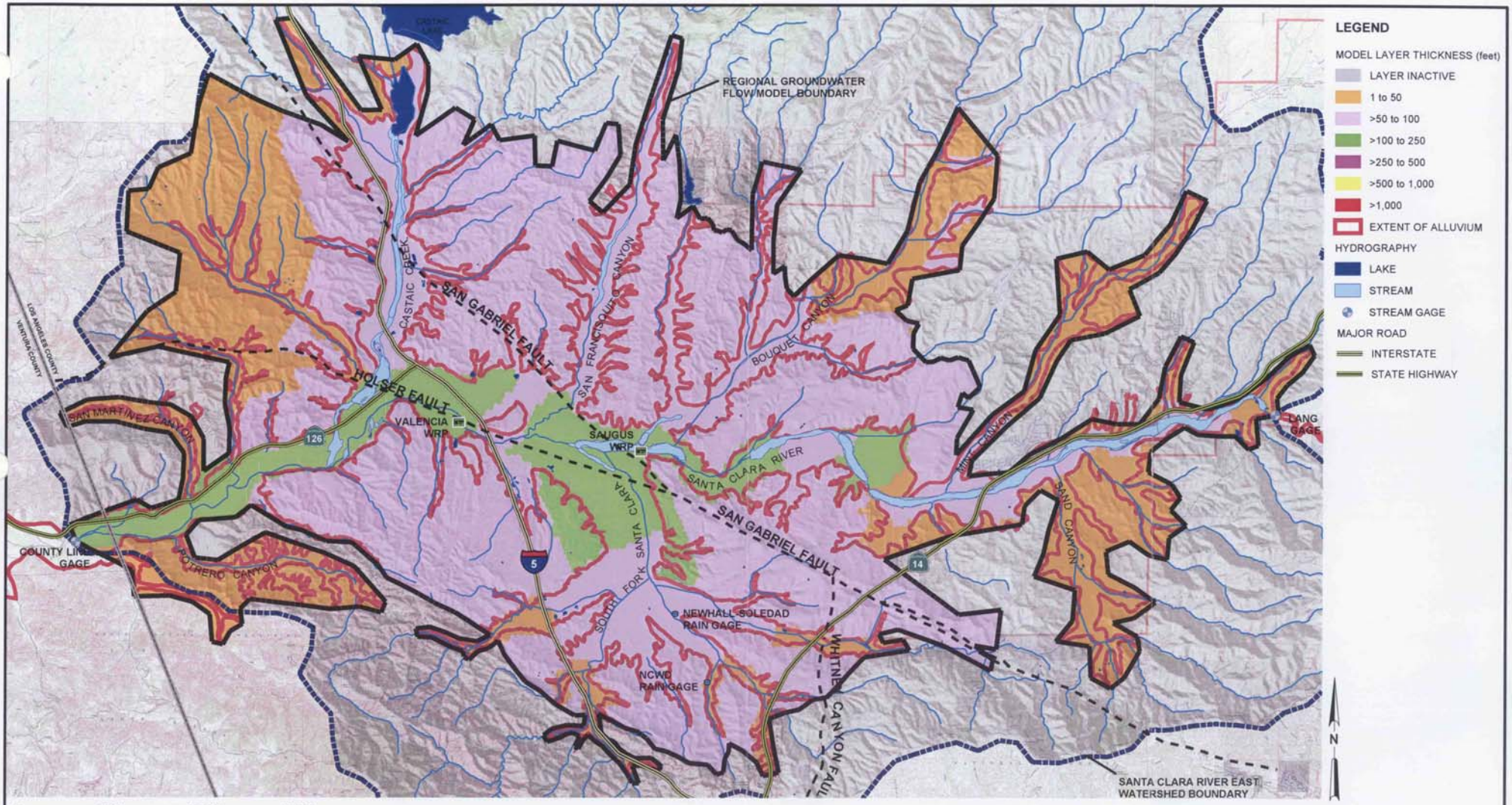

FIGURE 3-3
THICKNESS OF MODEL LAYER 1
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG020.MXD FIG03-03.PDF 02/02/2004 13:01:44

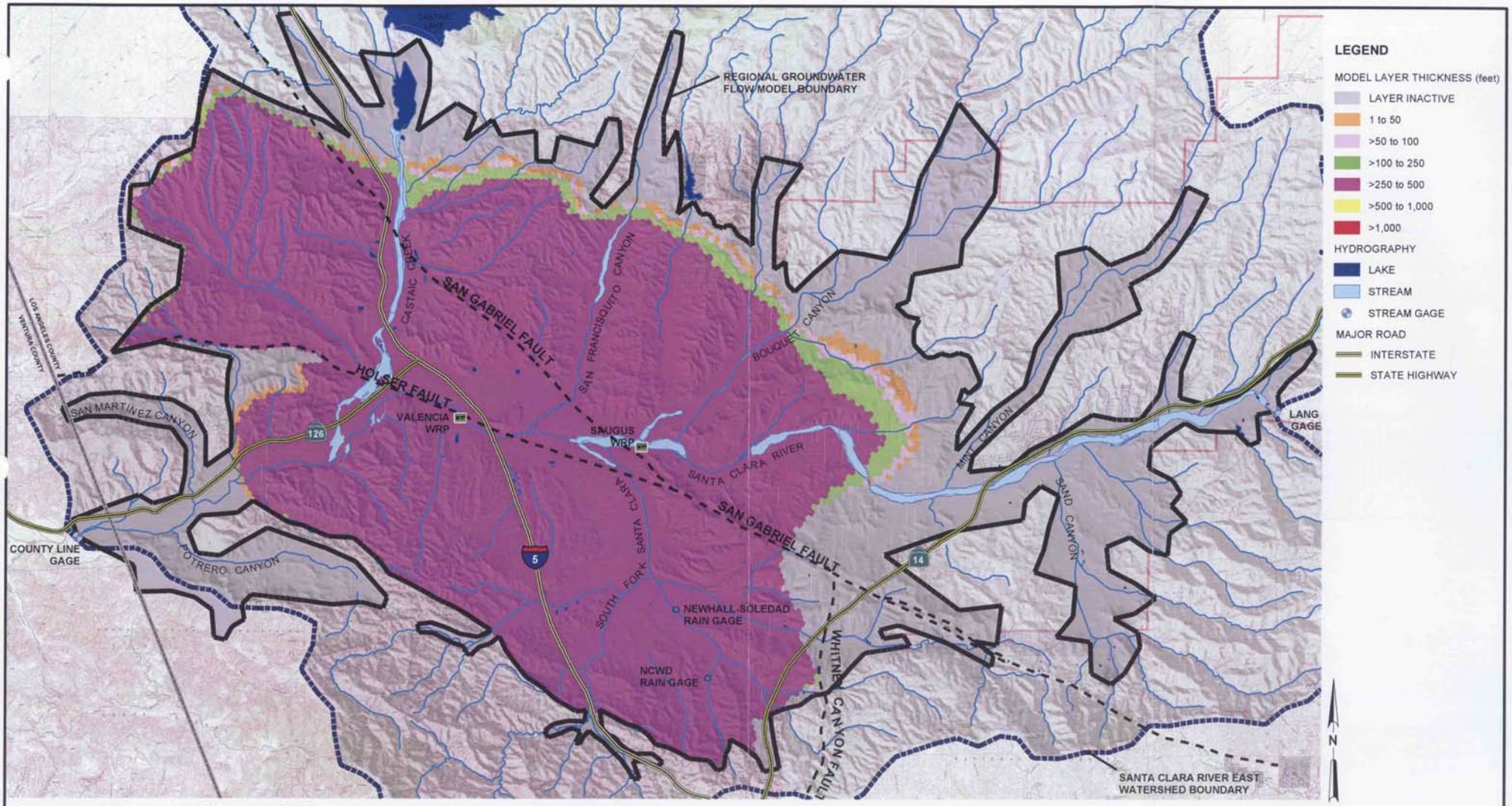

FIGURE 3-4
THICKNESS OF MODEL LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG021.MXD FIG03-04.PDF 02/02/2004 13:21:28

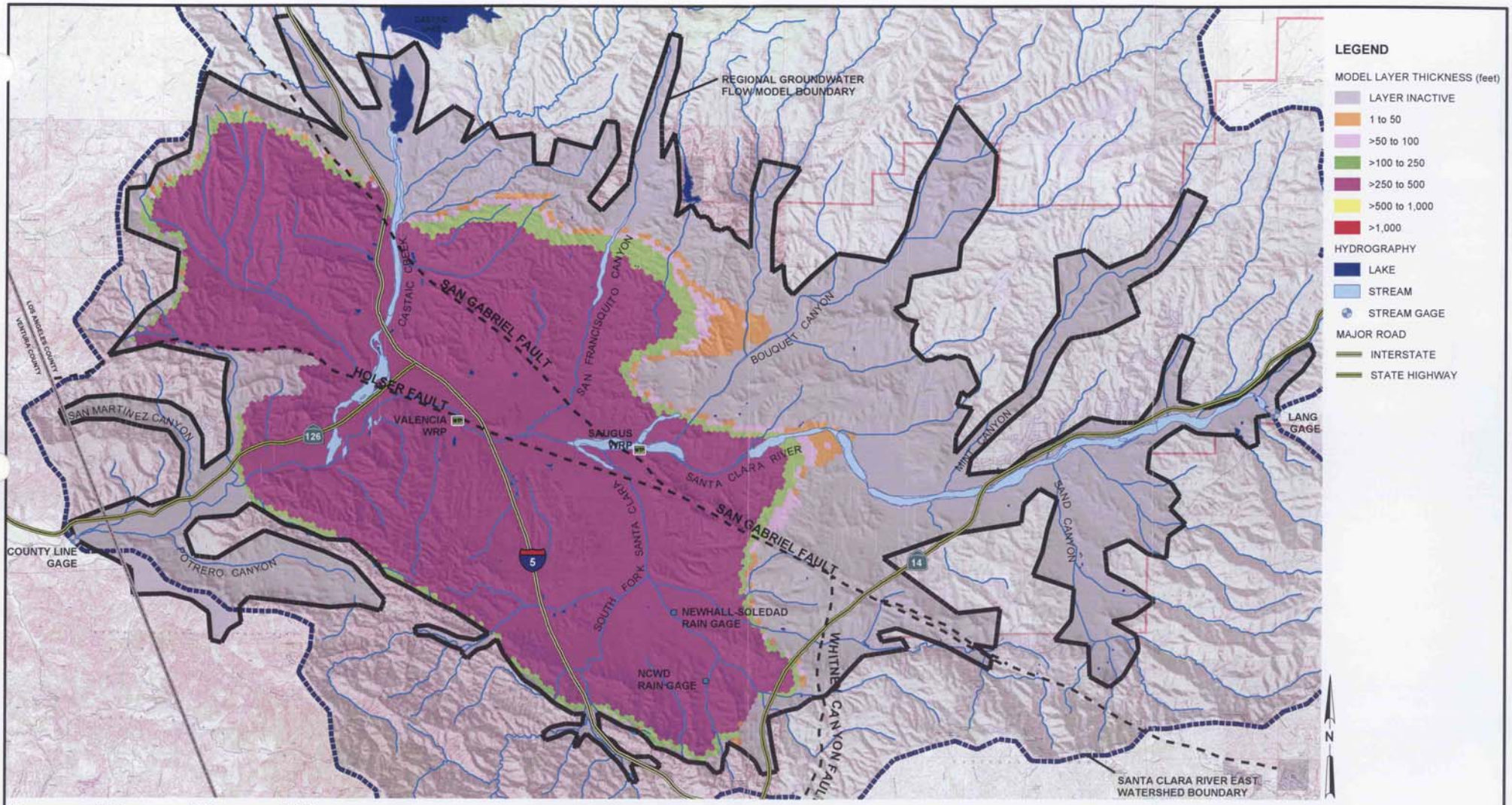

FIGURE 3-5
THICKNESS OF MODEL LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG022.MXD FIG03-05.PDF 02/04/2004 11:14:10

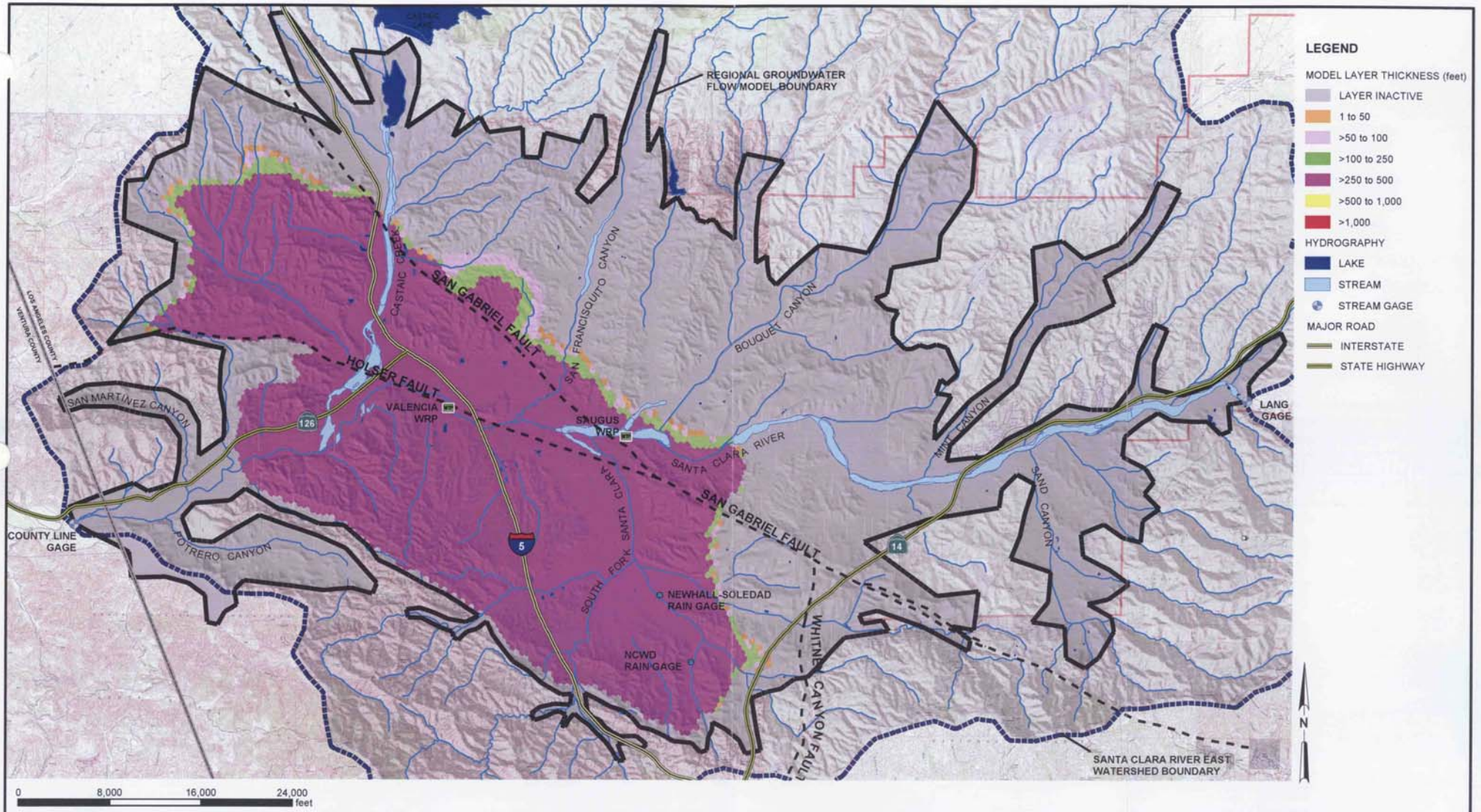

FIGURE 3-6
THICKNESS OF MODEL LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG023.MXD FIG03-06.PDF 02/04/2004 11:19:11

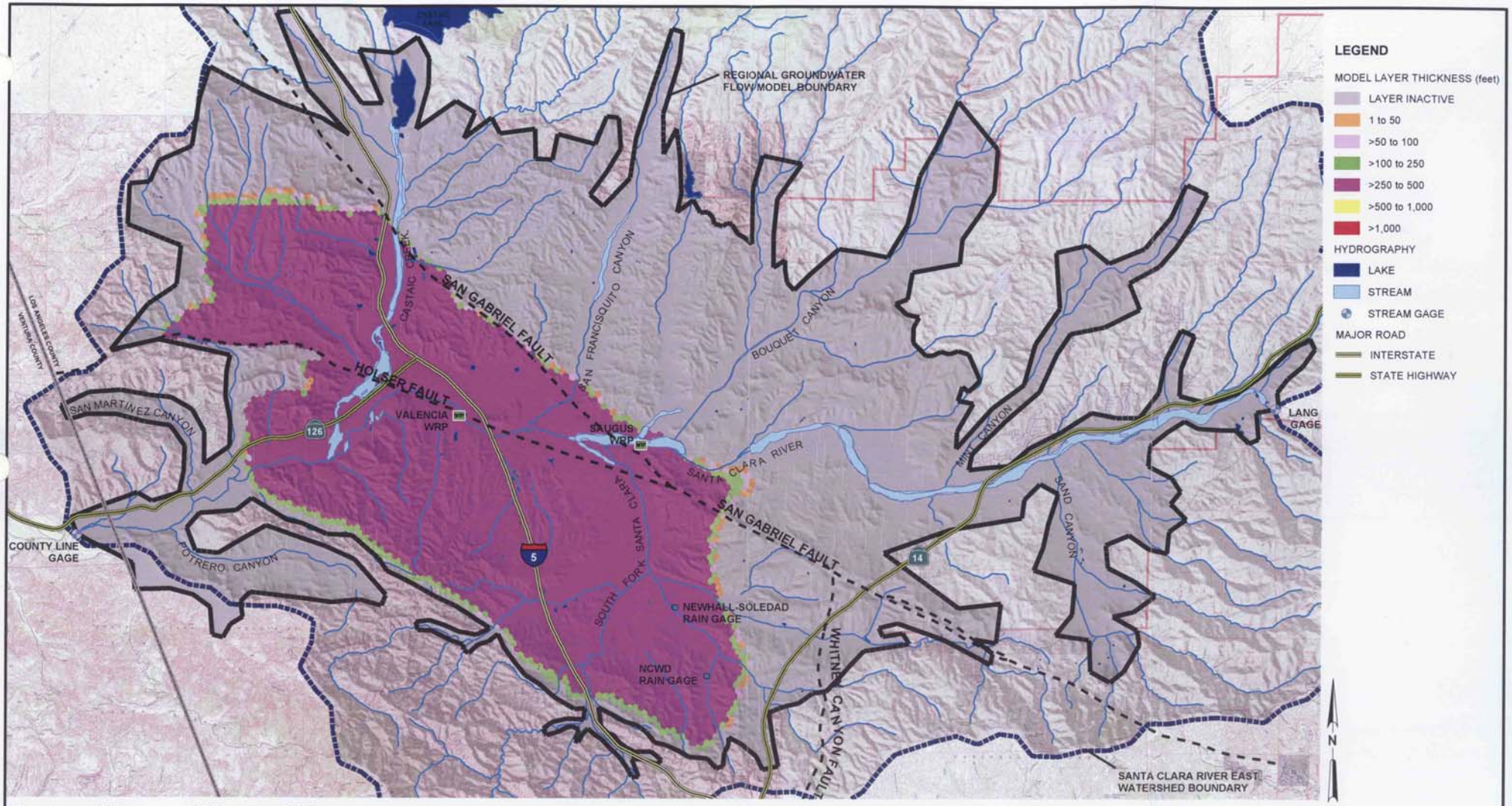

FIGURE 3-7
THICKNESS OF MODEL LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG024.MXD FIG03-07.PDF 02/04/2004 11:23:01

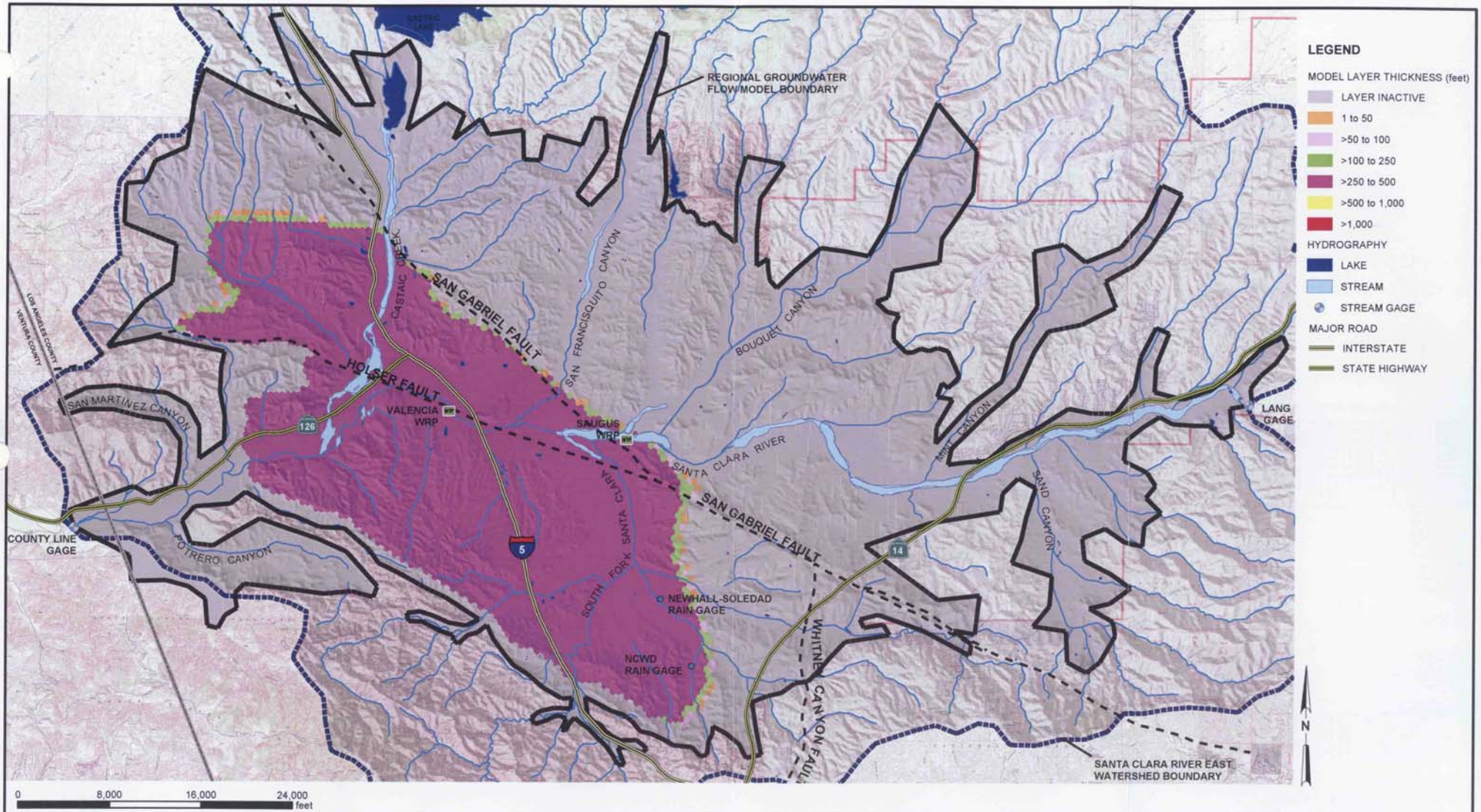

FIGURE 3-8
THICKNESS OF MODEL LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG025.MXD FIG03-08.PDF 02/04/2004 11:26:22

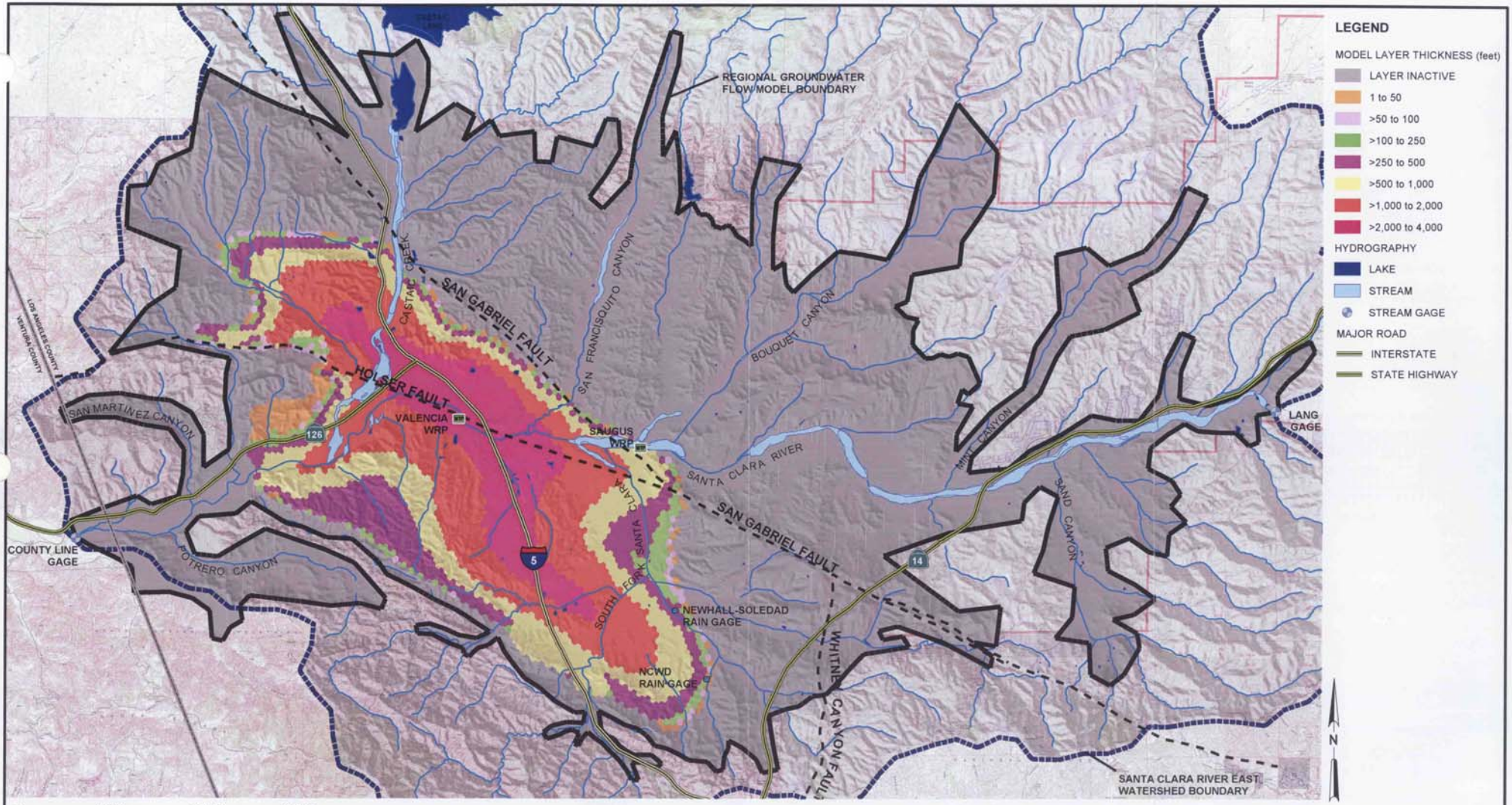

FIGURE 3-9
THICKNESS OF MODEL LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG026.MXD FIG03-09.PDF 02/02/2004 14:09:12

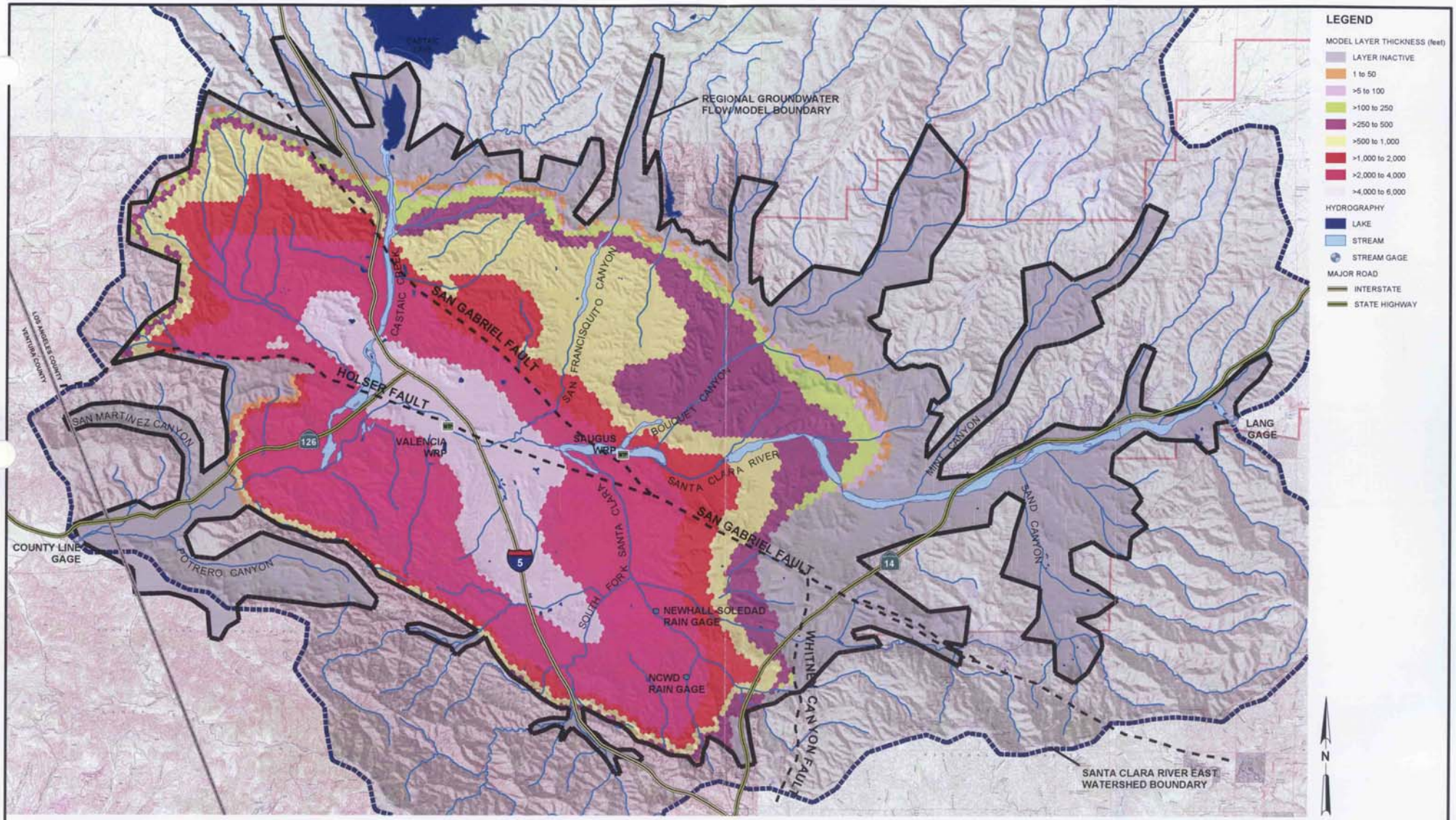

FIGURE 3-10
THICKNESS OF SAUGUS FORMATION (MODEL LAYERS 1 THROUGH 7)
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG044.MXD FIG03-10.PDF 02/04/2004 14:19:00

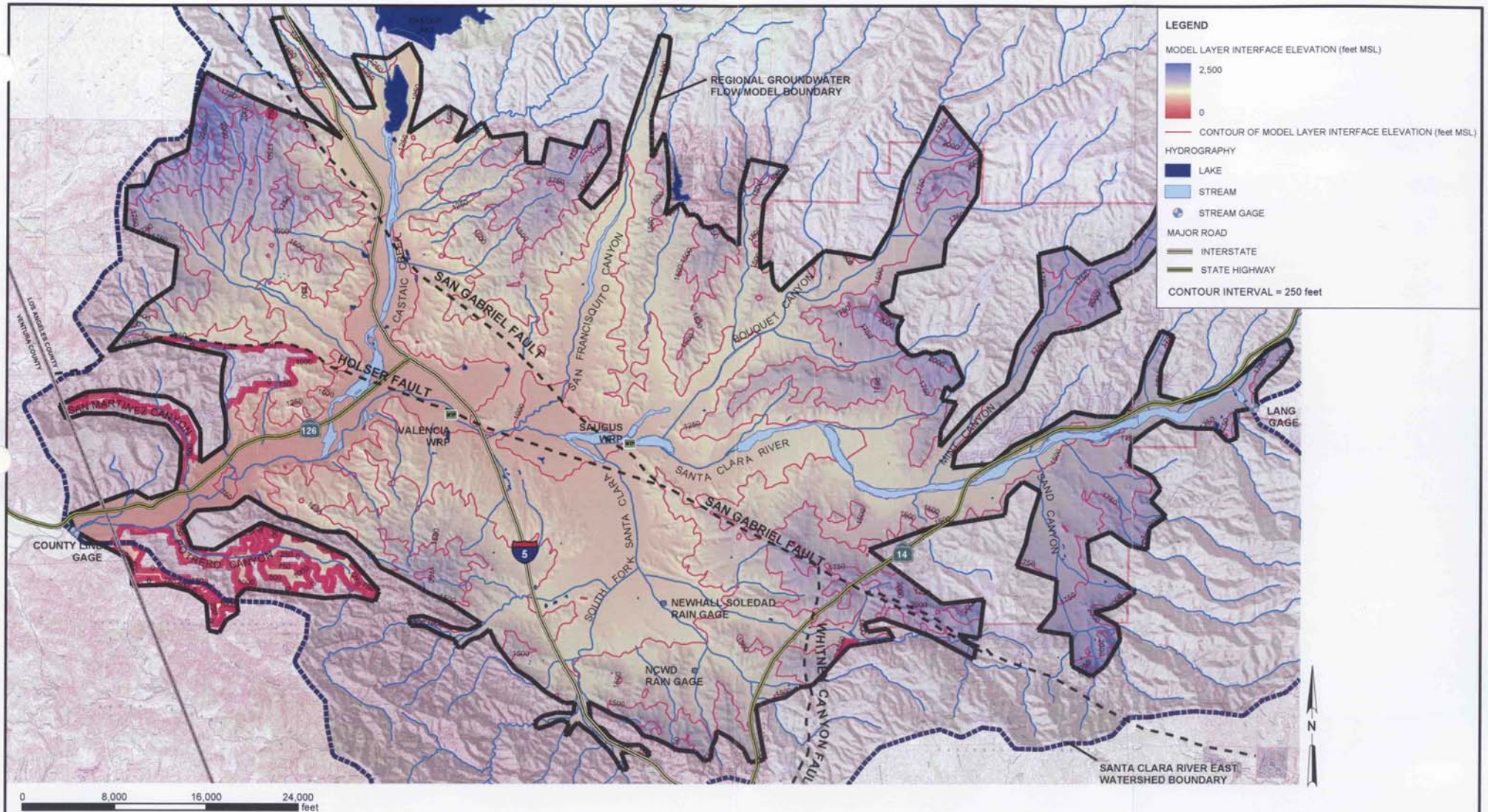

FIGURE 3-11
LAYER 1 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG027.MXD FIG03-11.PDF 02/04/2004 11:36:12

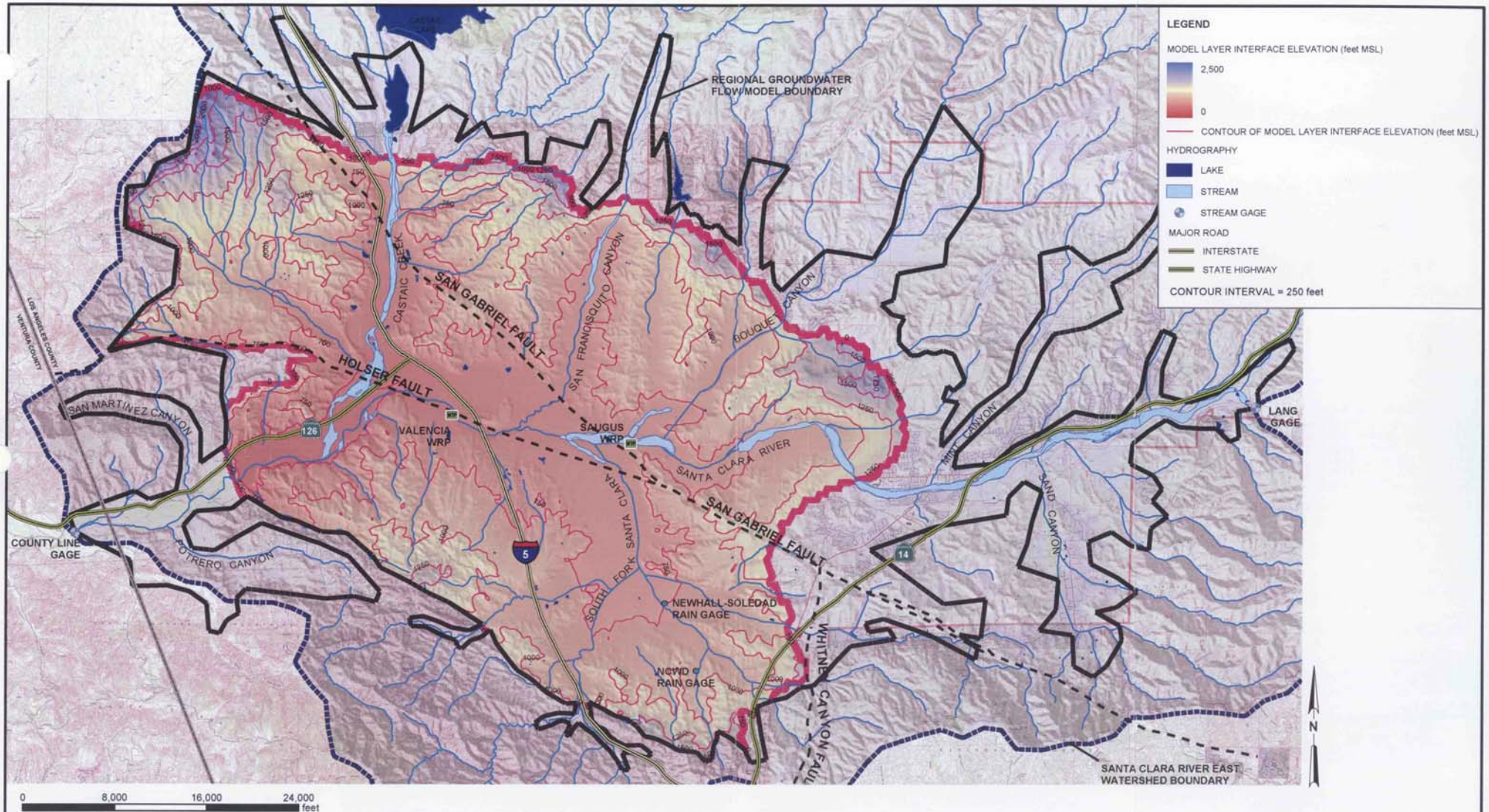

FIGURE 3-12
LAYER 2 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG028.MXD FIG03-12.PDF 02/04/2004 11:36:12

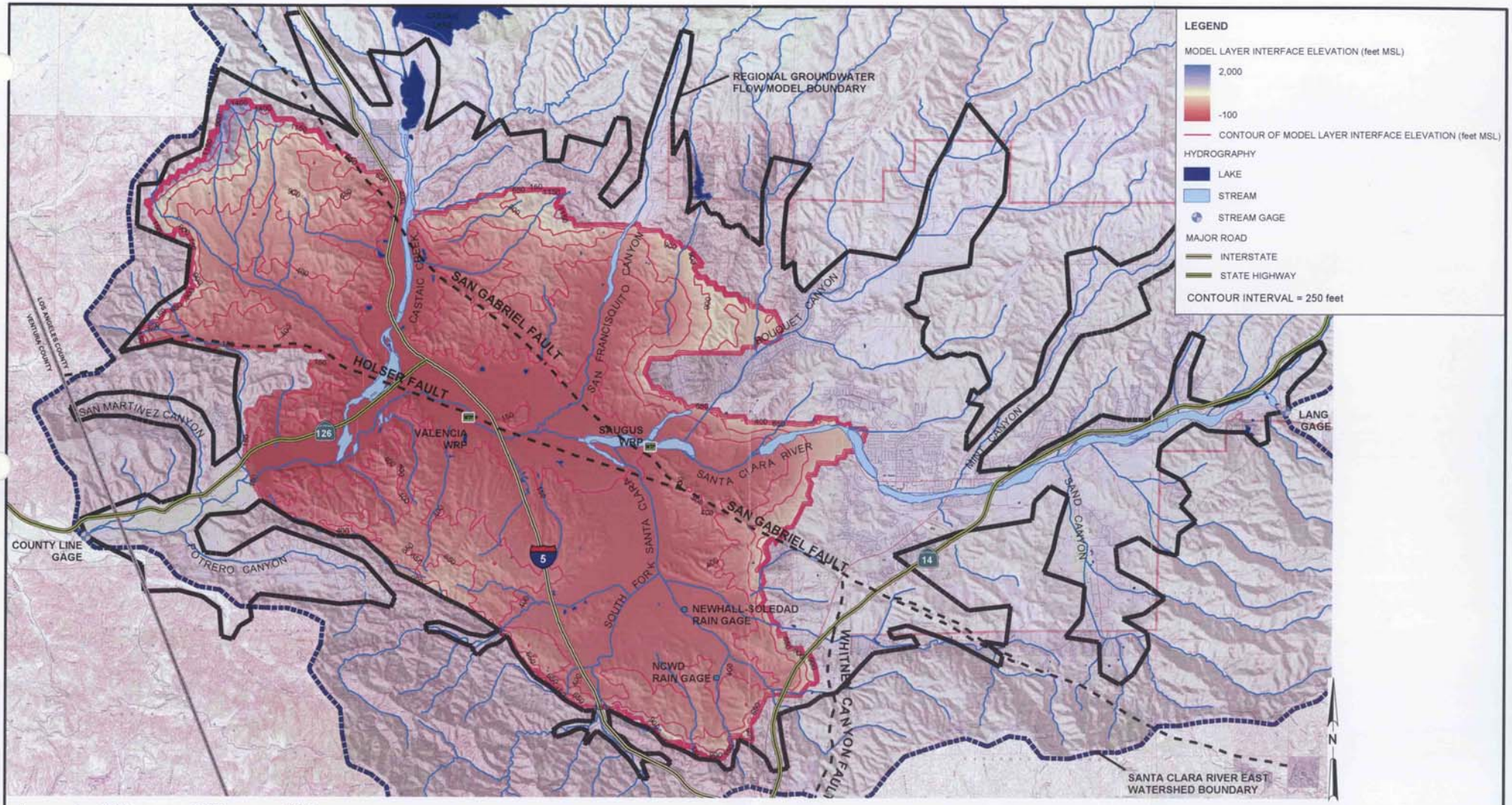

FIGURE 3-13
LAYER 3 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG029.MXD FIG03-13.PDF 02/04/2004 11:42:48

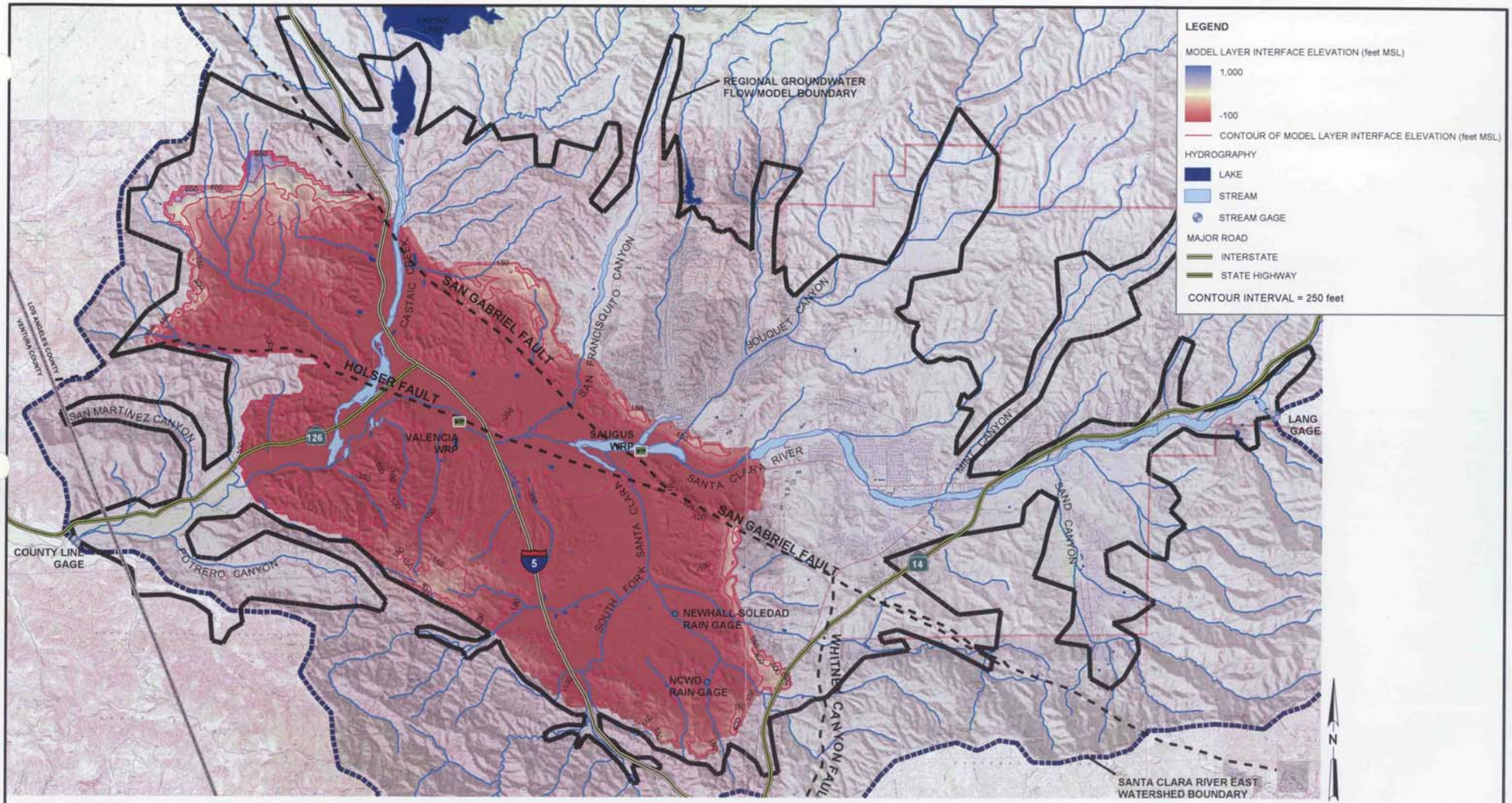

FIGURE 3-14
LAYER 4 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG030.MXD FIG03-14.PDF 02/04/2004 11:53:17

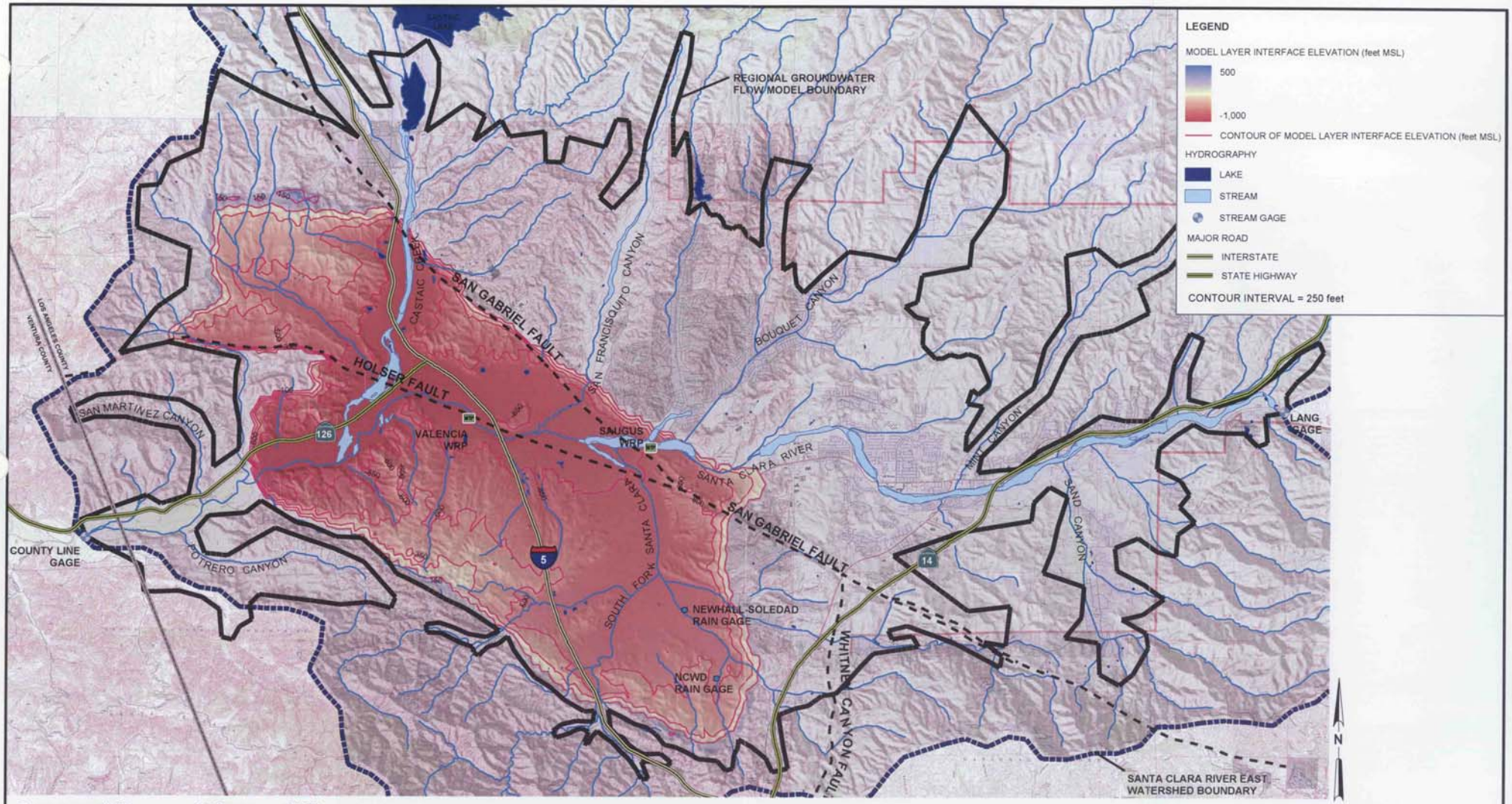

FIGURE 3-15
LAYER 5 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG031.MXD FIG03-15.PDF 02/04/2004 12:53:31

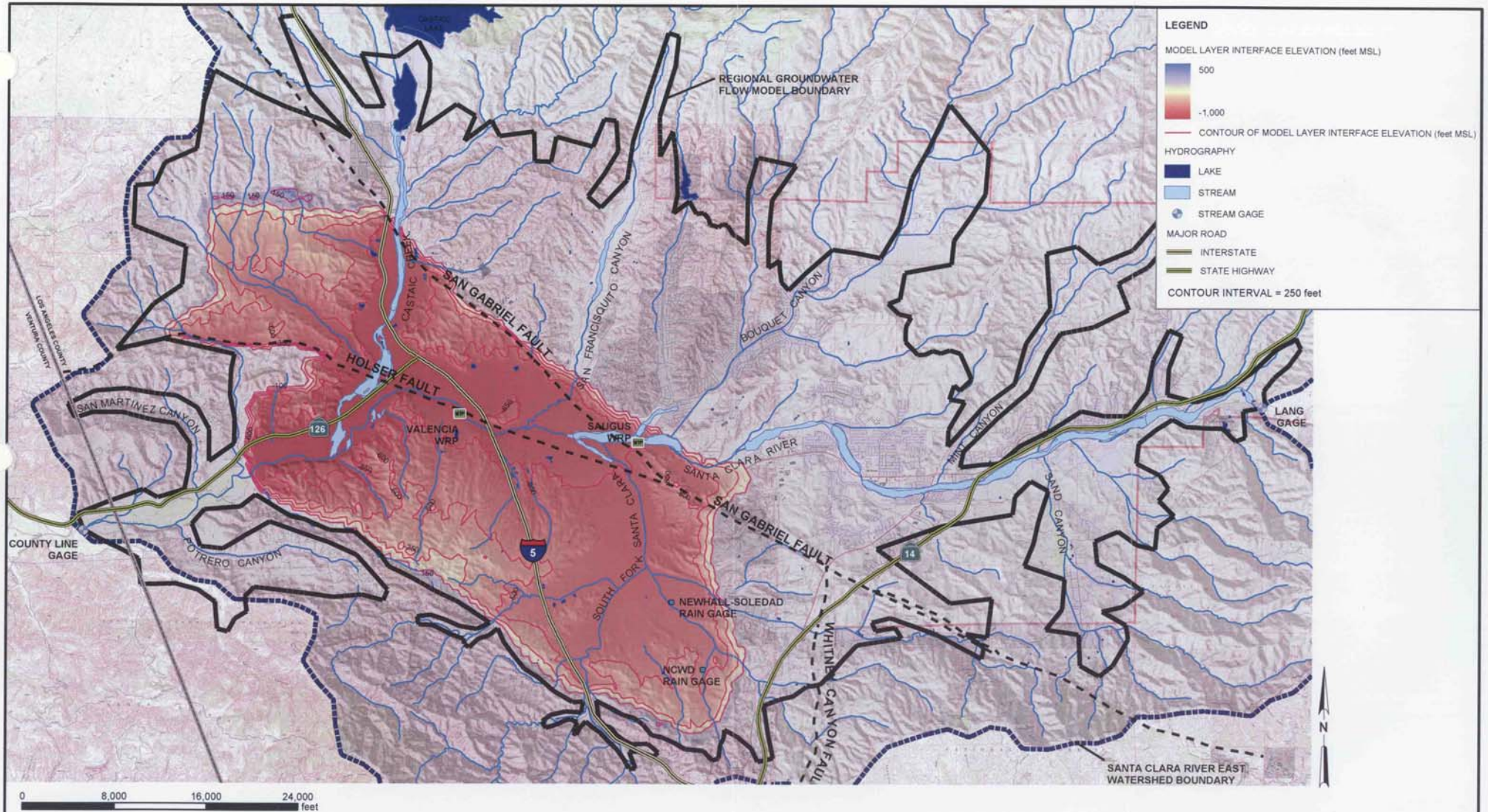


FIGURE 3-16
LAYER 6 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG032.MXD FIG03-16.PDF 02/04/2004 13:03:59

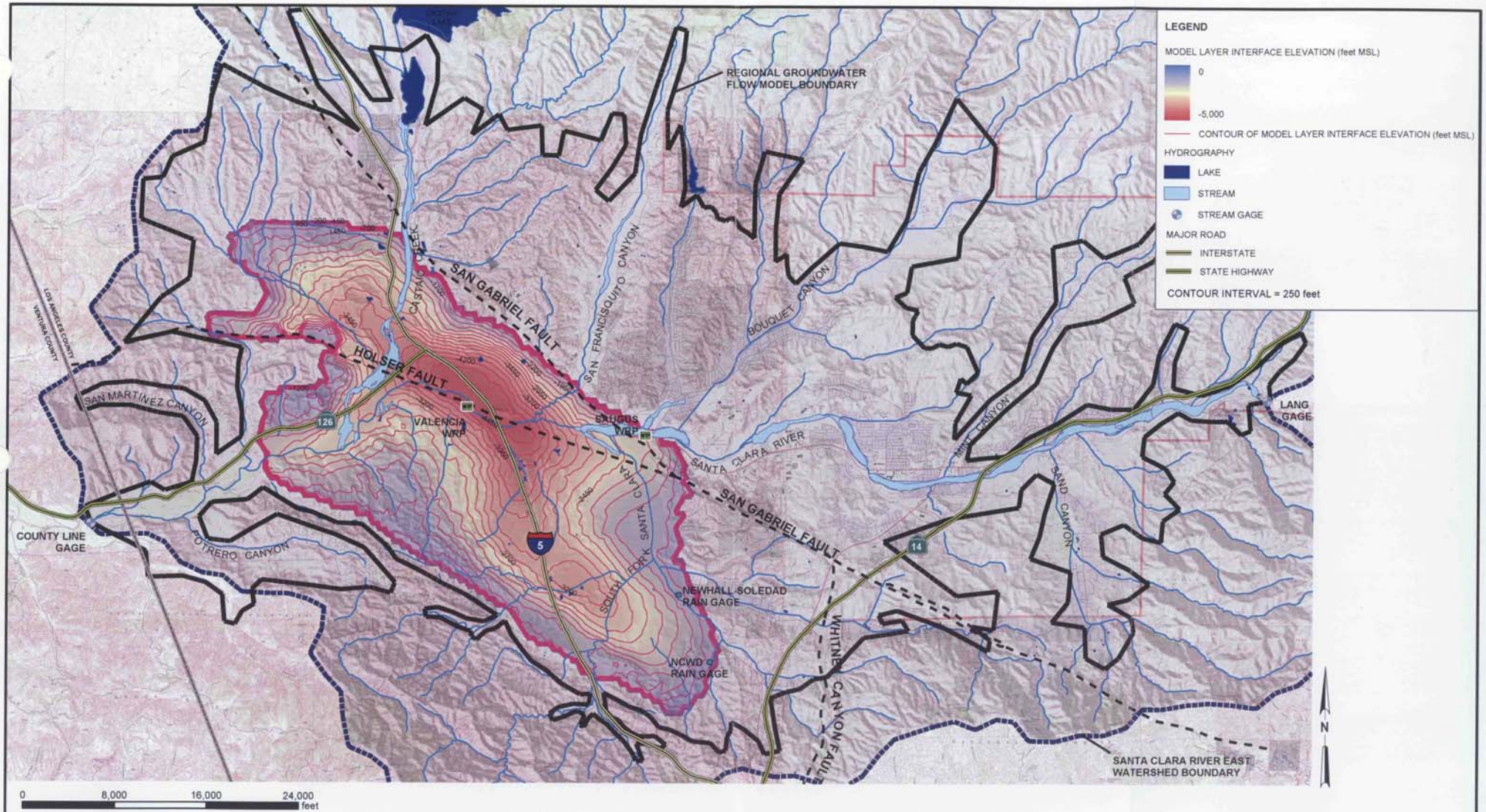
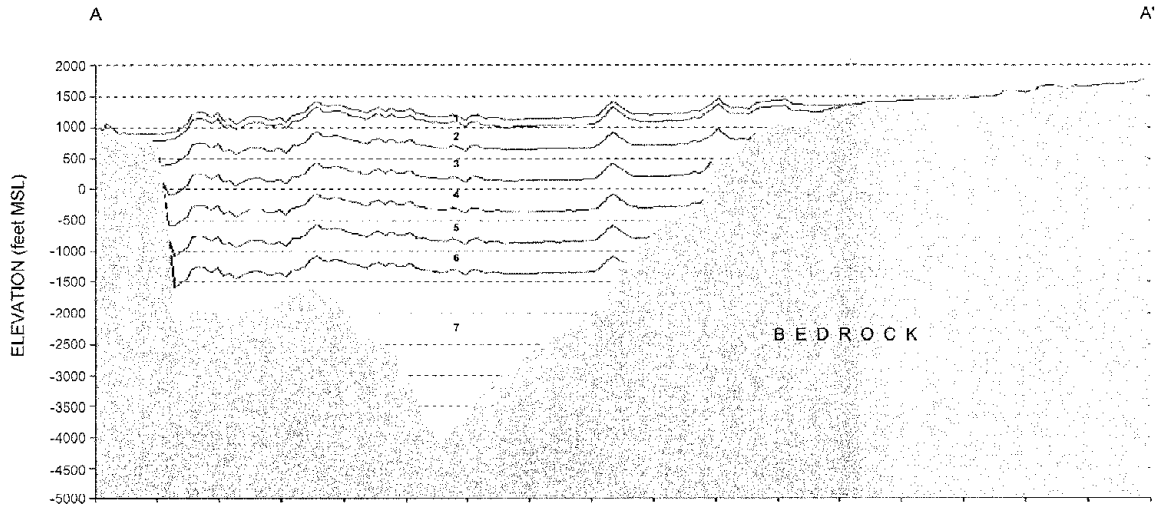
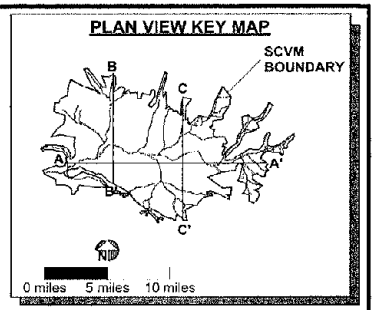


FIGURE 3-17
LAYER 7 BASE ELEVATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG033.MXD FIG03-17.PDF 02/03/2004 13:13:34





LEGEND

1 = MODEL LAYER 1

2 = MODEL LAYER 2

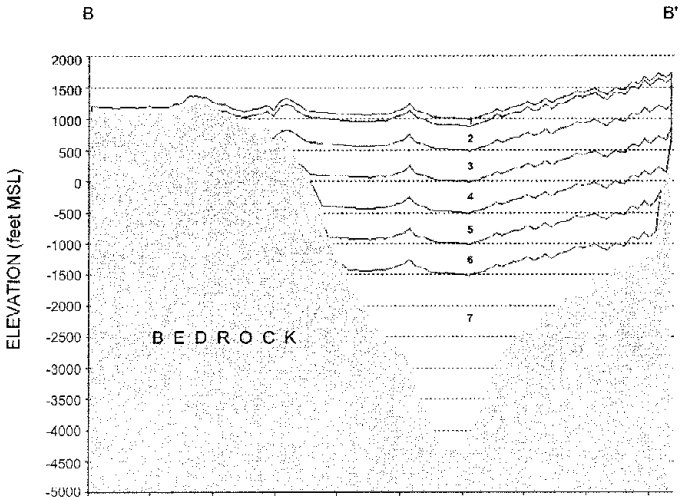
3 = MODEL LAYER 3

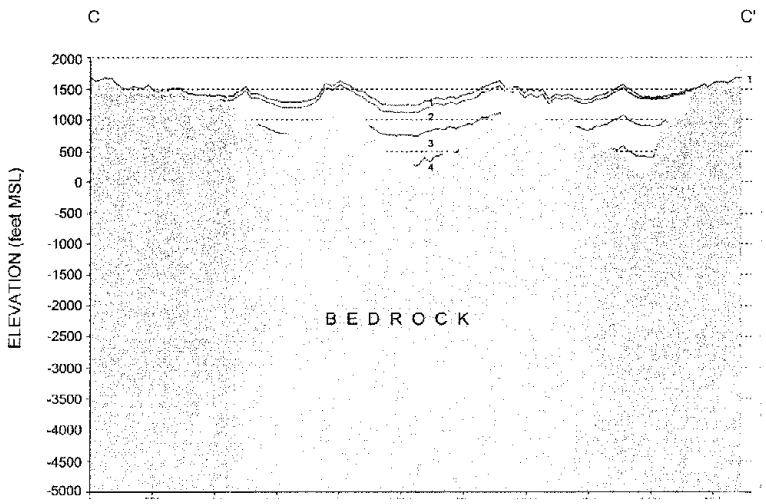
4 = MODEL LAYER 4

5 = MODEL LAYER 5

6 = MODEL LAYER 6

7 = MODEL LAYER 7





HORIZONTAL CROSS SECTION SCALE

0 feet 10,000 feet 20,000 feet

5x VERTICAL EXAGGERATION

FIGURE 3-18
SCHEMATIC CROSS SECTIONS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

SCHEMATICCROSSSECTIONS.SRF

SECTION 4

Model Calibration Process

This section describes the model calibration process. The Regional Model was calibrated according to the *Standard Guide for Calibrating a Ground-Water Flow Model Application,* published by the American Society for Testing and Materials (1996), which describes how to calibrate a model using historical data, including how to establish calibration target data, identify calibration parameters, and compare field data to model calibration results.

Following are discussions of the historical field conditions that were simulated during calibration; the goals of the calibration process; the model parameters (variables) that were adjusted during calibration; and the procedures and target data that were used to conduct the calibration process.

4.1 Calibration Conditions

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation.

4.1.1 Steady-State Calibration

The steady-state calibration was performed for calendar years 1980 through 1985. The purpose of the steady-state model was to simulate average regional flow patterns, regional hydraulic gradients, and groundwater budgets during the initial time period to be modeled as part of the transient calibration effort. The steady-state model also provided initial groundwater elevations for the beginning of the transient model.

During the 1980 through 1985 period:

a. The average precipitation (20.15 in/yr) was approximately 2.5 inches higher than the 1950 through 2000 mean (17.35 in/yr).

b. Alluvial Aquifer pumping decreased slightly (see Table 2-1).

c. Saugus pumping remained relatively constant, between 3,800 and 5,000 AF/yr (see Table 2-2).

d. Importation of SWP water increased steadily, from 1,125 acre-feet in 1980 to 11,823 acre-feet in 1985.

e. WRP discharges into the Santa Clara River increased from approximately 7,400 AF in 1980 to approximately 9,600 AF in 1985.

f. Groundwater elevations in the Alluvial Aquifer remained relatively stable, except for a slight decline in the eastern part of the valley during 1984 and 1985, due to below-normal rainfall during those years.

g. Groundwater elevations in the Saugus Formation remained relatively stable.

Hence, even though SWP imports and WRP discharges increased during this period, groundwater elevations did not rise, instead remaining fairly stable or decreasing slightly due to the relatively stable natural hydrologic conditions during this 6-year period and the below-normal rainfall in 1984 and 1985. Consequently, this time period was deemed suitable for the steady-state portion of the model calibration effort.

4.1.2 Transient Calibration

The transient calibration was performed for calendar years 1980 through 1999 to create a model capable of simulating seasonal and long-term variations in groundwater elevations, groundwater recharge, and groundwater discharge for a historical period characterized by variable rainfall and recharge and changing land use and water use patterns. This 20-year period was chosen for the following reasons:

a. The volume of data is greater during this period than in previous years. In particular, SCWC and VWC installed several production wells in the Saugus Formation during this time period. Also, regular monitoring of groundwater levels was performed at more wells during this period than before.

b. Annual pumping volumes are well known before and after the 1970s, but are not as well known during that decade. Hence, it would be more difficult to calibrate a model during the 1970s because of the uncertainties in pumping volumes during that time.

c. Significant urban growth occurred in the valley between 1980 and 1999. This growth resulted in changes in land use and increased importation of SWP water, from 1,125 acre-feet in 1980 to 27,302 acre-feet in 1999.

d. The local hydrology and the hydrology of the SWP system varied considerably during this period, and included single-year and multi-year droughts both locally and in the SWP system. (See Section 2.6.3.3.) Specifically, the groundwater elevations in the Alluvial Aquifer and the Saugus Formation showed multi-year periods of water level decline followed by multi-year periods of water level recovery. Consequently, calibrating to this period would allow a model to predict basin conditions during and between future drought periods.

4.2 Calibration Goals

The success of the model calibration was determined by its ability to satisfy specific calibration goals that were established by the CH2M HILL project team and the Purveyors. Separate calibration goals were defined for the steady-state model and the transient model. The specific goals are given below, along with a discussion of how calibration success was measured. Calibration goals are comprised of quantitative (statistical) and qualitative criteria.

4.2.1 Calibration Goals for the Steady-State Model

a. **Groundwater Flow Directions.** Correctly simulate groundwater flow directions in the Alluvial Aquifer and Saugus Formation, as defined by regional groundwater elevation contour maps prepared by RCS (1985, 1986, 2002) for various periods in both aquifer systems. (See Figures 2-7 and 2-8.)

b. **Groundwater Elevation Residuals.** At each target well, simulate groundwater elevations to within 10 feet in the Alluvial Aquifer and 25 feet in the Saugus Formation, compared with observed average groundwater elevations during this period. The value of the modeled groundwater elevation minus the observed average groundwater elevation is called the residual error (residual). A positive residual at a given target well indicates that the model simulates too high a groundwater elevation. Conversely, a negative residual indicates that the model simulates too low a groundwater elevation.

c. **Statistics of Groundwater Elevation Residuals.** Achieve the following statistics for the residuals on a modelwide scale (i.e., for the combined group of calibration target wells):

   1. A mean residual as close to zero as possible.

   2. A mean residual that is less than 5 percent of the range in groundwater elevations measured at the target wells.

   3. A root-mean-square (RMS) error of less than 10 feet for the residuals at Alluvial Aquifer target wells and less than 25 feet for the residuals at Saugus target wells.

   4. A normalized RMS error of 10 percent or less. The normalized RMS error equals the modelwide RMS error divided by the range in groundwater elevations across the entire model domain.

   5. A normalized residual standard deviation of less than 10 percent. The normalized residual standard deviation equals the standard deviation of the residuals divided by the range in groundwater elevations across the entire model domain.

   6. Minimize the degree of spatial bias in the distribution of the residuals. Specifically, avoid creating large areas where the residuals are predominantly positive or predominantly negative. A well-calibrated model shows a scattering of negative and positive residuals within any given localized area.

d. **Groundwater Gradients.** Simulate the direction and magnitude of groundwater gradients across the model domain, including a significant horizontal gradient in the Saugus Formation that exists across the San Gabriel Fault (as measured at four multi-port monitoring wells located on the Whittaker-Bermite property, east of wells SCWC-Saugus1 and SCWC-Saugus2).

e. **Groundwater Below Ground Surface.** At nodes where streams are not present, maintain groundwater elevations below ground surface. At stream nodes, groundwater elevations should also be below ground surface in most ephemeral reaches, though a limited number of nodes can have higher groundwater elevations in the downstream ephemeral reaches, where the exact location of the transition from ephemeral to perennial conditions is variable over time and is only approximately known.

f. **Groundwater Discharge to River.** Simulate a groundwater discharge to the Santa Clara River on the order of 29,000 AF/yr, which is the estimated average baseflow during the steady-state model period (see Section 2.6.2.5).

4.2.2 Calibration Goals for the Transient Model

a. **Water Level Trends/Hydrographs.** Match observed fluctuations in groundwater elevations.

b. **Groundwater Below Ground Surface.** Maintain groundwater elevations below ground surface in the same general areas as previously discussed for the steady-state model.

c. **Total River Flow at County Line Gage.** Match the observed Santa Clara River flows measured at the County Line gage.

d. **Groundwater Discharge to River.** Match the estimated groundwater discharge rates to the Santa Clara River.

Discussions of how these calibration goals are met by the Regional Model are contained in Section 4.4.

4.3 Calibration Variables

The following variables were the subject of model calibration and testing:

a. The horizontal hydraulic conductivity (Kh) and the vertical anisotropy (R), which is the ratio of horizontal to vertical hydraulic conductivity

b. The storage coefficients

c. The relationship between rainfall and stormwater runoff in the tributary watersheds lying upstream of the groundwater basin

d. The riverbed permeabilities in gaining and losing reaches of stream systems, particularly in the ephemeral reach of the Santa Clara River and in Castaic Creek

e. ET parameters (primarily rooting depth and the maximum potential ET rate)

4.3.1 Horizontal Hydraulic Conductivity and Vertical Anisotropy

Because the Regional Model consists of over 17,000 active nodes in each of the seven model layers, the calibration process relied on the definition of zones of uniform hydraulic conductivity (K), spanning multiple nodes in a given layer and, in some areas, spanning multiple layers. Specifically, in a given layer, a geographic area was defined as a zone, and the Kh and R values were assigned to all model cells in that zone.

The number of zones and their locations were assigned in the model by primarily considering the hydrostratigraphy and the locations of target wells in the various calibration models, then considering the spatial variations in saturated thickness as summarized by RCS (2002). During the course of the calibration process, adjustments were made to the locations of the zone boundaries and the number of zones. Figures 4-1 and 4-2 show the geographic area designations for the Alluvial Aquifer and Saugus Formation, respectively. In the final calibrated Regional Model, 48 zones were used in the Alluvial Aquifer and 8 zones were used in the Saugus Formation, including a zone along the San Gabriel fault.

The values of Kh for each zone in the Alluvial Aquifer were specified at the beginning of the calibration process from the analyses of specific capacity tests (Table 2-3). In the Saugus Formation, Kh and R values were initially defined from the ASR test analysis (CH2M HILL, 2001) and, in the case of Kh values, also from slug test results on the Whittaker-Bermite property (CH2M HILL, 2003). During calibration, attempts were made to keep these values as close to the initial assigned values as possible. However, adjustments were made if changes to other parameter values were unable to bring the model into calibration.

4.3.2 Storage Coefficients

Model layer 1 was assigned a specific yield of 0.10 to simulate this layer as unconfined. The specific yield was allowed to range between values as low as 0.075 and as high as 0.15. The final Regional Model used a value of 0.10 at each node in layer 1 for both the Alluvial Aquifer and the Saugus Formation (see Section 5).

In model layers 2 through 7, which simulate portions of the Saugus Formation lying below the uppermost model layer, the storage coefficients were allowed to range between 10^{-4} and 10^{-3}, based on analyses of the ASR test results (RCS, 2001) and pumping tests at other Saugus wells (RCS, 2002).

4.3.3 Stormwater Runoff in Upstream Watersheds

See Section 3.6 and Appendix C for discussions of the SWRM, which determined the amount of stormwater generated in upstream watersheds that is available to recharge the Alluvial Aquifer.

4.3.4 Riverbed Permeabilities

The establishment of streambed permeabilities for perennial (gaining) and ephemeral (losing) stream reaches are discussed separately below.

4.3.4.1 Perennial (Gaining) Streams

The streambed conductance terms in the MicroFEM® drain and wadi packages regulate the rate of water exchange between groundwater and surface water along selected stream reaches in the valley. As discussed in Section 3.5, the wadi package is used along the perennial reach of the Santa Clara River, and the drain package is used in the river's ephemeral reach and along Castaic Creek to drain groundwater during periods of high water table conditions. For the drain and wadi packages, the streambed conductance at each node where these packages are used is defined from the following relationship:

$$C = (a/LW) * ([0.5*b_{aq}/Kv_{aq}] + [b_{stream}/Kv_{stream}]) \quad (1)$$

where at each stream node:

a = wetted area of the streambed

L = one-half of the combined lengths of the two grid segments (lines) that connect the stream node to the adjoining upstream and downstream stream nodes

W = the width of the streambed

b_{aq} = the thickness of the Alluvial Aquifer beneath the stream node

Kv_{aq} = the vertical hydraulic conductivity of the Alluvial Aquifer beneath the stream node

b_{stream} = the thickness of the riverbed sediments

Kv_{stream} = the vertical hydraulic conductivity of the riverbed sediments

The calibrated Regional Model uses values of 2 feet for b_{aq} and 10 ft/day (3.5×10^{-3} centimeters per second [cm/sec]) for Kv_{aq}.

4.3.4.2 Ephemeral (Losing) Streams

During the transient calibration phase of model development, the SWRM adjusted the streambed conductance terms for Castaic Creek and for the ephemeral reach of the Santa Clara River. Adjustments in streambed conductance values were made for the following reasons:

a. To integrate this term into the transient model calibration process

b. To account for the variations in streambed conductance that arise from:

   1. Variations in riverbed permeability along the length of the streambed
   2. Variations in riverbed permeability that can occur at a given location due to sediment scouring and redeposition processes that occur during storm runoff periods
   3. Variations in streambed conductance that arise from variations in the width of the river (greatest during storm runoff periods, smallest during low-flow periods)

The adjustment of streambed conductance values during calibration of the transient model was performed for each month and was conducted in an iterative manner by running both the SWRM and the Regional Model repeatedly until the streambed conductance terms or groundwater elevations showed no significant changes (see Appendix C).

4.3.5 Evapotranspiration Parameters

The ET rooting depth was set at 10 feet to correspond to typical rooting depths for phreatophytes such as the willow and cottonwood trees that are present in the riparian corridor along the perennial reach of the Santa Clara River. The maximum potential ET rate was set at 6 feet per year (ft/yr) during model calibration. Ground surface elevation was specified by importing USGS Digital Elevation Model files.

4.4 Calibration Procedure and Target Calibration Data

The steady-state and transient models were calibrated by running the Regional Model and comparing results to the calibration goals described in Section 4.2. The comparison of model results with calibration goals relied on the use of target data that consisted of groundwater elevation data, groundwater discharge to the river, and total flow in the river. Following are discussions of the target calibration data.

4.4.1 Groundwater Elevation Target Data

Alluvial Aquifer target wells were selected for each of the Alluvial zones shown in Figure 4-1. In the Saugus Formation, most wells were used as targets (Figure 4-2). Generally, the selected target wells were those with the greatest number of groundwater elevation measurements during the periods 1980 through 1985 for the steady-state model and 1980 through 1999 for the transient model. Some wells were measured routinely through 1985 but not through 1999, and some wells were not measured until after 1985. Therefore, the list of wells used as targets is different for the steady-state and transient models.

Figure 4-1 shows the target wells for the Alluvial Aquifer, and Figure 4-2 shows the target wells for the Saugus Formation. Table 4-1 provides location and construction information for each target well. The target wells include (1) purveyor-owned production wells; (2) production wells located at the Wayside Honor Rancho (WHR) facility; and (3) a network of non-pumping or low-pumping monitoring wells where water levels have been measured routinely by the Los Angeles County Flood Control District (LACFCD) for many years.

For the production wells, the available water level measurements have been recorded as pumping elevations and static elevations. Static elevations are collected when the well is not pumping. Model-simulated groundwater elevations at a pumping well will be higher than those measured under pumping conditions for the following reasons:

a. In the model, pumping is assigned at these wells, but the pumping nodes have much larger areas than the diameter of the borehole in which each well is completed.

b. The field measurements of groundwater elevations under pumping conditions measure lower groundwater elevations than exist in the aquifer adjacent to the borehole, due to well losses across the borehole wall and the screen or slotted pipe.

Therefore, for model calibration purposes, the calibration goal at target wells that pump was to simulate groundwater elevations as close to the static elevations as possible, while also ensuring that simulated elevations were higher than the pumping elevations. More importantly, the transient calibration effort focused on the periods with the greatest groundwater elevation changes, and the analysis specifically focused on the slopes of the hydrographs, not just the absolute magnitudes of the groundwater elevations.

In the tributary canyons east of I-5, geologic logs were unavailable for many of the LACFCD wells. The total depths and open intervals for many of these wells suggested that they were completed in the geologic units underlying the alluvium, probably due to limited saturated thickness in the alluvium, particularly in the upper reaches of each canyon. For this reason, no targets were selected in Mint Canyon or upstream of the SCWC-Clark production well in Bouquet Canyon. In Sand Canyon, only the well farthest downstream, 7188A, was deemed suitable for use as an Alluvial Aquifer target well. Along the South Fork Santa Clara River, geologic logs and well construction data indicate that all target wells are constructed in the Saugus Formation, not the alluvium. The geologic data indicate that there is very limited saturated thickness in the alluvium in this area.

4.4.2 Santa Clara River Baseflow and Total Flow

Target river flow data to which the Regional Model results were compared were the total gaged flow at the County Line gage and estimates of how much of the gaged flow consisted of groundwater discharge to the river (baseflow).

The simulated total flow at the County Line gage equaled the sum of:

a. The simulated groundwater discharge to the river as calculated by the groundwater model from all wadi and drain nodes

b. The volume of water in the streams that the Visual Basic program (described in Section 3.6 and Appendix C) calculated as surplus stream flow that would not infiltrate to the underlying Alluvial Aquifer

This simulated total flow was compared directly with County Line gage results. The simulated groundwater discharge to the river was compared with the estimated values of river baseflow described previously in Section 2.6.2.5 of this report and listed in Table 2-6. For the steady-state model, the average baseflow during the period 1980 through 1985 was approximately 29,000 AF/yr.

4.4.3 Adjustments to Model Parameters

The steady-state and transient calibration process involved the adjustment of multiple parameters. Initially, the calibration effort focused on the steady-state model, where adjustments were made to Kh and Kv values and streambed coefficients, particularly in the gaining reaches of streams, to establish groundwater elevations, gradients, and flow directions. Attention was then devoted to the transient model, where the parameters receiving adjustment were the storativity, Sy, and the stormwater infiltration rates. Adjustments to Kh and Kv values that had been established during steady-state calibration were considered during transient calibration, but adjustments to these parameters were found to be unnecessary.

Initially, these efforts to calibrate the steady-state and transient models used a fixed, specified relationship between precipitation and stormwater to define the amount of water available for potential infiltration to groundwater. As Appendix C discusses, this relationship was in the form of an empirical power-function equation developed by Turner (1986). The empirical equation uses power-function coefficients that Turner (1986) developed from measurements of the yields from 68 different watersheds throughout California. Although the equation was used throughout the calibration process, including in the final model, the steady-state and transient calibration processes indicated that the empirical power-function coefficients reported by Turner (1986) generated too much stormwater and groundwater recharge to the Santa Clarita Valley during dry years and too little stormwater and groundwater recharge during wet years. This was determined by comparing hydrographs of measured and modeled groundwater elevations and river flows. After many attempts to achieve calibration by adjusting other model parameters, it was concluded that a different set of power coefficients would need to be developed for the Santa Clarita Valley. Consequently, during the final stages of calibration, adjustments to the model focused primarily on the values of these coefficients and on the values of the streambed vertical hydraulic conductivity. Calibration was considered complete once it was determined that the calibration goals were achieved or that no further improvements to the model were possible.

Tables

TABLE 4-1
Target Wells for Calibration of the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Well Name	Location	Model Zone	Well in Steady-State Model	Well in Transient Model	Year Drilled	Status 1986	Status 2001	Well Use	Easting (feet)[a]	Northing (feet)[a]	Measuring Point Elevation (feet MSL)	Total Depth (feet bgs)	Depth to Top of Open Interval (feet bgs)	Depth to Base of Open Interval (feet bgs)	Type of Open Interval	Drilling Method	Sanitary Seal Depth (feet bgs)	Depth of Pump Intake (feet bgs)
Alluvial Aquifer West of I-5																		
NLF-B11	Santa Clara River	C1c	No	Yes	---	Active	Active	Agricultural supply	6362161	1971971	886							
NLF-B10	Santa Clara River	C1c	Yes	No	1956	Active	Active	Agricultural supply	6364235	1974541	901.4	142	30	130	Knife cut			
NLF-B7	Santa Clara River	C1c	No	Yes	1946	Active	Active	Agricultural supply	6364397	1973939	901.6	102	18	88	Knife cut			
NLF-C5	Santa Clara River	C1b	Yes	No	1939	Active	Active	Agricultural supply	6371746	1977874	960.1	139	31	133	Knife cut			
NLF-C6	Santa Clara River	C1b	No	Yes	1939	Active	Active	Agricultural supply	6371835	1978154	966	103	26	93	Knife cut			
NLF-E4	Santa Clara River	C1a	Yes	Yes	1940	Active	Active	Agricultural supply	6374844	1982371	982.5	142	50	136	Knife cut			
6995D	Santa Clara River	C1a	Yes	No	1970	Active	Active	Water levels	6379091	1983329	1018						0	
NLF-G45	Santa Clara River	B1b1	No	Yes	---	Active	Active	Agricultural supply	6381356	1982222	1030	140	40	140				
7076C	Santa Clara River	B1b1	Yes	No	---	Active	Destroyed?	Water levels	6385042	1980084	1059						0	
Alluvial Aquifer between I-5 and Soledad Canyon																		
VWC-I	Santa Clara River	B1b2	No	Yes	1945	Active	Inactive	Municipal supply	6388567	1981657	1090	171	30	165			55	120
NLF-S3	Santa Clara River	B1a	No	Yes	---	Active	Destroyed	Agricultural supply	6393334	1978292	1129	250	95	205				
VWC-N	Santa Clara River	B1a	No	Yes	1936	Active	Active	Municipal supply	6395527	1976081	1130	280	76	237	Knife cut		50	140
VWC-K2	Santa Clara River	B1a	Yes	No	1945	Active	Active	Municipal supply	6395788	1976021	1132	242	62	230	Knife cut		50	63
NLF-R	Santa Clara River	B1a	Yes	No	---	Active	Destroyed	Agricultural supply	6397463	1977860	1157	160	40	140				
7067D	Santa Clara River	B1a	No	Yes	1964	Active	Destroyed?	Water levels	6398546	1977483	1157.5						0	
VWC-Q2	Santa Clara River	B1a	No	Yes	1954	Active	Active	Municipal supply	6399032	1977459	1158	170	76	126				100
Alluvial Aquifer in Soledad Canyon																		
SCWC-Stadium	Santa Clara River	A1e1	Yes	Yes	1946	Active	Active	Municipal supply	6402385	1974713	1197	130	33	130	Knife cut	Unknown		130
VWC-T4	Santa Clara River	A1e1	Yes	No	1953	Active	Active	Municipal supply	6403350	1975164	1191	150	50	135	Knife cut		50	100
VWC-T2	Santa Clara River	A1e1	No	Yes	1952	Active	Active	Municipal supply	6403623	1975127	1201	150	50	138	Knife cut			100
LACFCD-7107C	Santa Clara River	A1d1	Yes	No	---	Active	Destroyed?	Water levels	6410792	1975622	1276						0	
SCWC-Honby	Santa Clara River	A1d1	No	Yes	1959	Active	Active	Municipal supply	6411408	1977202	1282	226	50	202	Factory	Rotary	30	130
7127D	Santa Clara River	A1d2	Yes	Yes	1974	Active	Active	Water levels	6417808	1977062	1333	157					0	
SCWC-N.Oaks West	Santa Clara River	A1d4	Yes	No	1940	Active	Active	Municipal supply	6421187	1972857	1392	136	80	118	Knife cut	Unknown		110
SCWC-N.Oaks East	Santa Clara River	A1d4	No	Yes	1940	Active	Active	Municipal supply	6421651	1972936	1398	132	81	150	Knife cut	Unknown		130
7148K	Santa Clara River	A1c1	No	Yes	---	Active	Active	Water levels	6423523	1973851	1435						0	
7158K	Santa Clara River	A1c2	Yes	No	1965 or earlier	Active	Active	Water levels	6427699	1973490	1460						0	
7168C	Santa Clara River	A1c2	Yes	Yes	---	Active	Active	Water levels	6430088	1974149	1488						0	
SCWC-Mitchell	Santa Clara River	A1c2	No	Yes	1976	Active	Active	Municipal supply	6430168	1974420	1489	262	76	246	125 Mesh	Rotary	76	162
SCWC-Sand Canyon	Santa Clara River	A1c3	Yes	No	1973	Active	Active	Municipal supply	6432953	1975589	1523	127	60	140	Factory	Rotary	60	112
7178D	Santa Clara River	A1c3	Yes	No	1950 or earlier	Active	Active	Water levels	6433648	1975837	1528						0	
SCWC-Lost Canyon 2	Santa Clara River	A1c3	No	Yes	1965	Active	Active	Municipal supply	6433582	1975573	1530	310	95	125	Factory	Rotary	30	295
7177B	Santa Clara River	A1b1	No	Yes	1949 or earlier	Active	Active	Water levels	6434745	1976476	1542						0	
7177P	Santa Clara River	A1b1	Yes	No	---	Active	Active	Water levels	6434036	1976556	1542						0	
7187C	Santa Clara River	A1b2	Yes	No	---	Active	Active	Water levels	6435847	1977582	1548						0	
7197	Santa Clara River	A1b2	Yes	Yes	1945 or earlier	Active	Destroyed?	Water levels	6437790	1977821	1579						0	
7197D	Santa Clara River	A1b2	No	Yes	---	Active	Active	Water levels	6438053	1977798	1582						0	
NCWD-Pinetree1	Santa Clara River	A1b2	No	Yes	1986	Active	Active	Municipal supply	6439881	1977964	1588	235	50	210			20	160
7197G	Santa Clara River	A1b2	Yes	No	1974 or earlier	Active	Active	Water levels	6440544	1978061	1600						0	
Alluvial Aquifer along Castaic Creek																		
VWC-D	Castaic Creek	C2b	No	Yes	1950	Active	Active	Municipal supply	6375668	1987267	1036	142	60	136	Knife cut		50	100
6993A	Castaic Creek	C2b	Yes	Yes	1958 or earlier	Active	Active	Water levels	6377865	1992457	1067						0	
6981D	Castaic Creek	C2a	Yes	Yes	1972 or earlier	Active	Active	Water levels	6376437	2000534	1127						0	
NCWD-Castaic3	Castaic Creek	C2a	No	Yes	1961	Active	Active	Municipal supply	6376475	2002309	1141	135	55	136				100
6980E	Castaic Creek	C2a	No	Yes	1962 or earlier	Active	Active	Water levels	6376282	2002242	1144						0	
6980G	Castaic Creek	C2a	Yes	No	1962 or earlier	Active	Destroyed?	Water levels	6376020	2002731	1151						0	

TABLE 4-1
Target Wells for Calibration of the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Well Owner-Well Name	Location	Model Zone	Well in Steady-State Model	Well in Transient Model	Year Drilled	Status 1986	Status 2001	Well Use	Easting (feet)[a]	Northing (feet)[a]	Measuring Point Elevation (feet MSL)	Total Depth (feet bgs)	Depth to Top of Open Interval (feet bgs)	Depth to Base of Open Interval (feet bgs)	Type of Open Interval	Drilling Method	Sanitary Seal Depth (feet bgs)	Depth of Pump Intake (feet bgs)
Alluvial Aquifer in Other Tributary Canyons to the Santa Clara River																		
VWC-W6	San Francisquito Canyon	B4c	Yes	Yes	1952	Active	Active	Municipal supply	6393601	1985449	1159	158	90	153	Knife cut		50	100
7066D	Bouquet Canyon	B2c	Yes	Yes	---	Active	Active	Water levels	6400238	1979734	1182						0	
7086B	Bouquet Canyon	B2c	Yes	No	---	Active	Active	Water levels	6405151	1981611	1247						0	
SCWC-Clark	Bouquet Canyon	B2c	No	Yes	1946	Active	Active	Municipal supply	6405894	1983061	1267	160	20	120	Knife cut	Unknown		110
7095	Bouquet Canyon	B2b	Yes	No	1930 or earlier	Active	Active	Water levels	6409922	1986103	1323	146					0	
7188A	Sand Canyon	A3b	No	Yes	1952	Active	Active	Water levels	6434878	1972313	1588						0	
Saugus Formation																		
VWC-160	Santa Clara River	E	Yes	Yes	1984	Active	Active	Municipal supply	6388950	1976191	1101	2000	950	2000	Louvers	Rotary	65	260
7048C	Santa Clara River	E	Yes	Yes	1981	Active	Destroyed?	Water levels	6395222	1974491	1147						0	
VWC-157	S. Fork Santa Clara River	E	Yes	Yes	1962	Active	Active	Municipal supply	6395696	1974099	1151	2008	586	2008	Vertical slots	Rotary	15	340
VWC-201	S. Fork Santa Clara River	E	No	Yes	1989	Not Built	Active	Municipal supply	6394125	1973032	1152	1690	540	1670	Louvers	Mud rotary	460	360
SCWC-Saugus1	S. Fork Santa Clara River	E	No	Yes	1988	Not Built	Inactive	Municipal supply	6397847	1973452	1162	1640	490	1620	Wire wrap screen	Reverse	450	500
SCWC-Saugus2	S. Fork Santa Clara River	E	No	Yes	1988	Not Built	Inactive	Municipal supply	6398514	1972540	1158	1612	490	1591	Wire wrap screen	Reverse	460	500
NCWD-11	S. Fork Santa Clara River	F	Yes	Yes	1973	Active	Active	Municipal supply	6399004	1968019	1187	1136	200	1075	Louvers	Reverse rotary	150	340
NCWD-13	S. Fork Santa Clara River	F	No	Yes	1990	Not Built	Active	Municipal supply	6399098	1967327	1194	1300	420	750			50	445
NCWD-12	S. Fork Santa Clara River	F	Yes	Yes	1985	Inactive	Active	Municipal supply	6399282	1965920	1206	1340	485	1280	Louvers	Reverse rotary	420	400
NCWD-10	S. Fork Santa Clara River	F	Yes	Yes	1961	Active	Inactive	Municipal supply	6399388	1965803	1207	1555	780	1544	Louvers	Rotary	114	335
5851	S. Fork Santa Clara River	F	Yes	Yes	1966	Active	Active	Water levels	6396468	1962593	1233						0	
5851A	S. Fork Santa Clara River	F	Yes	No	1968	Active	Active	Water levels	6396432	1962504	1233						0	
5842F	S. Fork Santa Clara River	A	Yes	No	1974	Active	Active	Water levels	6395286	1960869	1248						0	
NCWD7	S. Fork Santa Clara River	F	Yes	Yes	1954	Active	Inactive	Municipal supply	6401264	1962732	1251	994	520	974	Knife cut	Cable tool		306
5841	S. Fork Santa Clara River	F	Yes	No	1973	Active	Active	Water levels	6393394	1963704	1256						0	
5871D	S. Fork Santa Clara River	F	Yes	No	1948 or earlier	Active	Active	Water levels	6402392	1962734	1262						0	
7053C	San Francisquito Canyon	D	Yes	No	---	Active	Destroyed?	Water levels	6397679	1992663	1291						0	
5882	S. Fork Santa Clara River	A	Yes	No	1931 or earlier	Active	Active	Water levels	6406409	1957586	1327						0	
5873E	S. Fork Santa Clara River	A	Yes	No	1957	Active	Active	Water levels	6403977	1957147	1353						0	
NCWD-9	S. Fork Santa Clara River	A	Yes	Yes	1958	Active	Inactive	Municipal supply	6404122	1956997	1354	675	311	674	Louvers	Rotary	75	230
5831	S. Fork Santa Clara River	A	Yes	No	1962	Active	Active	Water levels	6391103	1961398	1381						0	
7053D	San Francisquito Canyon	D	Yes	No		Active	Active	Water levels	6398884	1990433	1402						0	
5912A	S. Fork Santa Clara River	A	Yes	No	1948 or earlier	Active	Active	Water levels	6414810	1960110	1445						0	
7043C	San Francisquito Canyon	D	Yes	No	---	Active	Active	Water levels	6392762	1994816	1528						0	

[a]Coordinates are listed in California State Plane, NAD83 Datum, Zone V.

Notes:
Wells without owner designations belong to the Los Angeles County Flood Control District (LACFCD).
-- = No data available.
N. = north.
S. = south.

Figures

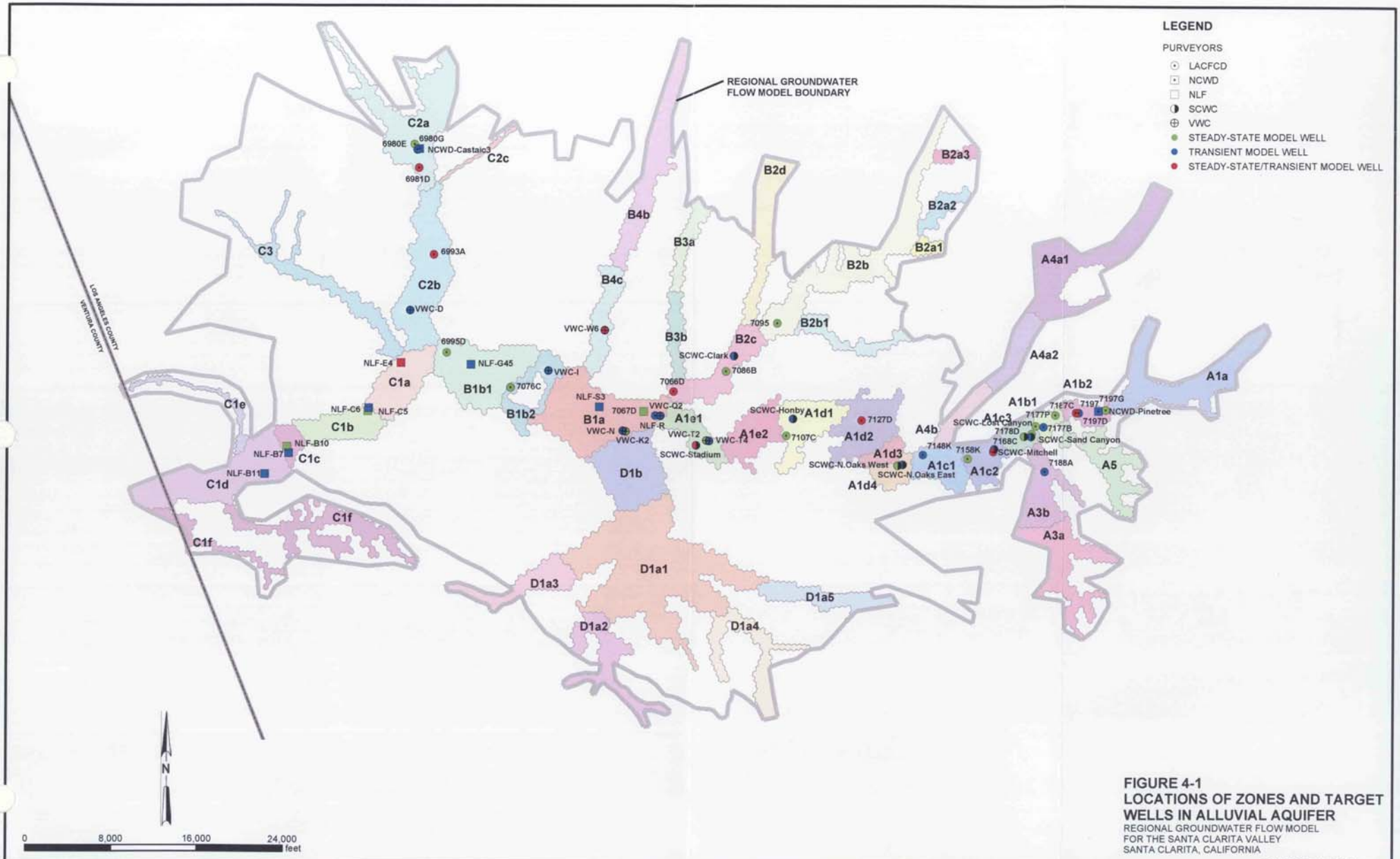


FIGURE 4-1
LOCATIONS OF ZONES AND TARGET WELLS IN ALLUVIAL AQUIFER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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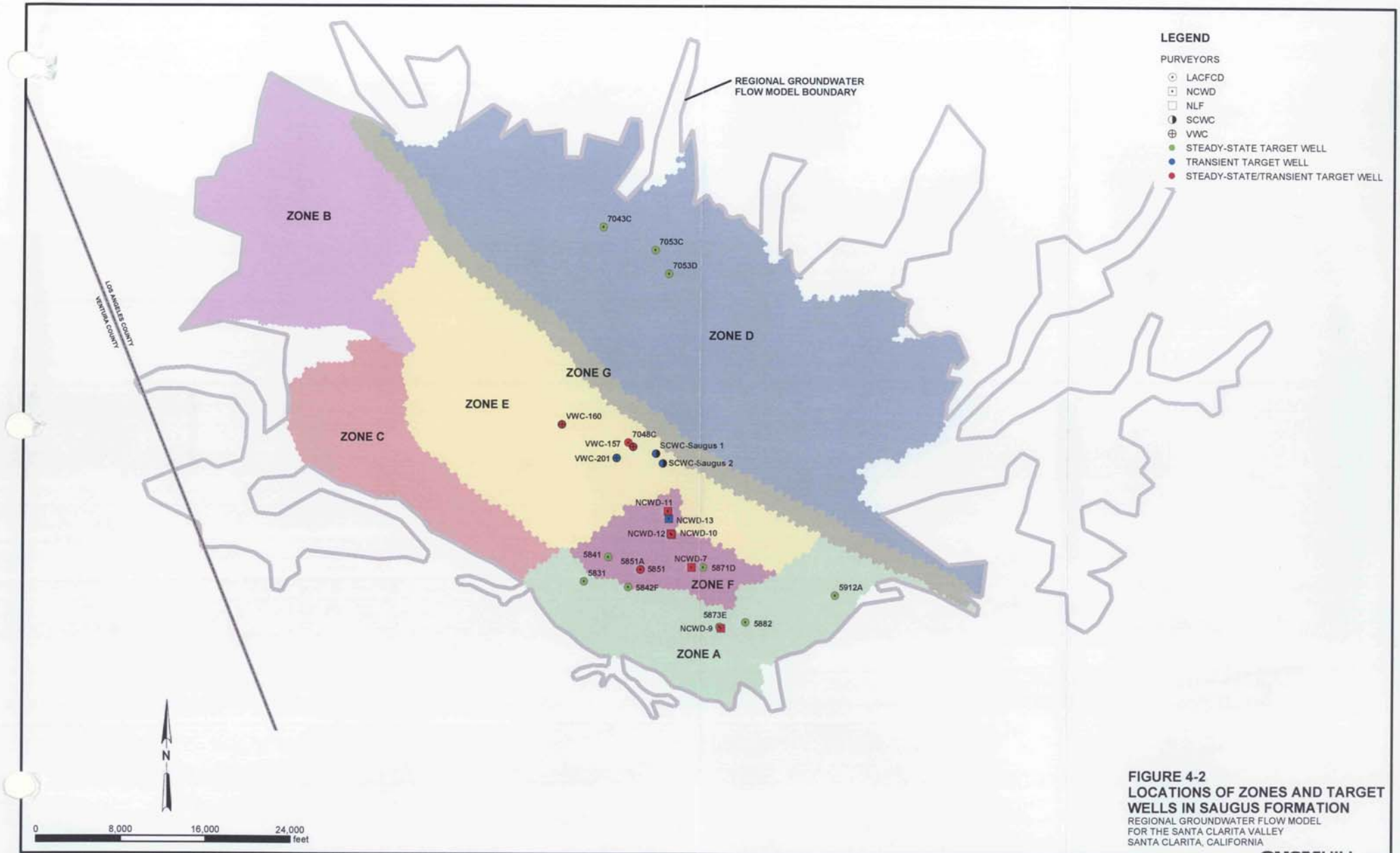

FIGURE 4-2
LOCATIONS OF ZONES AND TARGET WELLS IN SAUGUS FORMATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 5

Calibration Results and Sensitivity Analysis

This section of the report presents the calibrated Regional Model and a sensitivity analysis of the Regional Model. Sections 5.1 and 5.2 discuss the calibration quality of the steady-state and transient models (respectively) with reference to the calibration goals discussed in Section 4.2. Section 5.3 discusses the groundwater budgets for both models. Section 5.4 describes a sensitivity analysis that further evaluated calibration quality by comparing the sensitivity of the model-predicted groundwater elevations and river flows to the values of key model parameters.

The distribution of Kh in the calibrated model is presented on Figures 5-1 through 5-7 for model layers 1 through 7, respectively. Table 5-1 summarizes the values of transmissivity, thickness, and hydraulic conductivity in the 48 alluvial zones. Table 5-2 summarizes values of the other calibrated hydraulic properties that are used in the model.

5.1 Calibration Results for the Steady-State Model

Following are discussions of how the calibrated model compares with the six calibration goals established for the 1980 through 1985 steady-state model.

5.1.1 Groundwater Flow Directions – Calibration Goal 1

Figure 5-8 shows simulated groundwater elevations and flow directions in the Alluvial Aquifer as computed by the steady-state model. The groundwater flow directions are from east to west along the Santa Clara River, which is in agreement with published contour maps for the Alluvial Aquifer (see Figure 2-7). The contours show a very flat hydraulic gradient in the lower reach of the valley containing the South Fork Santa Clara River, which also agrees with published interpretations.

Figures 5-9 through 5-14 show groundwater elevation contour maps for layers 2 through 7 of the Regional Model, which represent the Saugus Formation. Layer 3 (Figure 5-10) is situated from 500 feet bgs to 1,000 bgs and is partially or fully screened by several of the Saugus production wells that are situated in the valley containing the South Fork Santa Clara River. In this area, the model-simulated flow directions in layer 3 are in good general agreement with published interpretations (see Figure 2-8).

5.1.2 Groundwater Elevation Residuals – Calibration Goal 2

Figure 5-15 is a scatter plot comparing simulated and observed average groundwater elevations for target wells in both the Alluvial Aquifer and the Saugus Formation. For a perfect simulation, each point shown on the figure would lie on the diagonal line. The figure shows that the Alluvial Aquifer target wells lie very close to the diagonal line, indicating a very good calibration to the observed average groundwater elevations from 1980 through 1985. For the Saugus Formation, there is greater variability. Some Saugus wells plot very close to the diagonal line, while one well (5882) lies 80 feet above the line and another well

(5831) lies 80 feet below the line. These two particular wells are near the southern model boundary, where the available water level data indicate that the groundwater gradients in the Saugus are very steep compared to areas closer to the Saugus production wells. Nonetheless, the Saugus wells are generally close to the diagonal line and do not plot consistently above or consistently below the line, indicating that the Saugus Formation is closely calibrated in the steady-state model.

Table 5-3 lists the residuals for Alluvial and Saugus wells. The residuals are also plotted on Figures 5-16 through 5-19. Positive residuals indicate that the Regional Model over-predicts the groundwater elevation, and negative residuals indicate that it under-predicts the groundwater elevation. Observations regarding the residuals are as follows:

a. Figure 5-16 shows the magnitudes of the groundwater elevation residuals for the 21 target wells in the Alluvial Aquifer that lie along the Santa Clara River. The plot shows the target wells in order from the downstream end of the valley (left side) to the upstream limit of the valley (right side). The plot shows that 13 of the 21 wells have residuals in the range of –5 to +5 feet, and that only one well (7158K) does not meet the 10-foot residual criterion for Goal 2. The plot also shows little, if any, spatial bias in the direction of the residuals; specifically, long reaches of the river do not show consistently positive or consistently negative residuals. Consequently, the groundwater elevations are very well calibrated along the Santa Clara River.

b. Figure 5-17 shows an equivalent plot for Alluvial Aquifer wells located in three of the tributary canyons. In these areas, where gradients are steep, the modeled groundwater elevations are generally within 10 to 11 feet of the average measured elevations. The plot indicates a tendency to slightly under-predict groundwater elevations, particularly in the upper-most reach of Bouquet Canyon, but the residuals generally meet the criterion for Goal 2.

c. Figures 5-18 and 5-19 show similar residual plots for production wells and for LACFCD monitoring wells, respectively, in the Saugus Formation. Three of the seven production wells meet the 25-foot residual criterion for Goal 2, and three of the monitoring wells meet this criterion. Both plots indicate a tendency to under-predict static groundwater elevations, particularly in four wells that are near the outer limits of the Saugus Formation (wells NCWD-9, 5831, 7043C, and 7053D). However, the water levels in these four wells appear to be anomalously high, compared with the water levels in surrounding wells. Consequently, the water level data indicate that these wells (particularly the three LACFCD wells) are constructed in perched Saugus zones lying above the regional Saugus aquifer system, and the negative residuals at these wells correspond to the anomalously high groundwater elevations. Excluding these four wells, three of the six production wells and five of the ten LACFCD monitoring wells meet the Goal 2 criterion, indicating that the steady-state calibration of the Saugus Formation is adequate, particularly because the focus of the model calibration effort is transient calibration, which is discussed in Section 5.2.

5.1.3 Statistics of Groundwater Elevation Residuals – Calibration Goal 3

Table 5-4 lists the residual statistics for target wells in both aquifer systems. The table shows statistics for the same wells listed in Table 5-3 and shown on Figures 5-16 through 5-19,

except for Saugus wells 5831, 7043C, and 7053D. Table 5-4 shows that the residual statistics for the Alluvial Aquifer generally meet the criteria specified in Goal 3. For the Saugus Formation, the statistics meet the mean residual criterion, but the statistics for the square of the residuals are slightly above the criteria of (1) less than 25 feet for RMS error or (2) 10 percent or less for normalized RMS error. The Regional Model as a whole, however, with the Alluvial Aquifer and Saugus Formation combined, meets all Goal 3 criteria.

5.1.4 Groundwater Gradients – Calibration Goal 4

In the Alluvial Aquifer, the results for the first three calibration goals indicate that the steady-state model simulates groundwater gradients quite well, and therefore meets Goal 4.

For the Saugus Formation, the residuals for the NCWD wellfield in the South Fork Santa Clara River are consistently negative. However, the residual at the upgradient end of the wellfield at NCWD-7[5] is similar in magnitude to the average residual at the downgradient end of the wellfield at NCWD-10 and NCWD-11. Consequently, the gradients in this area are simulated reasonably well. Simulated gradients from the NCWD wellfield to the downgradient well VWC-160 are slightly low, as suggested by the more negative residuals in the NCWD wellfield and the less negative residual at VWC-160.

Additionally, recent water level data from the Whittaker-Bermite property indicate that the gradients are well simulated within the Saugus Formation in that area, which lies east and northeast of NCWD's wellfield. Table 5-5 shows the calculations of the model-simulated and measured groundwater gradients between wells MP-1 and MP-2, which are both on the downthrown side of the San Gabriel fault, and between MP-2 and MP-3, which are located on the downthrown side and upthrown side of the fault, respectively. These calculations are based on three rounds of manual water level measurements that were taken from January through October in 2003. Between wells MP-1 and MP-2, the gradients are almost perfectly matched. However, across the San Gabriel fault, the modeled gradient is approximately half as large as the measured gradient because the simulated groundwater elevation is low at MP-3.

Several attempts were made during model calibration to reduce the Saugus permeability to very low levels across the fault, but no further increases in MP-3 water levels could be obtained. The calibrated Regional Model uses a permeability along the fault that is between 100 and 1,000 times lower than the permeability of adjoining Saugus areas. Although the Regional Model was unable to simulate as high a groundwater elevation as has been measured recently at MP-3, it does simulate a substantial drop in groundwater elevations across the San Gabriel fault, which is consistent with the understanding of the limited hydraulic connection across the fault (see Section 2.4.2 and Figure 2-9). Therefore, the Regional Model is well calibrated across the fault because it simulates the permeability differences that exist on each side of the fault and also simulates the very limited movement of groundwater across the fault that is indicated by the significant difference in groundwater elevations that has been measured in the multi-port wells on each side of the fault.

[5] Well NCWD-9 is located farther upgradient, but has been used only sparingly since 1987.

5.1.5 Groundwater Below Ground Surface – Calibration Goal 5

Groundwater elevations simulated by the steady-state model are below ground surface at all non-stream nodes and in each tributary stream. Along the Santa Clara River, a small number of nodes showed groundwater elevations above the streambed in the western portion of Soledad Canyon, and also at and immediately upstream of Round Mountain, a Saugus outcrop that likely lies at shallow depths beneath the river itself. The reach of the river west of I-5 was calculated to be predominantly gaining (groundwater above ground surface). However, the Regional Model predicts that the river is losing over a reach extending between approximately 0.75 mile upstream to 0.5 mile downstream of the location where the river crosses over the western limit of the Saugus Formation. In this area, the riverbed has a gentler slope than in adjoining areas, and the riverbed does not lie beneath the water table in this particular reach.

5.1.6 Groundwater Discharge to River – Calibration Goal 6

The model-simulated groundwater discharge to the river was 28,600 AF/yr, which closely agrees with the 29,000 AF/yr value estimated from the hydrograph separation process described in Section 2.6.2.5.

5.2 Calibration Results for the Transient Model

Following are discussions of how the calibrated Regional Model compares with the four calibration goals established for the 1980 through 1999 transient model.

5.2.1 Groundwater Elevation Trends/Hydrographs – Calibration Goal 1

Trends in groundwater elevations are discussed for the following areas:

a. The Alluvial Aquifer along the Santa Clara River, west of I-5, as shown on Figure 5-20

b. The Alluvial Aquifer along the Santa Clara River, between I-5 and Soledad Canyon, as shown on Figure 5-21

c. The Alluvial Aquifer along the Santa Clara River in Soledad Canyon, as shown on Figure 5-22

d. The Alluvial Aquifer along Castaic Creek, as shown on Figure 5-23

e. The Alluvial Aquifer in other tributary canyons to the Santa Clara River, as shown on Figure 5-24

f. The Saugus Formation, where targets are located along the South Fork Santa Clara River, as shown on Figure 5-25

As discussed in Section 4.4.1, the calibration goal at target production wells was to simulate groundwater elevations that were higher than the pumping elevations and as close as possible to the static elevations. Therefore, the hydrographs show the model-simulated groundwater elevations, the measured static groundwater elevations, and, for production wells, the measured pumping groundwater elevations.

5.2.1.1 Alluvial Aquifer West of I-5

Modeled and measured groundwater elevations both show long-term stability, with no significant increases or decreases during the 1980 through 1999 transient calibration period. The Regional Model simulates somewhat greater seasonal variation in groundwater elevations than is suggested by the field measurements. However, the field measurements were collected infrequently. In general, the Regional Model is well calibrated in this area because of the close match between simulated and measured groundwater elevations and because it simulates the long-term stability of groundwater elevations in this area.

5.2.1.2 Alluvial Aquifer Between I-5 and Soledad Canyon

North of the Santa Clara River, near the mouth of San Francisquito Canyon, the Regional Model simulates the observed trends in static groundwater elevations at wells NLF-S3 and VWC-I during the period that data are available. The groundwater elevation trends are particularly well simulated at VWC-I starting in mid-1996, when the water level measurement frequency increased at this well.

Just upstream and along the south side of the river, the Regional Model simulates the trends in static water levels at well VWC-N very closely throughout the 20-year simulation period. The Regional Model also simulates the trends in static water levels quite well at well VWC-Q2, near the mouth of Soledad Canyon. In this same area, monitoring well 7067D simulates groundwater elevations that are somewhat lower than measured elevations, and the 40-foot fluctuation in simulated water levels at this well is of a generally similar magnitude as the observed fluctuation of 50 feet.

5.2.1.3 Alluvial Aquifer In Soledad Canyon

At wells throughout Soledad Canyon, the Regional Model closely simulates the regional decline in groundwater elevations during the late 1980s and early 1990s. The simulated and measured declines are especially close for wells in the eastern portion of this area, such as SCWC-North Oaks, SCWC-Mitchell, SCWC-Lost Canyon 2, and NCWD-Pinetree1.

Although the sharp increases in groundwater elevations in 1992 and 1993 are modeled well, these same wells (in the eastern half of Soledad Canyon) are unable to maintain high enough groundwater elevations during short dry periods that occur intermittently from 1993 through 1999. During this period, wells further to the west, such as SCWC-Stadium, VWC-T2, SCWC-Honby, and 7127D show better matches between modeled and measured groundwater elevations. Many model runs were performed to try to maintain higher water levels in eastern Soledad Canyon, but no substantial improvements could be made, suggesting that the lack of stream gage data at the Lang gage during this period may be responsible for the discrepancies.

A visual inspection of the former Lang gage station was conducted on July 17, 2003 during the model calibration process. The equipment that records the depth of water in the river was observed to be approximately 3 to 4 feet above the bed of the river at the time of the inspection. Although high river flows are known to have occurred since the time the gage was abandoned, it is unlikely that the bed elevation would have been lowered 3 or 4 feet by the net sediment scouring and redeposition processes that occur during high river flows. This observation means there likely was more flow occurring in the river prior to October

1989 than was recorded by this gage. This in turn means that measured and estimated flows during the period 1980 through 1999 are likely too low in the Regional Model, which would explain the model's simulation of too rapid a decline in water levels after high river flows recharge the aquifer. In summary, the design of the gage and the absence of data after October 1989 are the likely reasons that the Regional Model has difficulty maintaining sufficiently high groundwater elevations during dry periods in the eastern portion of the Alluvial Aquifer.

5.2.1.4 Alluvial Aquifer Along Castaic Creek

In the upper reaches of the Castaic Creek valley, the Regional Model simulates the measured groundwater elevation trends very well during the drought at wells NCWD-Castaic3, 6980E, and 6980G, though this evaluation is somewhat uncertain during the early 1980s due to infrequent data collection. However, these same wells show too much recovery during the initial post-drought recovery period in 1992, and they also show a small rise in groundwater elevations from 1993 through 1999 that is not indicated by the field measurements.

Farther downstream, the Regional Model closely matches the measured groundwater elevation trends at well 6993A well until the last few years of the drought, when groundwater elevations do not drop sufficiently. Well VWC-D (farther downstream) is modeled even better, but also shows a bit too much fluctuation during the mid- and late 1990s.

5.2.1.5 Alluvial Aquifer in Other Tributary Canyons to the Santa Clara River

At production well VWC-W6 in the lower reaches of San Francisquito Canyon, the Regional Model appears to simulate the measured groundwater elevations well, except for a possibly insufficient decline in early 1992 at the conclusion of the regional drought.

In Bouquet Canyon, the Regional Model closely simulates the measured groundwater elevation changes at the SCWC-Clark production well, although the groundwater elevations are a bit high throughout the simulation. The groundwater elevation trends are also well simulated farther downstream at monitoring well 7066D, though the groundwater elevations are somewhat under-predicted throughout the simulation.

In Sand Canyon, the simulation at monitoring well 7188A is good, although there is some uncertainty at the end of the drought due to the lack of data collection during 1990 and 1991.

5.2.1.6 Saugus Formation

In general, the Regional Model simulates the trends in groundwater elevations quite well at each Saugus production and monitoring well. Simulated and measured static groundwater elevations agree particularly well in the NCWD wellfield at the observation well (5851) and each NCWD production well.

Farther downgradient, the model tends to slightly over-predict groundwater elevations in the VWC and SCWC production wells (VWC-157, VWC-201, SCWC-Saugus1, and SCWC-Saugus2) and slightly under-predict groundwater elevations in the lone monitoring well (7048-C). However, the Regional Model closely simulates the groundwater elevation trends

at each of these locations, which is the primary consideration for evaluating the quality of the transient calibration process in the Saugus Formation.

5.2.2 Groundwater Below Ground Surface – Calibration Goal 2

This goal was met at each target in the transient model. Of the 44 transient model target wells, 11 had simulated groundwater elevations within 5 feet of ground surface during the wettest periods of the model simulation. Three of these wells were located in the Castaic Valley (6980E, 6981D, and NCWD-Castaic3), one was in lower Sand Canyon (7188A), one was in Bouquet Canyon (SCWC-Clark), and six were in Soledad Canyon (VWC-T2, 7127D, SCWC-Mitchell, SCWC-Lost Canyon 2, 7177B, and NCWD-Pinetree1).

5.2.3 Total River Flow at County Line Gage – Calibration Goal 3

Figure 5-26 compares the modeled and measured total flows of the Santa Clara River at the County Line gage. The figure contains both a linear plot and a semi-logarithmic plot to better illustrate how the modeled and measured flows compare during low flow periods in the river.

Figure 5-26 also shows that the Regional Model adequately replicates seasonal cycles of low and high river flows. Prior to 1992, peak flows during the wettest months tend to be somewhat underestimated, probably because of under-predicted flow in the streams rather than insufficient groundwater discharge to the river. From 1992 through 1997, peak flows match well, but they are again underestimated in 1998 and 1999.

Seasonal low flows, during the summer months, are slightly over-predicted. In years such as 1990, the model over-estimates river flows by approximately 100 to 200 acre-feet per month. In other years, the Regional Model over-estimates the river flows by as much as 1,000 acre-feet per month. To evaluate this further, the estimated and model-simulated groundwater discharges to the river were compared, as discussed below.

5.2.4 Groundwater Discharge to River – Calibration Goal 4

Figure 5-27 compares the model-simulated groundwater discharges to the river with the discharges that have been estimated from hydrograph separation techniques (see Section 2.6.2.5). Because of uncertainty in the amount of treated water that infiltrates the streambed, Figure 5-27 displays a range for the estimated values, varying according to how much of the Saugus WRP treated water is estimated to infiltrate to groundwater as it travels down the Santa Clara River. For the purposes of this comparison, it was estimated that the infiltration could be negligible (blue line) and would be unlikely to exceed 75 percent of the Saugus WRP discharge (green line).

Figure 5-27 shows that the Regional Model simulates the patterns of groundwater discharges well. The Regional Model predicts lower groundwater discharge rates during high flow/high water table periods than were estimated from the hydrograph separation technique, but model uncertainty may not be the cause of this difference. It is equally, if not more, likely that the difference is due to the significant uncertainties associated with the hydrograph separation process during periods of high river flows. Specifically, as discussed in Section 2.6.2.5, it is difficult to determine how much of the receding flow after peak flow

events is due to groundwater discharges versus continued stormwater drainage from within the basin or from upstream watersheds.

Figure 5-27 also shows that the Regional Model tends to predict higher rates of groundwater discharge during dry periods than estimated from the County Line gage. This is consistent with the Regional Model's over-prediction of total river flows, but anecdotal observations at the former gaging station site during low flow periods indicate that the river sometimes carved small channels that diverted a portion of the flow away from the gage, where it could not be measured. Consequently, the differences between modeled and measured total river flows and measured versus estimated groundwater discharges result from uncertainties in both the Regional Model and the gage data.

5.3 Groundwater Budget

Table 5-6 summarizes the groundwater budget for the 1980 through 1985 steady-state model. The values in the table are the average groundwater recharge and discharge rates in AF/yr during this period. As shown in the table, the majority of the recharge occurs from direct rainfall and stormwater flows, with irrigation and Castaic Lake underflow each comprising a very small portion of the total basin recharge. Groundwater discharge during this time period was approximately one-third pumping and one-third discharge to the Santa Clara River, with the rest consisting of subsurface outflow and ET. The table shows that ET is an important part of the groundwater budget, 15 percent of the total groundwater discharge in the basin.

Table 5-7 summarizes the groundwater budget for each year of the 20-year transient model simulation period (1980 through 1999). Figures 5-28 and 5-29 show the annual groundwater recharge and groundwater discharge rates, respectively. Figure 5-30 shows the change in groundwater storage each year, and Figure 5-31 shows the cumulative change in groundwater storage during the simulation period.

As is evident from Figure 5-28, recharge from precipitation and streamflows varies considerably from year to year, ranging from less than 15,000 AF/yr in the driest years to over 100,000 AF/yr in wetter years. In fact, for the five wettest years during this period, the model estimates that groundwater recharge ranged between 175,000 AF/yr and 270,000 AF/yr. In contrast, total groundwater discharges have been less variable (Figure 5-29), ranging from approximately 61,000 AF/yr at the end of the drought in the late 1980s through early 1990s to 116,000 acre-feet during 1998. Table 5-7 and Figure 5-29 together show that this variability in groundwater discharge does not follow the year-to-year pumping patterns, but instead is caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlate well with groundwater recharge patterns. For example, groundwater discharge rates increase during or immediately after significant rainfall years in 1983, 1992 through 1993, 1995, and 1998, and subsequently decrease in response to below-normal precipitation in the ensuing 1 to 2 years. This indicates that the predominant factors influencing changes in storage and groundwater discharge are the local rainfall recharge and stream recharge patterns from year to year, with anthropogenic influences (pumping and irrigation) having a smaller effect on the groundwater system. This is reinforced by Figures 5-30 and 5-31, which show that changes in groundwater storage volumes reflect year-to-year variations in regional rainfall.

5.4 Sensitivity Analysis

Sensitivity analyses were performed on the calibrated Regional Model to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the model. The sensitivity analyses focused on the transient model. Following is a description of the design of the analyses and the findings.

5.4.1 Method of Sensitivity Analysis

Analysis focused on identifying the sensitivity of the transient model to Kh and Kv for both aquifer systems, the permeability of the bed of the Santa Clara River, and, to a lesser degree, the ET parameters.

To perform the analysis, one model variable, or group of variables, was varied upward or downward, and the model was run again. The amount by which each model variable was adjusted upward or downward was based on the range of values that was considered to be plausible for the variable, according to the data analysis that was conducted in support of development of the hydrogeologic conceptual model for the valley, which is described in Section 2 of this report. The following pairs of sensitivity runs were performed:

a. Adjusting the Kh. This parameter was multiplied and divided by a factor of 1.5 in all model layers. The R (Kh:Kv) was left unchanged for these runs, but the change in Kh caused a change in Kv values.

b. Adjusting the R upward or downward by a factor of 4.0. This caused changes to Kv, but not to Kh.

c. Adjusting the storage parameters. In model layer 1, the Sy was adjusted from the calibrated model value of 0.10 to 0.075 and 0.15. In model layers 2 through 7, the storativity was adjusted from the calibrated model value of 5×10^{-4} to values of 1×10^{-4} and 1×10^{-3}. The reductions to Sy and storativity were run simultaneously in a single model run, and the increases in Sy and storativity were run simultaneously in a single model run.

d. Adjusting the riverbed leakage terms at drain and wadi nodes in the Santa Clara River and Castaic Creek. These terms were multiplied and divided by a factor of 10.

e. Adjusting the ET parameters in a way that produced less ET. In one run, the maximum evaporation depth was changed from 10 feet to 5 feet. In another run, the maximum evaporation rate was changed from 6 ft/yr to 3 ft/yr.

5.4.2 Sensitivity Analysis Results

The results of the focused sensitivity analysis are presented as time-series plots of water levels and groundwater discharges to the river. Results are first presented for the aquifer hydraulic parameters (Kh, R, Sy, and storativity), then for the riverbed permeability and ET terms.

5.4.2.1 Sensitivity of Groundwater Elevation Trends to Aquifer Parameters

Figures 5-32 through 5-38 show the sensitivity of Alluvial Aquifer groundwater elevations in the transient model to variations in Kh, R, and Sy. Figures 5-39 through 5-43 show the same information for three Saugus production wells and two Saugus monitoring wells. The results and the conclusions that can be drawn from them are:

a. Alluvial wells in the western part of the basin (NLF-B7 and NLF-G45) show slight sensitivity to the choice of Kh, and little sensitivity to R and Sy. Lower Kh values would degrade the calibration quality of the Regional Model, whereas the tested ranges of the other parameters would have little effect on calibration quality.

b. Further east, VWC-N shows greater sensitivity to each parameter, though it is relatively insensitive to lower Kh values. Lower Kh values or changes to R values would not degrade calibration quality, whereas other parameter changes could potentially degrade the calibration.

c. Results are similar in Soledad Canyon at SCWC-Stadium, SCWC-North Oaks East, and NCWD-Pinetree1. Higher Kh values substantially degrade the calibration quality of the transient model at each of these wells.

d. The transient model was slightly to moderately sensitive to the choice of Alluvial Aquifer Kh in Castaic Creek at well VWC-D. In this area, it showed little sensitivity to R or Sy in the Alluvial Aquifer. The results suggest that higher K values could slightly improve the calibration.

e. Water levels at Saugus production wells along the lower reaches of the South Fork Santa Clara River (VWC-201 and SCWC-Saugus2) are sensitive to the choice of R, moderately sensitive to the choice of Kh, and comparatively insensitive to storativity. The transient model is more sensitive to Kh and storativity at nearby monitoring well 7048C than at the pumping wells. The plots generally indicate the model is well calibrated, although small decreases in Kh might slightly improve the calibration quality.

f. Similar results are seen for production well NCWD-11 and monitoring well 5851 farther upstream in the South Fork Santa Clara River valley. At NCWD-11, the R appears to be particularly well calibrated, as lower values cause groundwater elevations to fluctuate insufficiently, and higher values cause too much fluctuation, and in some cases, model-simulated water levels that are below pumping levels. Changes to Kh would not improve the model, and could in fact degrade it at the monitoring well.

5.4.2.2 Sensitivity of Groundwater Elevation Trends to River and Evapotranspiration Parameters

Figures 5-44 through 5-50 show the sensitivity of Alluvial Aquifer groundwater elevations in the transient model to variations in the riverbed K for drain and wadi nodes and to decreases in the two ET parameters, extinction depth and maximum potential ET rate. Figures 5-51 through 5-55 show the same information for the three Saugus production wells and two Saugus monitoring wells discussed in Section 5.4.2.1. The results and the conclusions that can be drawn from them are:

a. Alluvial wells in the western and central parts of the basin (NLF-B7, NLF-G45, and VWC-N) and along Castaic Creek (VWC-D) are sensitive to the choice of the riverbed K for the drain and wadi nodes. Reduced conductivity values notably increase the groundwater elevations at some wells, while higher values somewhat decrease groundwater elevations. The plots suggest that changes to this term would not improve calibration quality and could substantially degrade the calibration at some of these wells. Further east, in Soledad Canyon, the Regional Model is relatively insensitive to riverbed K in the gaining reaches of the Santa Clara River.

b. Reductions in drain and wadi riverbed K increase groundwater elevations by raising groundwater elevations in the Alluvial Aquifer, to which the Saugus discharges. Decreased riverbed permeability backs up water in the Alluvial Aquifer, and hence in the Saugus Formation. Changes to riverbed permeability do not improve Saugus calibration.

c. Groundwater levels in both the Alluvial Aquifer and the Saugus Formation are insensitive to the choice of ET parameters.

5.4.2.3 Sensitivity of Groundwater Discharge to the River to Changes in Aquifer Parameters

Figures 5-56 shows the sensitivity of discharges of Alluvial Aquifer groundwater to the river to changes in K, R, and Sy. The plots show that the model-calculated discharge to the river is sensitive to Kh, but not to R or Sy. A reduction in Alluvial Aquifer Kh would improve the calibration quality during seasonal or longer dry periods, but at the expense of degrading the calibration during the rainfall season for all but the wettest years. Increasing the Kh would slightly increase the predicted discharges during seasonal or longer dry periods.

5.4.2.4 Sensitivity of Groundwater Discharge to the River to Changes in River and Evapotranspiration Parameters

Figure 5-56 also shows the sensitivity of discharges of Alluvial Aquifer groundwater to the river to changes in riverbed K for drain and wadi nodes and to decreases in the two ET parameters, extinction depth and maximum potential ET rate. Figure 5-56 shows that a lower riverbed permeability would improve calibration during seasonal and longer dry periods, but notably degrade calibration during all rainfall periods. Figure 5-56 shows that reducing the ET extinction depth from 10 feet to 5 feet has little effect on model-calculated discharge to the river, while reducing the maximum ET rate slightly increases the model-calculated discharge.

5.5 Conclusion

The process of calibrating the Regional Model to a 20-year period of groundwater elevation and streamflow data has resulted in a model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary attributes of the model's calibration that makes this tool appropriate for its intended uses are:

a. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased SWP water imports (from outside the valley), and associated changes in land use and water use.

b. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property).

c. Its use of an integrated model of the watershed (the SWRM) to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system.

The calibration process has resulted in a Regional Model that closely simulates, on a monthly basis, total flows in the river and estimated volumes of groundwater discharging to the river. The calibration process has also resulted in a Regional Model that closely simulates the short-term and long-term time-varying trends in groundwater elevations throughout the valley, which is necessary for evaluating groundwater management strategies. The close calibration of the groundwater elevation trends and absolute groundwater elevations in both the Alluvial Aquifer and the Saugus Formation near the Whittaker-Bermite property also renders the Regional Model suitable for particle-tracking analyses, to support the design of a long-term pumping and groundwater treatment plan that will restore impaired water supplies while also preventing contamination in unimpacted portions of the aquifer.

Tables

TABLE 5-1
Alluvial Aquifer Parameters in Calibrated Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Zone	Location	T (ft^2/day)	Kh (ft/day)	Average Alluvium Thickness (feet)
A1a	Santa Clara River below Lang gage	9,000 to 25,500	300	30 to 85
A1b2	Santa Clara River below A1a	31,500	350	90
A1b1	Santa Clara River below A1b2	31,500	350	90
A1c3	Santa Clara River below A1b1	36,000	400	90
A1c2	Santa Clara River below A1c3	49,500	550	90
A1c1	Santa Clara River below A1c2	49,500	550	90
A1d4	Santa Clara River below A1c1	49,500	550	90
A1d3	Santa Clara River below A1d4	16,500	550	30
A1d2	Santa Clara River below A1d3	60,500	550	110
A1d1	Santa Clara River below A1d2	49,500	550	90
A1e2	Santa Clara River below A1d1	63,250	550	115
A1e1	Santa Clara River below A1e2	63,250	550	115
B1a	Santa Clara River at South Fork mouth	54,375 to 79,750	375 to 550	145
B1b2	Santa Clara River below B1a	22,500	375	60
B1b1	Santa Clara River below Bb2	63,250	550	115
C1a	Santa Clara River below B1b1	71,500	550	130
C1b	Santa Clara River below C1a	60,500	550	110
C1c	Santa Clara River below C1b	60,500	550	110
C1d	Santa Clara River below C1c	60,500	550	110
D1b	Lower South Fork Santa Clara River	12,600	105	120
D1a1	Upper South Fork Santa Clara River	5,775	105	55
D1a2	Gavin Canyon	15	0.75	20
D1a3	Pico Canyon	15	0.75	20
D1a4	Newhall Canyon	15	0.75	20
D1a5	Placerita Canyon	200	10	20
A3a	Upper Sand Canyon	1,750	175	10
A3b	Lower Sand Canyon	5,250	105	50
A4a1	Upper Mint Canyon	2,800	140	20
A4a2	Central Mint Canyon	2,100	105	20
A4b	Lower Mint Canyon	13,125	175	75
A5	Oak Spring Canyon	8,750	175	50
B2a1	Unnamed tributary canyon	10,500	105	100
B2a2	Vasquer Canyon	10,500	105	100
B2a3	Texas Canyon	10,500	105	100

TABLE 5-1
Alluvial Aquifer Parameters in Calibrated Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Model Zone	Location	T (ft^2/day)	Kh (ft/day)	Average Alluvium Thickness (feet)
B2b1	Plum Canyon	10,500	105	100
B2b	Upper Bouquet Canyon	2,625 to 12,600	25 to 90	105
B2c	Lower Bouquet Canyon	22,050	245	90
B2d	Haskell Canyon	6,825	105	65
B3a	Lower Dry Canyon	6,300	105	60
B3b	Upper Dry Canyon	6,300	105	60
B4b	Upper San Francisquito Canyon	6,300	105	60
B4c	Lower San Francisquito Canyon	10,500	105	100
C1e	San Martinez Canyon	5,250	105	50
C1f	Potrero and Salt Canyons	5,250	105	50
C2a	Upper Castaic Creek valley	25,200	315	80
C2b	Lower Castaic Creek valley	35,000	350	100
C2c	Charlie Canyon	10,500 to 17,500	175	60 to 100
C3	Hasley Canyon	3,150	30	105

Notes:

The zones are based on alluvial storage units defined by RCS (1986, 2002).
However, they have been further subdivided in certain areas to facilitate model calibration.

See Figure 4-1 for the locations of the alluvial storage units.

TABLE 5-2
Aquifer Hydraulic Parameters Used in the Regional Model
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Parameter	Aquifer	Value	Comment
Kh	Alluvium	Variable	See Figure 5-1 and Table 5-1.
	Saugus	Variable	See Figures 5-2 through 5-7.
R (Kh:Kv)	Alluvium	10:1	Derived during model calibration process.
	Saugus	50:1 to 100:1	
Sy	Alluvium and Saugus outcrops	0.10	Derived during model calibration process.
Storativity	Saugus below model layer 1	5×10^{-4}	Derived during model calibration process.
Santa Clara River and Castaic Creek streambed thicknesses	Alluvium	2 feet	Assumed thickness of streambed sediments in gaining river reaches.
Santa Clara River and Castaic Creek streambed Kv	Alluvium	10 ft/day (3.5×10^{-3} cm/sec)	Derived during model calibration process.
ET extinction depth	Alluvium and Saugus	10 feet	Corresponds to typical rooting depth for phreatophytes along Santa Clara River.
Potential ET rate	Alluvium and Saugus	6 ft/yr	Estimated maximum water use by phreatophytes along Santa Clara River.

Notes:
cm/sec = centimeters per second
ET = evapotranspiration

TABLE 5-3

Residual Errors for 1980 through 1985 Steady-State Calibration Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Aquifer	Owner	Well Name	Number of Measurements	Measured Groundwater Elevation (feet msl)	Modeled Groundwater Elevation (feet msl)	Residual (Modeled - Measured) (feet)	Residual^2 (ft^2)
Alluvium	NLF	B10	5	890.70	889.51	-1.19	1.42E+00
	NLF	C5	14	940.61	945.04	4.44	1.97E+01
	NLF	E4	4	977.18	977.84	0.67	4.45E-01
	LACFCD	6995D	17	1003.04	998.75	-4.29	1.84E+01
	LACFCD	7076C	5	1037.16	1027.58	-9.58	9.18E+01
	VWC	K2	2	1113.00	1114.36	1.36	1.84E+00
	NLF	R	4	1137.50	1129.94	-7.56	5.72E+01
	VWC	T4	14	1180.20	1187.69	7.49	5.61E+01
	SCWC	Stadium	15	1186.27	1184.41	-1.86	3.44E+00
	LACFCD	7107C	51	1258.45	1256.45	-2.00	4.00E+00
	LACFCD	7127D	66	1315.83	1320.11	4.28	1.83E+01
	SCWC	N.Oaks West	45	1378.61	1373.49	-5.12	2.62E+01
	LACFCD	7158K	13	1427.48	1444.48	17.00	2.89E+02
	LACFCD	7168C	13	1464.85	1465.79	0.94	8.85E-01
	LACFCD	7178B	12	1495.78	1493.56	-2.21	4.90E+00
	SCWC	Sand Canyon	60	1504.32	1503.73	-0.59	3.47E-01
	LACFCD	7178D	12	1499.21	1509.63	10.42	1.09E+02
	LACFCD	7177P	11	1523.64	1514.99	-8.65	7.47E+01
	LACFCD	7187C	16	1526.06	1534.57	8.51	7.24E+01
	LACFCD	7197	13	1560.34	1556.41	-3.93	1.55E+01
	LACFCD	7197G	3	1577.00	1584.72	7.72	5.96E+01
	LACFCD	6993A	12	1042.95	1032.18	-10.77	1.16E+02
	LACFCD	6981D	3	1092.00	1092.24	0.24	5.66E-02
	LACFCD	6980G	10	1110.77	1107.87	-2.90	8.43E+00
	VWC	W6	5	1146.80	1139.03	-7.77	6.04E+01
	LACFCD	7066D	13	1154.92	1158.65	3.72	1.39E+01
	LACFCD	7086B	9	1227.33	1216.15	-11.19	1.25E+02
	LACFCD	7095	11	1297.96	1277.59	-20.38	4.15E+02
Saugus	LACFCD	5841	14	1114.98	1104.27	-10.71	1.15E+02
	LACFCD	5842F	13	1154.65	1111.16	-43.49	1.89E+03
	LACFCD	5851	45	1137.58	1109.08	-28.50	8.12E+02
	LACFCD	5851A	42	1140.77	1109.09	-31.68	1.00E+03
	LACFCD	5871D	13	1138.03	1117.18	-20.85	4.35E+02
	LACFCD	5873E	3	1286.67	1243.22	-43.44	1.89E+03
	LACFCD	5882	11	1251.99	1318.26	66.26	4.39E+03
	LACFCD	5912A	10	1424.13	1441.47	17.34	3.01E+02
	LACFCD	7048C	47	1110.32	1099.48	-10.84	1.17E+02
	LACFCD	7053C	9	1266.52	1267.60	1.08	1.16E+00

TABLE 5-4

Statistics of Residual Errors for 1980 through 1985 Steady-State Calibration Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Statistic	Alluvial Aquifer	Saugus Formation	Combined System	Criterion for Goal 3
Target Groundwater Elevations				
Number of Target Wells	28	10	38	---
Maximum Groundwater Elevation	1,577	1,424	1,577	---
Minimum Groundwater Elevation	891	1,110	891	---
Range in Groundwater Elevations	686	314	686	---
Statistics for Residuals				
Mean Residual	-1.19	-10.48	-3.63	As close to zero as possible
Mean Residual / Range in Groundwater Elevations	-0.2%	-3.3%	-0.5%	5%
Standard Deviation of Residuals	7.62	31.39	17.86	---
Standard Deviation of Residuals / Range in Groundwater Elevations	1.1%	10.0%	2.6%	10%
Statistics for Residual^2 Values				
Sum of Residual^2 Values	1,664	10,954	12,617	---
Average of Residual^2 Values	59	1,095	332	---
Root-Mean-Square Error (RMS)	8	33	18	10 feet for Alluvial, 25 feet for Saugus
RMS / Range in GW Elevations	1.1%	10.5%	2.7%	10%

Note:

An entry of --- means no criterion was established.

TABLE 5-5

Comparison of Modeled and Measured Horizontal Hydraulic Gradients for Multi-Port Monitoring Wells Near the San Gabriel Fault

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

	MP-3	MP-2	MP-1	MP-2
Modeled Groundwater Elevation (feet)	1,225.52	1,092.02	1,084.78	1,092.02
Measured Groundwater Elevation (feet)	1,304.46	1,074.28	1,066.99	1,074.28
Residual Error (feet)	-78.94	17.74	17.79	17.74
Easting (feet)	6,406,801	6,405,215	6,399,944	6,405,215
Northing (feet)	1,971,284	1,968,850	1,970,850	1,968,850
Distance Between Wells		2,905.13		5,637.68
Difference in Modeled Groundwater Elevations		133.50		-7.24
Difference in Measured Groundwater Elevations		230.18		-7.29
Modeled Horizontal Gradient		-4.60E-02		1.28E-03
Measured Horizontal Gradient		-7.92E-02		1.29E-03
Modeled Gradient / Measured Gradient		0.58		0.99

Notes:

Wells MP-1 and MP-2 are located on the west (downthrown) side of the fault.

Well MP-3 is located on the east (upthrown) side of the fault.

Measured groundwater elevations are the average of measurements from January through July of 2003.

Wells MP-1 and MP-2 are in model layer 4; well MP-3 is in model layer 2.

TABLE 5-6

Groundwater Budget for 1980 through 1985 Steady-State Model

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Total Recharge	**AF/yr**	**Percent**
Rainfall	35,000	44.8
Streams	38,200	48.8
Irrigation	3,300	4.2
Subsurface Inflow (Castaic)	1,700	2.2
Total	**78,200**	**100.0**

Total Discharge	**AF/yr**	**Percent**
Discharge to Santa Clara River	28,600	36.6
Evapotranspiration	12,000	15.3
Subsurface Outflow	6,600	8.4
Pumping	31,000	39.6
Total	**78,200**	**100.0**

TABLE 5-7

Annual Water Budgets Calculated by the Calibrated Regional Model for 1980 through 1999

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Castaic Dam Underflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
1980 to 1981	41,003	3,375	43,226	1,705	89,310	35,542	30,507	15,387	6,691	88,128	1,181	1,181
1981 to 1982	12,102	3,871	13,148	1,700	30,821	35,209	22,304	9,214	6,641	73,368	-42,547	-41,365
1982 to 1983	52,415	3,022	35,134	1,700	92,270	24,918	25,583	11,157	6,695	68,353	23,917	-17,448
1983 to 1984	183,342	2,657	79,681	1,700	267,380	23,169	51,128	26,020	7,017	107,333	160,047	142,598
1984 to 1985	1,316	3,606	10,714	1,705	17,341	30,645	32,258	19,609	6,647	89,158	-71,817	70,781
1985 to 1986	2	3,279	9,082	1,700	14,063	28,963	25,369	10,629	6,572	71,533	-57,470	13,311
1986 to 1987	43,258	3,211	26,471	1,700	74,641	28,658	27,557	12,354	6,668	75,236	-595	12,716
1987 to 1988	11,915	2,991	9,694	1,700	26,299	27,085	24,434	8,601	6,566	66,686	-40,386	-27,670
1988 to 1989	27,949	3,075	17,106	1,705	49,835	27,571	23,518	8,752	6,613	66,454	-16,619	-44,289
1989 to 1990	0	3,393	7,899	1,700	12,993	30,415	21,004	6,676	6,520	64,614	-51,621	-95,911
1990 to 1991	0	3,787	9,092	1,700	14,579	31,652	18,151	4,711	6,530	61,043	-46,464	-142,375
1991 to 1992	51,315	3,397	28,933	1,700	85,345	41,067	19,924	6,963	6,647	74,600	10,745	-131,630
1992 to 1993	131,293	3,850	60,449	1,705	197,296	37,567	27,043	14,114	6,906	85,629	111,666	-19,964
1993 to 1994	113,547	3,773	64,341	1,700	183,361	39,741	34,976	22,598	6,875	104,191	79,170	59,207
1994 to 1995	813	4,415	13,436	1,700	20,365	44,120	21,612	12,839	6,586	85,157	-64,793	-5,586
1995 to 1996	114,663	4,517	60,647	1,700	181,527	42,009	32,426	21,314	6,887	102,637	78,890	73,305
1996 to 1997	46,312	5,205	30,512	1,705	83,734	45,574	25,888	17,092	6,762	95,317	-11,583	61,721
1997 to 1998	17,485	5,267	16,277	1,700	40,729	47,051	21,488	12,791	6,667	87,997	-47,268	14,453
1998 to 1999	138,991	4,758	90,634	1,700	236,084	42,043	41,283	26,213	6,959	116,498	119,585	134,039
1999 to 2000	26	5,343	13,714	1,700	20,783	46,867	24,335	15,943	6,607	93,752	-72,969	61,070
Minimum	0	2,657	7,899	1,700	12,993	23,169	18,151	4,711	6,520	61,043	-72,969	-142,375
Maximum	183,342	5,343	90,634	1,705	267,380	47,051	51,128	26,213	7,017	116,498	160,047	142,598
Average	49,387	3,840	32,010	1,701	86,938	35,493	27,539	14,149	6,703	83,884	3,053	5,907
Median	34,476	3,689	21,789	1,700	62,238	35,376	25,476	12,815	6,657	85,393	-14,101	6,949

Note:

All flow volumes are listed in AF/yr.

Figures

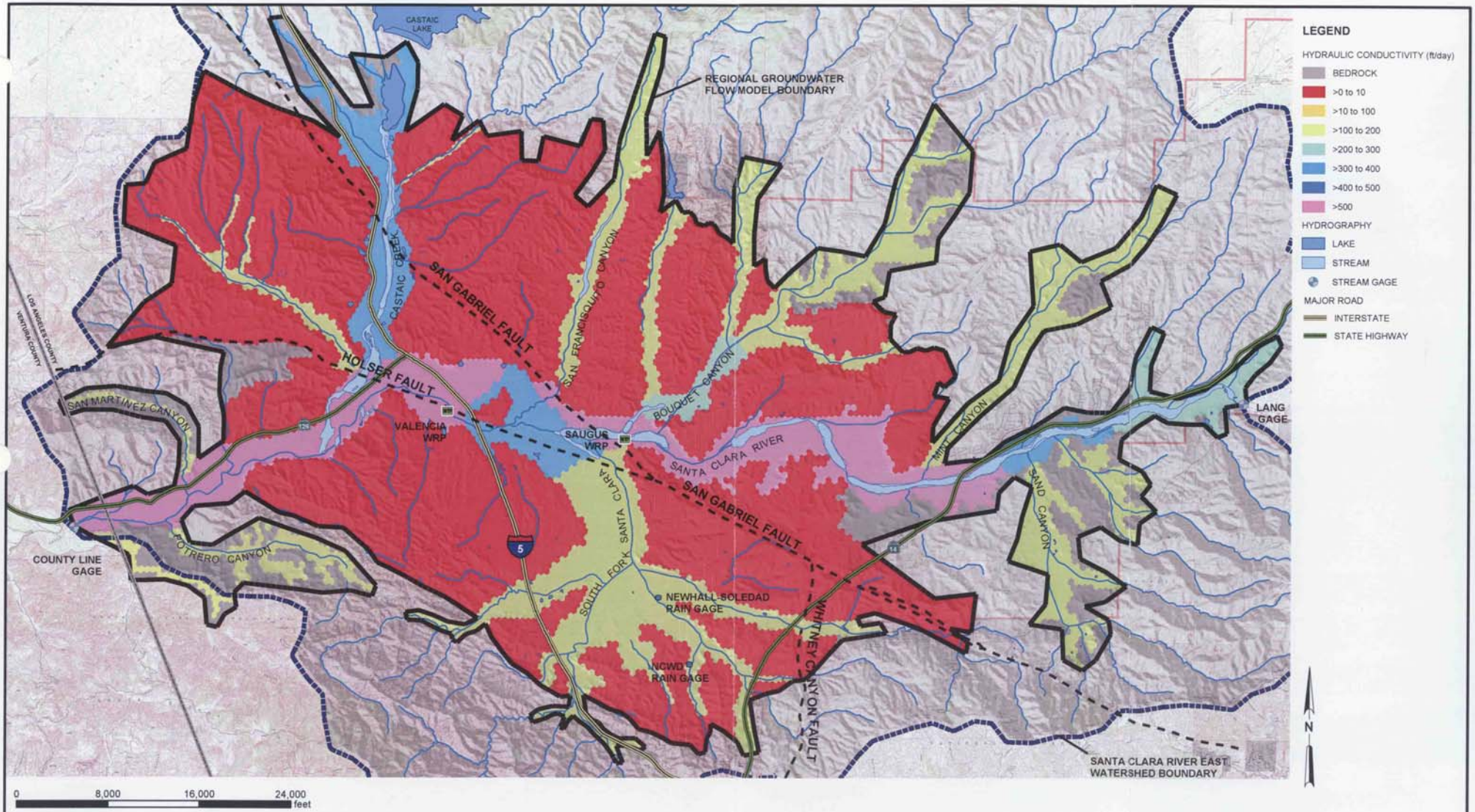

FIGURE 5-1
HYDRAULIC CONDUCTIVITY LAYER 1
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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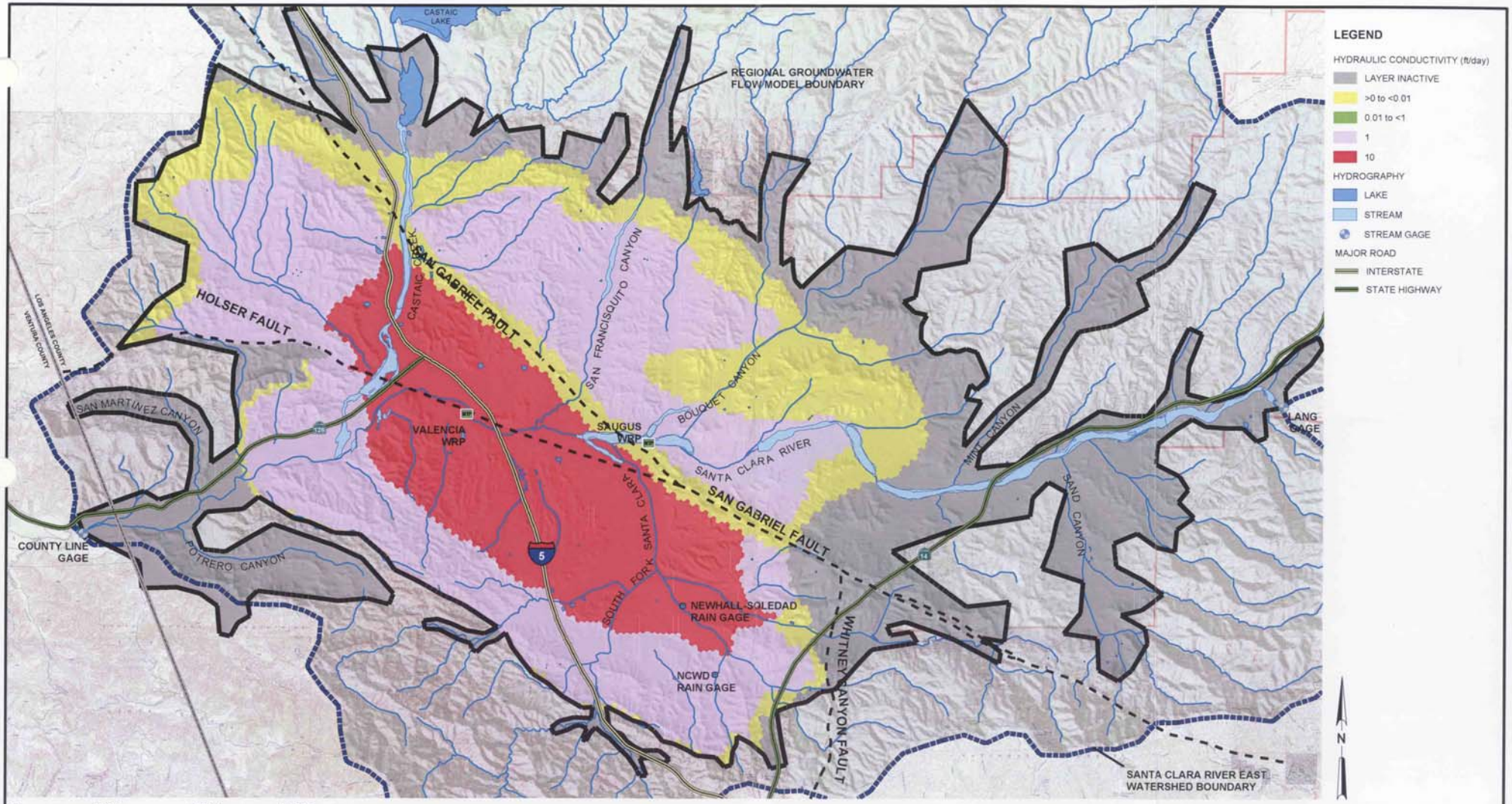

FIGURE 5-2
HYDRAULIC CONDUCTIVITY LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG037.MXD FIG05-02.PDF 01/22/2004 17:55:45

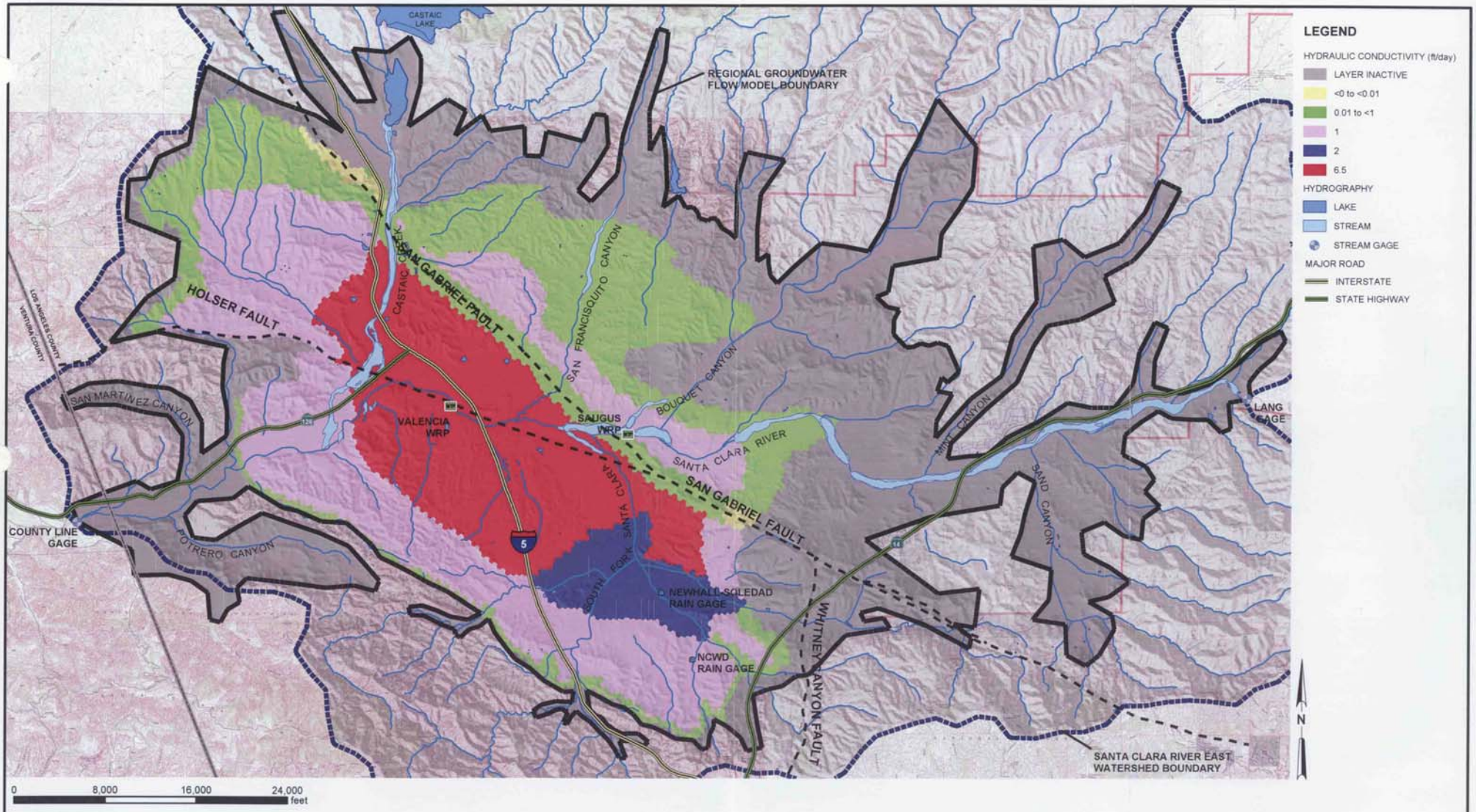

FIGURE 5-3
HYDRAULIC CONDUCTIVITY LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG039.MXD FIG05-03.PDF 01/22/2004 18:08:34

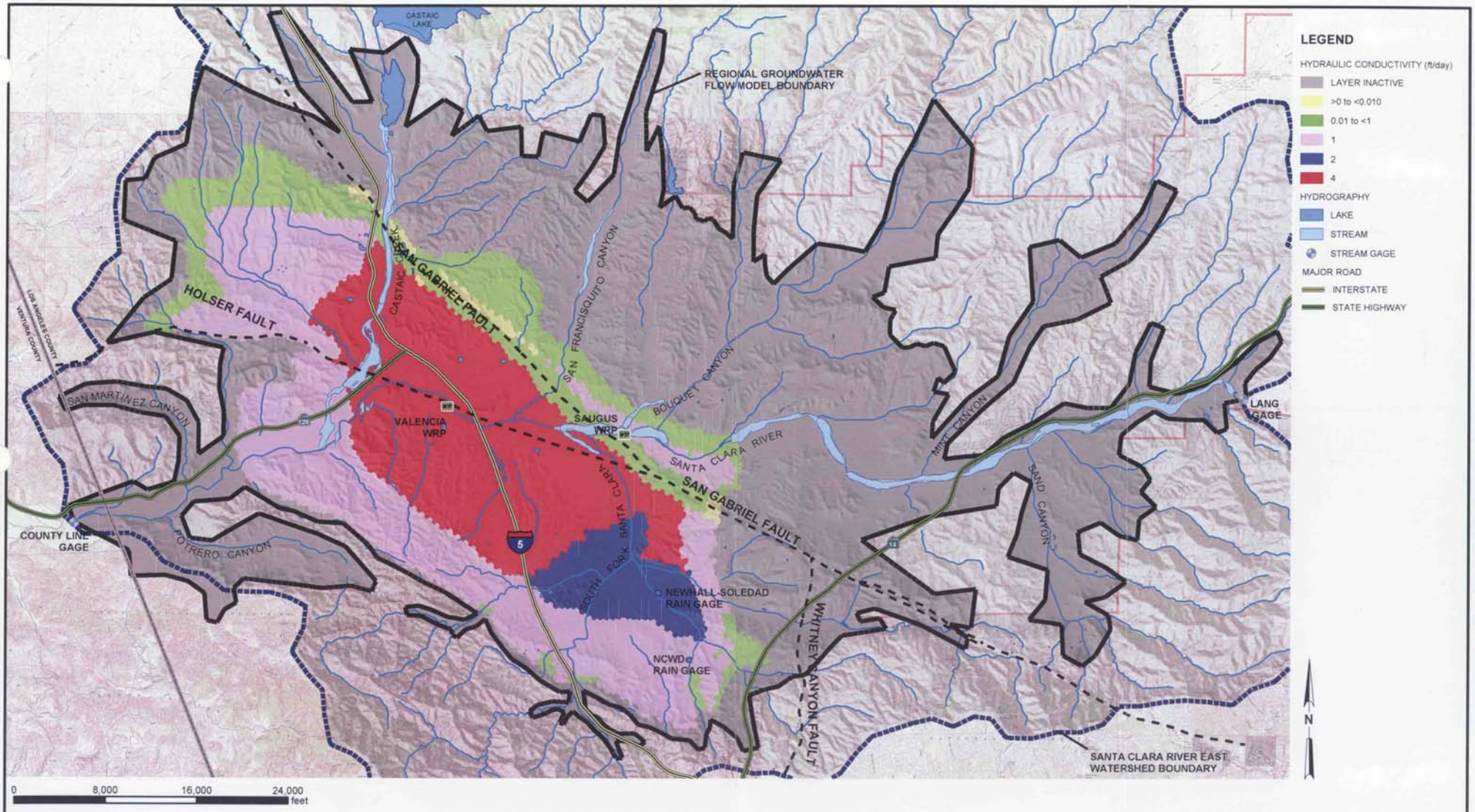

FIGURE 5-4
HYDRAULIC CONDUCTIVITY LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG040.MXD FIG05-04.PDF 01/22/2004 18:16:22

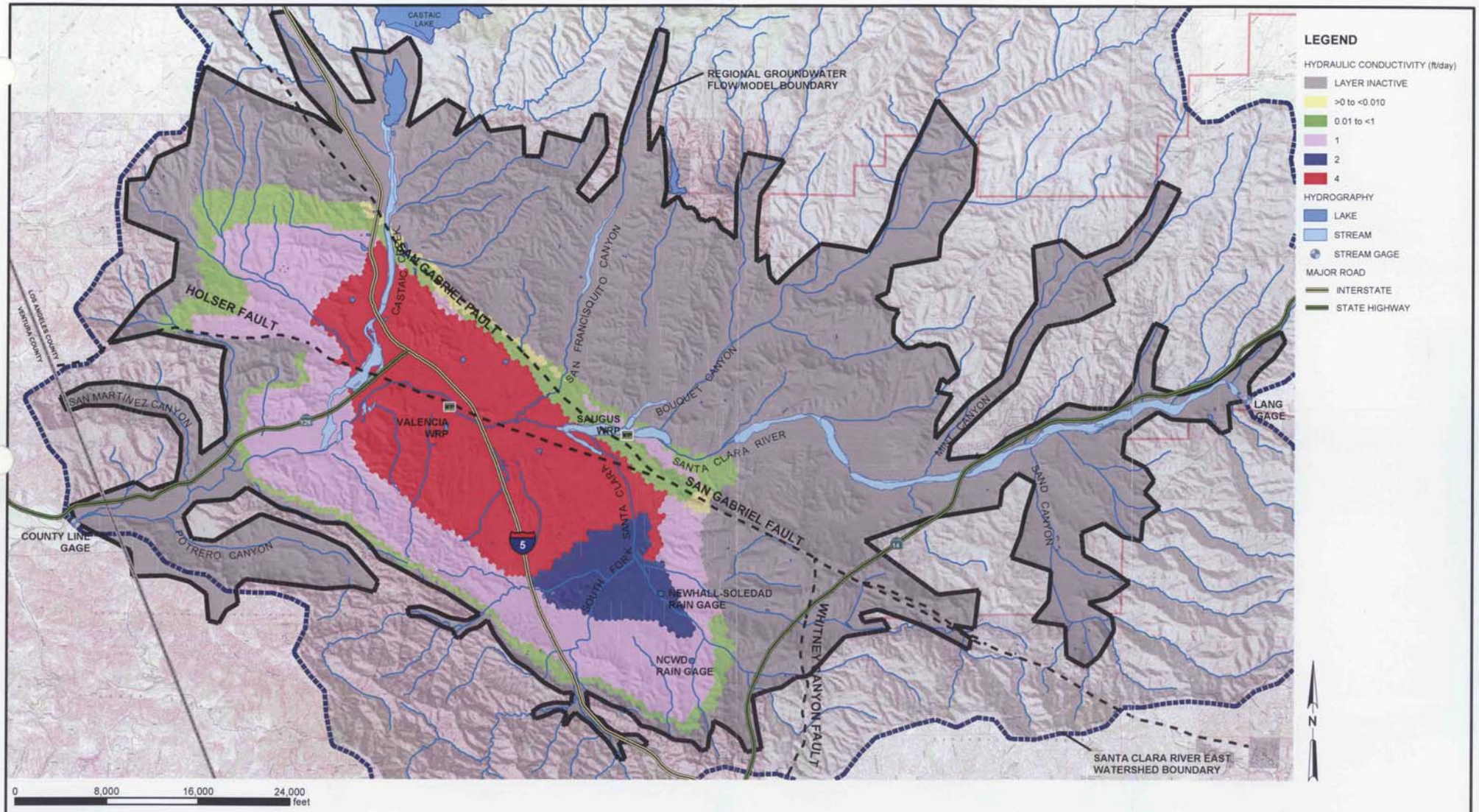

FIGURE 5-5
HYDRAULIC CONDUCTIVITY LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG041.MXD FIG05-05.PDF 01/22/2004 18:16:22

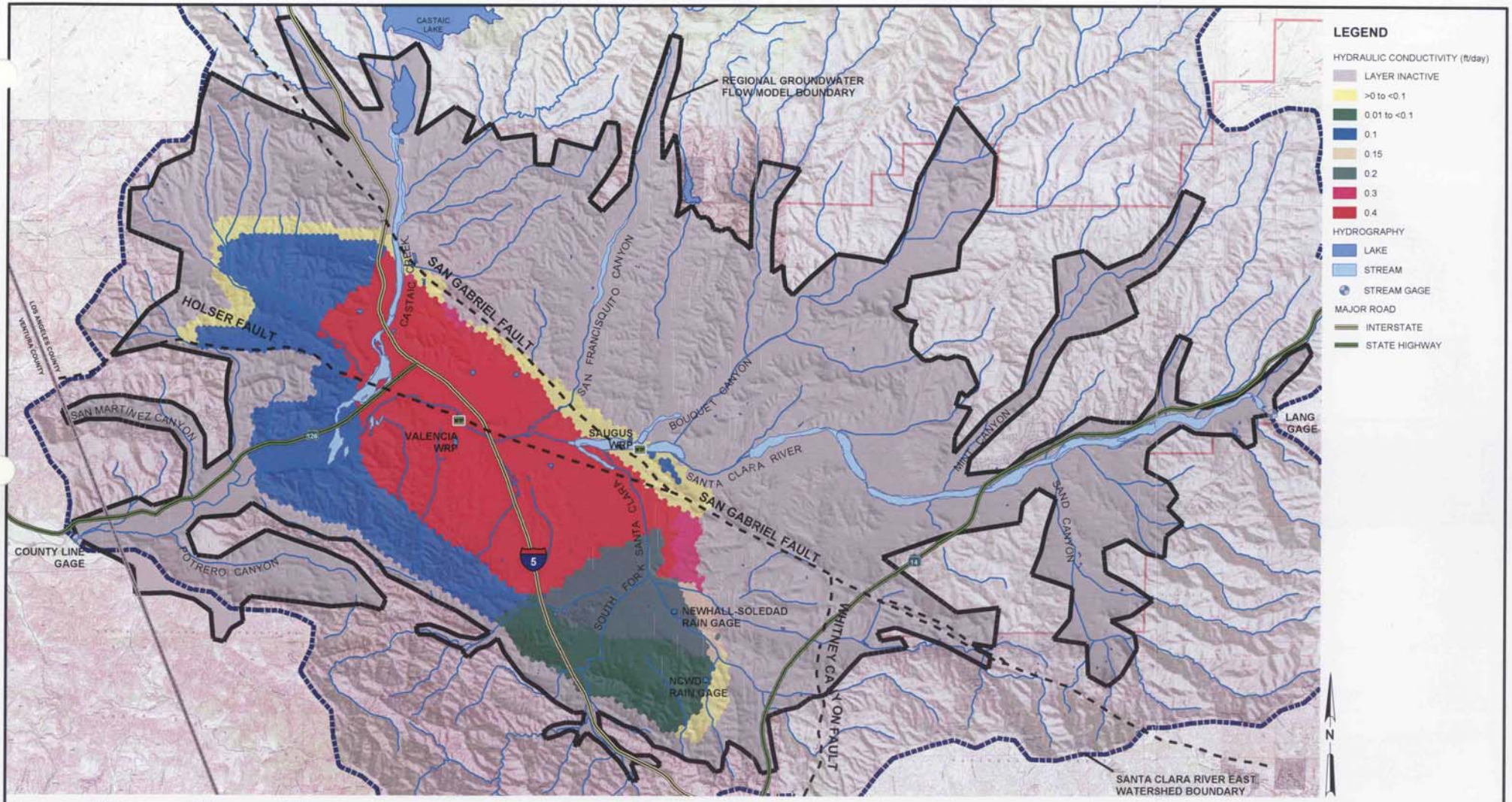

FIGURE 5-6
HYDRAULIC CONDUCTIVITY LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG038_.MXD FIG05-06.PDF 01/22/2004 18:47:29

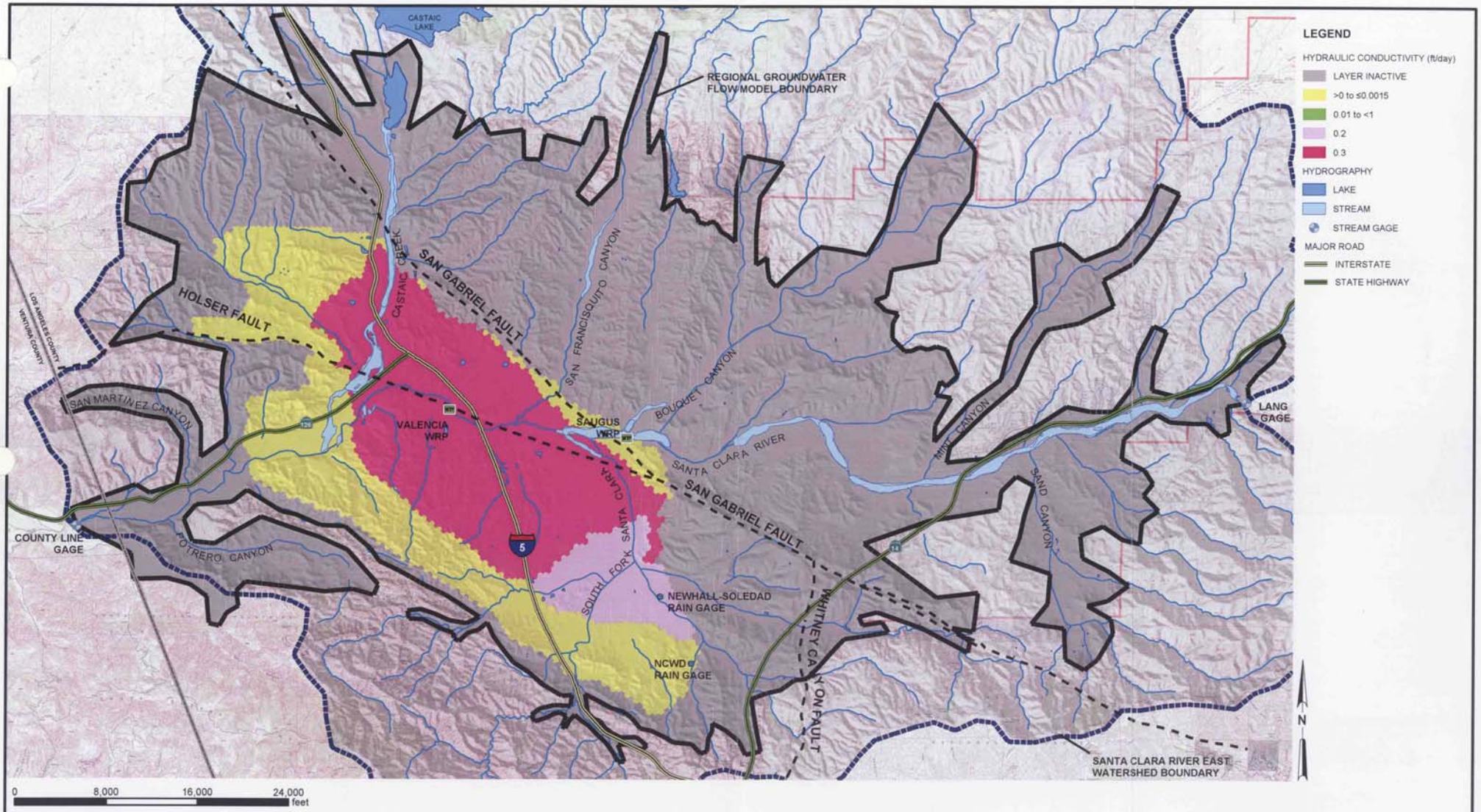

FIGURE 5-7
HYDRAULIC CONDUCTIVITY LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\RDD31002540\55\SANTACLARITA_MOU\FIGURES\MXD\FIG042.MXD FIG05-07.PDF 01/22/2004 18:22:27

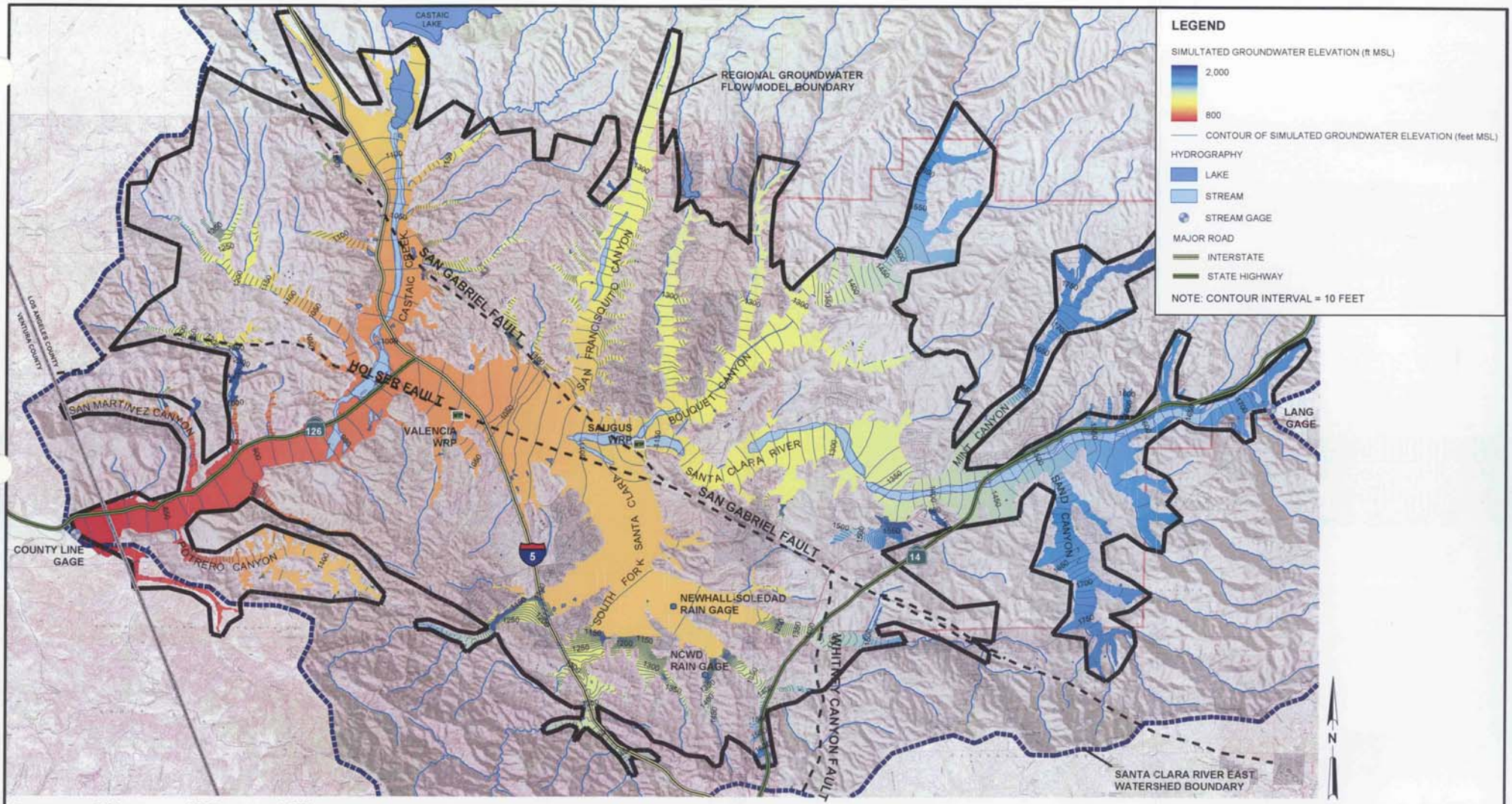

FIGURE 5-8
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR ALLUVIAL AQUIFER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG052.MXD FIG05-8.PDF 02/03/2004 08:46:47

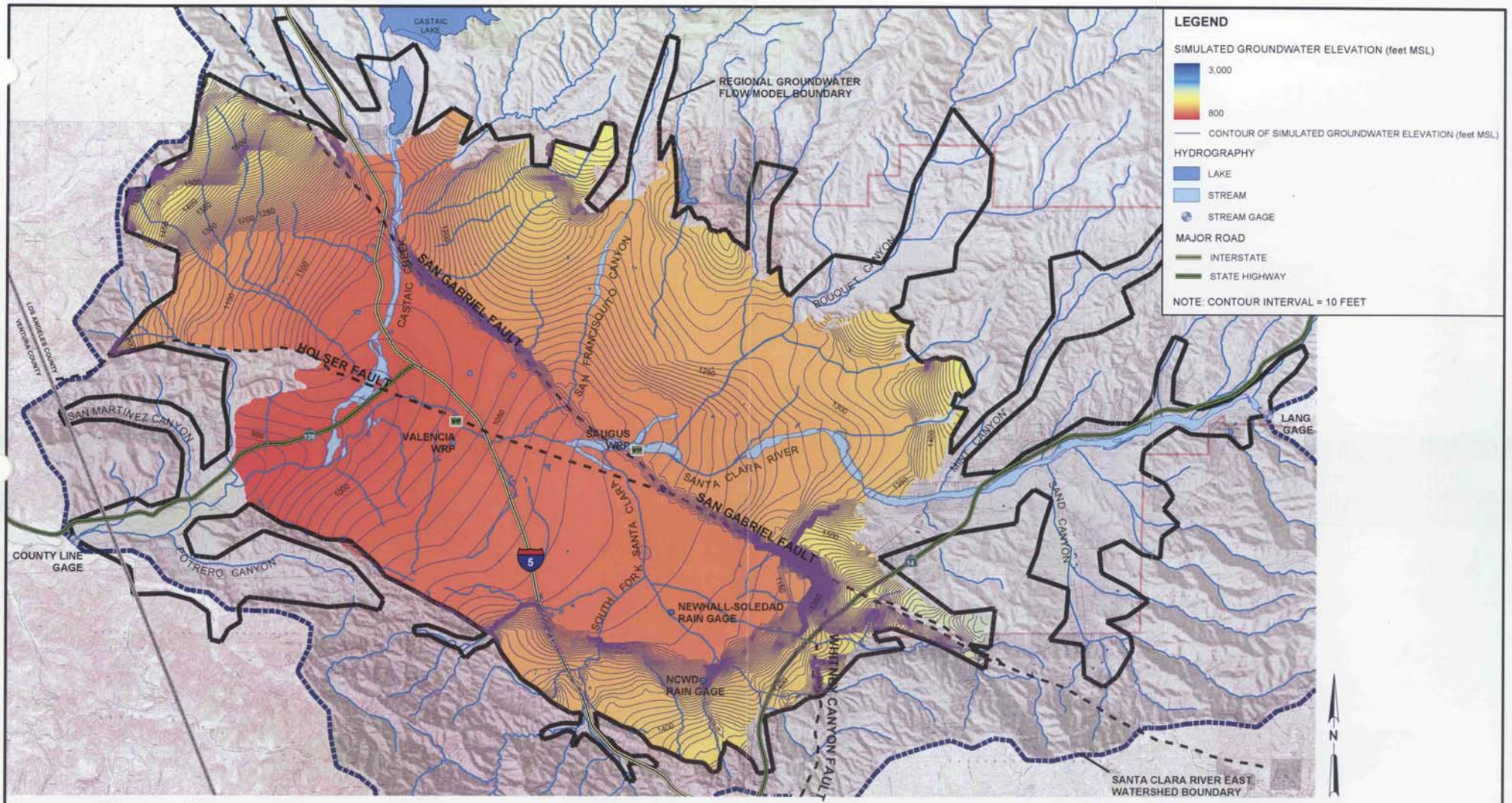

FIGURE 5-9
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 2
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG046.MXD FIG05-9.PDF 02/02/2004 10:58:01

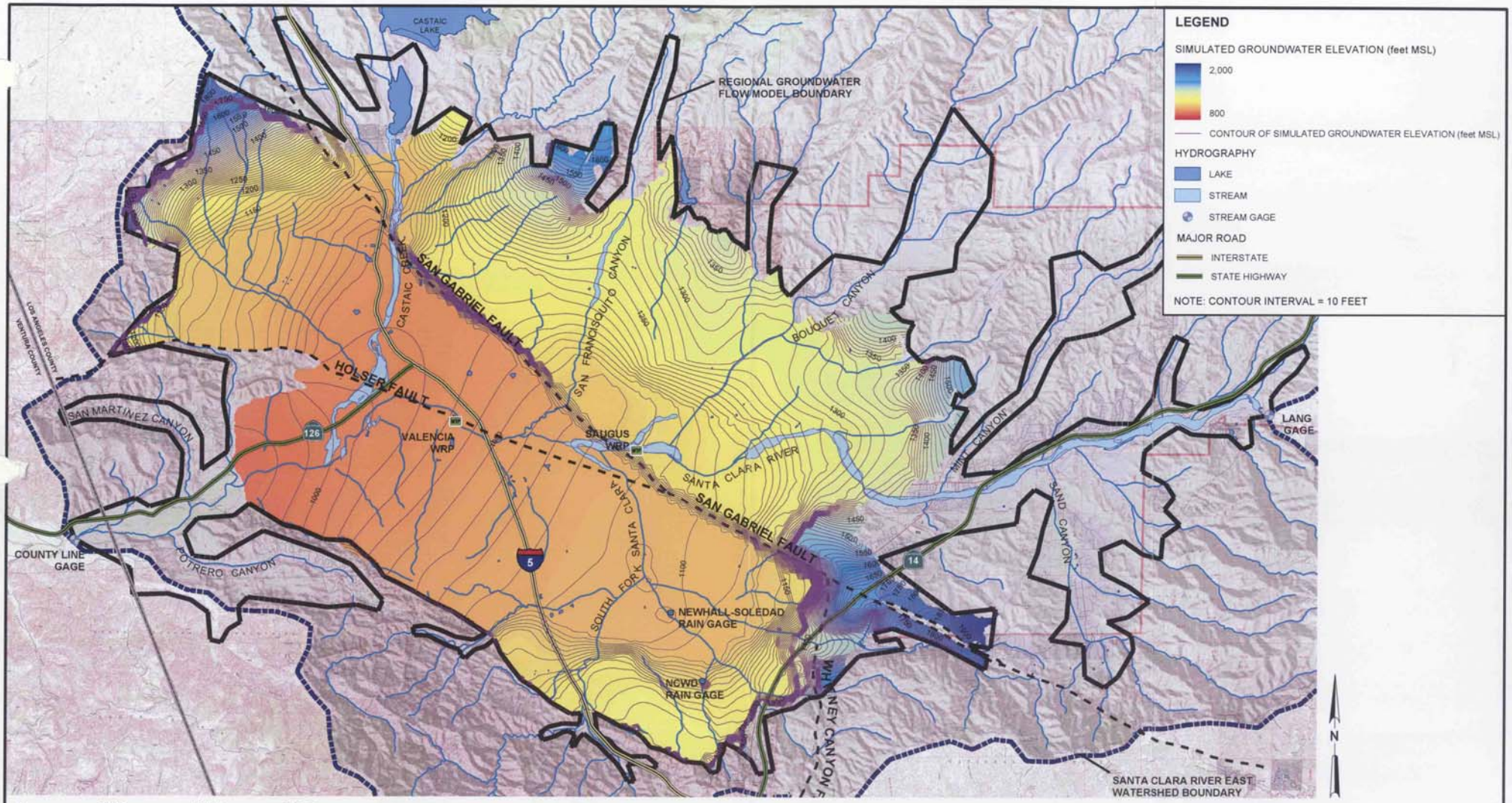

FIGURE 5-10
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 3
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG045.MXD FIG05-10.PDF 02/02/2004 10:42:32

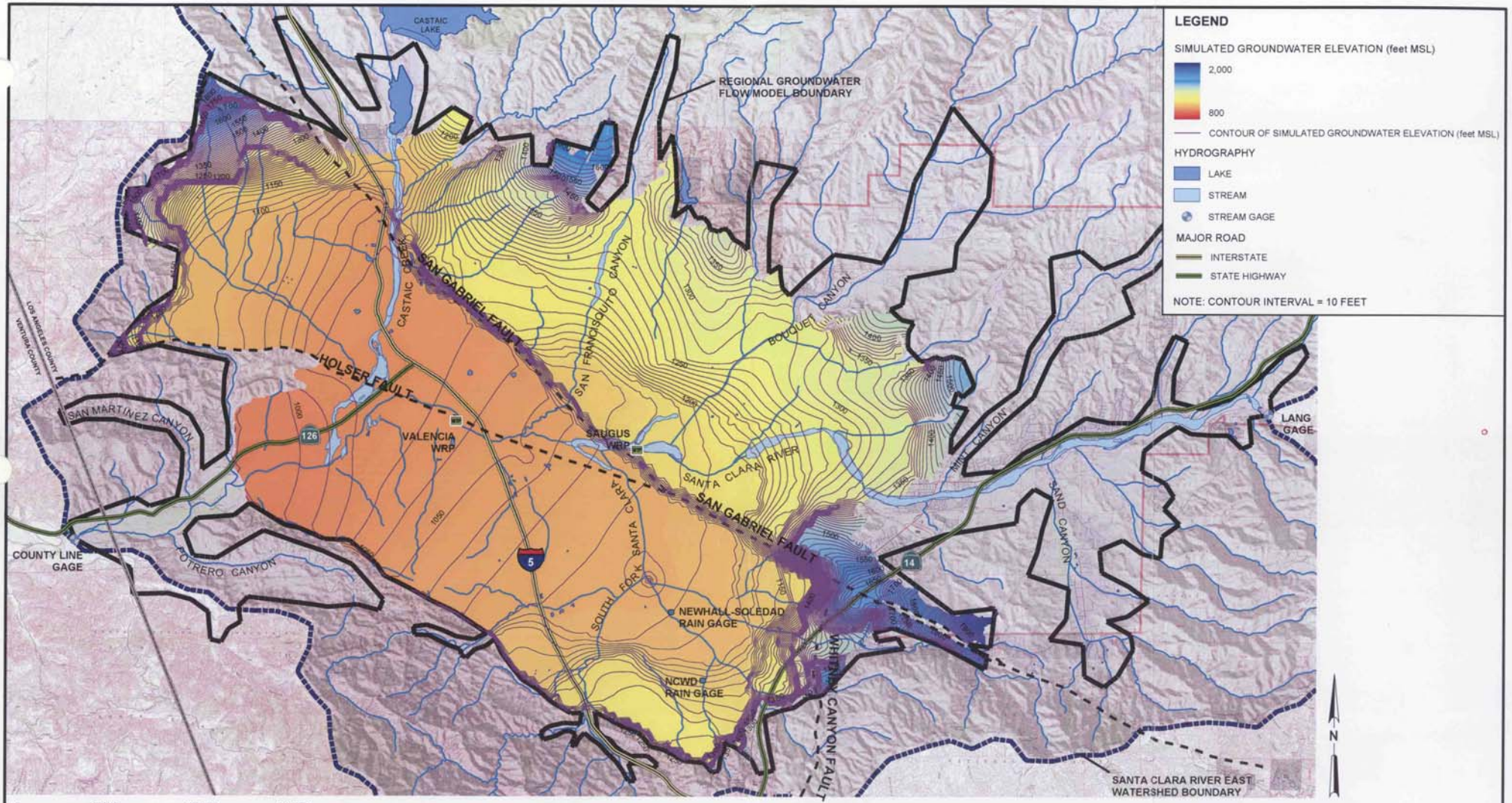

FIGURE 5-11
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 4
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG047.MXD FIG05-11.PDF 02/02/2004 10:07:23

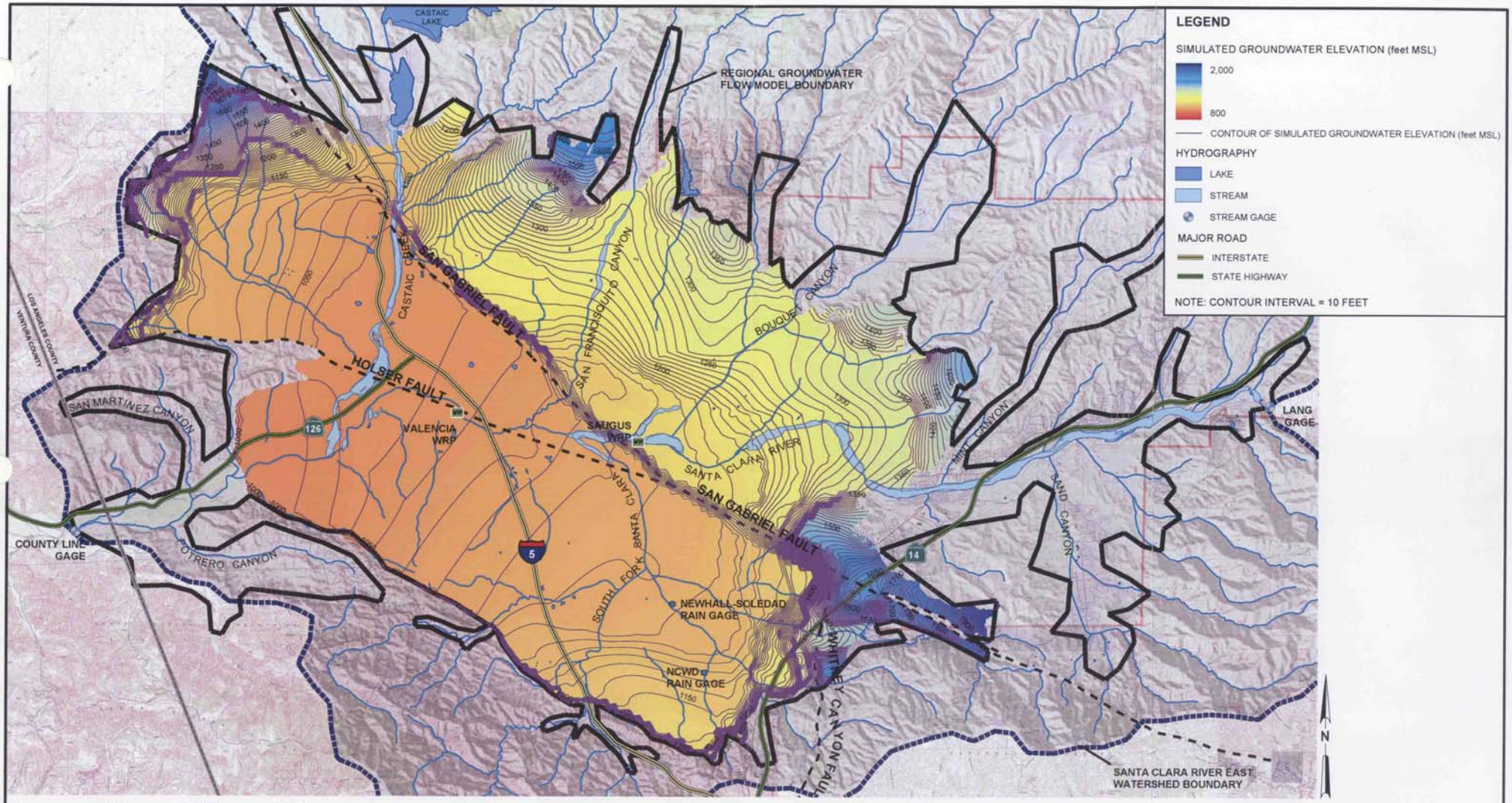

FIGURE 5-12
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 5
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG048.MXD FIG05-12.PDF 02/02/2004 11:04:46

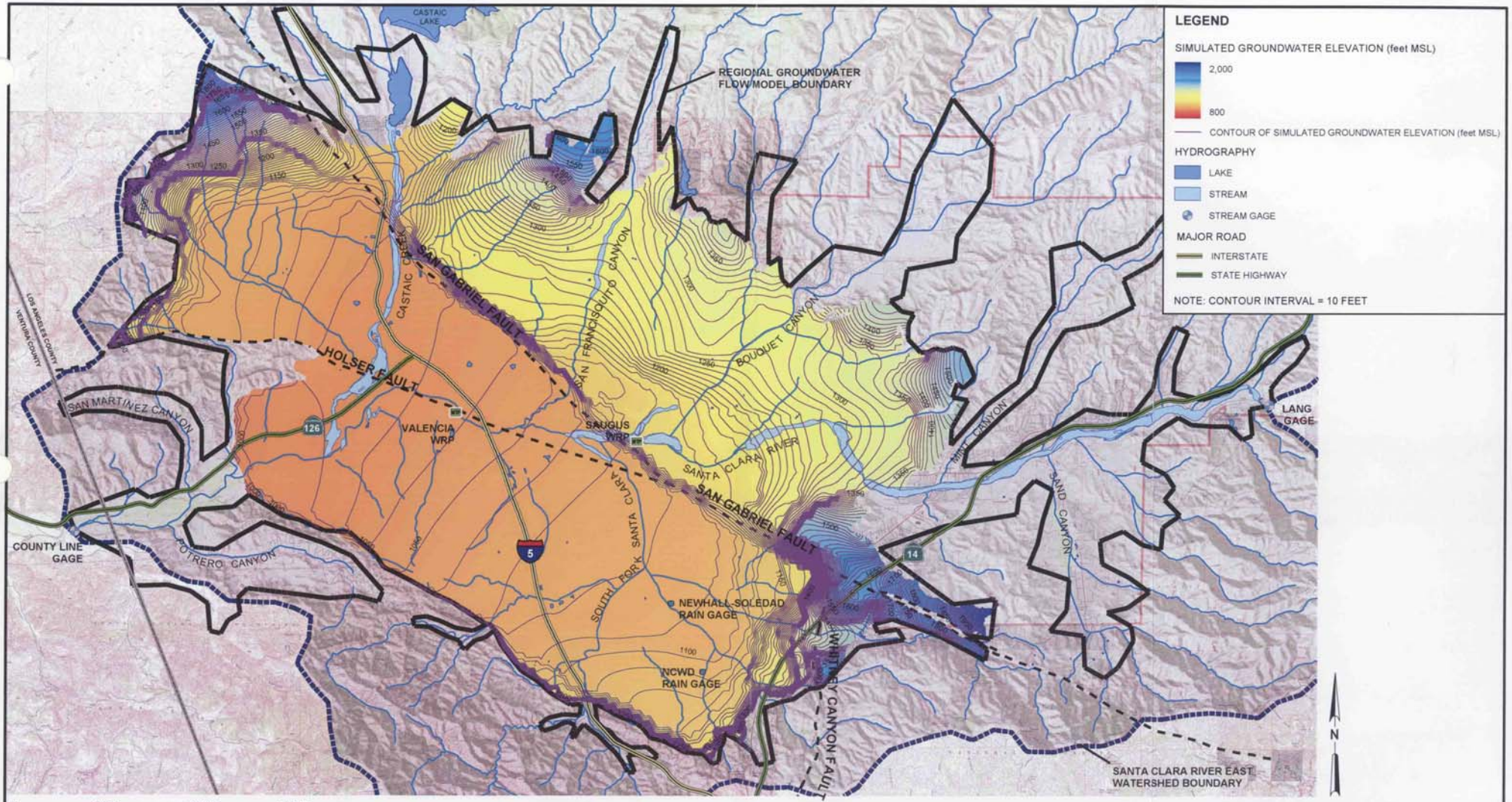

FIGURE 5-13
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 6
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG051.MXD FIG05-13.PDF 02/02/2004 11:11:08

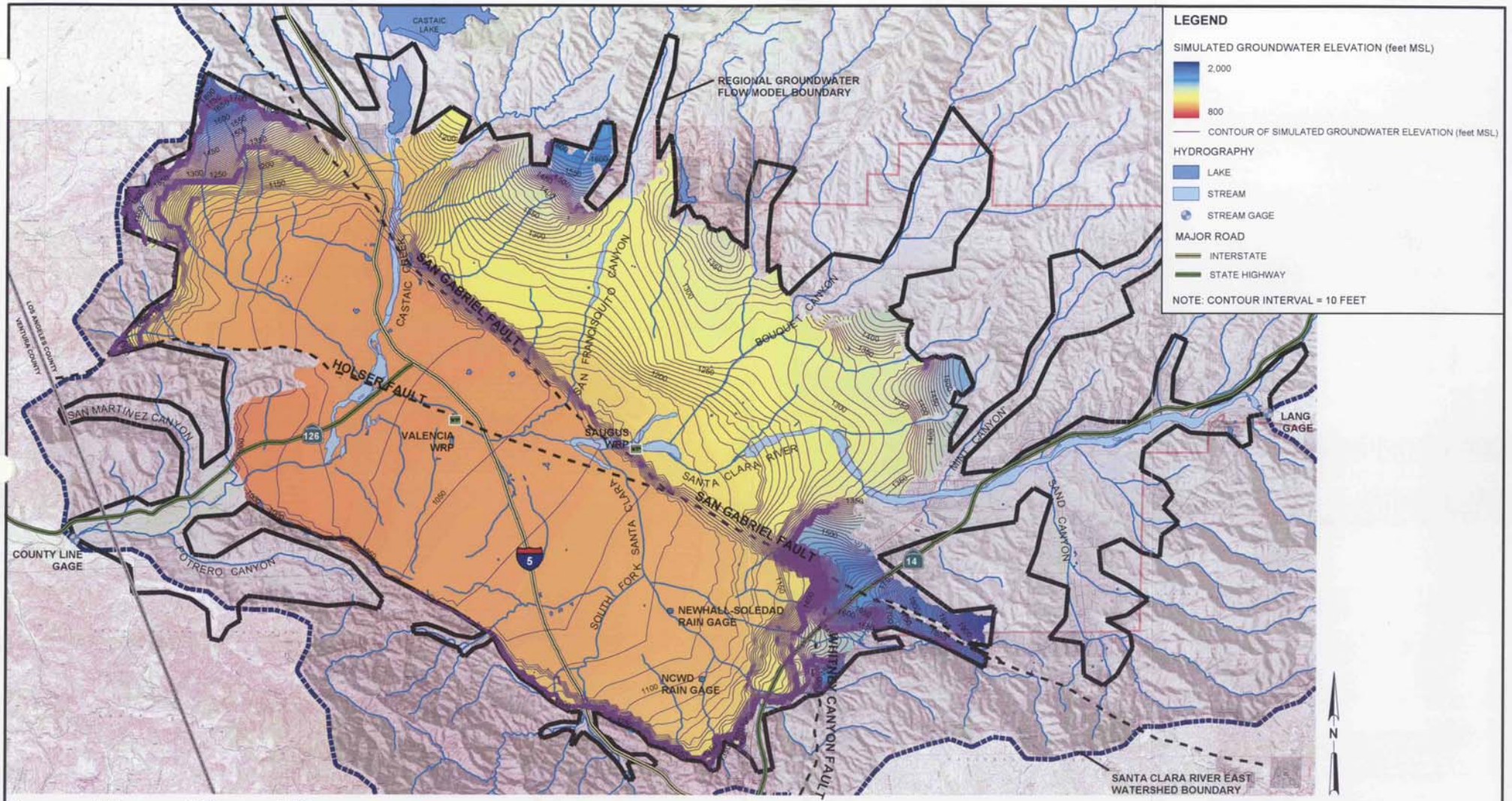

FIGURE 5-14
STEADY-STATE 1980-1985 GROUNDWATER ELEVATION CONTOURS FOR SAUGUS FORMATION IN MODEL LAYER 7
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIG050.MXD FIG05-14.PDF 02/02/2004 11:18:17

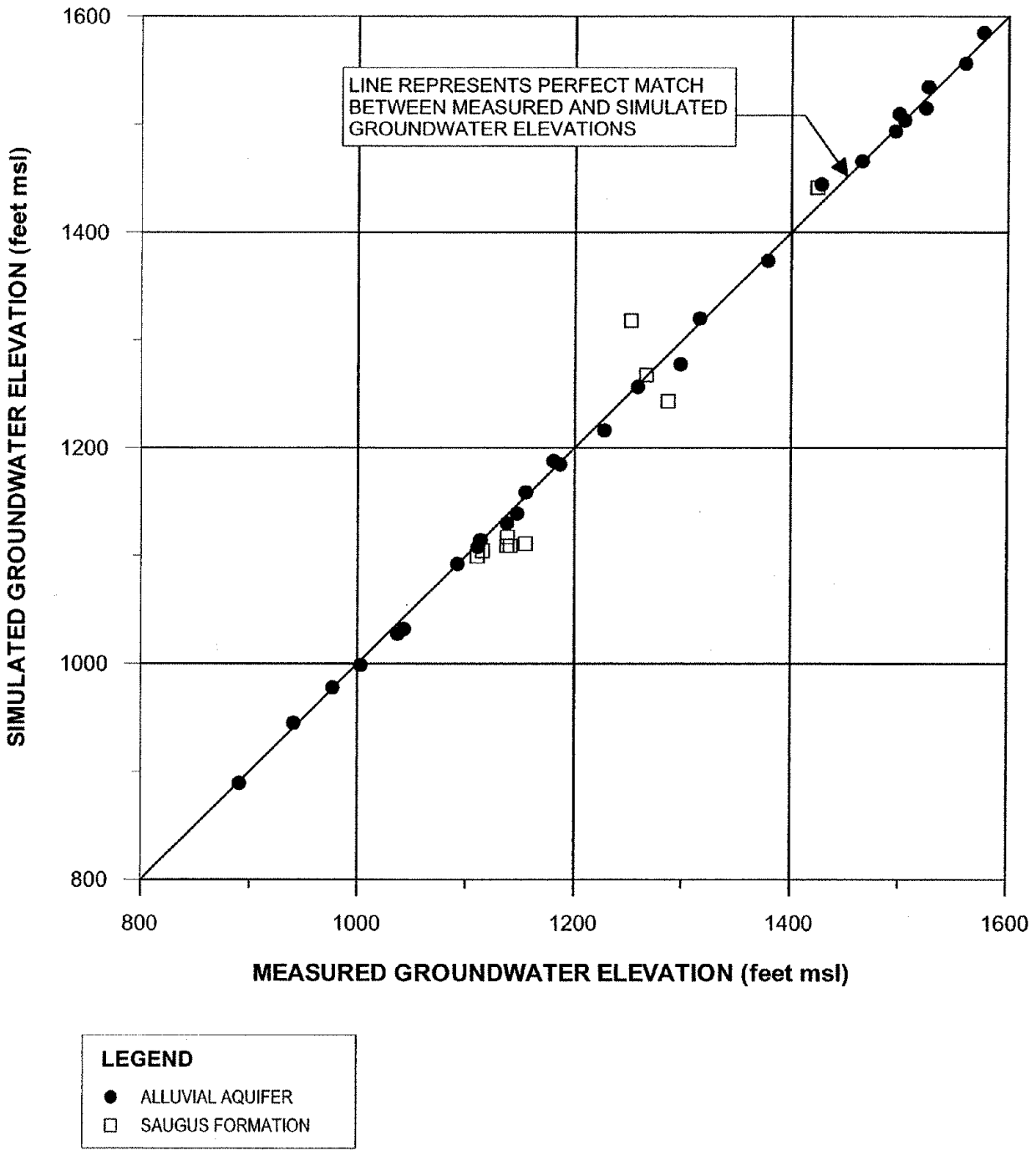

FIGURE 5-15
SIMULATED VERSUS MEASURED GROUNDWATER ELEVATIONS FOR THE STEADY-STATE MODEL
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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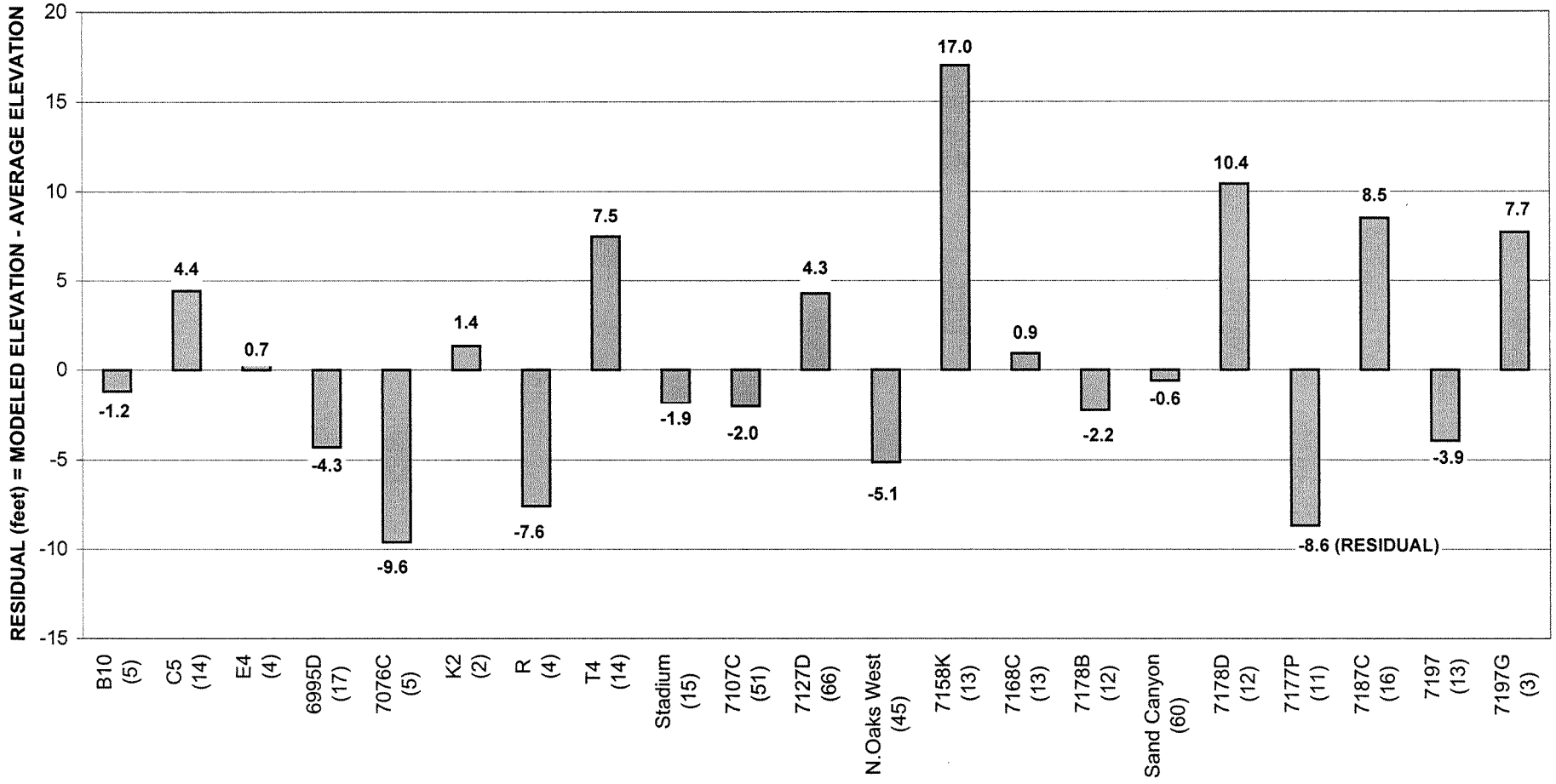

FIGURE 5-16
STEADY-STATE MODEL ERROR FOR ALLUVIAL AQUIFER TARGET WELLS ALONG THE SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

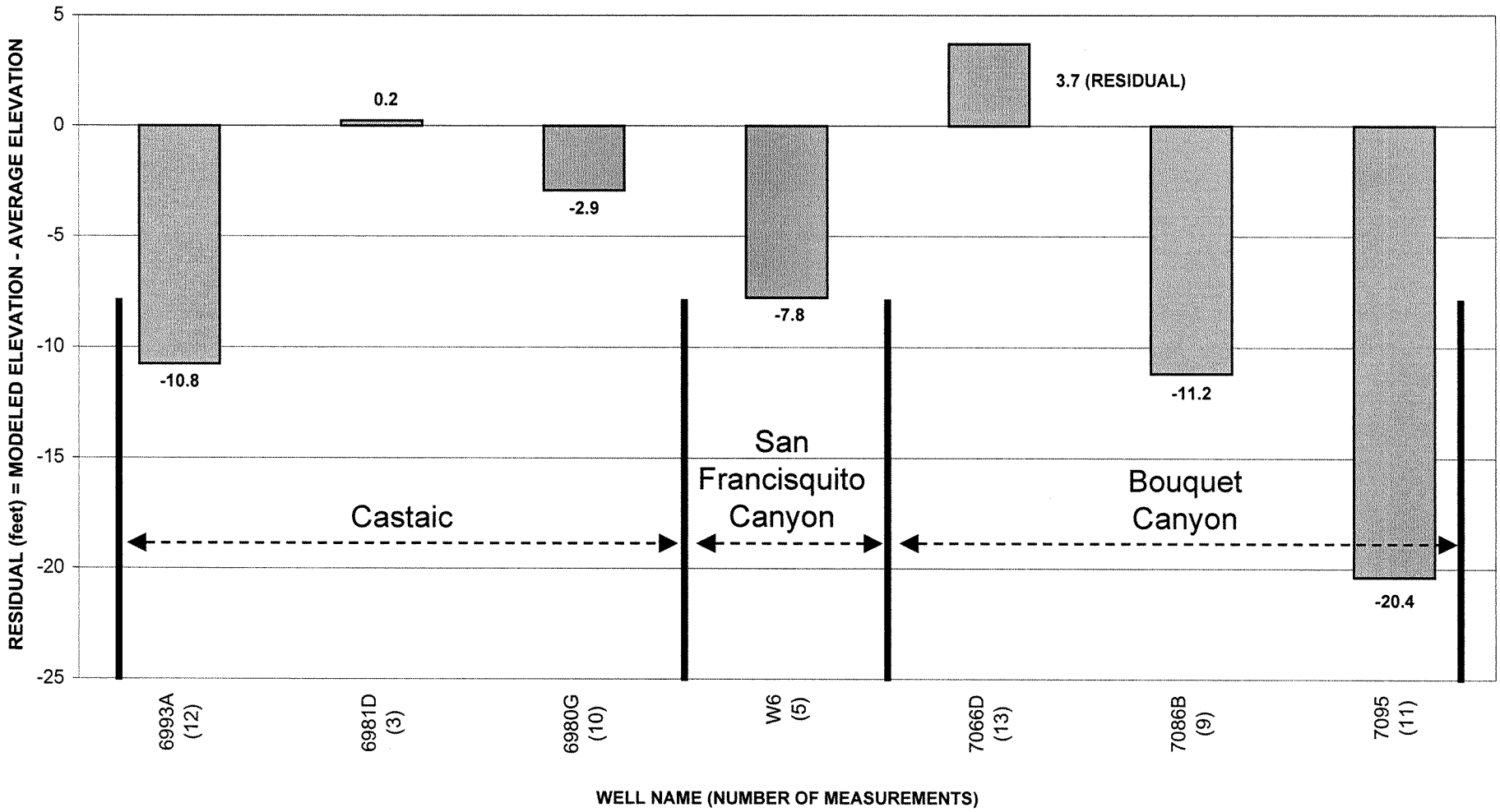

FIGURE 5-17
STEADY-STATE MODEL ERROR FOR ALLUVIAL AQUIFER TARGET WELLS AWAY FROM THE SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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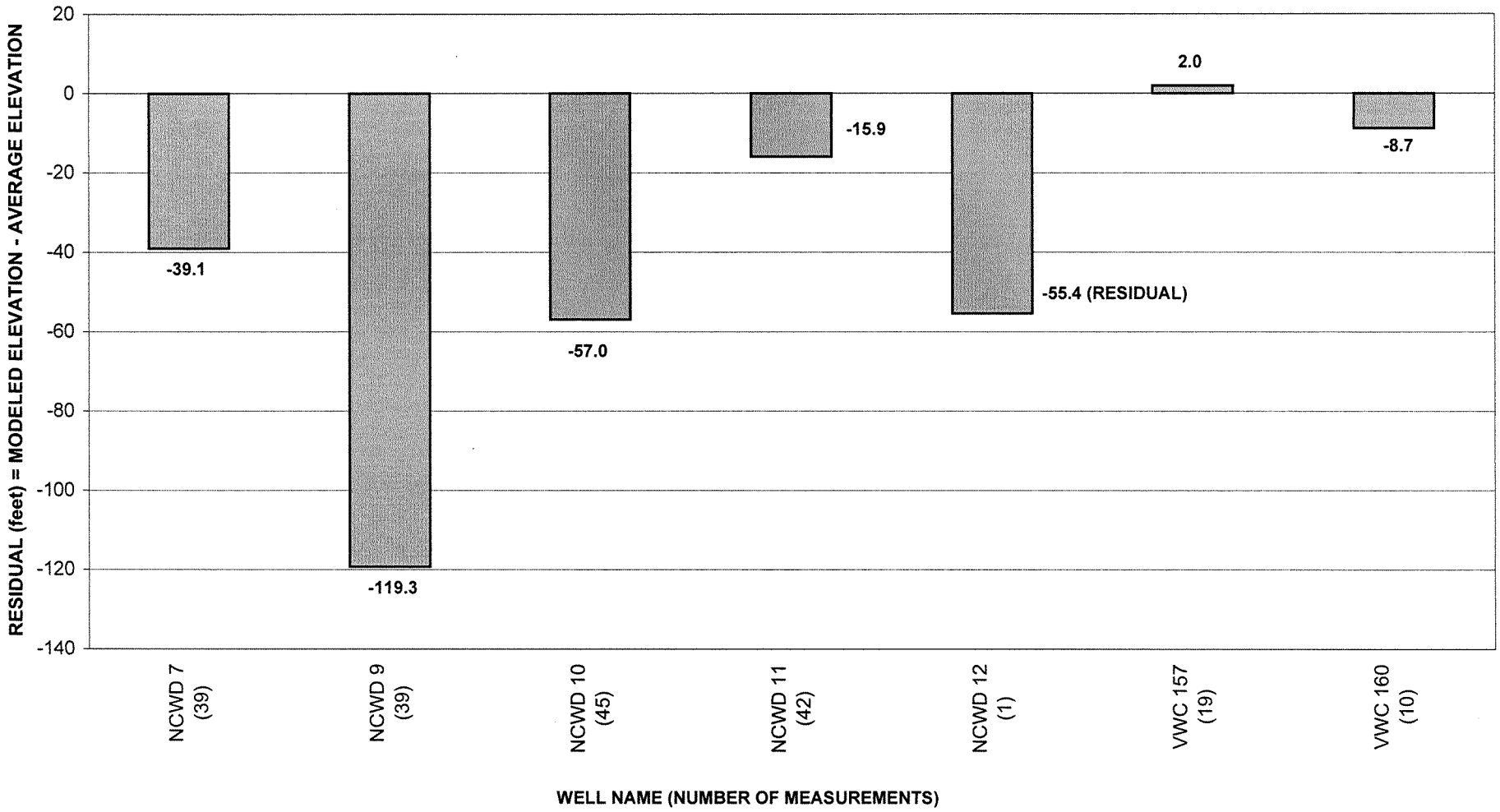
178973-403.xls/Fig 5-17



NOTE:
ALL WELLS SHOWN ON THIS PLOT ARE LOCATED IN THE SOUTH FORK SANTA CLARA RIVER VALLEY

FIGURE 5-18
STEADY-STATE MODEL ERROR FOR SAUGUS FORMATION PRODUCTION WELLS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

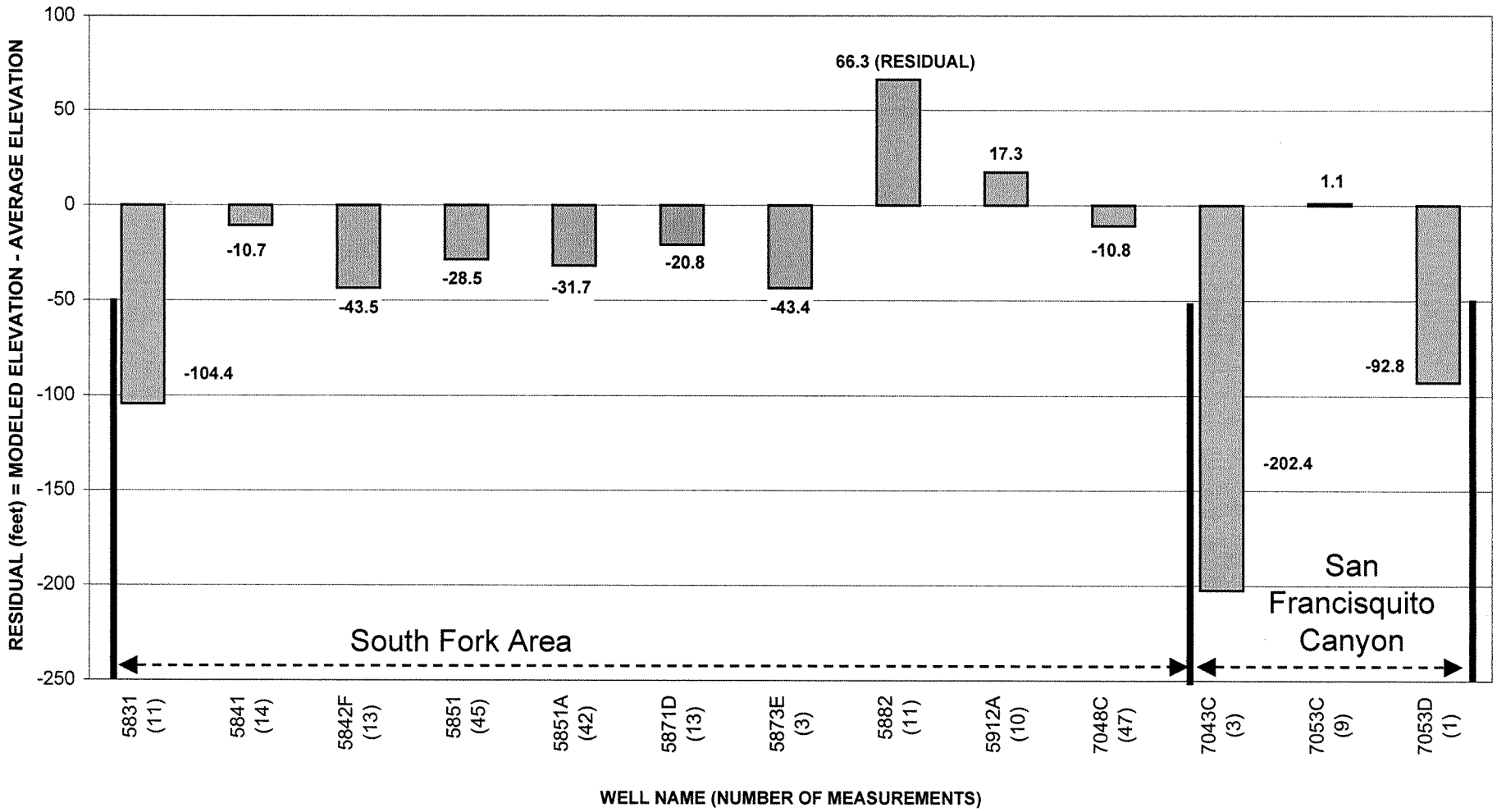
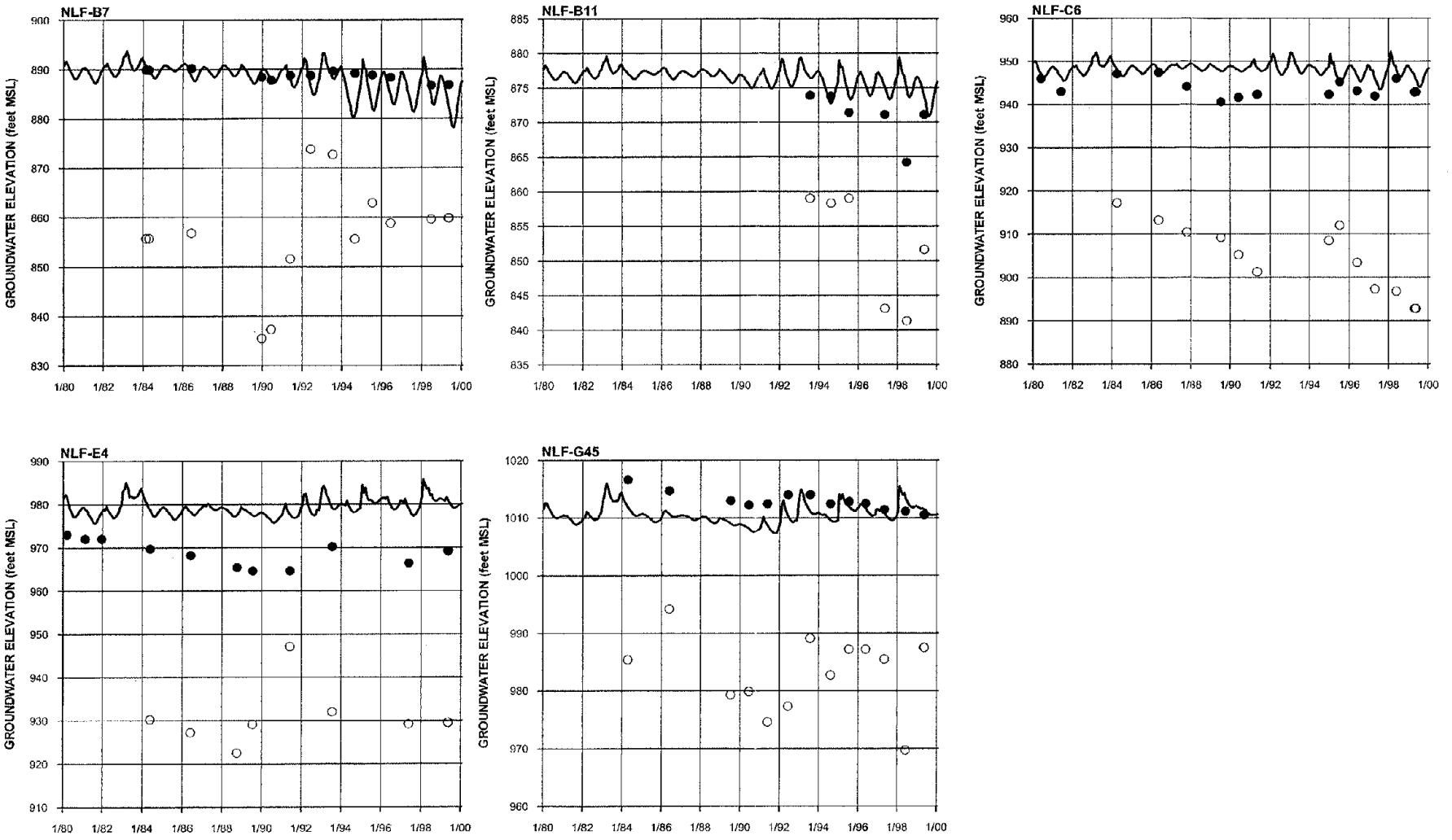


FIGURE 5-19
STEADY-STATE MODEL ERROR FOR SAUGUS FORMATION OBSERVATION WELLS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

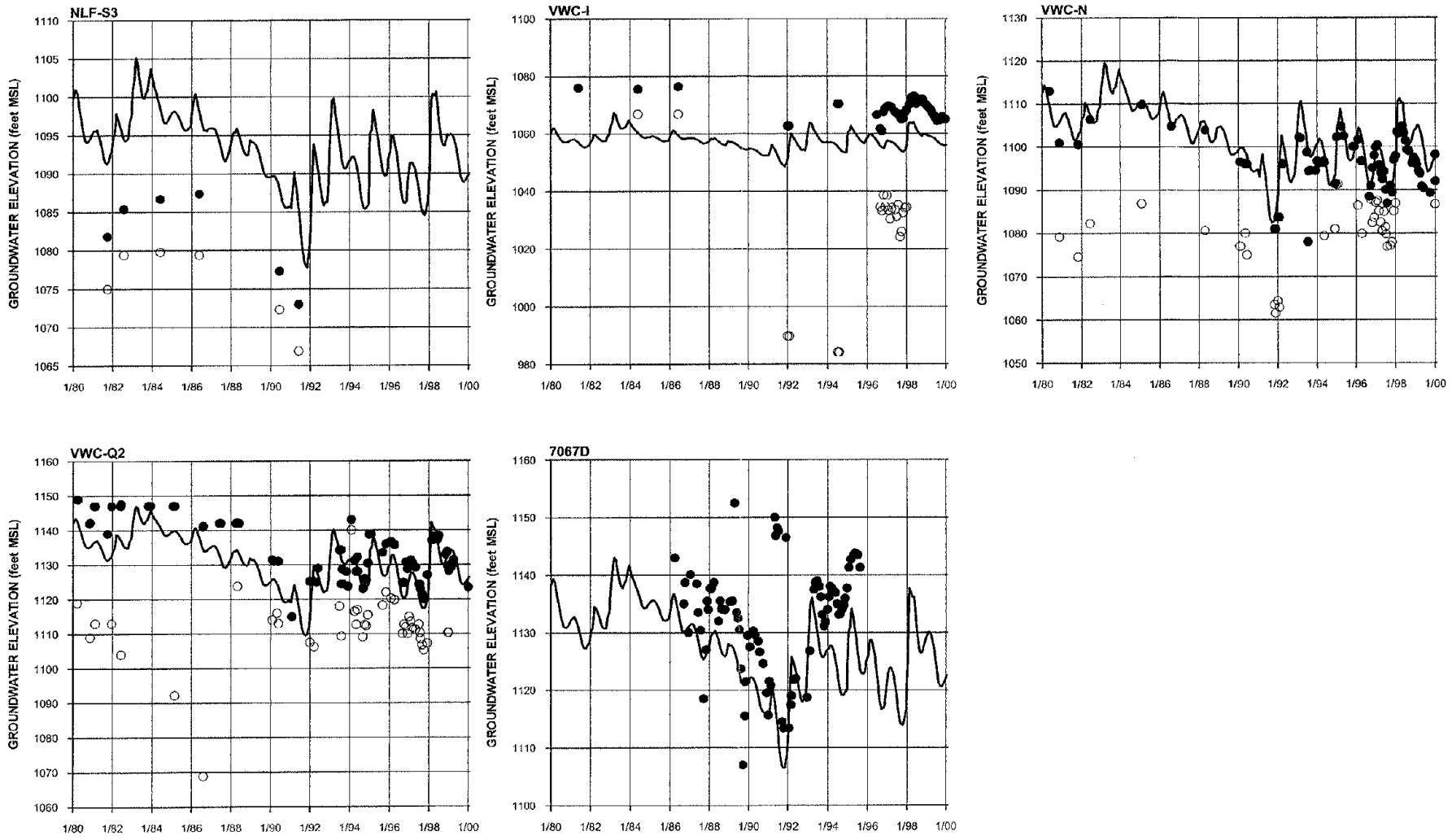


NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

FIGURE 5-20
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS WEST OF INTERSTATE 5
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

175570-310.GRF



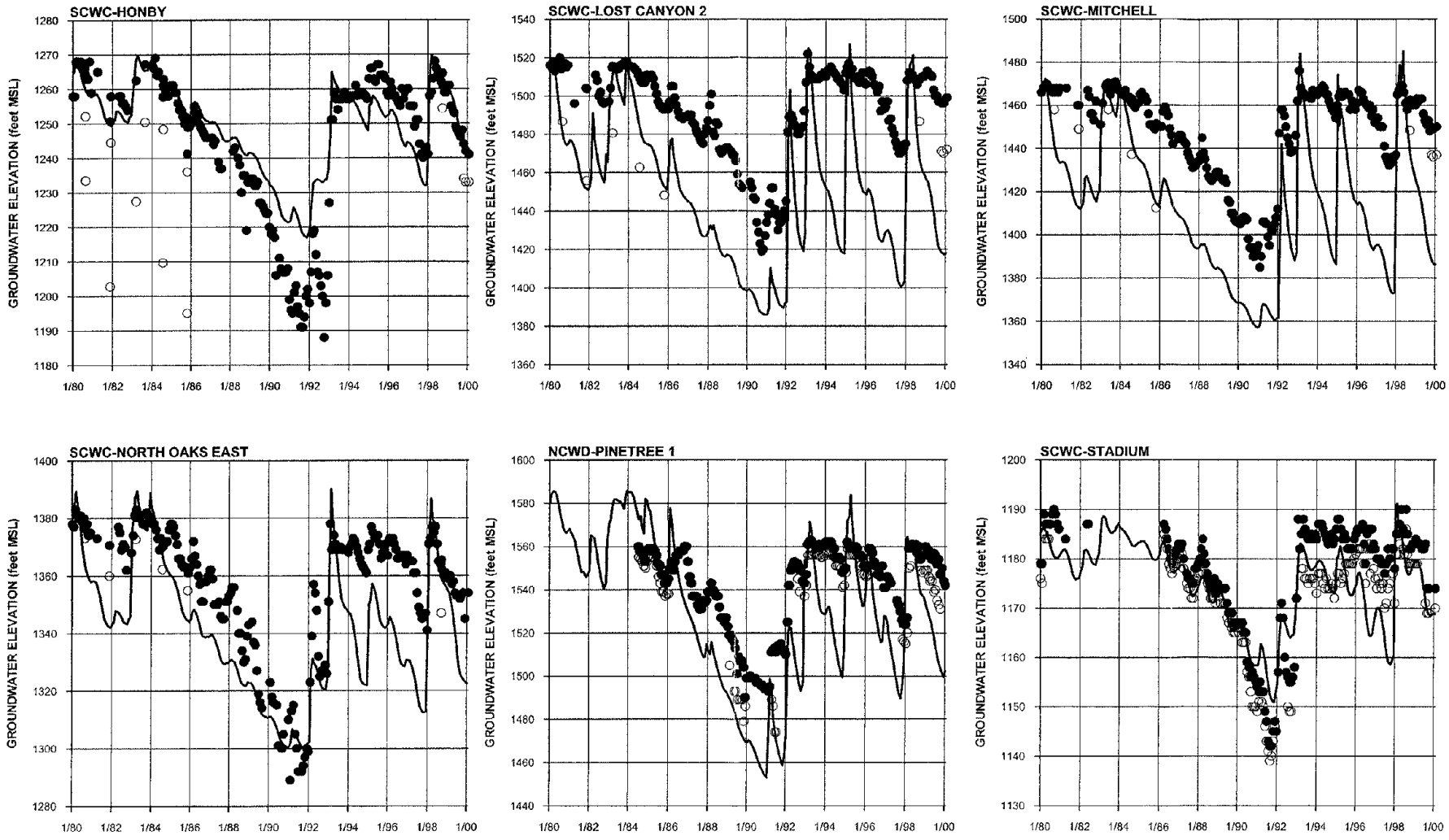
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

FIGURE 5-21
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS BETWEEN INTERSTATE 5 AND SOLEDAD CANYON

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

175570-312.GRF



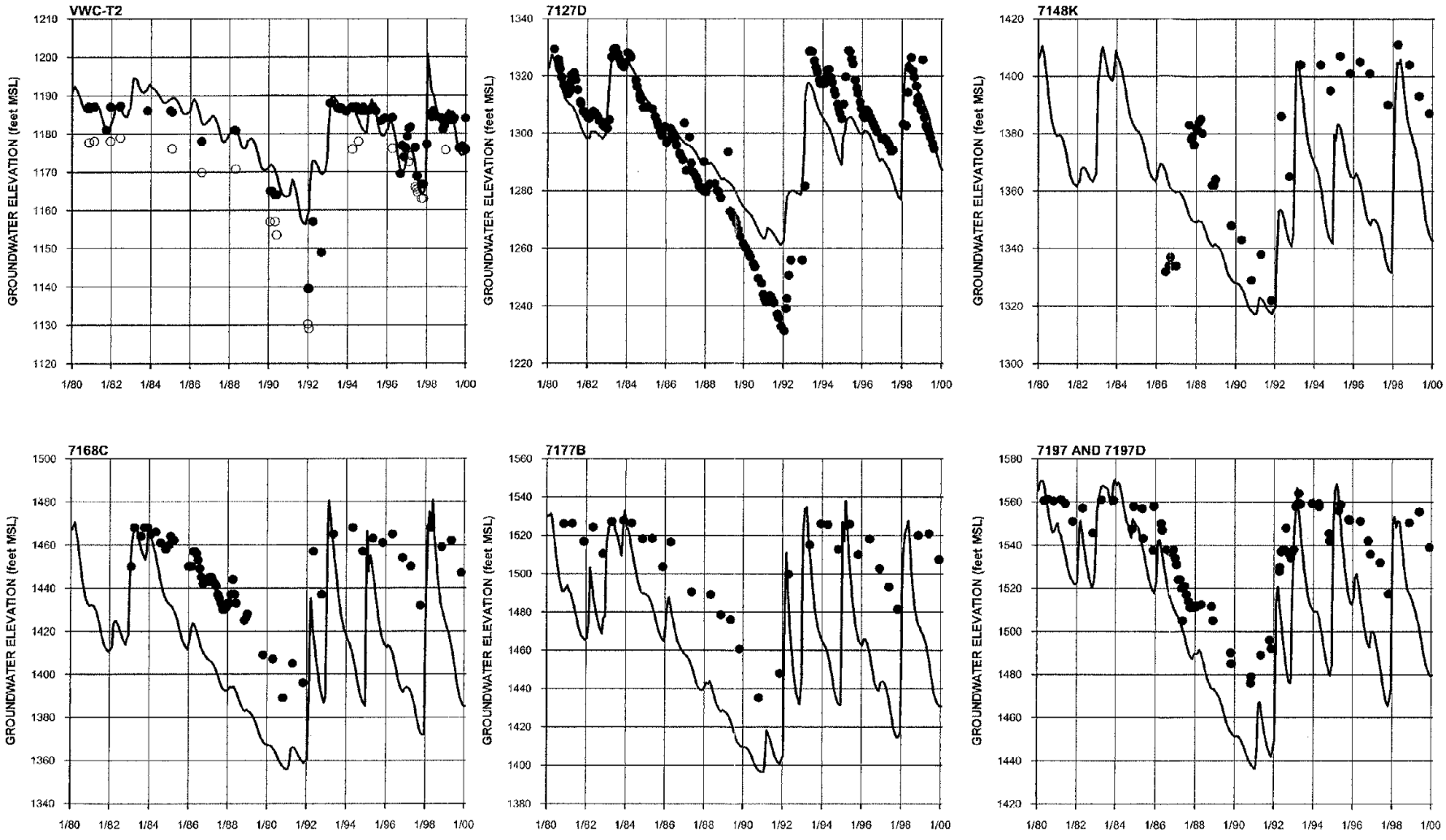
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

178973-313.GRF

FIGURE 5-22
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 1 OF 2)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



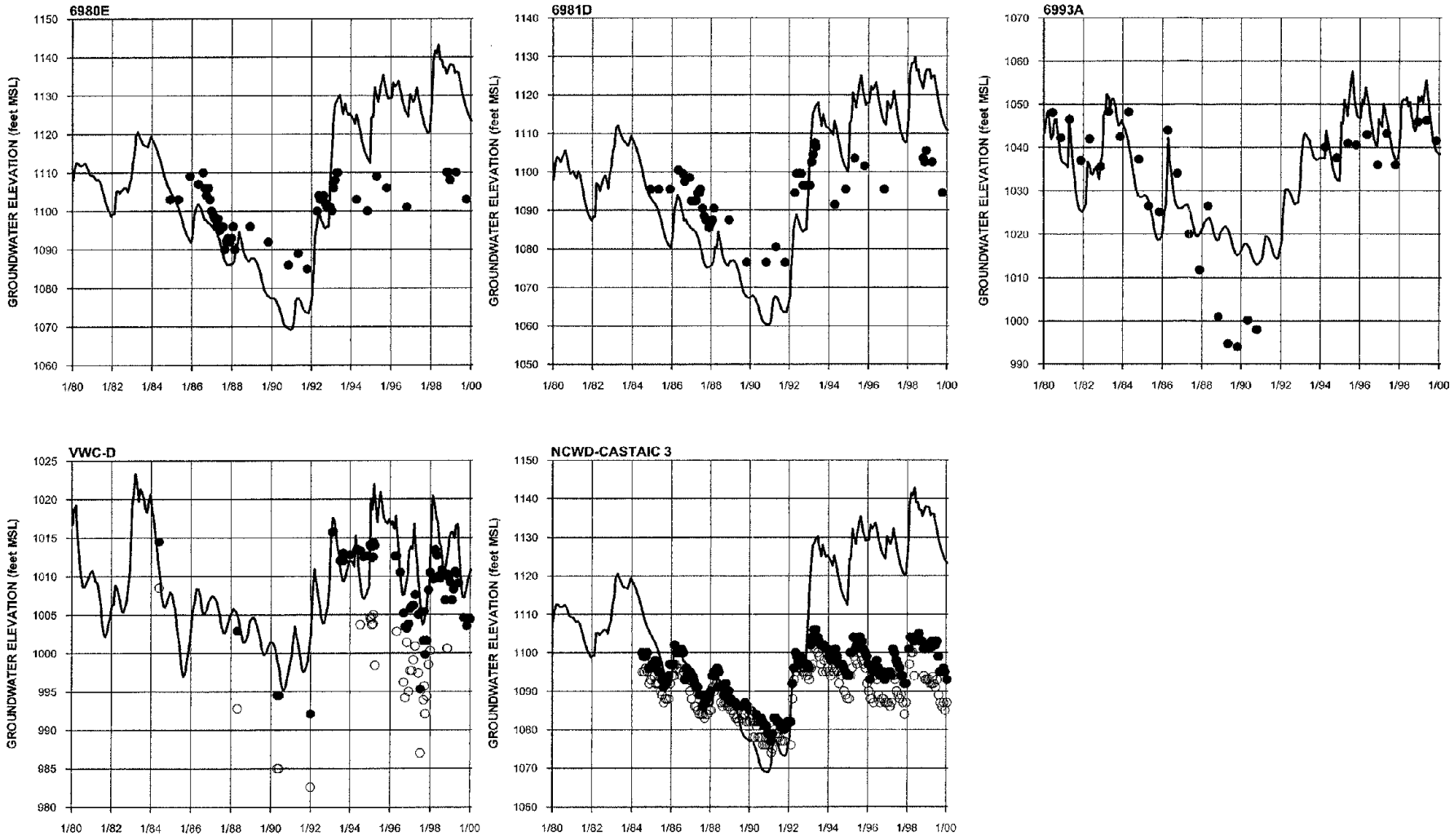
NOTE: SEE FIGURE 2-3 FOR LOCATION OF WELLS.

178973-314.GRF

FIGURE 5-22
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 2 OF 2)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



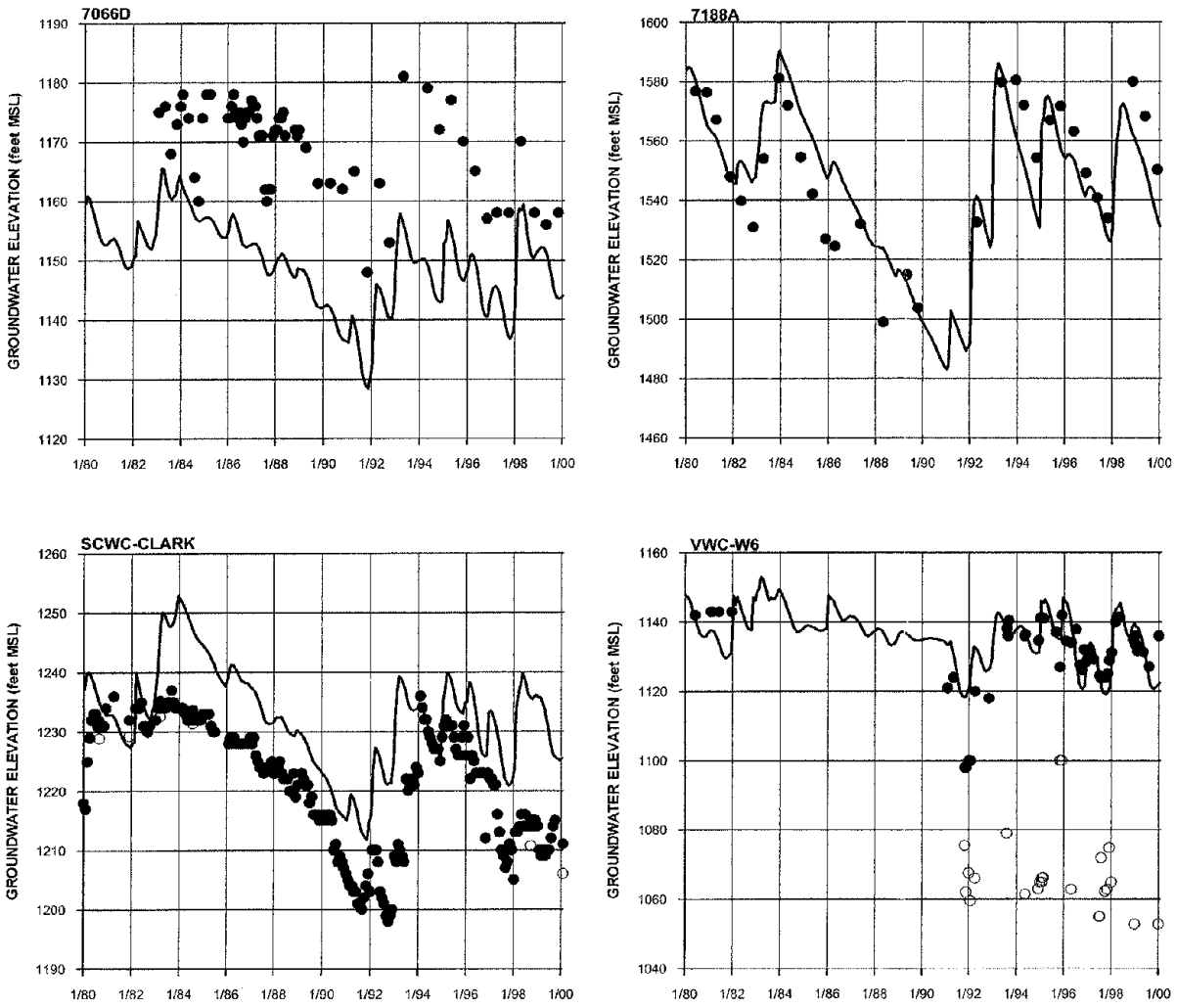
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-315.GRF

FIGURE 5-23
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS ALONG CASTAIC CREEK

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



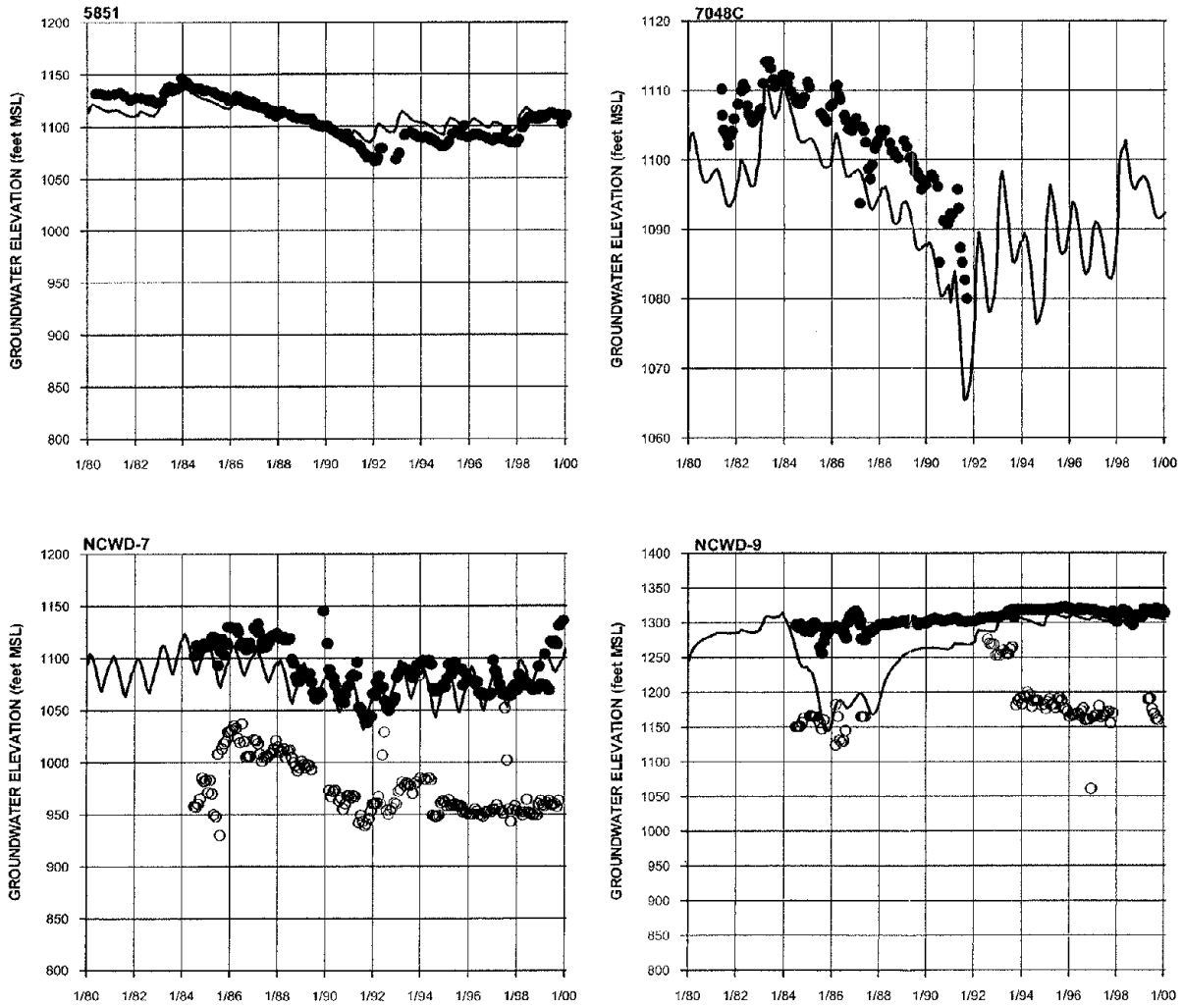
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-316.GRF

FIGURE 5-24
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN OTHER TRIBUTARY CANYONS TO THE SANTA CLARA RIVER

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



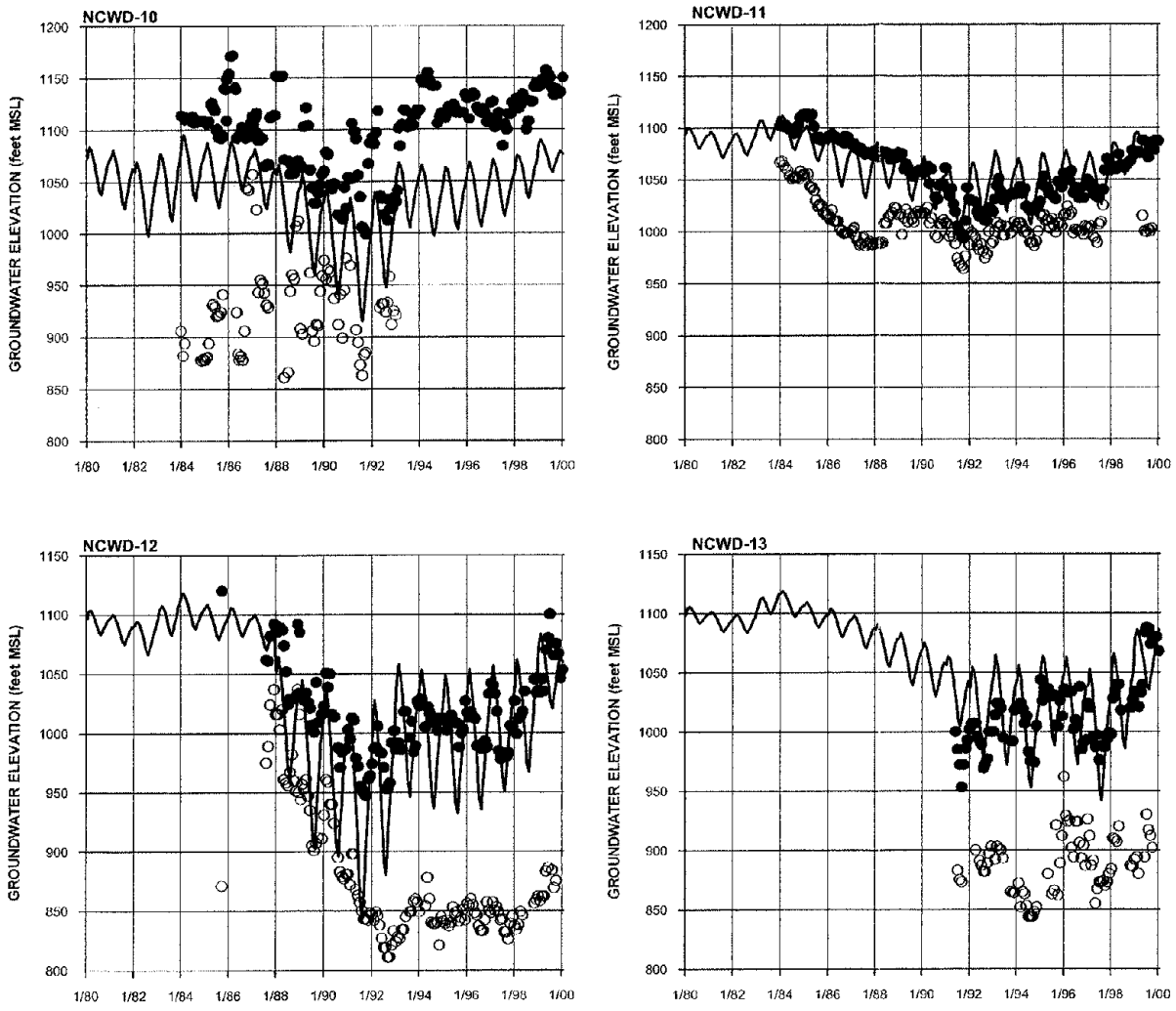
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-319.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 1 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



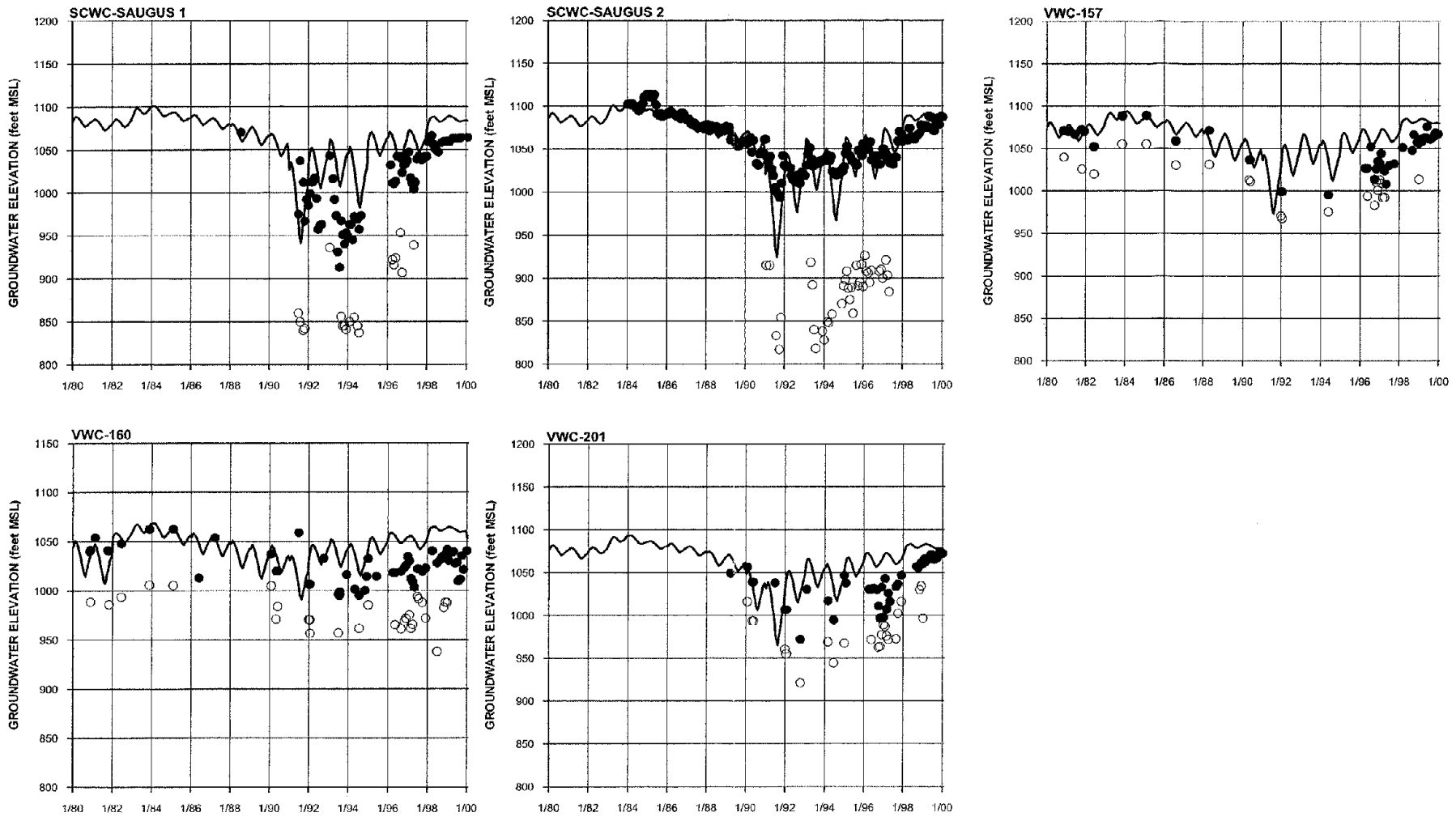
NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-317.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 2 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL



NOTE: SEE FIGURE 2-3 FOR LOCATIONS OF WELLS.

175570-318.GRF

FIGURE 5-25
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 3 0F 3)

REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

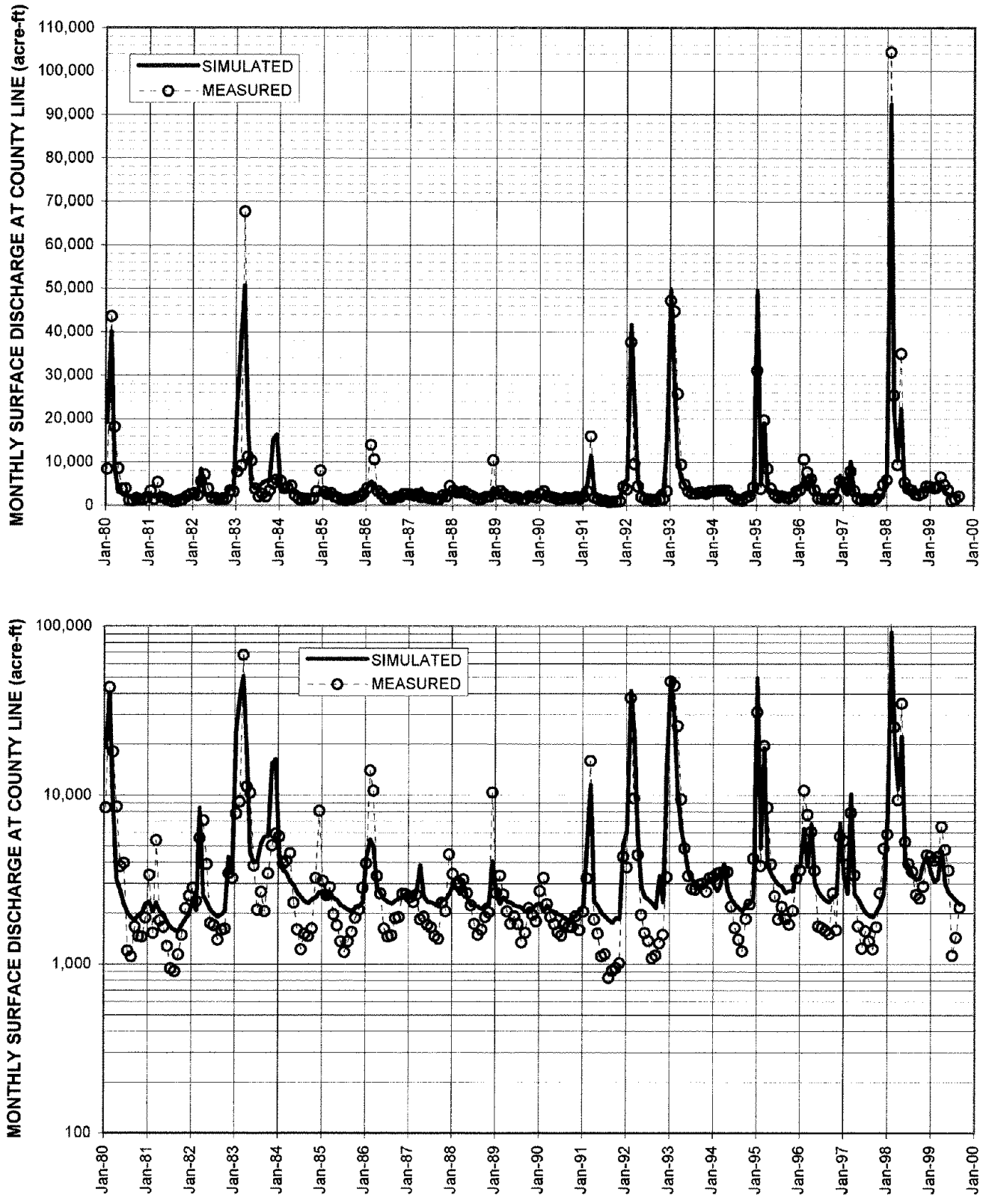


FIGURE 5-26
SIMULATED VERSUS MEASURED HYDROGRAPHS OF SANTA CLARA RIVER FLOW AT COUNTY LINE
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

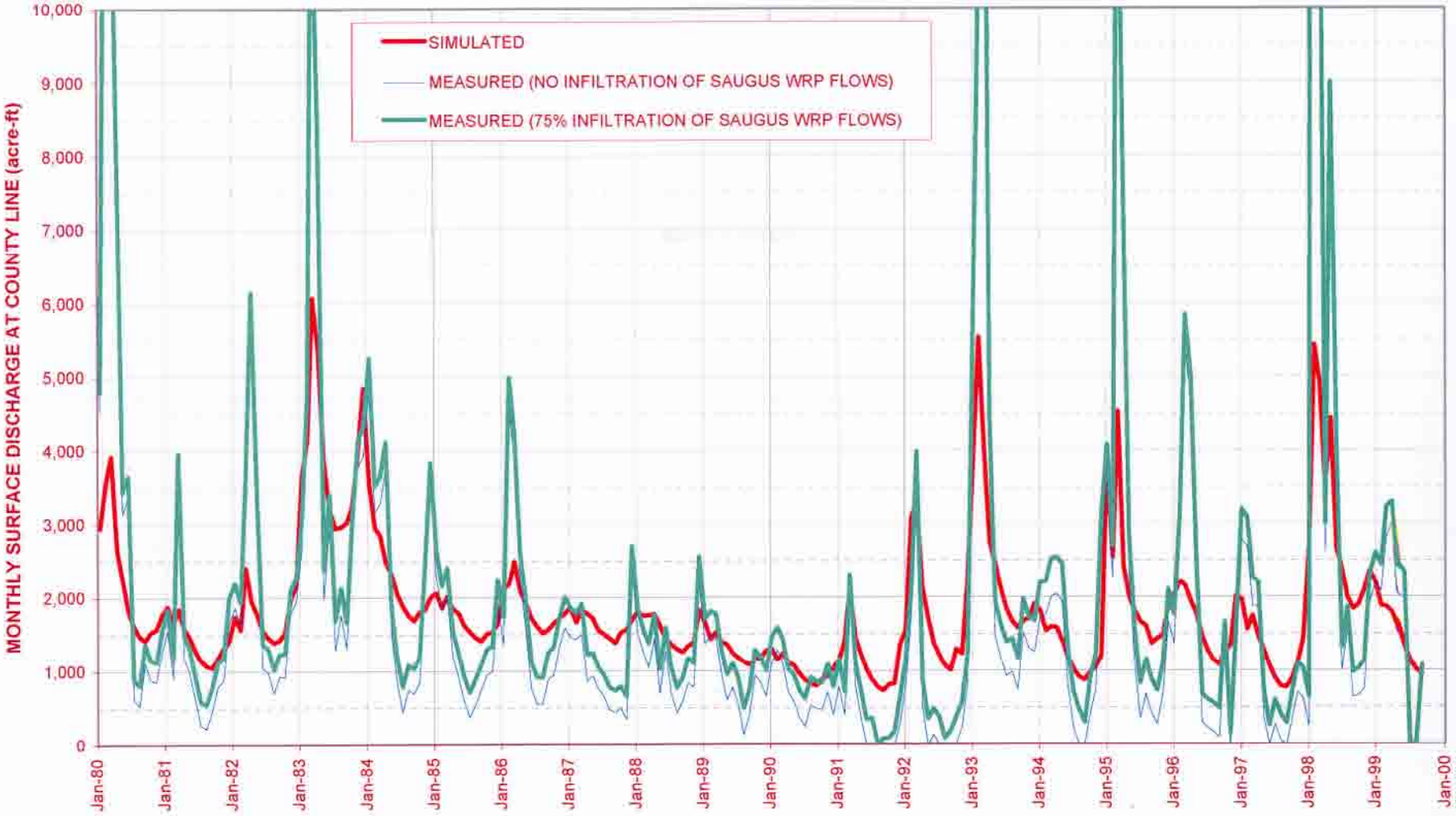


FIGURE 5-27
SIMULATED VERSUS MEASURED HYDROGRAPH OF GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

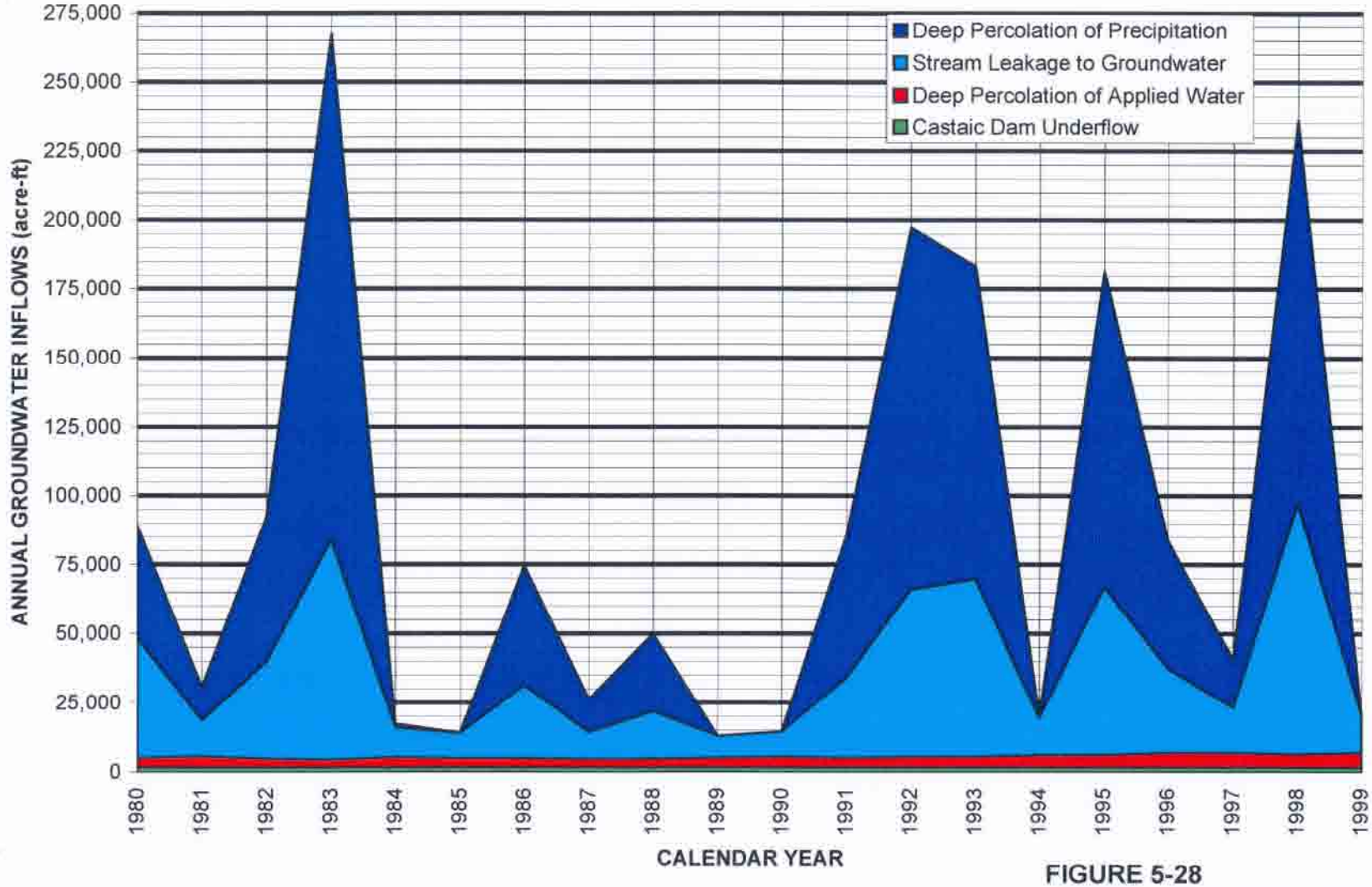


FIGURE 5-28
ANNUAL GROUNDWATER INFLOWS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

04/04/2004
178973-410.xls/Fig 5-28

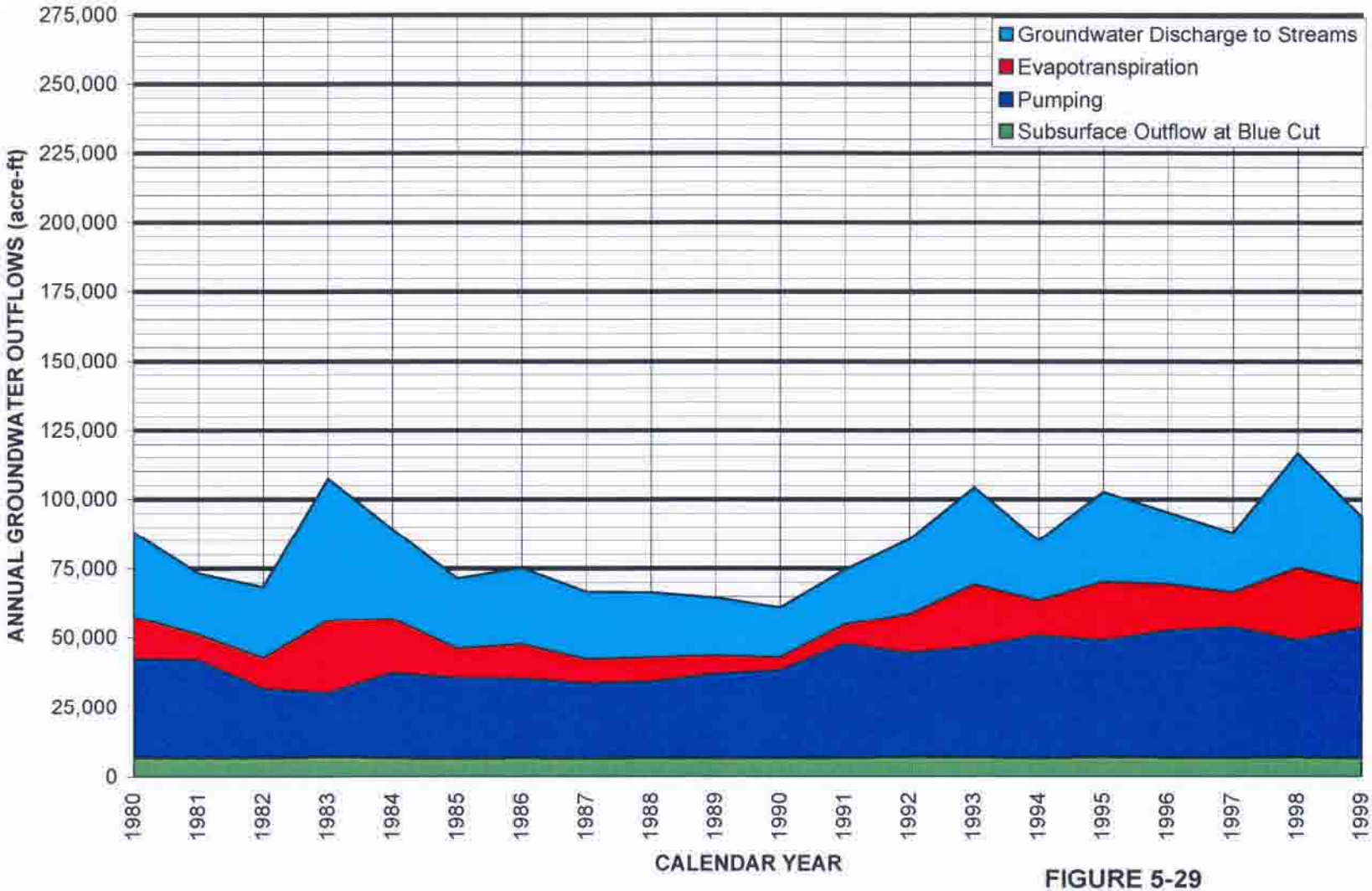


FIGURE 5-29
ANNUAL GROUNDWATER OUTFLOWS
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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04/04/2004
178973-410.xls/Fig 5-29

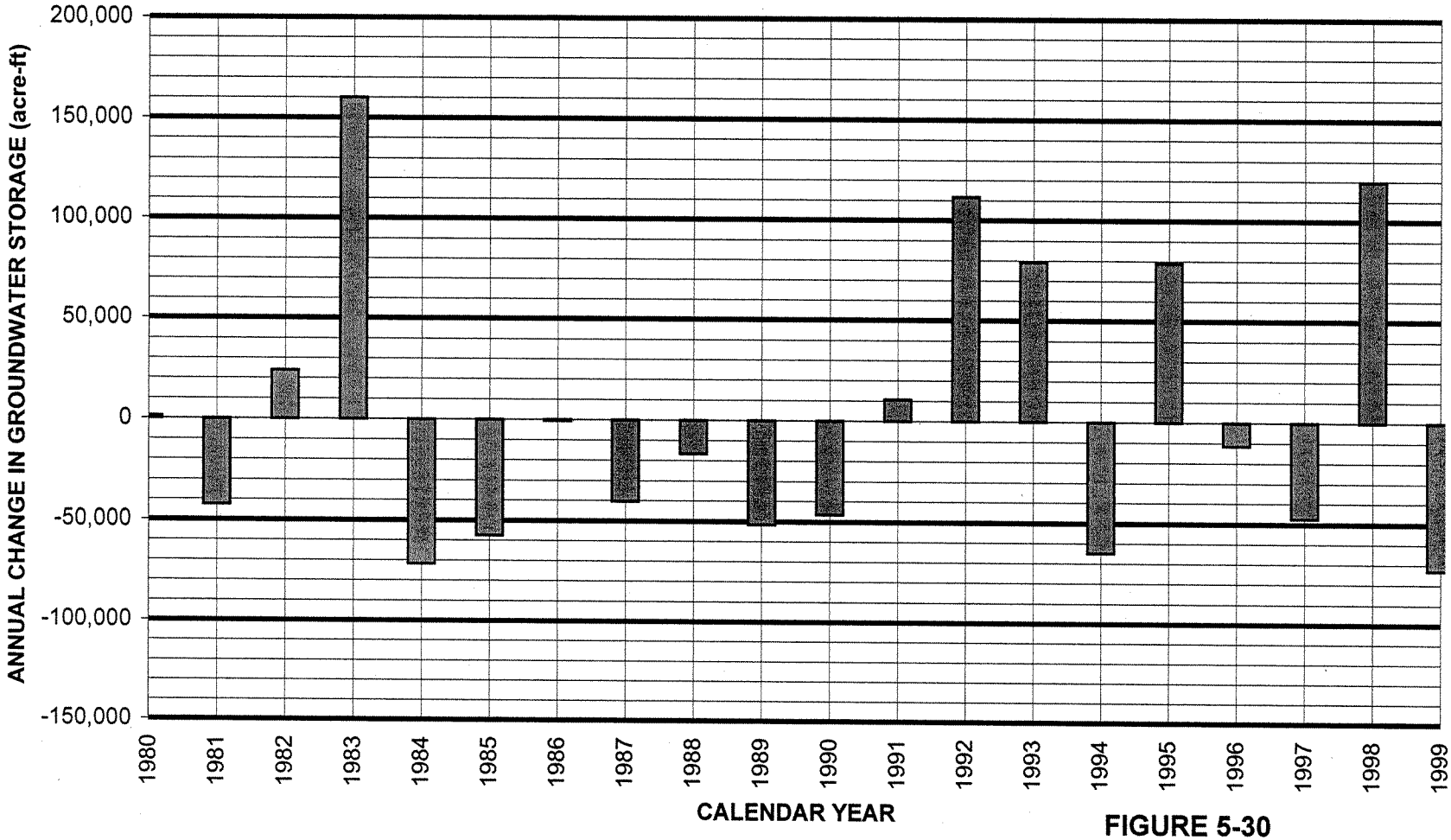

FIGURE 5-30
ANNUAL CHANGE IN GROUNDWATER STORAGE
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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04/04/2004
178973-410.xls/Fig 5-30

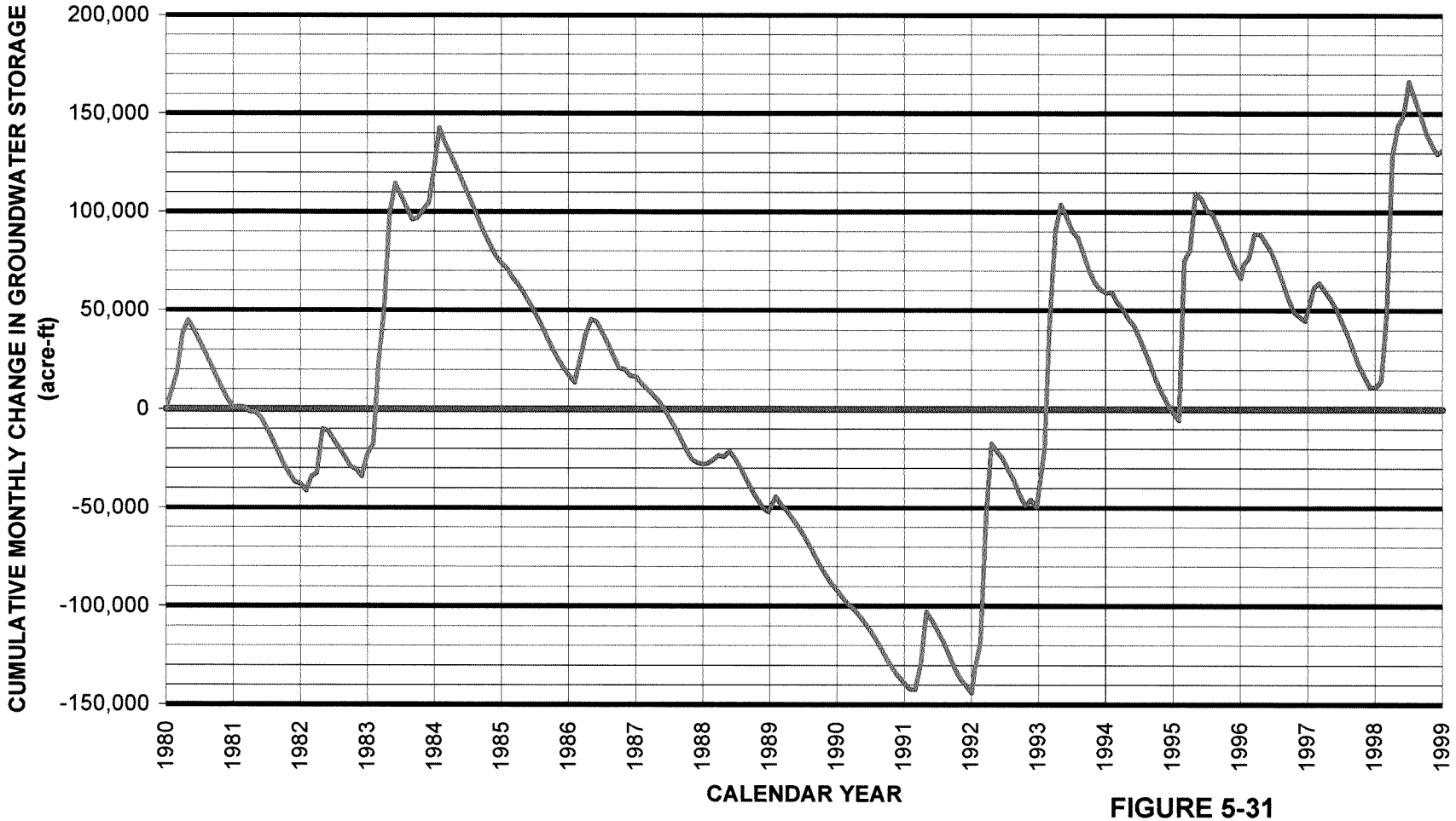
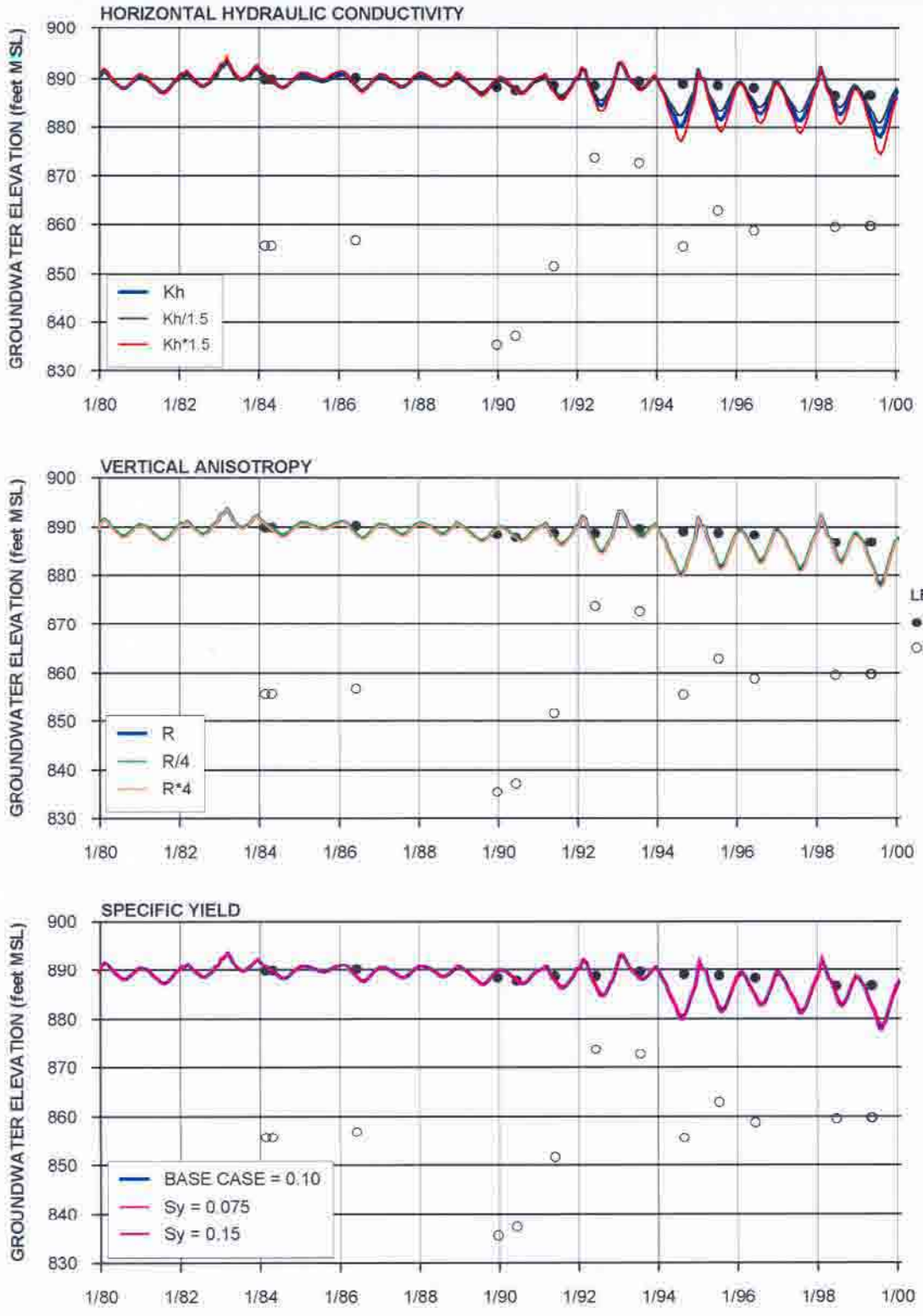


FIGURE 5-31
CUMULATIVE CHANGE IN GROUNDWATER STORAGE
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

04/04/2004
178973-410.xls/Fig 5-31

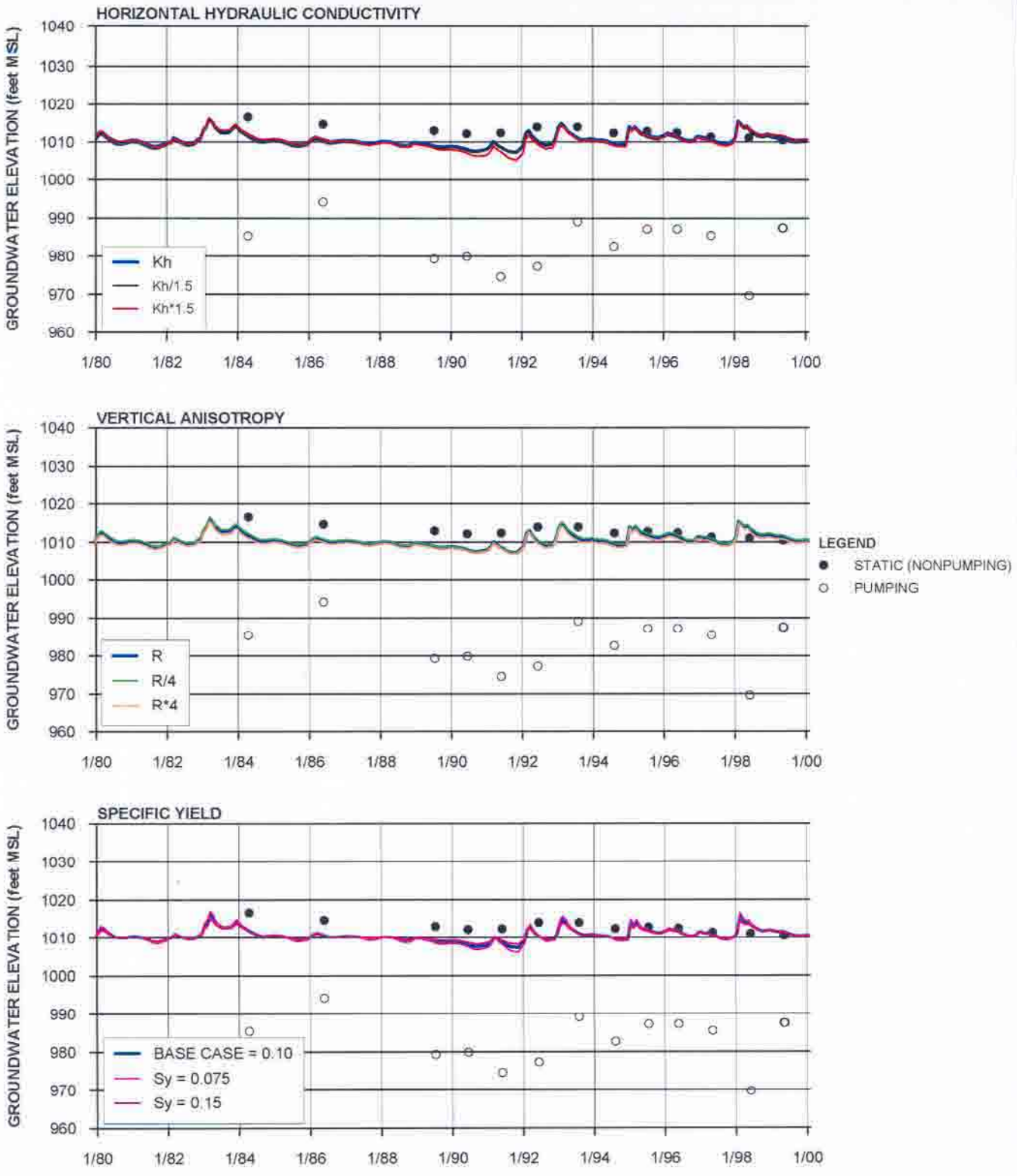


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-32
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-B7 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-311.GRF

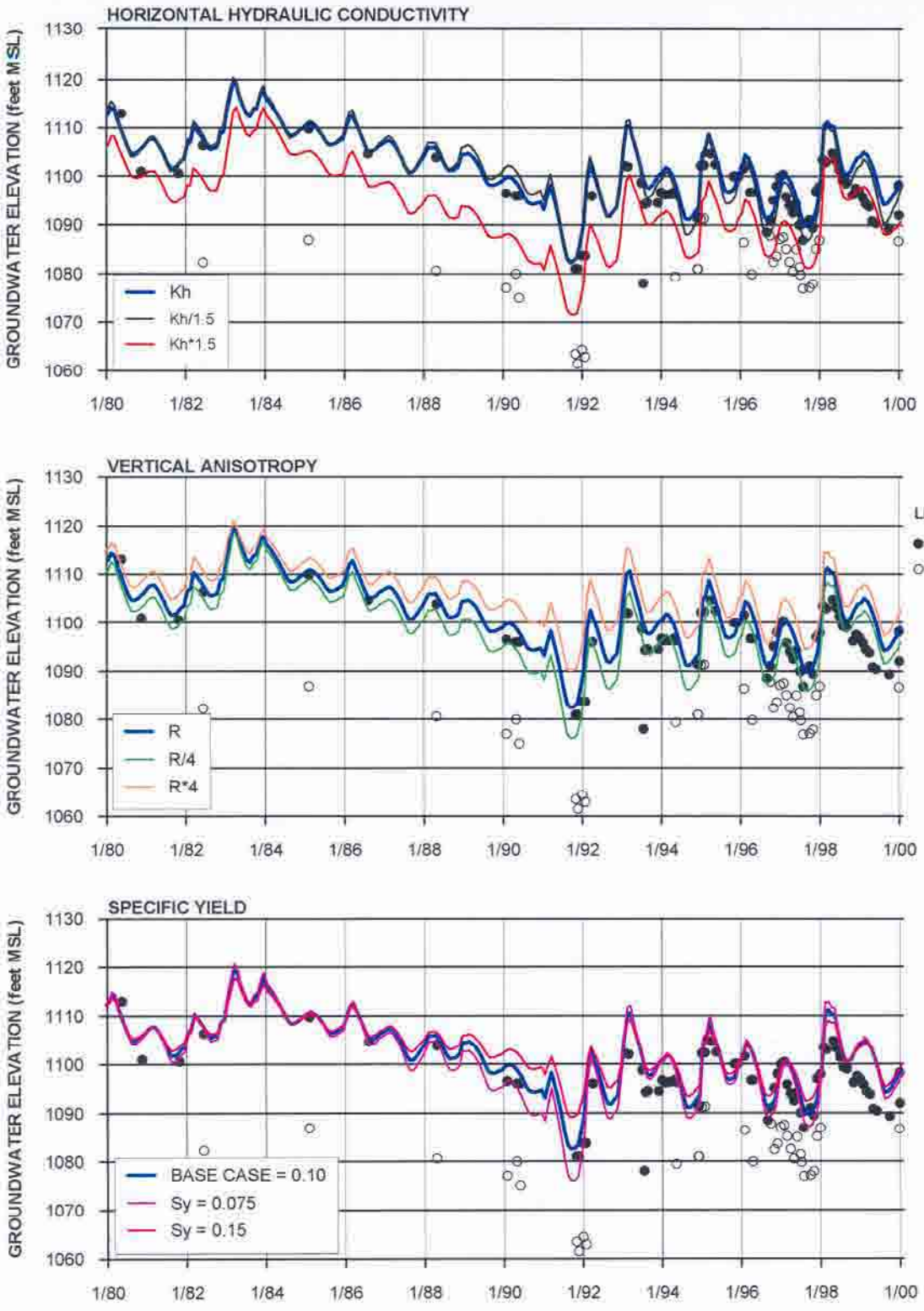


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-33
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-G45 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-320.GRF

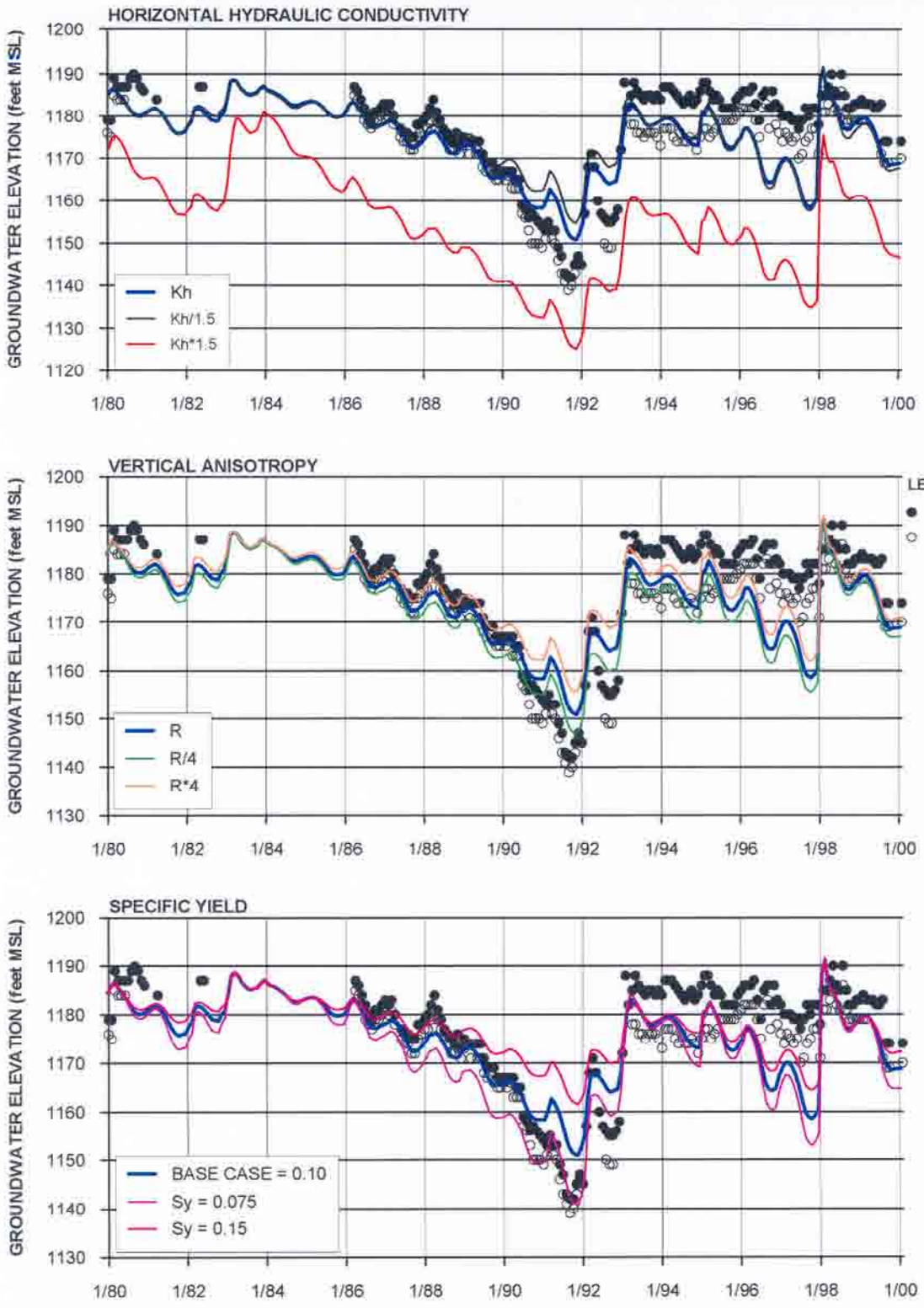


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-34
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-N TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-321.GRF

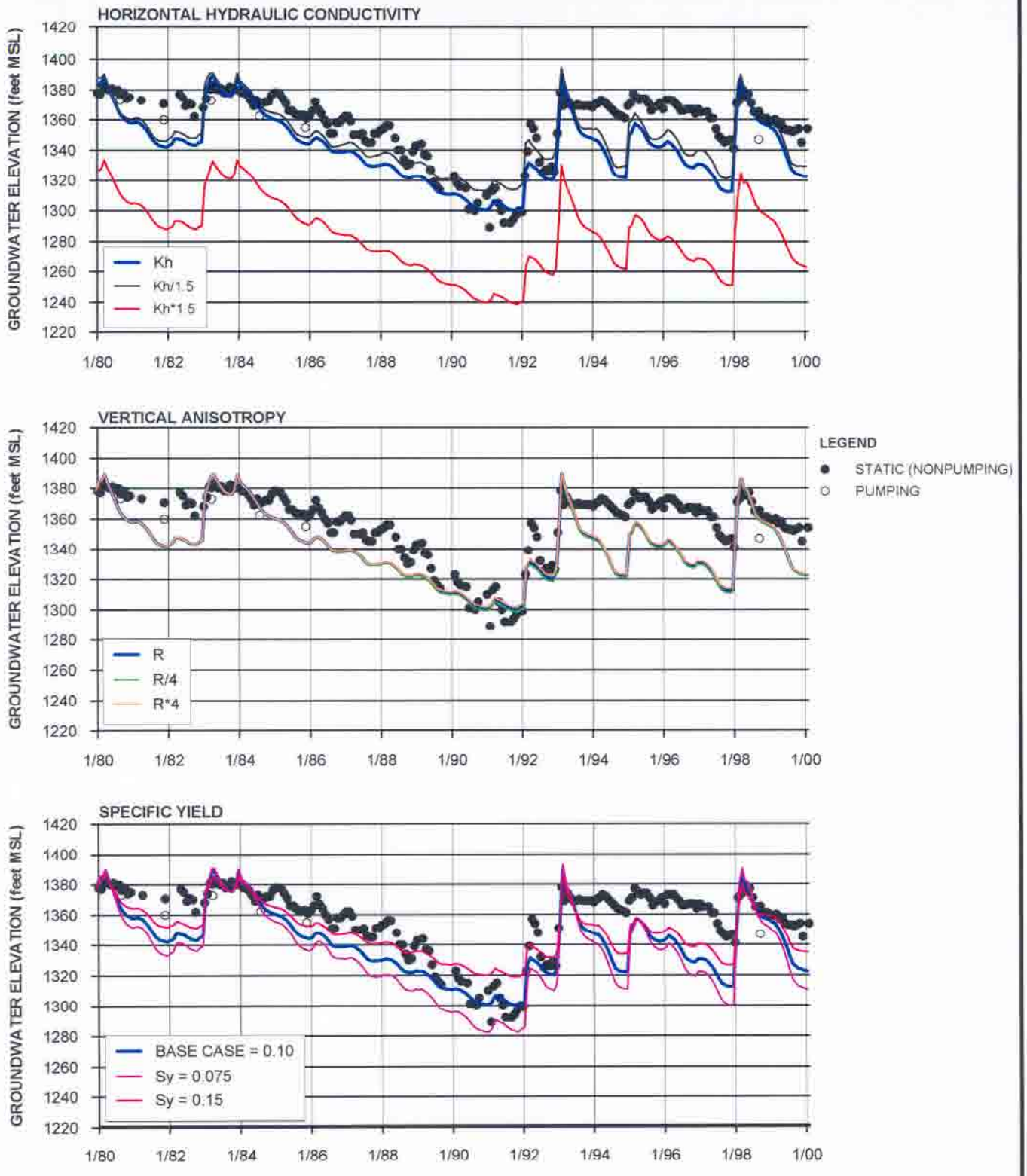


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-35
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-STADIUM TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-322.GRF

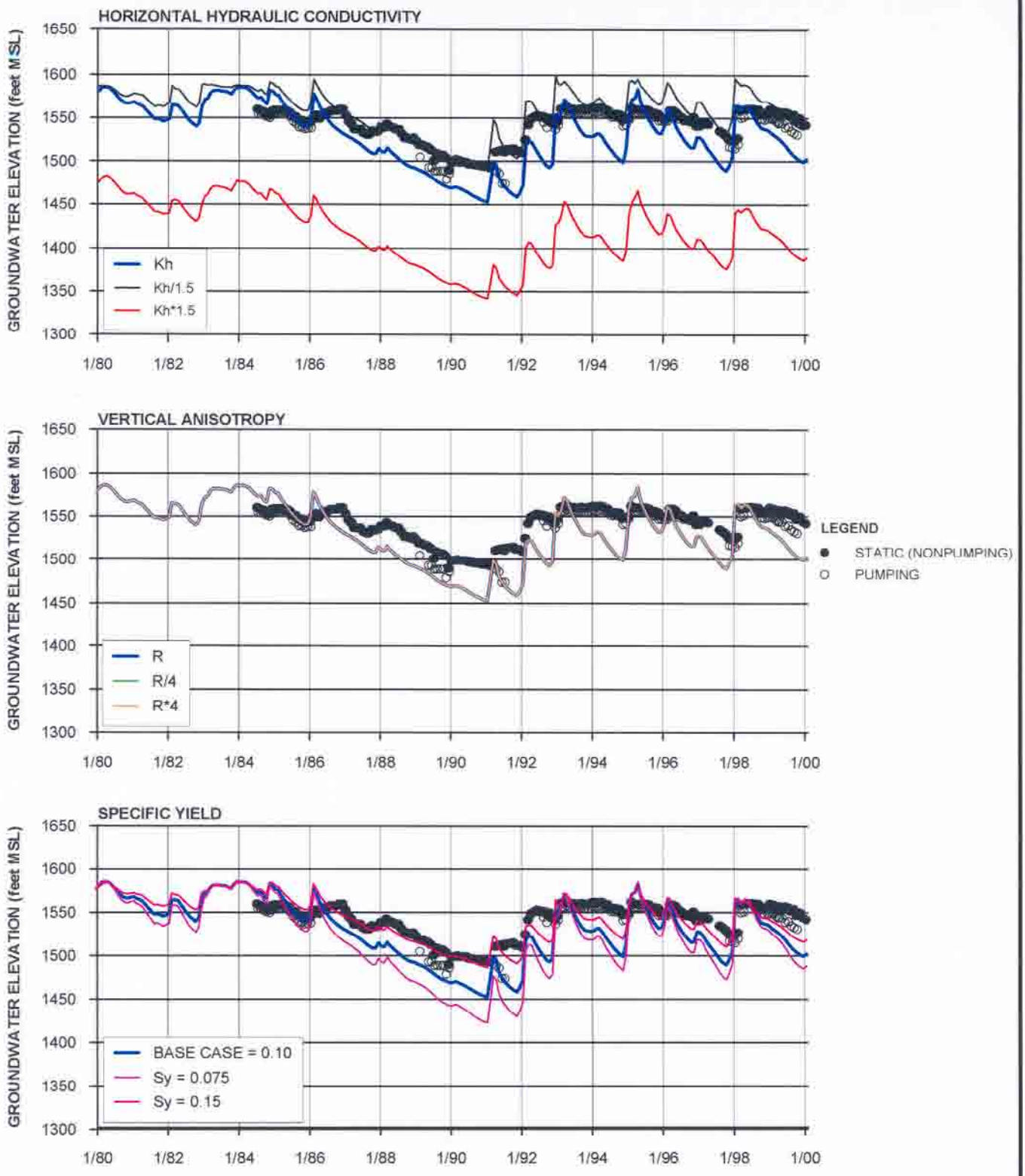


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-36
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-NORTH OAKS EAST TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-325.GRF

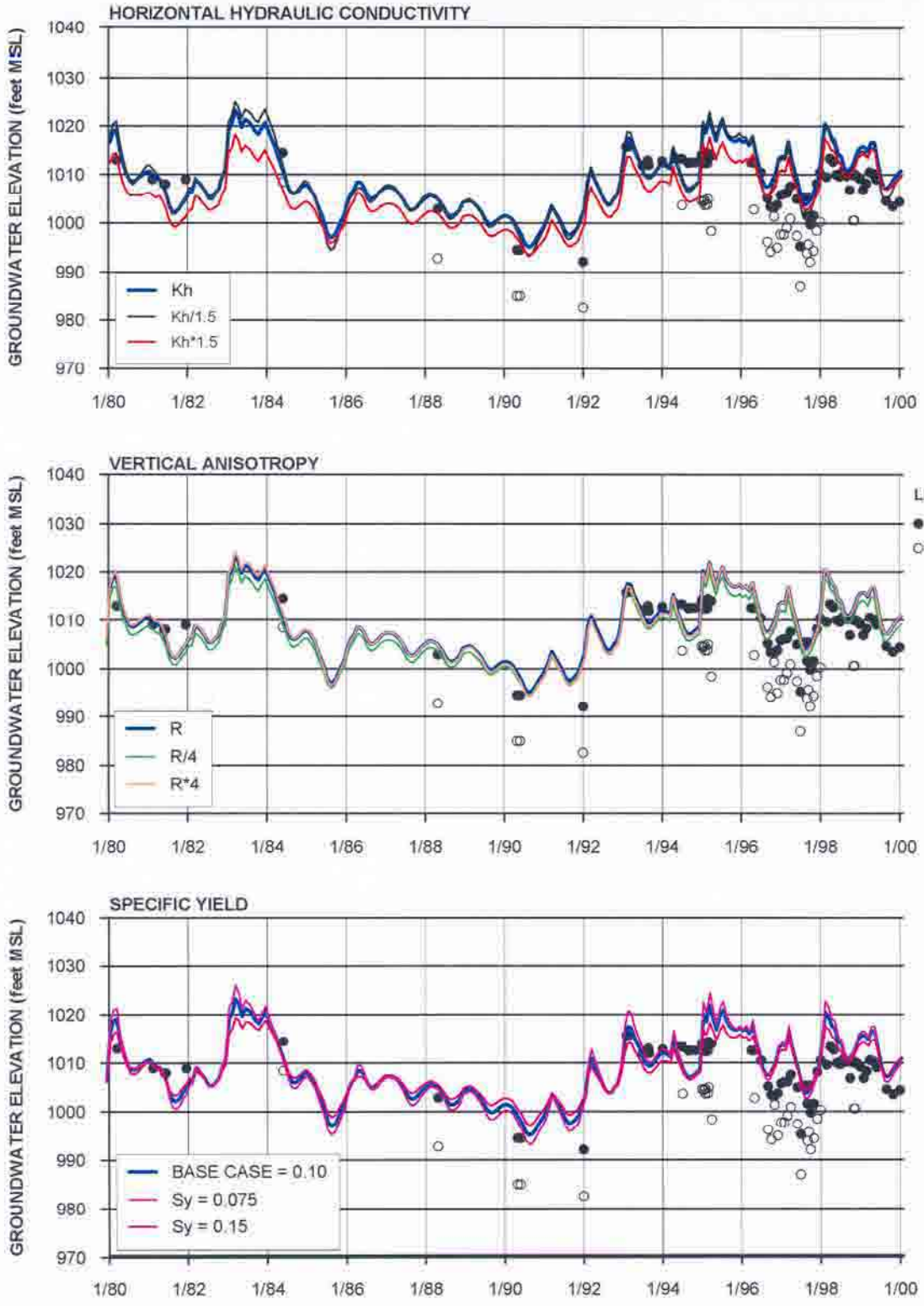


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-37
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NCWD-PINETREE1 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-323.GRF

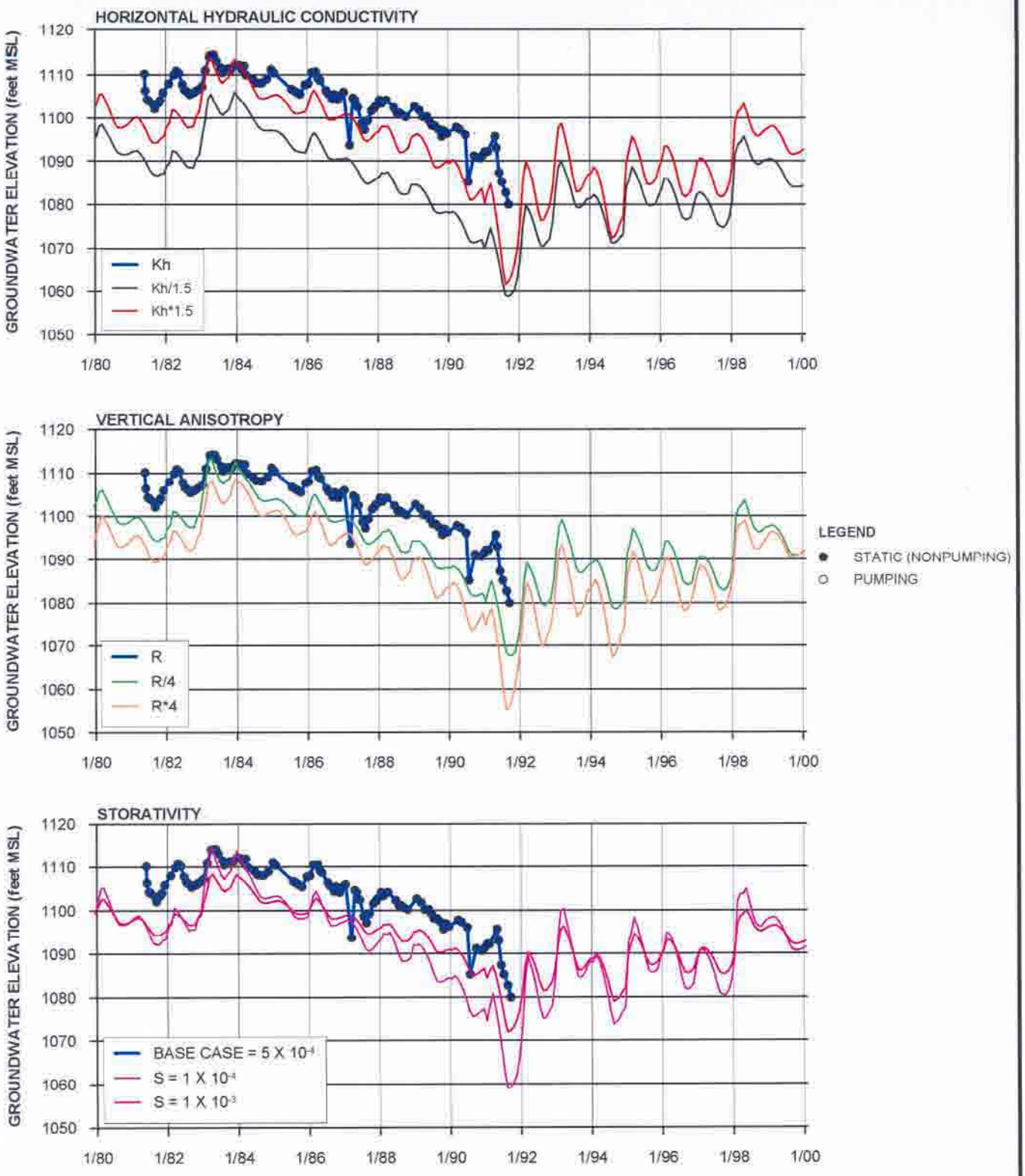


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. Sy= SPECIFIC YIELD
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-38
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-D TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-324.GRF

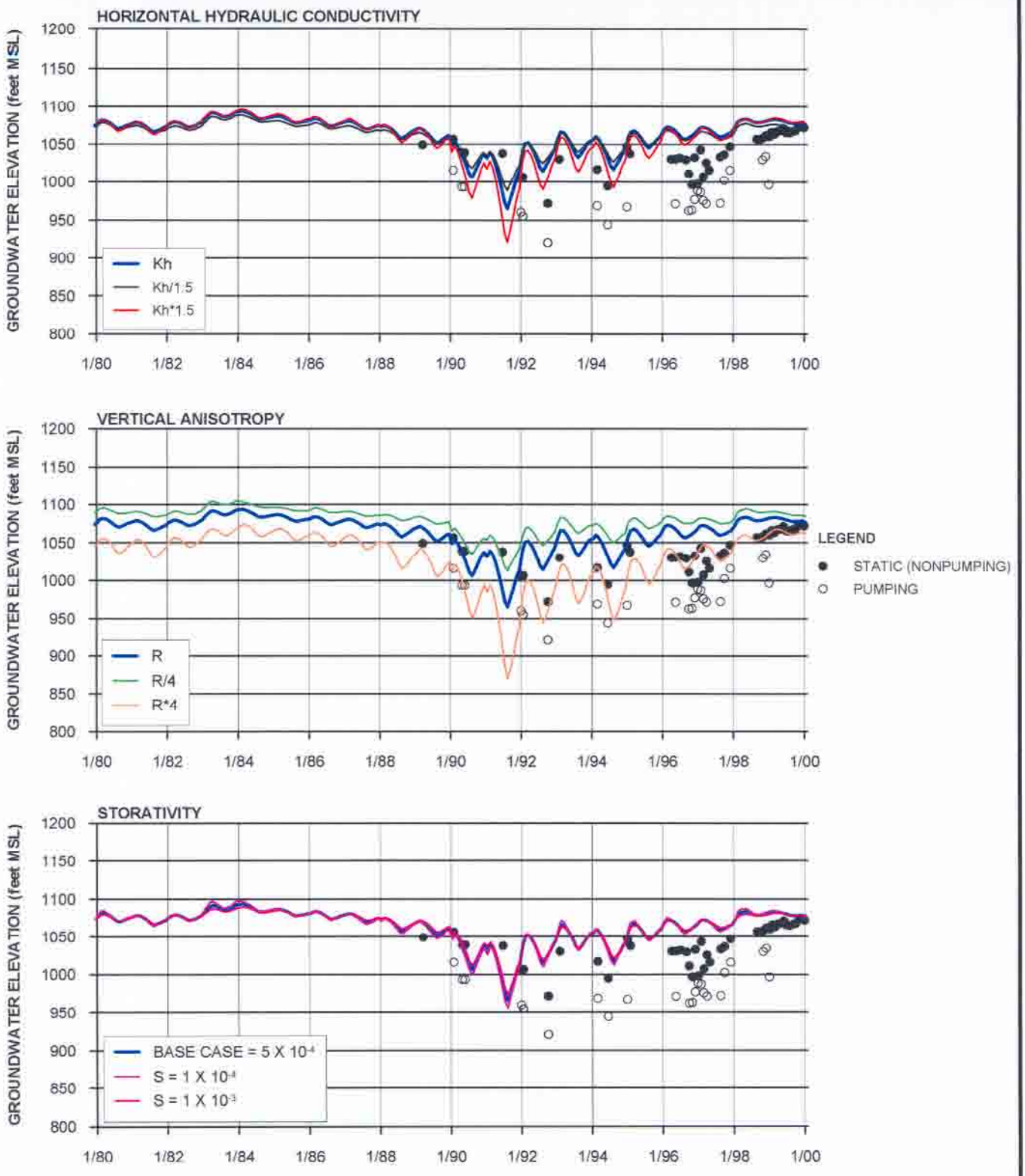


NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-39
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 7048C TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-327.GRF



NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-40
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT VWC-201 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-328.GRF

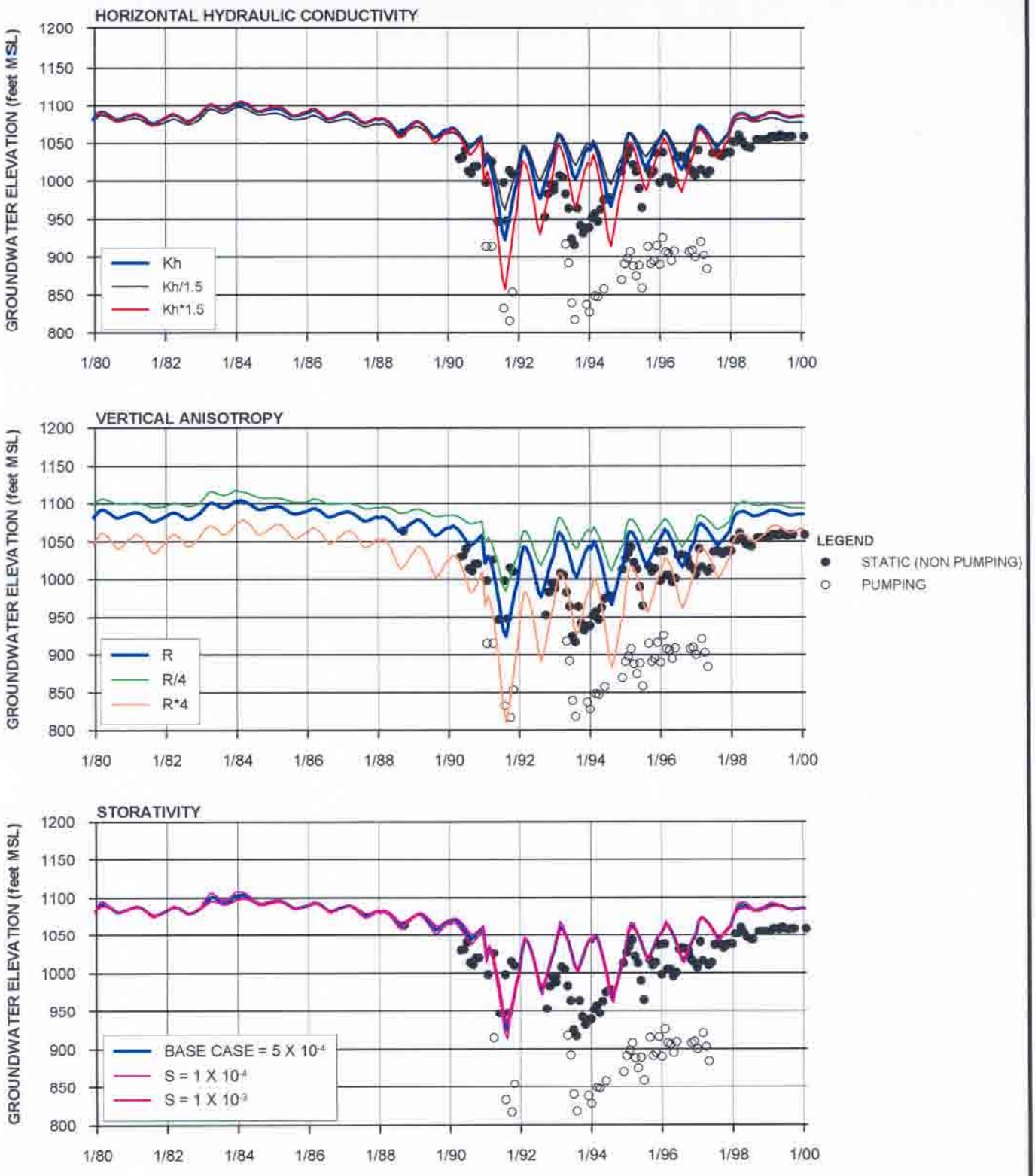


FIGURE 5-41
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT SCWC-SAUGUS 2 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

CH2MHILL

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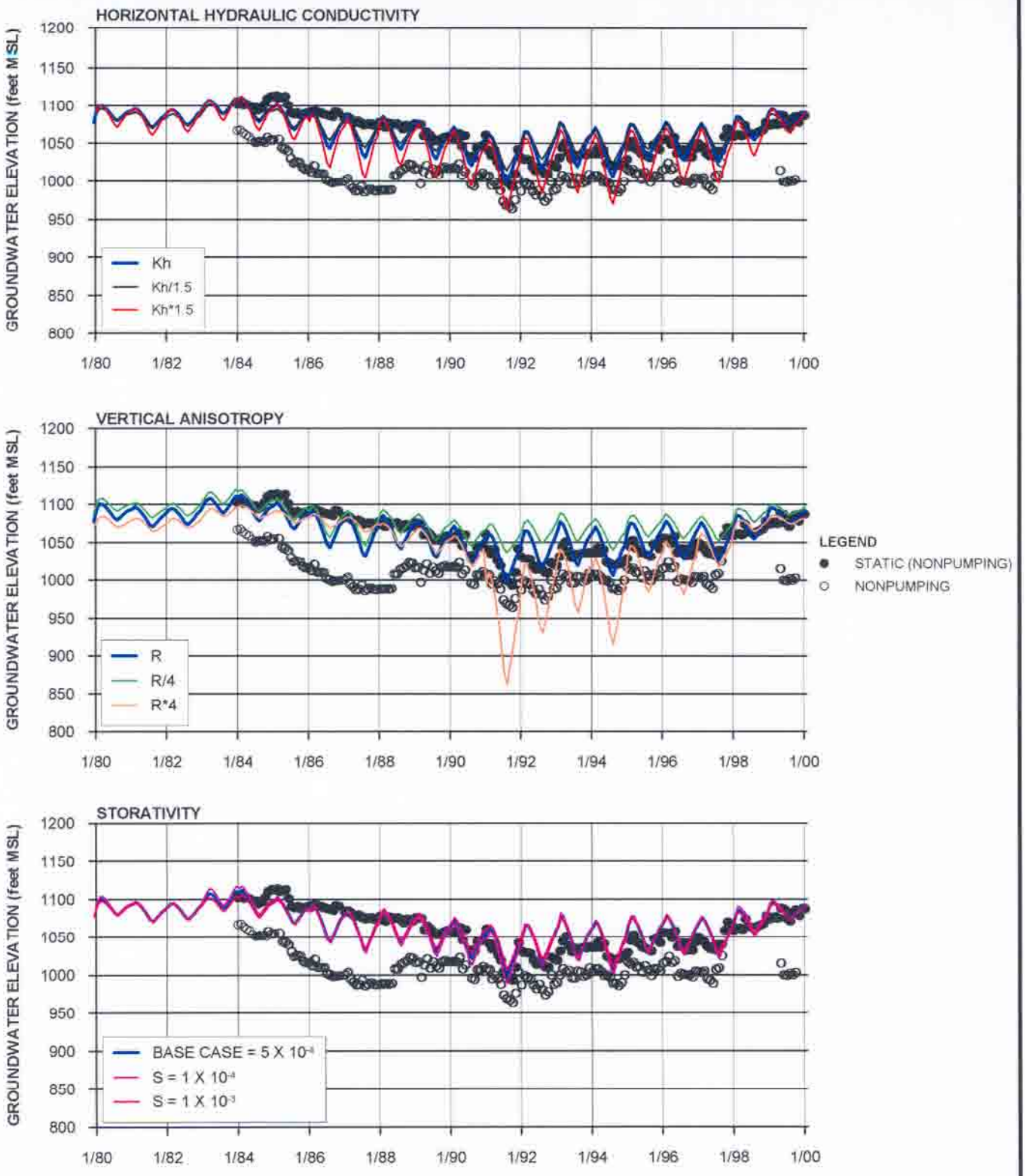
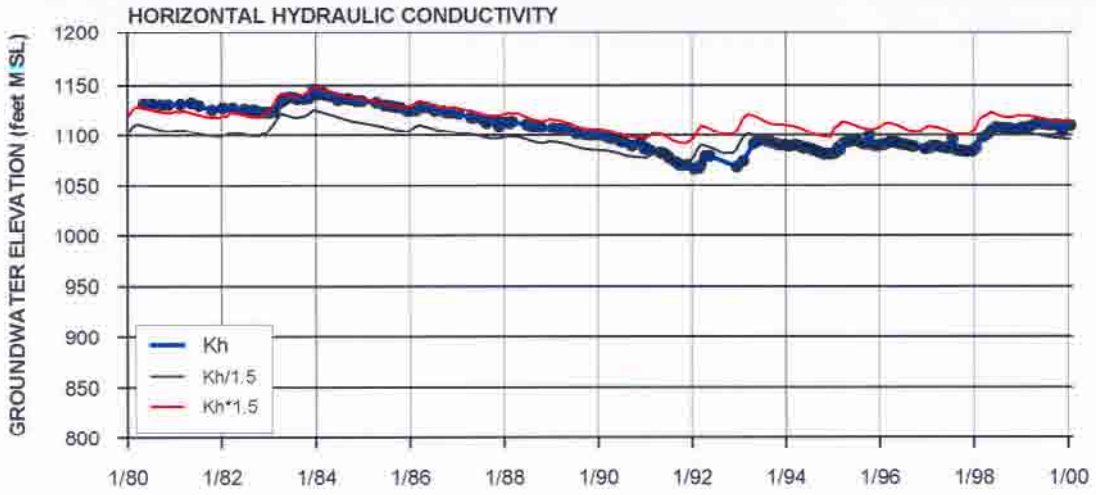


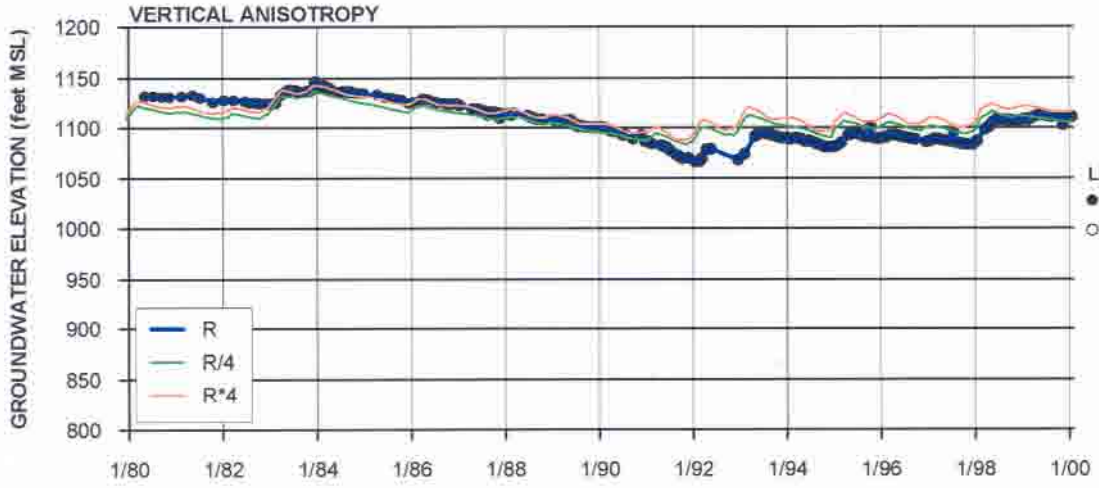
NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

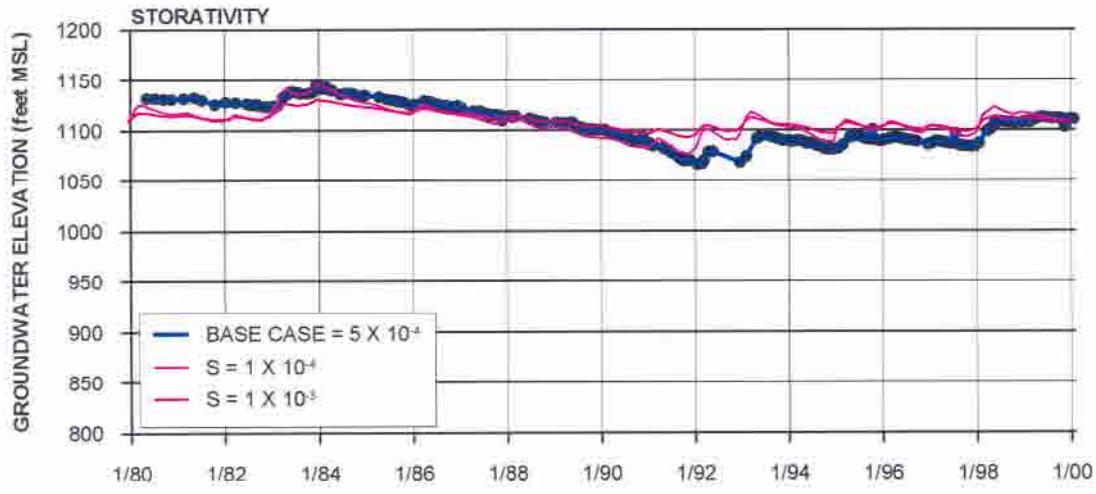
FIGURE 5-42
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT NCWD-11 TO AQUIFER PARAMETER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-330.GRF







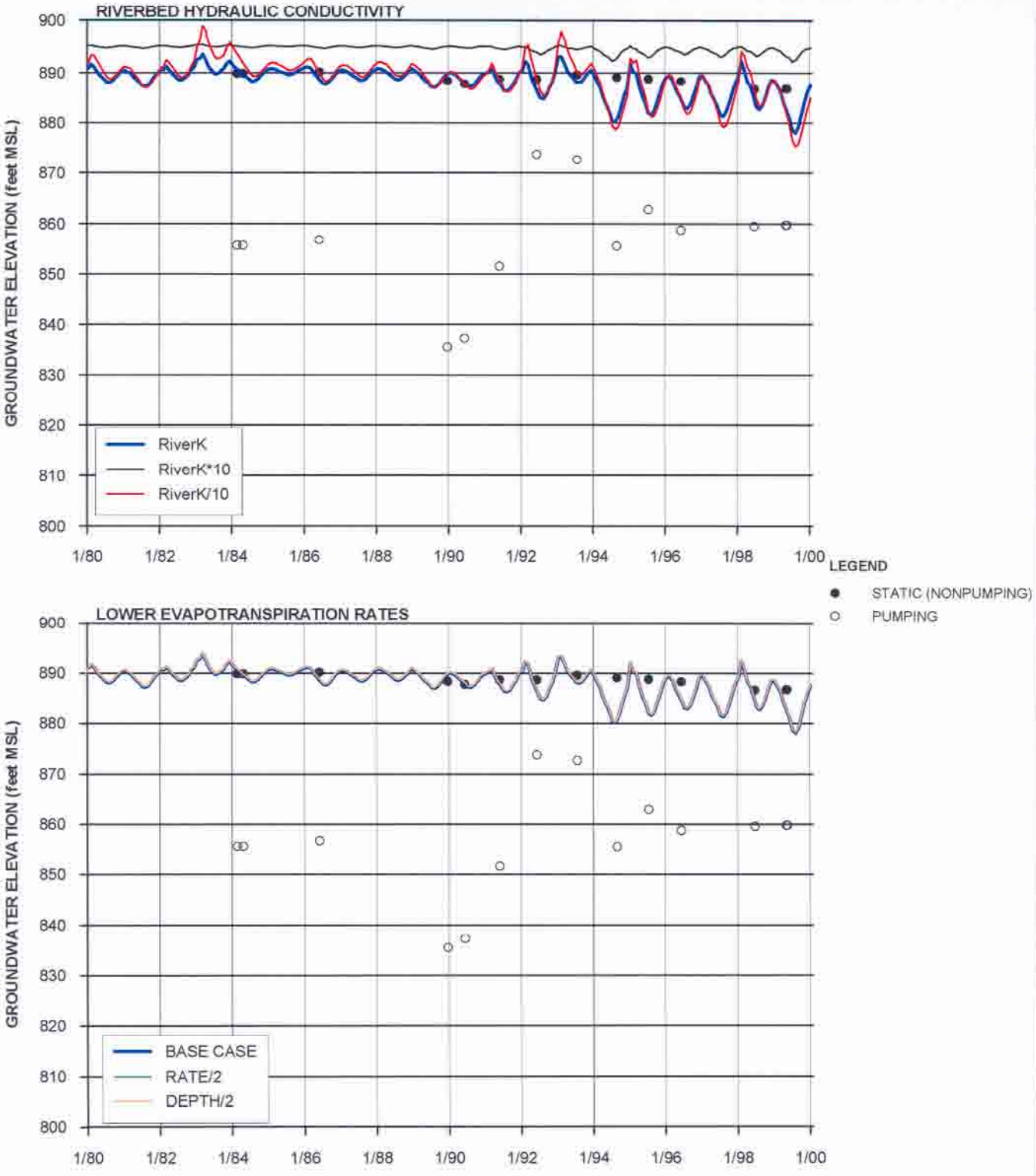
LEGEND
- ● STATIC (NONPUMPING)
- ○ PUMPING

NOTES:
1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. S = STORATIVITY
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-43
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 5851 TO AQUIFER PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-331.GRF

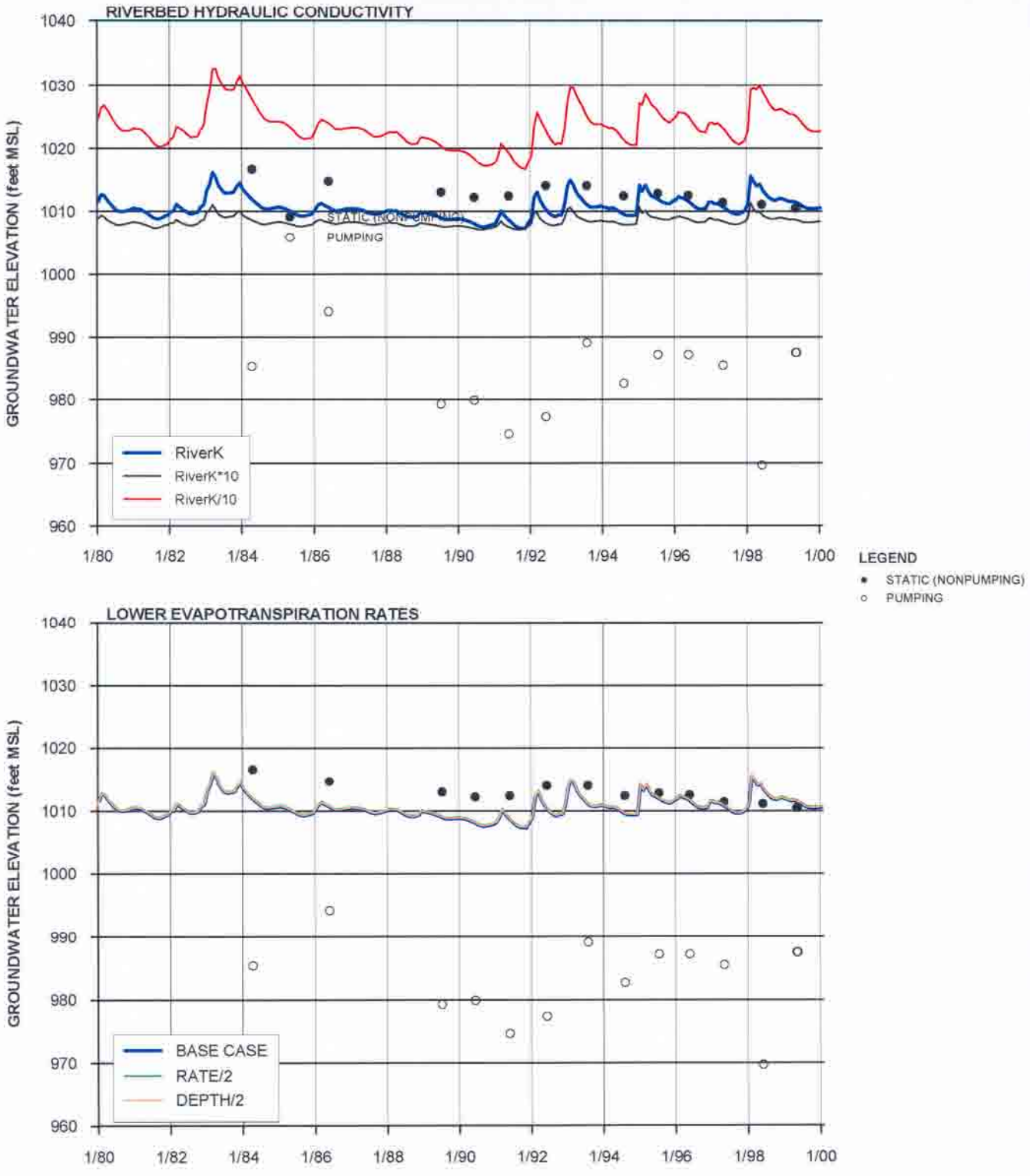


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-44
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-B7 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-332.GRF

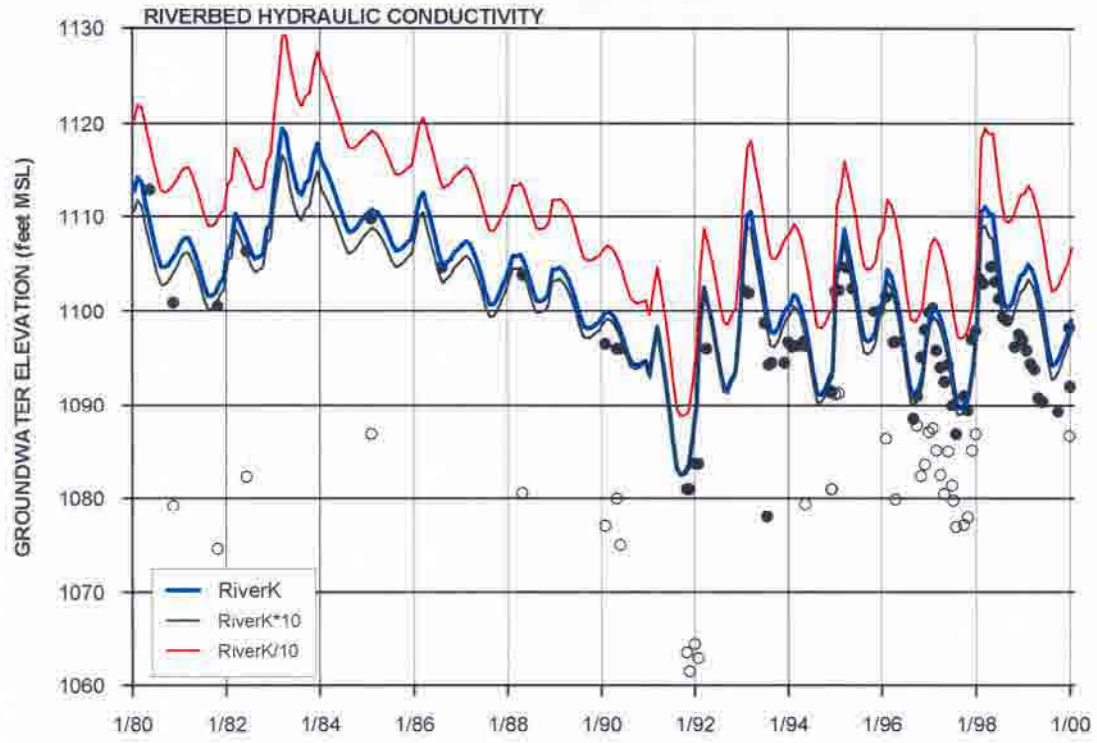


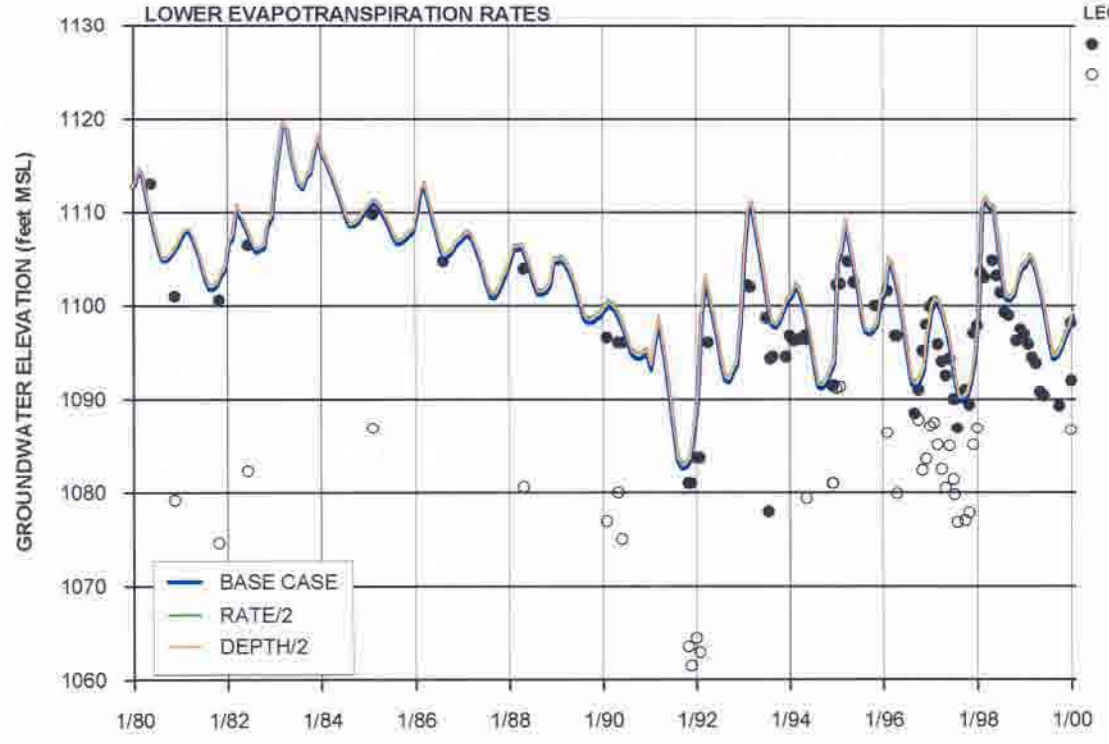
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-45
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT NLF-G45 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-333.GRF



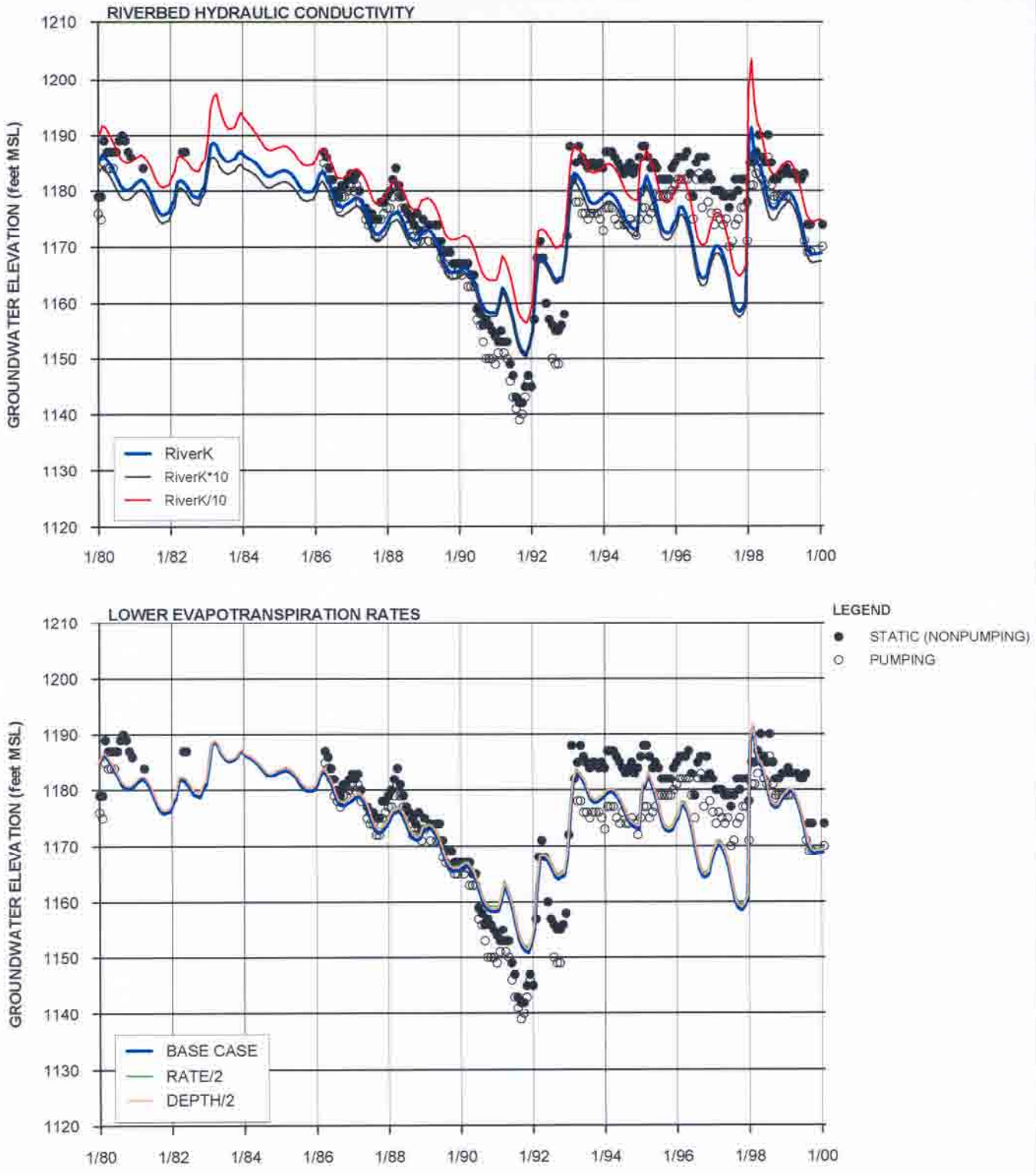


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-46
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-N TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-334.GRF

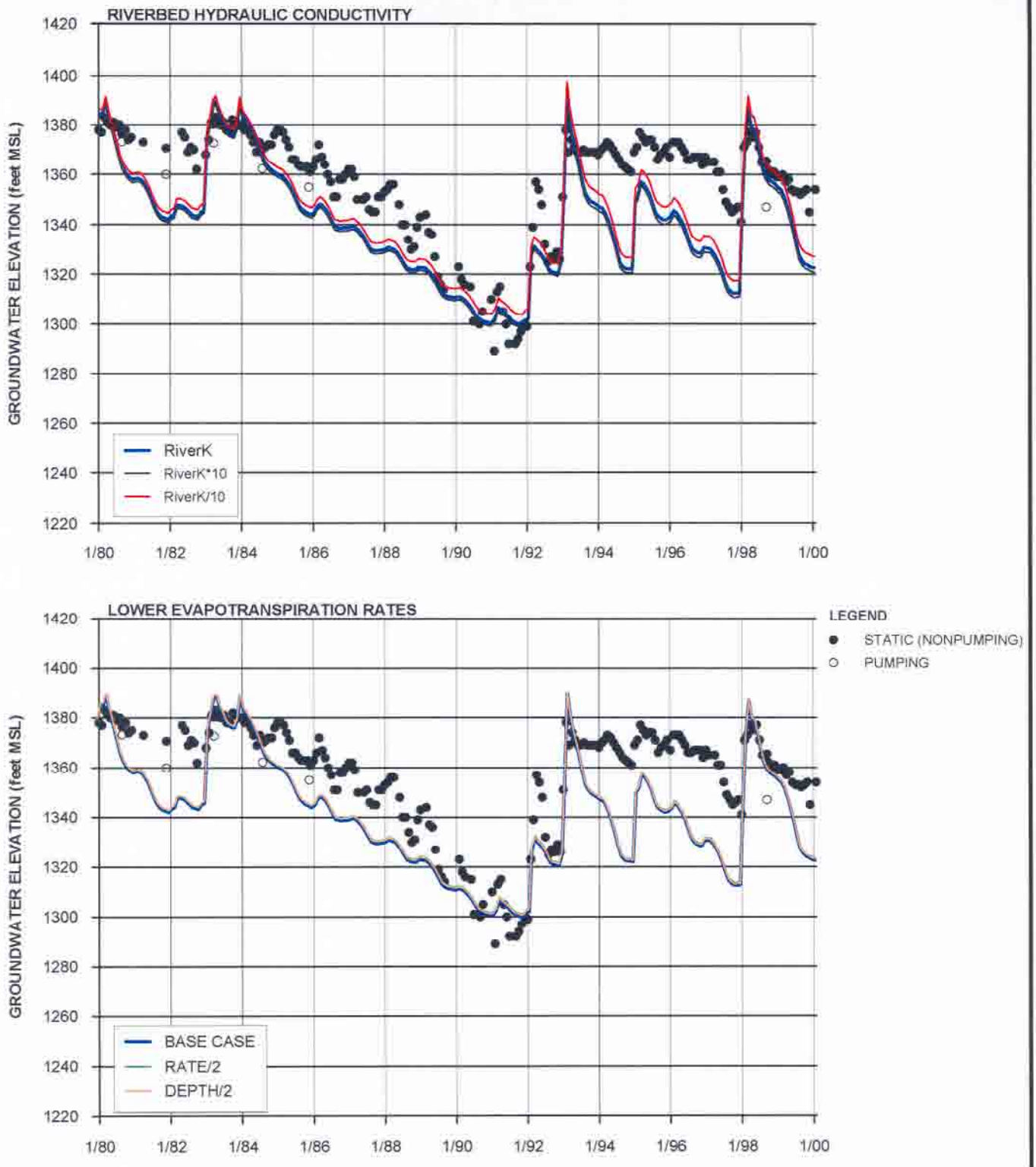


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-47
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-STADIUM TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-335.GRF

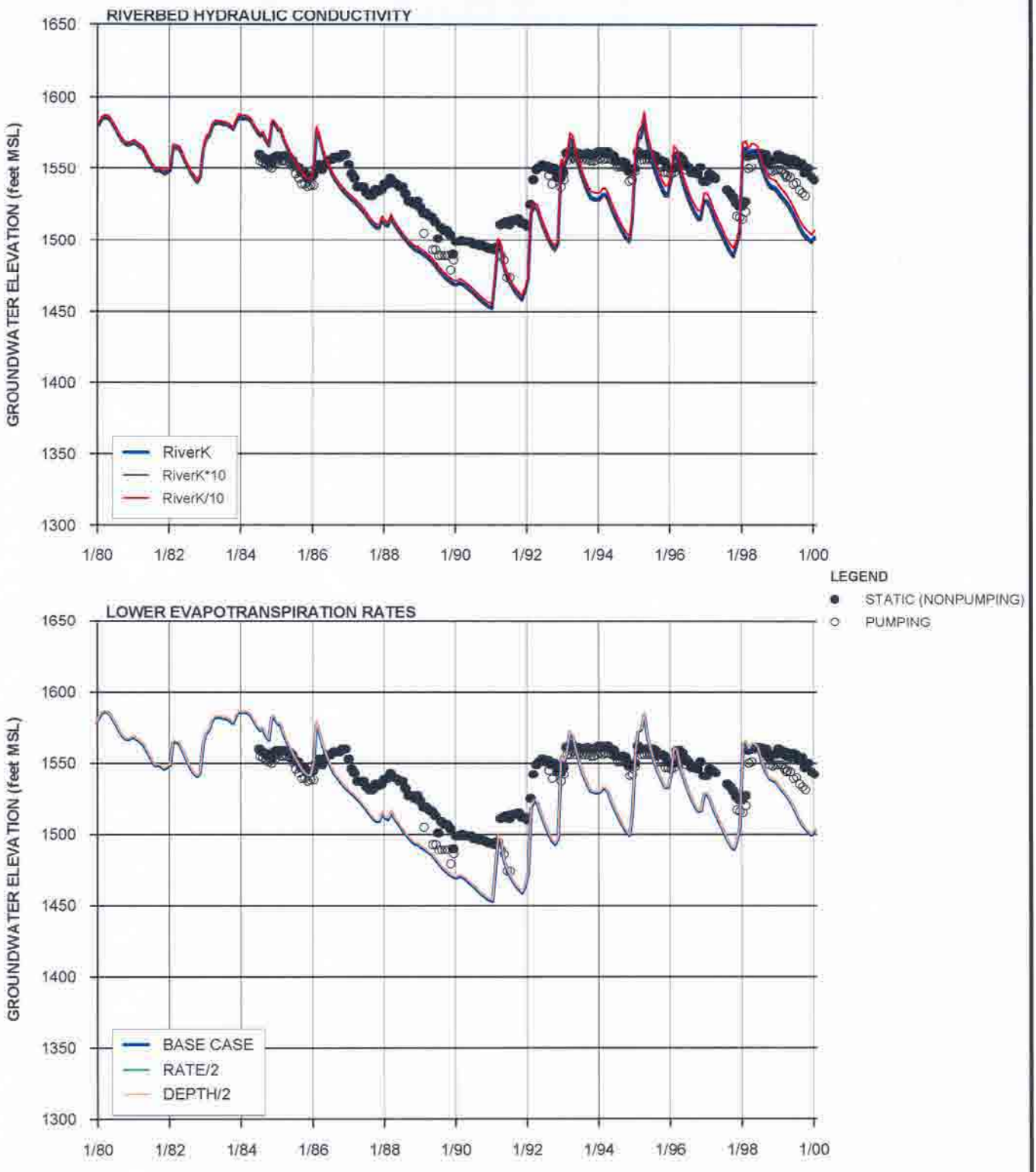


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-48
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-NORTH OAKS EAST TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-336.GRF

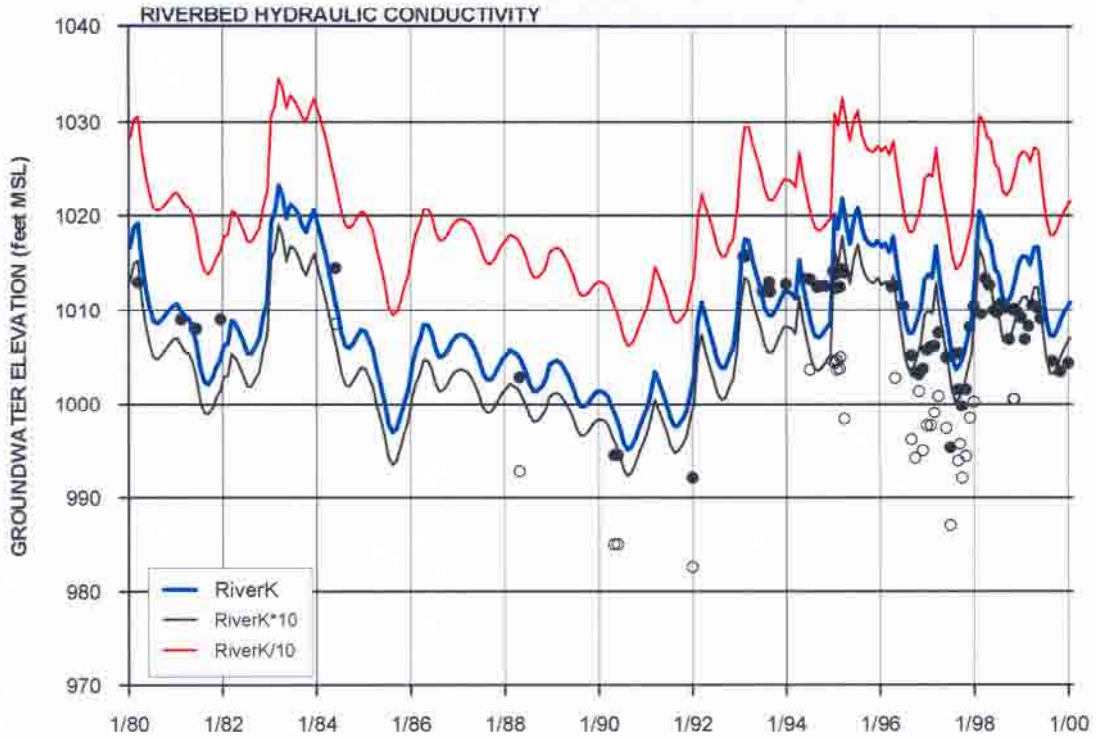


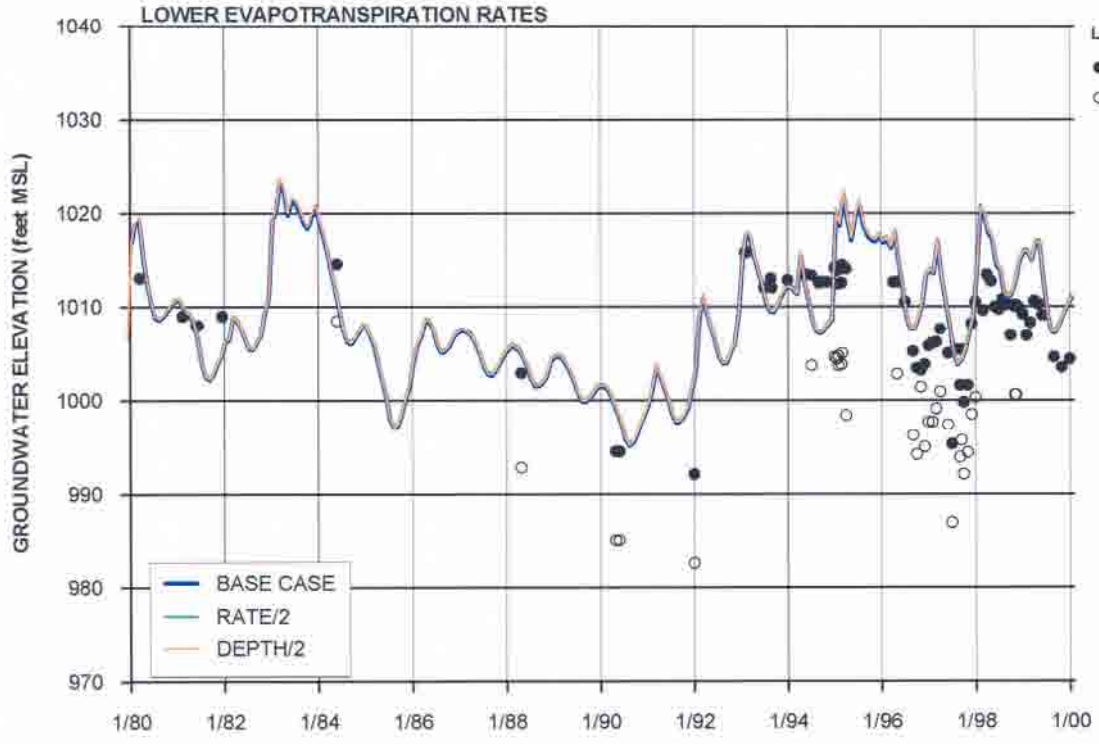
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-49
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT SCWC-PINETREE1 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-337.GRF



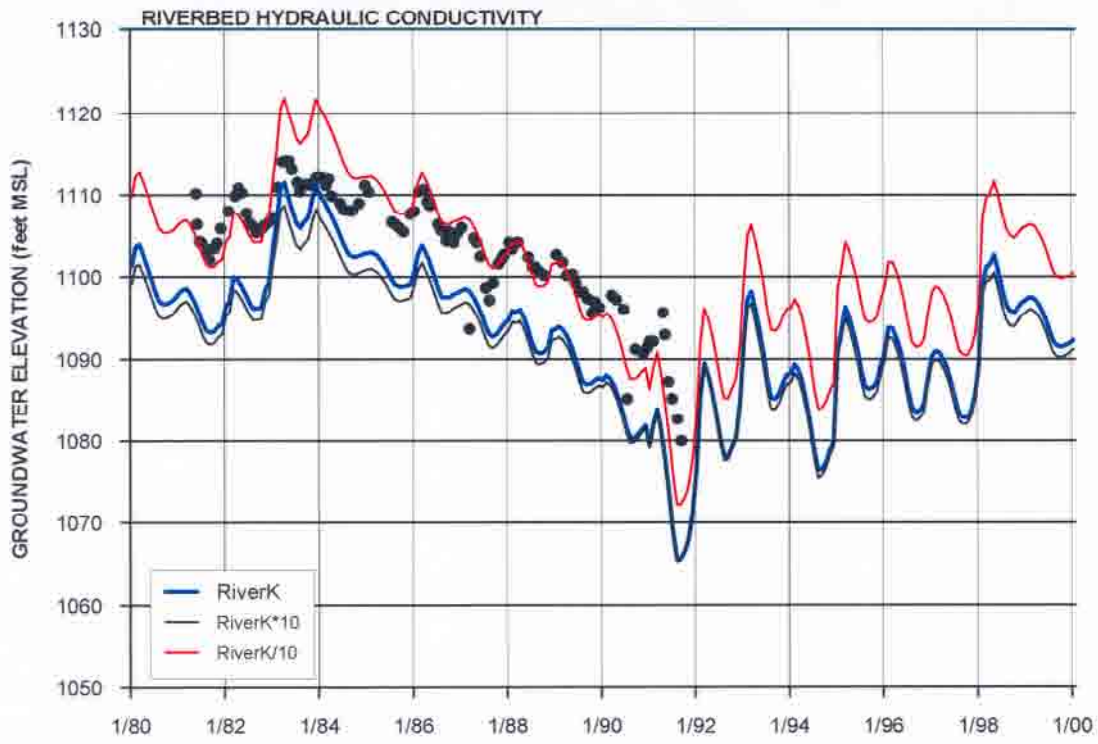


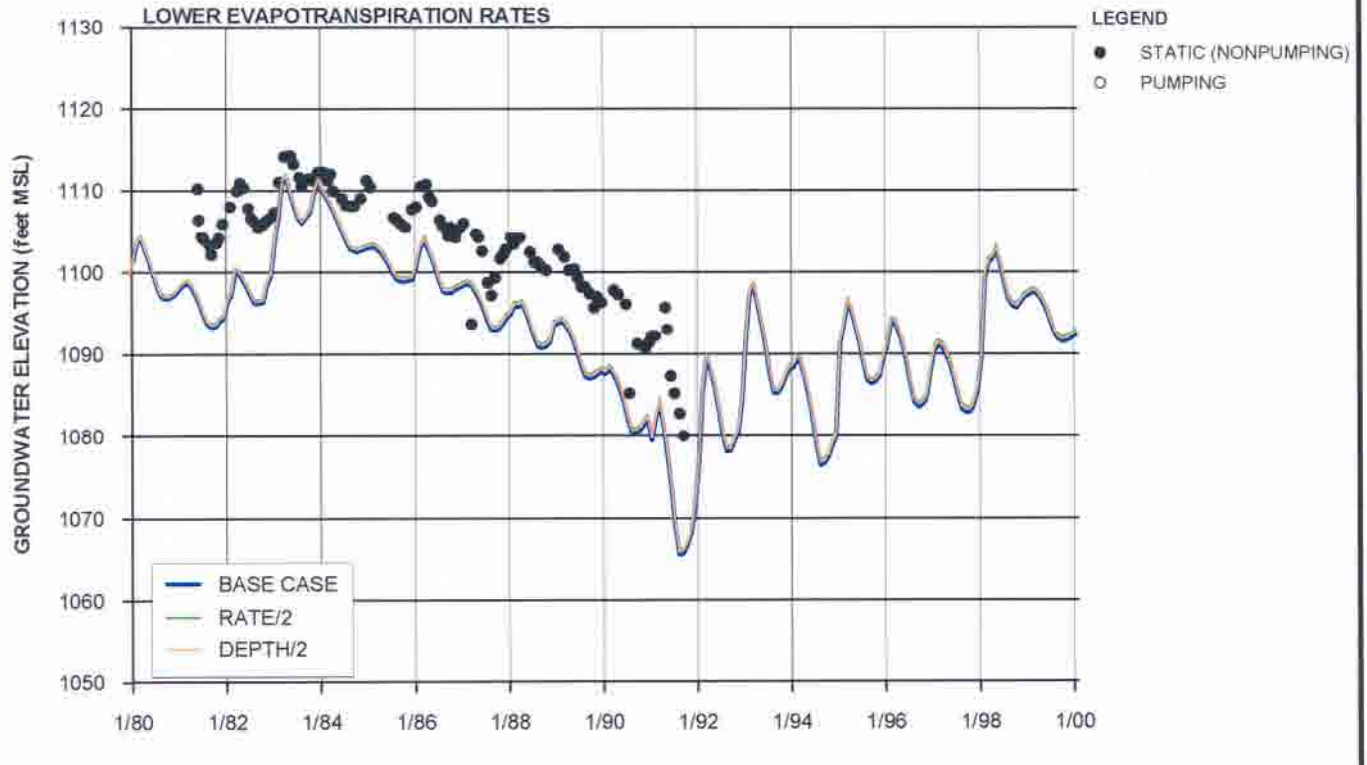
NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-50
SENSITIVITY OF ALLUVIAL GROUNDWATER ELEVATIONS AT VWC-D TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-338.GRF





NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-51
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 7048C TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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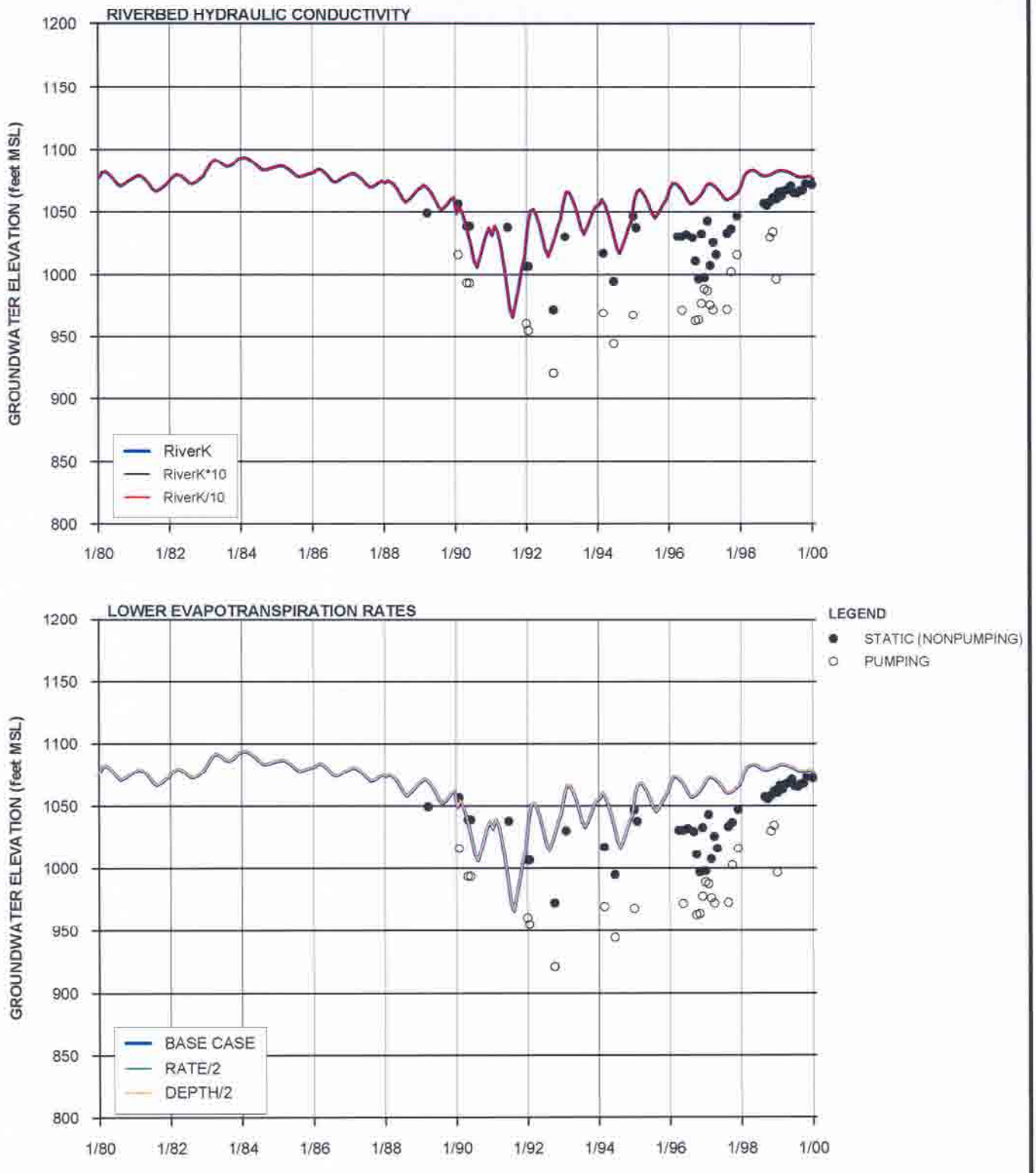
178973-339.GRF

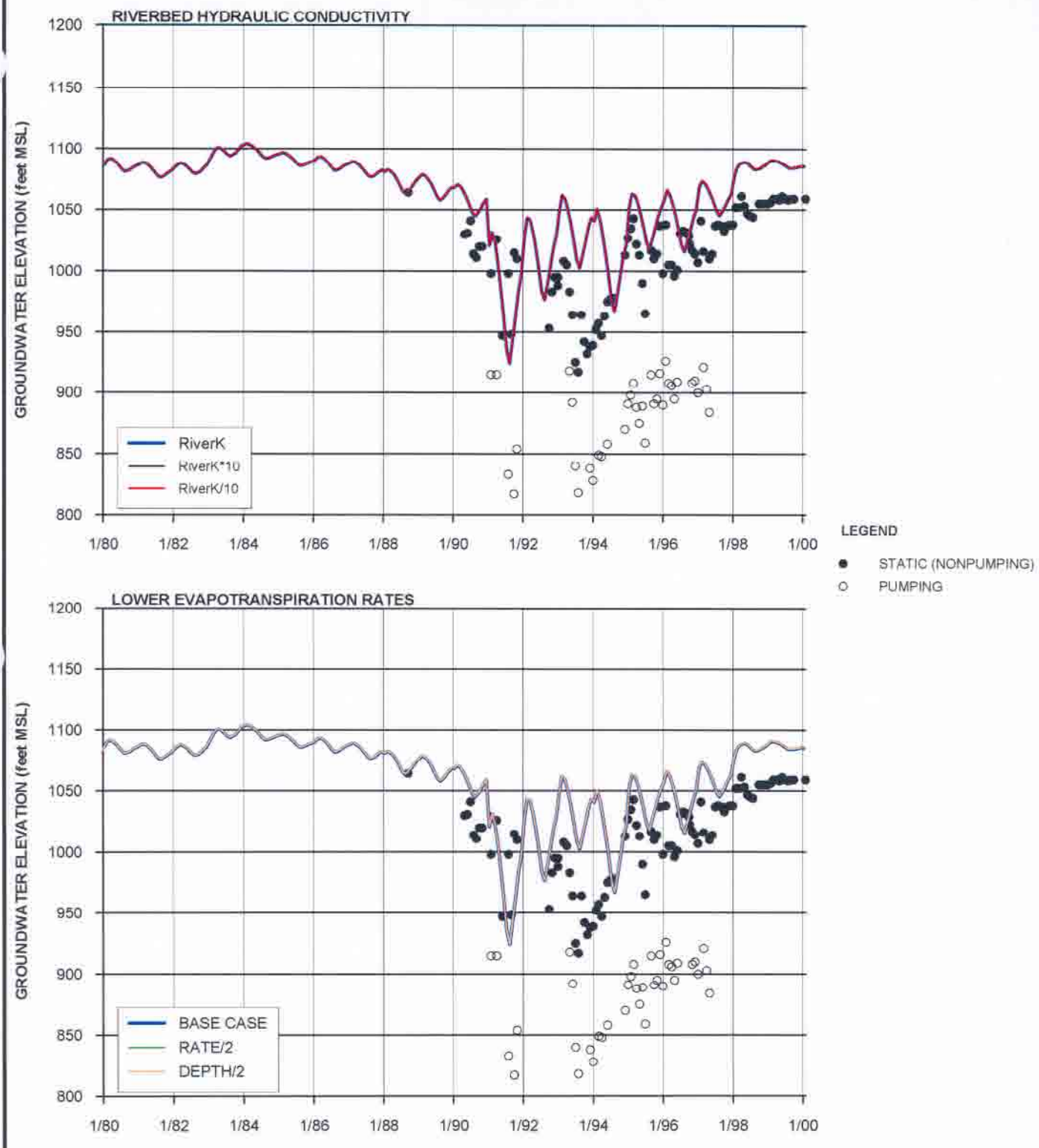


NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-52
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT VWC-201 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-340.GRF



NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-53
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT SCWC-SAUGUS 2 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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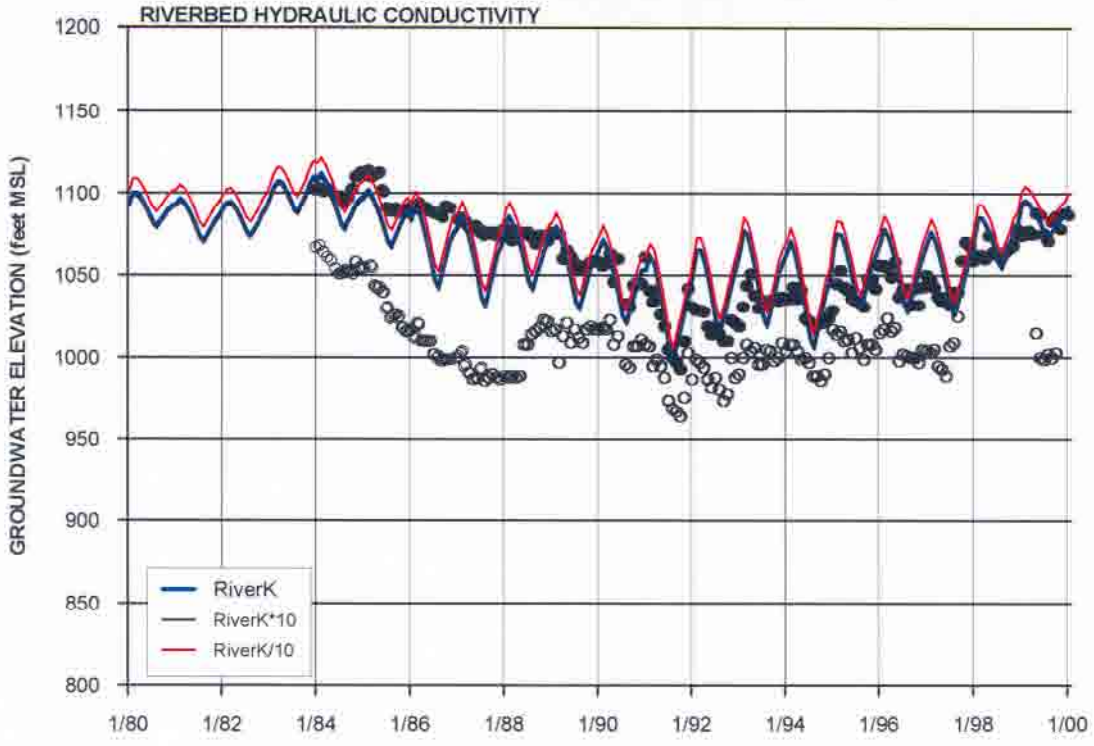

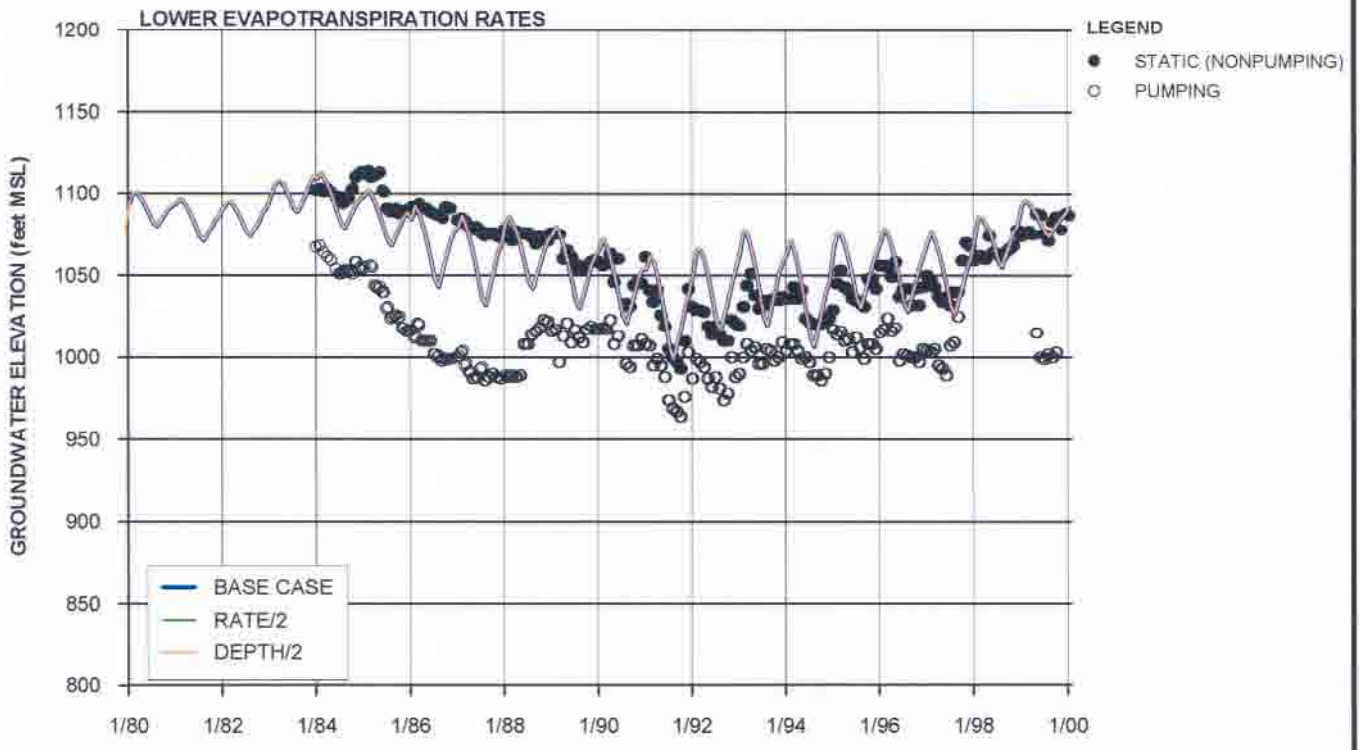

NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-54
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT NCWD-11 TO RIVER AND EVAPORTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

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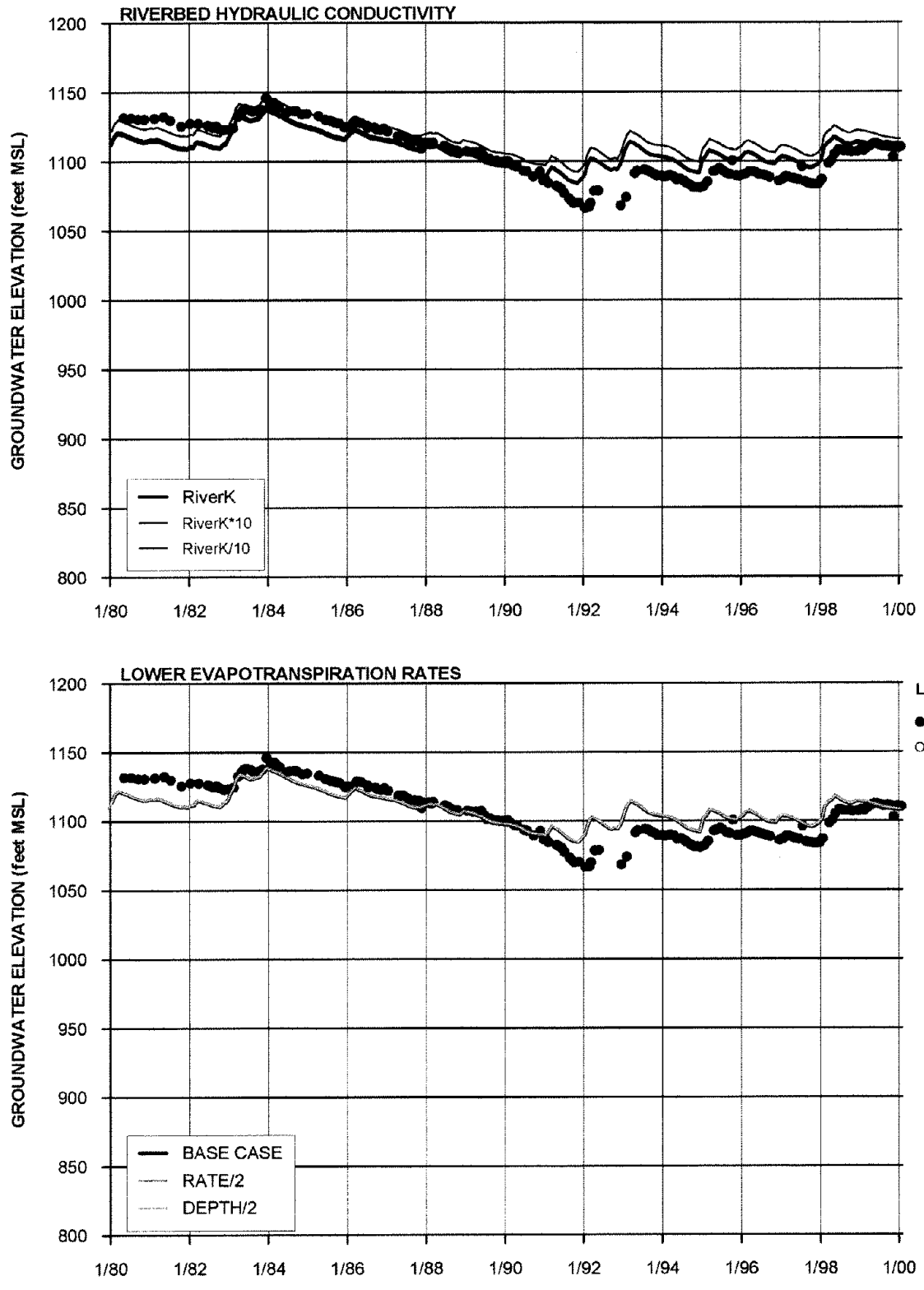

NOTES:
1. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
2. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
3. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)
4. SEE FIGURE 2-3 FOR LOCATIONS OF WELLS

FIGURE 5-55
SENSITIVITY OF SAUGUS GROUNDWATER ELEVATIONS AT 5851 TO RIVER AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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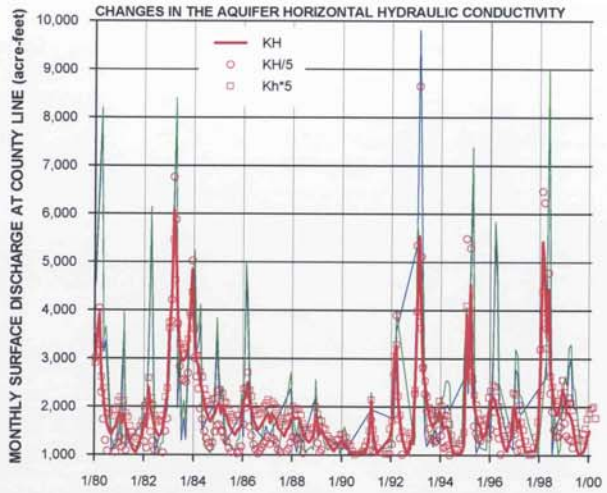

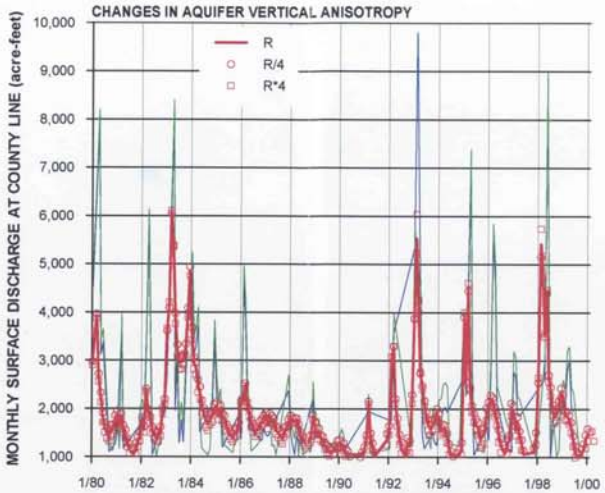

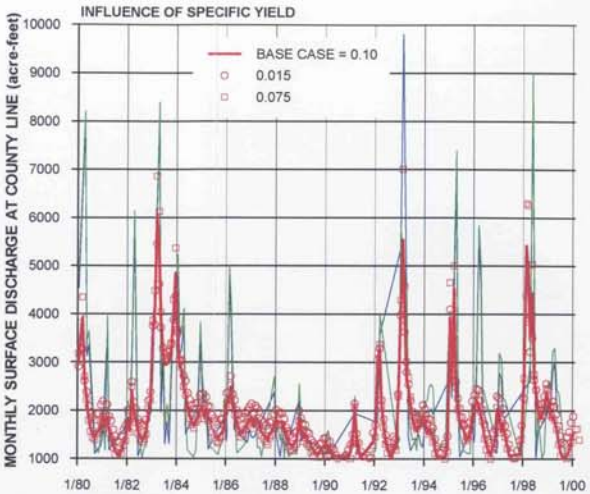

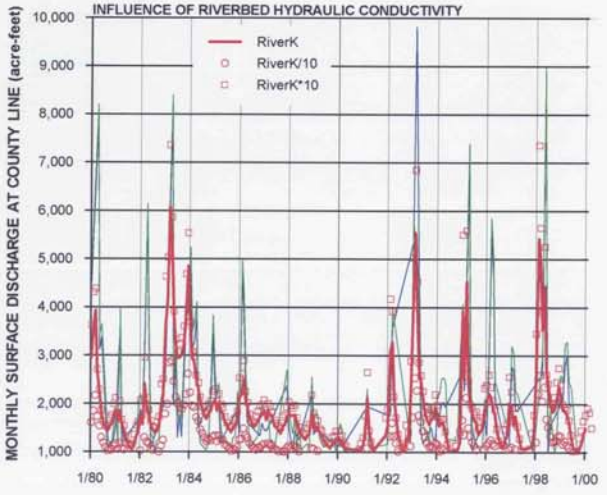

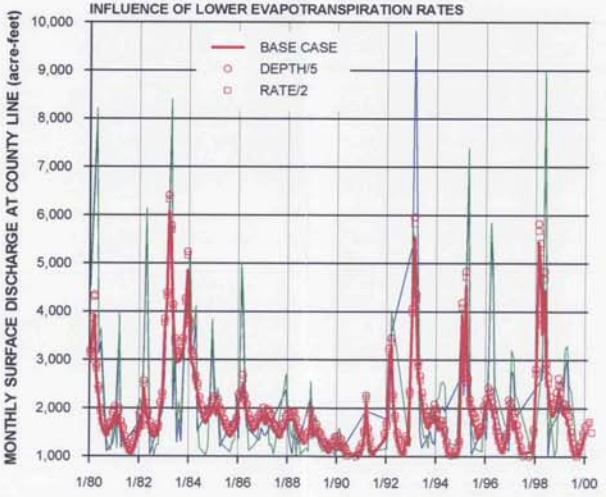

LEGEND

MEASURED (NO INFILTRATION OF SAUGUS WRP FLOWS)
MEASURED (75% INFILTRATION OF SAUGUS WRP FLOWS)

NOTES:

1. Kh = HORIZONTAL HYDRAULIC CONDUCTIVITY
2. R = VERTICAL ANISOTROPY RATIO (RATIO OF HORIZONTAL TO VERTICAL HYDRAULIC CONDUCTIVITY)
3. RiverK = RIVERBED VERTICAL HYDRAULIC CONDUCTIVITY
4. RATE = MAXIMUM RATE OF EVAPOTRANSPIRATION
5. DEPTH = ROOTING DEPTH (EXTINCTION DEPTH FOR EVAPOTRANSPIRATION)

FIGURE 5-56
SENSITIVITY OF GROUNDWATER DISCHARGES TO THE SANTA CLARA RIVER TO AQUIFER, RIVER, AND EVAPOTRANSPIRATION PARAMETERS
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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SECTION 6

Model Applicability to Local Water Resource Management

The Purveyors have developed the Regional Model as the main computer tool for their use in ongoing management of the groundwater resources in the Santa Clarita Valley. Among the objectives in developing the model were (1) to be able to evaluate the long-term sustainability (yield) of the Alluvial and Saugus aquifer systems under a range of existing and potential future water resource management conditions, and (2) to facilitate general management of water quantity and water quality issues.

The Regional Model simulates groundwater flow in the two aquifers that are present in the Santa Clara River Valley East Groundwater Subbasin. It has been developed using the database and GIS that were developed by, and are being used by, the Purveyors to manage the valley's water resources. The modeling effort built upon previous and ongoing hydrogeologic studies in the valley (RCS, 1986, 1988, 2001, 2002; CH2M HILL, 2003), as well as previous modeling efforts (CH2M HILL, 1996, 2001, 2002). Key aspects of the Regional Model's construction and calibration include the following:

a. The Regional Model covers the entire Santa Clara River Valley East Groundwater Subbasin, from the Lang stream gage, at the eastern end of the valley, to Blue Cut, just west of the county line.

b. The Regional Model includes the SWRM, which determines the monthly volume of rainfall that is available to streams that are tributaries to the Santa Clara River. The SWRM also computes how much of the runoff can recharge the Alluvial Aquifer, the locations of the recharge, and the amount of flow that remains in each stream. Further, the SWRM calculates how much flow occurs in the Santa Clara River due to tributary inflows and to WRP discharges. Together, the SWRM and the Regional Model allow for estimation of the time-varying magnitudes of total river flow and groundwater discharges to the river. In summary, the Regional Model is actually a groundwater flow model coupled with an empirical tool that estimates stormwater generation from each watershed lying upstream of, and extending into, the Regional Model's boundaries.

c. The Regional Model has been calibrated on a monthly basis to time-varying hydrologic conditions that were observed from 1980 through 1999. Calibration data consisted of groundwater elevations in both aquifers at production and monitoring wells; estimated fluctuations in groundwater discharges to the Santa Clara River; and gaged flows in the Santa Clara River. Consequently, the Regional Model is calibrated not only to groundwater elevation trends, but also to the flows of water into and out of the valley.

The Regional Model has been specifically designed for use in managing groundwater resources on a local and regional scale. Its design and calibration make it a useful tool for:

a. Evaluating groundwater management strategies, including analyzing basin operations over multi-year wet/dry cycles

b. Evaluating ASR projects or other aquifer recharge projects

c. Evaluating options for locating new or proposed water supply wells, with consideration of the avoidance and management of any contamination in the aquifer system

d. Evaluating the restoration of pumping capacity that has been impacted by perchlorate contamination in the vicinity of the Whittaker-Bermite property in the central part of the valley

Nonetheless, because no model is perfect, it should be used with care, and all model results should be examined by qualified and experienced hydrogeologists and water resource managers. Specific recommendations for the continued use and maintenance of this tool, including hydrogeologic data needs, are as follows:

a. Future predictive modeling activities should include sensitivity analyses on key model variables, particularly the Kh and Kv of both aquifer systems. This recommendation is based on the sensitivity analysis results, which show that groundwater elevations and groundwater discharge to the Santa Clara River are both sensitive to these parameters.

b. Streamflow monitoring should resume at the Lang gage, to better understand the magnitudes and timing of Santa Clara River flows into the valley. Stream gaging was discontinued at this location after October 1989. Because inflow in the Santa Clara River is one of the principal sources of water, the absence of data at this location is likely the primary reason that the Regional Model has difficulties simulating historical water level trends during certain periods at wells in the eastern-most portion of the valley. Without data from the Lang gage, simulations of future water level trends in this area will be uncertain, due to the Regional Model's tendency to under-predict groundwater elevations during drought periods.

c. The Regional Model and the SWRM should both be updated as water use conditions change in the future. Specific activities that merit updates to these tools include the planned implementation of recycled water use in the valley, continued urbanization in currently undeveloped and agricultural lands, and the increasing import of SWP water in response to increasing urban water demands.

d. Transient calibration runs should eventually be performed to test the transient model's ability to simulate conditions after 1999. The success of this activity will be more likely if streamflow data are collected at the Lang gage.

e. The Regional Model's calibration in the Saugus Formation should be tested whenever new wells are completed in this aquifer. Specifically, long-term water level monitoring should commence in these wells, and controlled pumping tests should be conducted to provide quantitative estimates of aquifer properties at new well locations, particularly in areas where wells have not been previously constructed.

f. Other activities described in the MOU between Ventura County and the Purveyors should continue, in order to provide data that can be used to improve the Regional Model and management of the local water resources. These data include pumping, rainfall, WRP discharge, streamflow, and groundwater elevation information. In particular, the groundwater elevation monitoring program that has been conducted for the past several years at production and monitoring wells should continue. Data from this program, collected by the Purveyors and LACFCD, provide valuable information for identifying and understanding the changes that occur in the hydrologic system, including the relationships between groundwater and surface water.

SECTION 7

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Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation.** The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights.** Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

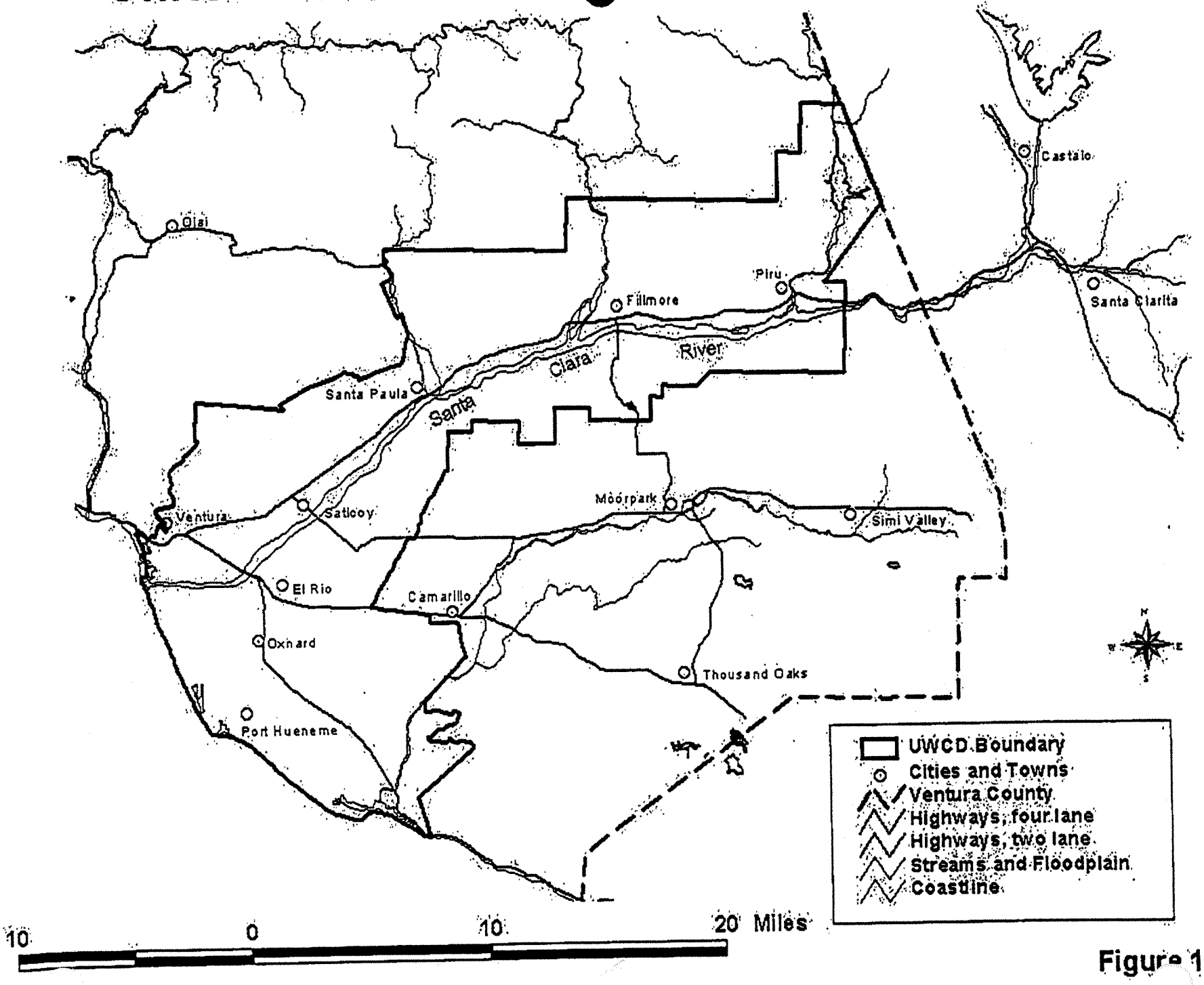


Figure 1-1

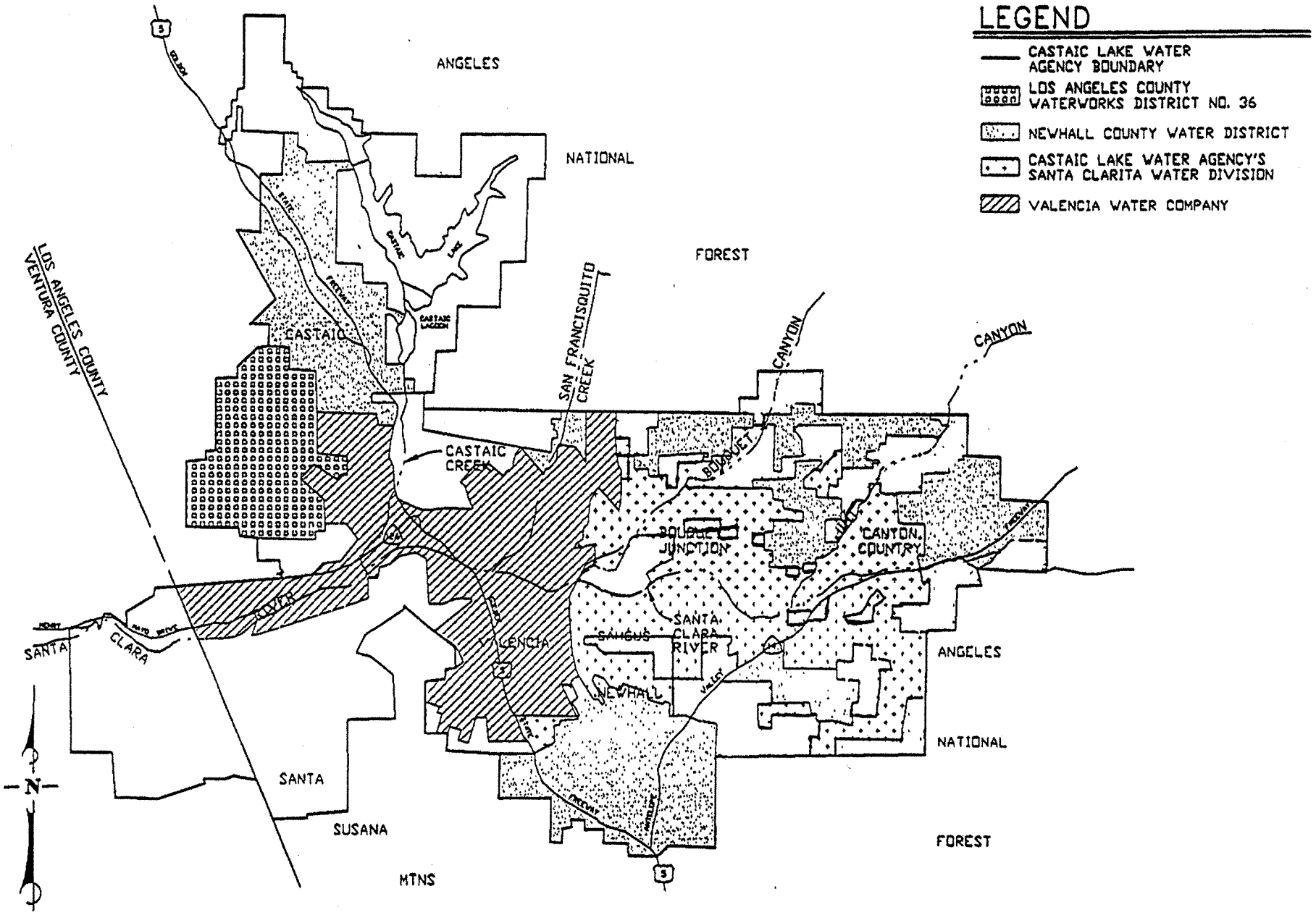


FIGURE 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

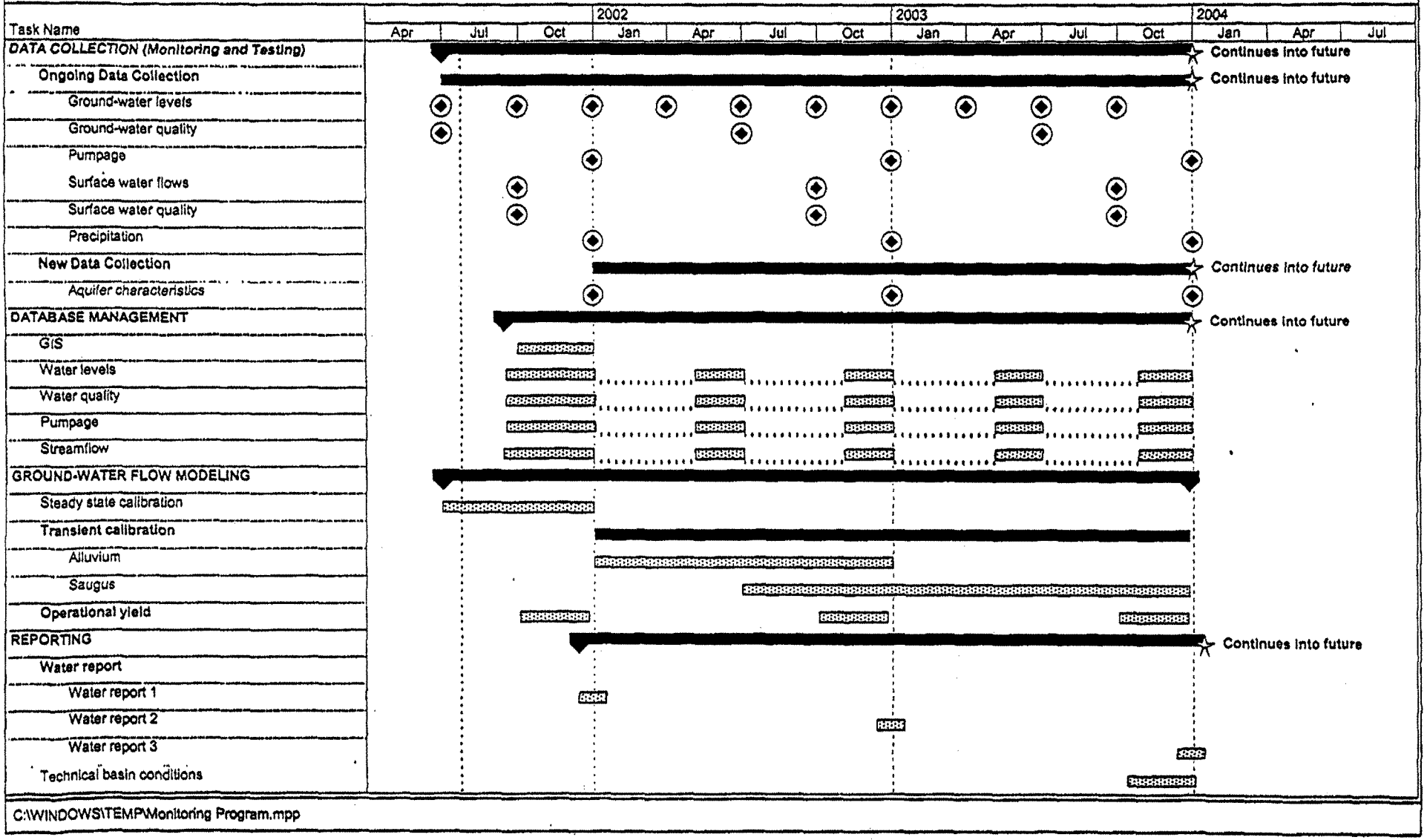
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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APPENDIX B

Analyses of Specific Capacity Test Data for the Alluvial Aquifer

Specific capacity data are available for production wells in the Alluvial Aquifer through 2000. Tables B-1 through B-6 present these data and the calculations of estimated transmissivity (T) and horizontal hydraulic conductivity (Kh) values, along with how these values compare with the values used in the calibrated groundwater flow model at each well location. Rows in bold font identify specific capacity tests that were considered to provide the best indications of aquifer properties.

The tables show the testing data for different geographic areas in the Alluvial Aquifer[1], as well as the estimated drawdown in the aquifer formation for different values of well efficiency. Because of the unconfined nature of the Alluvial Aquifer system, the following equations were used to calculate T and Kh (Driscoll, 1986):

$$s = s_{well} * E$$

$$T = 1500 * Q / s \qquad (1)$$

$$Kh = T / (7.48 * b_{typical})$$

where:

s = the estimated drawdown in the aquifer formation

s_{well} = the measured drawdown in the well during the efficiency test

E = the well estimated efficiency

T = the transmissivity (gallons per day per foot [gpd/ft])

Q = the pumping rate (gallons per minute [gpm])

Q/s = specific capacity of the well

Kh = the horizontal hydraulic conductivity of the alluvial aquifer (feet per day [ft/day])

$b_{typical}$ = the typical long-term average saturated thickness (feet [ft]) of the alluvial aquifer at the location of the specific well

For each test, Tables B-1 through B-6 show the data and the calculations for drawdown, T, and Kh at different estimated well efficiencies (70 percent is the typical efficiency of a well that is in good condition; 50 percent reflects a well that is less efficient).[2] As shown in the table, the T and Kh values vary widely with location, as well as over time at individual wells. The table uses bold font to identify those tests that are believed to be the least affected

[1] See Figure 2-3 for well locations. See also Figure 4-1 for the locations of the target wells and zones that were used during calibration of the Alluvial Aquifer in the Santa Clarita Valley Groundwater Model (Regional Model).

[2] Well efficiency is a function of the design, construction, and condition of the well.

by well efficiency issues (i.e., show the highest specific capacity values) and therefore provide the best estimate of aquifer parameter values at each well location. Specific conclusions from this analysis are:

a. In the western alluvium along the main Santa Clara River valley (west of I-5), it appears that few wells have high enough efficiencies to provide estimates of Alluvial Aquifer Kh values. The highest specific capacities for the Alluvial Aquifer are indicated by only about 19 of the 335 tests performed in this area. For these 19 tests and a well efficiency of 70 percent, the Kh ranges from approximately 300 to 1,000 ft/day and is typically approximately 500 to 600 ft/day. The Regional Model uses a Kh of 550 ft/day throughout this area.

b. In the central valley, between I-5 and Soledad Canyon, 8 of the 11 tested wells appear to provide usable estimates of Alluvial Aquifer Kh values. These wells indicate a Kh range typically between 250 and 600 feet/day, though one well (NLF-R2) indicates Kh values potentially as high as 800 ft/day or greater. The Regional Model uses values between 245 and 375 ft/day in most of this area, and 550 ft/day at the very eastern edge of this area, at the mouth of Soledad Canyon.

c. In the lower reach of Soledad Canyon, most wells indicate Kh values ranging from 600 ft/day to more than 1,000 ft/day. Only the SCWC-Honby well suggests lower Kh values of approximately 300 to 550 ft/day. The Regional Model uses a Kh of 550 ft/day throughout this area.

d. In the upper reach of Soledad Canyon, the Kh values show more variability from well to well than lower Soledad Canyon. Kh values in upper Soledad Canyon range from approximately 300 to 700 ft/day at some wells, and 900 to 1,500 ft/day at the other wells. The Regional Model uses Kh values ranging from 350 ft/day at the eastern end of the canyon to 550 ft/day farther west.

e. In the tributary canyons north of the Santa Clara River, Alluvial Aquifer Kh values tend to be slightly lower than along the Santa Clara River main valley.

    1. Along Castaic Creek, Kh values are commonly between 350 and 600 ft/day, though a few tests suggest values as high as 800 to 1,000 ft/day. The Regional Model uses a value of 315 ft/day below Castaic Dam and at the NCWD Castaic wellfield, and 350 ft/day between this wellfield and the alluvial valley containing the Santa Clara River.

    2. In San Francisquito Canyon, the W series wells owned by VWC and NLF suggest Kh values of approximately 200 to 400 ft/day. The Regional Model uses a value of 105 ft/day.

    3. In Bouquet Canyon, the two SCWC wells suggest Kh values of approximately 500 to 900 ft/day. The Regional Model uses a value of 140 ft/day at SCWC-Guida in the central portion of the canyon, and 245 ft/day at SCWC-Clark well in the lower reaches of the canyon.

The estimation of K values from specific capacity test data is a method that provides only an approximation of aquifer properties. This method is valuable for constraining the Regional Model's calibration because specific capacity tests provide the only source of data that allow

estimation and comparison of Alluvial Aquifer properties across the valley. Nonetheless, the method is affected by the following factors and uncertainties:

a. The measured drawdown in a well is affected by the radius of the well and the borehole, and the efficiency of the well at the time it is tested.

b. Yield and drawdown are affected by the length of the well screen and the fraction of the aquifer's thickness that is screened.

c. Fluctuations in water levels that occur seasonally and over multi-year periods affect the yield and drawdown of the well, and also the estimates of saturated thickness that are necessary for performing the calculations.

Reference

Driscoll, Fletcher G. 1986. *Groundwater and Wells*. Second Edition.

Tables

TABLE B-1

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Western Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	B5	**04/24/1984**	**1988**	**6.9**	**288.1**	**6.9**	**4.83**	**3.45**	**82,534**	**115,548**	**60,500**	**110**	**750**	**1,050**	**550**
		06/09/1986	1816	5.6	324.3	5.6	3.92	2.8	92,905	130,067		110	845	1,182	
		10/15/1987	1878	6.6	284.5	6.6	4.62	3.3	81,503	114,104		110	741	1,037	
		10/04/1988	1342	6.7	200.3	6.7	4.69	3.35	57,382	80,334		110	522	730	
		07/20/1989	1659	8.6	192.9	8.6	6.02	4.3	55,262	77,366		110	502	703	
		06/13/1990	1699	8	212.4	8	5.6	4	60,848	85,187		110	553	774	
		05/28/1991	**2013**	**7.6**	**264.9**	**7.6**	**5.32**	**3.8**	**75,888**	**106,243**	**60,500**	**110**	**690**	**966**	**550**
		07/26/1993	1895	7.2	263.2	7.2	5.04	3.6	75,401	105,561		110	685	960	
		08/15/1994	1870	6.3	296.8	6.3	4.41	3.15	85,027	119,037		110	773	1,082	
		07/18/1995	2081	6.5	320.2	6.5	4.55	3.25	91,730	128,422		110	834	1,167	
		06/10/1996	**2045**	**6.5**	**314.6**	**6.5**	**4.55**	**3.25**	**90,126**	**126,176**	**60,500**	**110**	**819**	**1,147**	**550**
		05/08/1997	1898	6.6	287.6	6.6	4.62	3.3	82,391	115,348		110	749	1,049	
		03/28/2000	**2357**	**6**	**392.8**	**6**	**4.2**	**3**	**112,529**	**157,540**	**60,500**	**110**	**1,023**	**1,432**	**550**
NLF	B6	05/21/1984	1473	12.1	121.7	12.1	8.47	6.05	34,864	48,810		110	317	444	
		06/09/1986	1886	15	125.7	15	10.5	7.5	36,010	50,414		110	327	458	
		10/15/1987	1190	10.4	114.4	10.4	7.28	5.2	32,773	45,882		110	298	417	
		07/20/1989	1043	8.4	124.2	8.4	5.88	4.2	35,581	49,813		110	323	453	
		06/13/1990	1083	10.4	104.1	10.4	7.28	5.2	29,822	41,751		110	271	380	
		05/30/1991	1603	11.9	134.7	11.9	8.33	5.95	38,589	54,024		110	351	491	
		06/10/1992	**1746**	**11.6**	**150.5**	**11.6**	**8.12**	**5.8**	**43,115**	**60,361**	**60,500**	**110**	**392**	**549**	**550**
		07/26/1993	1473	6.7	219.9	6.7	4.69	3.35	62,997	88,195		110	573	802	
		08/15/1994	1460	15.5	94.2	15.5	10.85	7.75	26,986	37,781		110	245	343	
		07/19/1995	**1600**	**9.2**	**173.9**	**9.2**	**6.44**	**4.6**	**49,819**	**69,746**	**60,500**	**110**	**453**	**634**	**550**
		06/10/1996	1274	18.6	68.5	18.6	13.02	9.3	19,624	27,473		110	178	250	
		05/08/1997	1394	15.6	89.4	15.6	10.92	7.8	25,611	35,856		110	233	326	
		06/26/1998	1554	15	103.6	15	10.5	7.5	29,679	41,551		110	270	378	
		05/06/1999	1504	13.3	113.1	13.3	9.31	6.65	32,401	45,361		110	295	412	
		05/21/1999	1504	13.3	113.1	13.3	9.31	6.65	32,401	45,361		110	295	412	
		04/21/2000	1086	22.4	48.5	22.4	15.68	11.2	13,894	19,452		110	126	177	
NLF	B7	02/24/1984	832	34.2	24.3	34.2	23.94	17.1	6,961	9,746	60,500	110	63	89	550
		04/24/1984	832	34.2	24.3	34.2	23.94	17.1	6,961	9,746		110	63	89	
		06/03/1986	766	33.4	22.9	33.4	23.38	16.7	6,560	9,184		110	60	83	
		12/21/1989	700	52.9	13.2	52.9	37.03	26.45	3,782	5,294		110	34	48	
		06/12/1990	766	50.5	15.2	50.5	35.35	25.25	4,354	6,096		110	40	55	
		05/29/1991	878	37.1	23.7	37.1	25.97	18.55	6,790	9,505		110	62	86	
		06/10/1992	837	14.9	56.2	14.9	10.43	7.45	16,100	22,540		110	146	205	
		07/23/1993	911	16.9	53.9	16.9	11.83	8.45	15,441	21,618		110	140	197	
		08/30/1994	730	33.5	21.8	33.5	23.45	16.75	6,245	8,743		110	57	79	
		07/17/1995	720	25.9	27.8	25.9	18.13	12.95	7,964	11,150		110	72	101	
		06/11/1996	725	29.5	24.6	29.5	20.65	14.75	7,047	9,866		110	64	90	
		06/26/1998	889	27.1	25.4	27.1	18.97	13.55	7,277	10,187		110	66	93	
		05/10/1999	915	27	33.9	27	18.9	13.5	9,712	13,596		110	88	124	
		05/21/1999	915	27	33.9	27	18.9	13.5	9,712	13,596		110	88	124	
		04/21/2000	945	49.6	19.1	49.6	34.72	24.8	5,472	7,660		110	50	70	
NLF	B10	07/13/1982	1325	33.2	39.9	33.2	23.24	16.6	11,430	16,003	60,500	110	104	145	550
		05/29/1991	1556	38.7	40.2	38.7	27.09	19.35	11,516	16,123		110	105	147	
		07/26/1993	1637	41	39.9	41	28.7	20.5	11,430	16,003		110	104	145	
		08/10/1994	1328	31.9	41.6	31.9	22.33	15.95	11,917	16,684		110	108	152	
		07/18/1995	1409	37.2	37.9	37.2	26.04	18.6	10,858	15,201		110	99	138	
		06/10/1996	1339	40	33.5	40	28	20	9,597	13,436		110	87	122	
		05/08/1997	1316	45.7	28.8	45.7	31.99	22.85	8,251	11,551		110	75	105	
		06/04/1998	1263	36.5	34.6	36.5	25.55	18.25	9,912	13,877		110	90	126	

TABLE B-1

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Western Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/06/1999	1259	43.4	29	43.4	30.38	21.7	8,308	11,631		110	76	106	
		05/21/1999	1259	43.4	29	43.4	30.38	21.7	8,308	11,631		110	76	106	
		04/21/2000	1259	39.4	32	39.4	27.58	19.7	9,167	12,834		110	83	117	
NLF	B11	07/27/1993	219	14.9	14.7	14.9	10.43	7.45	4,211	5,896	60,500	110	38	54	550
		08/17/1994	226	15.5	14.6	15.5	10.85	7.75	4,183	5,856		110	38	53	
		07/17/1995	429	12.4	34.6	12.4	8.68	6.2	9,912	13,877		110	90	126	
		05/14/1997	950	28	33.9	28	19.6	14	9,712	13,596		110	88	124	
		06/26/1998	817	22.9	35.7	22.9	16.03	11.45	10,227	14,318		110	93	130	
		05/10/1999	714	19.5	36.6	19.5	13.65	9.75	10,485	14,679		110	95	133	
		05/21/1999	714	19.5	36.6	19.5	13.65	9.75	10,485	14,679		110	95	133	
		04/21/2000	860	26.2	32.8	26.2	18.34	13.1	9,396	13,155		110	85	120	
NLF	C	04/09/1984	1351	49.4	27.3	49.4	34.58	24.7	7,821	10,949	60,500	110	71	100	550
		05/21/1986	1325	54.2	24.4	54.2	37.94	27.1	6,990	9,786		110	64	89	
		10/19/1987	1342	46	29.2	46	32.2	23	8,365	11,711		110	76	106	
		10/04/1988	1336	45	29.7	45	31.5	22.5	8,508	11,912		110	77	108	
		07/10/1989	1360	35.2	38.6	35.2	24.64	17.6	11,058	15,481		110	101	141	
		06/11/1990	1331	36.6	36.4	36.6	25.62	18.3	10,428	14,599		110	95	133	
		05/06/1991	1342	48.3	27.8	48.3	33.81	24.15	7,964	11,150		110	72	101	
		06/08/1992	1257	48	26.2	48	33.6	24	7,506	10,508		110	68	96	
		07/30/1993	1178	26.6	44.3	26.6	18.62	13.3	12,691	17,767		110	115	162	
		08/02/1994	1318	24.6	53.6	24.6	17.22	12.3	15,355	21,497		110	140	195	
		06/28/1995	1290	29	44.5	29	20.3	14.5	12,748	17,848		110	116	162	
		05/30/1996	1238	35.6	34.8	35.6	24.92	17.8	9,969	13,957		110	91	127	
		04/24/1997	1247	34	36.7	34	23.8	17	10,514	14,719		110	96	134	
		05/27/1998	1282	36.3	35.3	36.3	25.41	18.15	10,113	14,158		110	92	129	
		04/27/1999	1152	37.6	30.6	37.6	26.32	18.8	8,766	12,273		110	80	112	
		05/21/1999	1152	37.6	30.6	37.6	26.32	18.8	8,766	12,273		110	80	112	
		04/21/2000	1195	34	35.1	34	23.8	17	10,055	14,078		110	91	128	
NLF	C3	04/17/1984	935	42.4	22.1	42.4	29.68	21.2	6,331	8,864	60,500	110	58	81	550
		05/14/1986	870	54.7	15.9	54.7	38.29	27.35	4,555	6,377		110	41	58	
		07/12/1989	908	37.3	24.3	37.3	26.11	18.65	6,961	9,746		110	63	89	
		06/11/1990	549	25.1	21.9	25.1	17.57	12.55	6,274	8,783		110	57	80	
		05/07/1991	573	24.3	23.6	24.3	17.01	12.15	6,761	9,465		110	61	86	
		06/09/1992	814	45.5	17.9	45.5	31.85	22.75	5,128	7,179		110	47	65	
		07/31/1993	633	31.4	20.2	31.4	21.98	15.7	5,787	8,102		110	53	74	
		08/05/1994	739	19.2	38.5	19.2	13.44	9.6	11,029	15,441		110	100	140	
		07/11/1995	638	23.3	27.4	23.3	16.31	11.65	7,850	10,989		110	71	100	
		06/04/1996	553	30.9	17.9	30.9	21.63	15.45	5,128	7,179		110	47	65	
		05/07/1997	894	62.4	14.3	62.4	43.68	31.2	4,097	5,735		110	37	52	
		06/03/1998	754	64.1	11.8	64.1	44.87	32.05	3,380	4,733		110	31	43	
		05/03/1999	653	74.7	8.7	74.7	52.29	37.35	2,492	3,489		110	23	32	
		05/21/1999	653	74.7	8.7	74.7	52.29	37.35	2,492	3,489		110	23	32	
		04/21/2000	573	53.2	10.8	53.2	37.24	26.6	3,094	4,332		110	28	39	
NLF	C4	04/17/1984	1280	43.2	29.6	43.2	30.24	21.6	8,480	11,872		110	77	108	
		05/14/1986	1056	41	25.8	41	28.7	20.5	7,391	10,348		110	67	94	
		06/11/1990	1130	30	37.7	30	21	15	10,800	15,120		110	98	137	
		05/07/1991	1348	35.9	37.5	35.9	25.13	17.95	10,743	15,040		110	98	137	
		06/09/1992	1225	36.7	33.4	36.7	25.69	18.35	9,568	13,396		110	87	122	
		07/29/1993	834	21.3	39.2	21.3	14.91	10.65	11,230	15,722		110	102	143	
		08/05/1994	**1038**	**12.6**	**82.4**	**12.6**	**8.82**	**6.3**	**23,606**	**33,048**	**60,500**	**110**	**215**	**300**	**550**
		07/11/1995	1248	24.9	50.1	24.9	17.43	12.45	14,353	20,094		110	130	183	
		06/04/1996	1279	25.1	51	25.1	17.57	12.55	14,610	20,455		110	133	186	

TABLE B-1

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Western Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/07/1997	1310	27.8	47.1	27.8	19.46	13.9	13,493	18,890		110	123	172	
		06/03/1998	1279	29.4	43.5	29.4	20.58	14.7	12,462	17,447		110	113	159	
		05/03/1999	1072	32	33.5	32	22.4	16	9,597	13,436		110	87	122	
		05/21/1999	1072	32	33.5	32	22.4	16	9,597	13,436		110	87	122	
		04/21/2000	1156	30	38.5	30	21	15	11,029	15,441		110	100	140	
NLF	C5	04/09/1984	674	56.9	11.8	56.9	39.83	28.45	3,380	4,733	60,500	110	31	43	550
		05/15/1986	592	88.2	6.7	88.2	61.74	44.1	1,919	2,687		110	17	24	
		10/19/1987	587	84.3	7	84.3	59.01	42.15	2,005	2,807		110	18	26	
		07/18/1989	697	49.9	14	49.9	34.93	24.95	4,011	5,615		110	36	51	
		06/12/1990	638	68.3	9.3	68.3	47.81	34.15	2,664	3,730		110	24	34	
		05/08/1991	715	63.5	11.3	63.5	44.45	31.75	3,237	4,532		110	29	41	
		06/09/1992	722	63.9	11.3	63.9	44.73	31.95	3,237	4,532		110	29	41	
		07/30/1993	715	41.9	17.1	41.9	29.33	20.95	4,899	6,858		110	45	62	
		08/08/1994	796	13.6	58.5	13.6	9.52	6.8	16,759	23,463		110	152	213	
		07/07/1995	802	14.9	53.8	14.9	10.43	7.45	15,413	21,578		110	140	196	
		05/30/1996	945	21.6	43.8	21.6	15.12	10.8	12,548	17,567		110	114	160	
		05/06/1997	880	18.2	48.4	18.2	12.74	9.1	13,866	19,412		110	126	176	
		06/01/1998	885	21.5	41.2	21.5	15.05	10.75	11,803	16,524		110	107	150	
		04/27/1999	895	21.2	42.2	21.2	14.84	10.6	12,089	16,925		110	110	154	
		05/21/1999	895	21.2	42.2	21.2	14.84	10.6	12,089	16,925		110	110	154	
		04/21/2000	804	17.2	46.7	17.2	12.04	8.6	13,379	18,730		110	122	170	
NLF	C6	04/09/1984	153	29.9	5.1	29.9	20.93	14.95	1,461	2,045	60,500	110	13	19	550
		05/15/1986	137	34.2	4	34.2	23.94	17.1	1,146	1,604		110	10	15	
		10/19/1987	147	33.7	4.4	33.7	23.59	16.85	1,261	1,765		110	11	16	
		07/12/1989	124	31.4	3.9	31.4	21.98	15.7	1,117	1,564		110	10	14	
		06/06/1990	141	36.4	3.9	36.4	25.48	18.2	1,117	1,564		110	10	14	
		05/08/1991	133	41	3.2	41	28.7	20.5	917	1,283		110	8	12	
		12/21/1994	445	33.8	13.2	33.8	23.66	16.9	3,782	5,294		110	34	48	
		07/07/1995	459	33.2	13.8	33.2	23.24	16.6	3,953	5,535		110	36	50	
		05/28/1996	405	39.7	10.2	39.7	27.79	19.85	2,922	4,091		110	27	37	
		04/24/1997	364	44.6	8.2	44.6	31.22	22.3	2,349	3,289		110	21	30	
		05/27/1998	349	49.2	7.1	49.2	34.44	24.6	2,034	2,848		110	18	26	
		04/27/1999	305	50	6.1	50	35	25	1,748	2,447		110	16	22	
		05/21/1999	305	50	6.1	50	35	25	1,748	2,447		110	16	22	
		04/21/2000	260	50.5	5.1	50.5	35.35	25.25	1,461	2,045		110	13	19	
NLF	C7	04/10/1984	1118	44.5	25.1	44.5	31.15	22.25	7,191	10,067	60,500	110	65	92	550
		05/15/1986	1050	42.4	24.8	42.4	29.68	21.2	7,105	9,947		110	65	90	
		10/14/1987	1104	38.5	28.7	38.5	26.95	19.25	8,222	11,511		110	75	105	
		07/10/1989	434	38.3	11.3	38.3	26.81	19.15	3,237	4,532		110	29	41	
		06/11/1990	1067	32.8	32.5	32.8	22.96	16.4	9,311	13,035		110	85	118	
		05/28/1991	1082	37.6	28.8	37.6	26.32	18.8	8,251	11,551		110	75	105	
		06/08/1992	1047	47.1	22.2	47.1	32.97	23.55	6,360	8,904		110	58	81	
		07/31/1993	1054	37.9	27.8	37.9	26.53	18.95	7,964	11,150		110	72	101	
		08/01/1994	1008	39.5	25.5	39.5	27.65	19.75	7,305	10,227		110	66	93	
		06/28/1995	1082	38.1	28.4	38.1	26.67	19.05	8,136	11,390		110	74	104	
		06/03/1996	1032	43.7	23.6	43.7	30.59	21.85	6,761	9,465		110	61	86	
		05/06/1997	995	44.4	22.4	44.4	31.08	22.2	6,417	8,984		110	58	82	
		06/03/1998	919	50.9	18.1	50.9	35.63	25.45	5,185	7,259		110	47	66	
		05/03/1999	944	44.6	21.2	44.6	31.22	22.3	6,073	8,503		110	55	77	
		05/21/1999	944	44.6	21.2	44.6	31.22	22.3	6,073	8,503		110	55	77	
		04/21/2000	914	42.5	21.5	42.5	29.75	21.25	6,159	8,623		110	56	78	

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Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	C8	10/19/1950	318	76.3	4.2	76.3	53.41	38.15	1,203	1,684	60,500	110	11	15	550
		09/26/1951	365	52.5	7	52.5	36.75	26.25	2,005	2,807		110	18	26	
		10/01/1952	434	39.4	11	39.4	27.58	19.7	3,151	4,412		110	29	40	
		02/08/1955	548	56.4	9.7	56.4	39.48	28.2	2,779	3,890		110	25	35	
		10/04/1956	351	76.4	4.6	76.4	53.48	38.2	1,318	1,845		110	12	17	
		07/05/1957	260	92	2.8	92	64.4	46	802	1,123		110	7	10	
		09/12/1957	522	77	6.8	77	53.9	38.5	1,948	2,727		110	18	25	
		07/30/1958	394	49	8	49	34.3	24.5	2,292	3,209		110	21	29	
		10/31/1958	493	69.3	7.1	69.3	48.51	34.65	2,034	2,848		110	18	26	
		08/05/1959	443	76	5.8	76	53.2	38	1,662	2,326		110	15	21	
		07/06/1960	443	78.4	5.7	78.4	54.88	39.2	1,633	2,286		110	15	21	
		07/20/1961	329	72.3	4.6	72.3	50.61	36.15	1,318	1,845		110	12	17	
		05/31/1962	318	97.2	3.3	97.2	68.04	48.6	945	1,324		110	9	12	
		05/09/1963	271	104.6	2.6	104.6	73.22	52.3	745	1,043		110	7	9	
		07/14/1964	365	87.2	4.2	87.2	61.04	43.6	1,203	1,684		110	11	15	
		08/04/1965	362	88.9	4.1	88.9	62.23	44.45	1,175	1,644		110	11	15	
		11/01/1966	410	85	4.8	85	59.5	42.5	1,375	1,925		110	13	18	
		08/09/1967	377	104	3.6	104	72.8	52	1,031	1,444		110	9	13	
		08/28/1968	332	96.6	3.4	96.6	67.62	48.3	974	1,364		110	9	12	
		08/19/1969	410	75.4	5.4	75.4	52.78	37.7	1,547	2,166		110	14	20	
		07/09/1970	351	71.5	4.9	71.5	50.05	35.75	1,404	1,965		110	13	18	
		08/04/1971	572	76.4	7.5	76.4	53.48	38.2	2,149	3,008		110	20	27	
		01/12/1972	373	122.8	3	122.8	85.96	61.4	859	1,203		110	8	11	
		05/18/1972	414	110.9	3.7	110.9	77.63	55.45	1,060	1,484		110	10	13	
		07/17/1973	439	90.8	4.8	90.8	63.56	45.4	1,375	1,925		110	13	18	
		07/01/1974	419	108.8	3.9	108.8	76.16	54.4	1,117	1,564		110	10	14	
		05/03/1976	363	99.8	3.6	99.8	69.86	49.9	1,031	1,444		110	9	13	
		05/21/1984	546	59	9.3	59	41.3	29.5	2,664	3,730		110	24	34	
		07/10/1989	477	52.7	9.1	52.7	36.89	26.35	2,607	3,650		110	24	33	
		06/12/1990	488	52.2	9.3	52.2	36.54	26.1	2,664	3,730		110	24	34	
		05/06/1991	525	49.4	10.6	49.4	34.58	24.7	3,037	4,251		110	28	39	
		06/08/1992	477	48.6	9.8	48.6	34.02	24.3	2,807	3,930		110	26	36	
		07/30/1993	488	51.6	9.5	51.6	36.12	25.8	2,722	3,810		110	25	35	
		08/02/1994	520	30.4	17.1	30.4	21.28	15.2	4,899	6,858		110	45	62	
		07/11/1995	503	24.6	20.4	24.6	17.22	12.3	5,844	8,182		110	53	74	
		06/03/1996	535	29.3	18.3	29.3	20.51	14.65	5,243	7,340		110	48	67	
		05/06/1997	476	36.9	12.9	36.9	25.83	18.45	3,696	5,174		110	34	47	
		06/01/1998	478	34.5	13.9	34.5	24.15	17.25	3,982	5,575		110	36	51	
		05/03/1999	475	32.7	14.5	32.7	22.89	16.35	4,154	5,816		110	38	53	
		05/21/1999	475	32.7	14.5	32.7	22.89	16.35	4,154	5,816		110	38	53	
		04/21/2000	455	30.8	14.8	30.8	21.56	15.4	4,240	5,936		110	39	54	
NLF	F4	05/24/1984	1473	39.5	37.3	39.5	27.65	19.75	10,686	14,960	71,500	130	82	115	550
		06/02/1986	1511	41	36.9	41	28.7	20.5	10,571	14,799		130	81	114	
		10/03/1988	1897	42.9	44.2	42.9	30.03	21.45	12,662	17,727		130	97	136	
		07/18/1989	1576	35.5	44.4	35.5	24.85	17.75	12,720	17,807		130	98	137	
		06/04/1991	1225	17.5	70	17.5	12.25	8.75	20,053	28,075		130	154	216	
		07/23/1993	1944	38.2	50.9	38.2	26.74	19.1	14,582	20,414		130	112	157	
		05/22/1997	1956	37.2	52.6	37.2	26.04	18.6	15,069	21,096		130	116	162	
		05/11/1999	1868	39.7	47.1	39.7	27.79	19.85	13,493	18,890		130	104	145	
		05/21/1999	1868	39.7	47.1	39.7	27.79	19.85	13,493	18,890		130	104	145	
		04/21/2000	1691	30.5	55.4	30.5	21.35	15.25	15,871	22,219		130	122	171	

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Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	E5	06/10/1992	1320	84	15.7	84	58.8	42	4,498	6,297		130	35	48	
		08/11/1993	1274	63.3	20.1	63.3	44.31	31.65	5,758	8,061		130	44	62	
		12/21/1994	1203	24.9	48.3	24.9	17.43	12.45	13,837	19,372		130	106	149	
		07/25/1995	1191	23.8	50	23.8	16.66	11.9	14,324	20,053		130	110	154	
		05/28/1996	824	13.6	60.6	13.6	9.52	6.8	17,361	24,305		130	134	187	
		05/12/1997	1179	15.1	78.1	15.1	10.57	7.55	22,374	31,324		130	172	241	
		06/04/1998	1022	22.7	45	22.7	15.89	11.35	12,892	18,048		130	99	139	
		06/05/1998	1022	22.7	45	22.7	15.89	11.35	12,892	18,048		130	99	139	
		08/18/2000	**705**	**5.1**	**138.2**	**5.1**	**3.57**	**2.55**	**39,591**	**55,428**	**71,500**	**130**	**305**	**426**	**550**
NLF	E7	08/11/1993	263	2.5	105.2	2.5	1.75	1.25	30,138	42,193	71,500	130	232	325	550
		08/08/1994	328	2.5	131.2	2.5	1.75	1.25	37,586	52,620		130	289	405	
		07/03/1995	325	2.4	135.4	2.4	1.68	1.2	38,789	54,305		130	298	418	
		06/05/1996	334	2.7	123.7	2.7	1.89	1.35	35,437	49,612		130	273	382	
		05/12/1997	320	2.6	123.1	2.6	1.82	1.3	35,265	49,372		130	271	380	
		05/16/1997	320	2.6	123.1	2.6	1.82	1.3	35,265	49,372		130	271	380	
NLF	E9	04/11/1984	601	75.6	7.9	75.6	52.92	37.8	2,263	3,168	63,250	130	17	24	550
		05/20/1986	578	76.2	7.6	76.2	53.34	38.1	2,177	3,048		130	17	23	
		12/11/1986	1190	57.1	20.8	57.1	39.97	28.55	5,959	8,342		130	46	64	
		10/13/1987	1069	59.9	17.8	59.9	41.93	29.95	5,099	7,139		130	39	55	
		09/28/1988	894	61.2	14.6	61.2	42.84	30.6	4,183	5,856		130	32	45	
		07/11/1989	897	60	15	60	42	30	4,297	6,016		130	33	46	
		05/29/1990	876	60.3	14.5	60.3	42.21	30.15	4,154	5,816		130	32	45	
		04/18/1991	970	60.3	16.1	60.3	42.21	30.15	4,612	6,457		130	35	50	
		06/04/1992	897	62.4	14.4	62.4	43.68	31.2	4,125	5,775		130	32	44	
		07/22/1993	1021	55.6	18.4	55.6	38.92	27.8	5,271	7,380		130	41	57	
		07/19/1994	1053	52.1	20.2	52.1	36.47	26.05	5,787	8,102		130	45	62	
		07/03/1995	1058	51.5	20.5	51.5	36.05	25.75	5,873	8,222		130	45	63	
		05/23/1996	1073	49.7	21.6	49.7	34.79	24.85	6,188	8,663		130	48	67	
		04/23/1997	1050	50.1	21	50.1	35.07	25.05	6,016	8,422		130	46	65	
		06/03/1998	1021	50.8	20.1	50.8	35.56	25.4	5,758	8,061		130	44	62	
		05/04/1999	1107	39.8	27.8	39.8	27.86	19.9	7,964	11,150		130	61	86	
		04/21/2000	1117	29.6	37.7	29.6	20.72	14.8	10,800	15,120		130	83	116	
NLF	G45	04/16/1984	1590	31.2	51	31.2	21.84	15.6	14,610	20,455	63,250	115	127	178	550
		05/27/1986	1008	20.5	49.2	20.5	14.35	10.25	14,095	19,733		115	123	172	
		07/13/1989	1379	33.7	40.9	33.7	23.59	16.85	11,717	16,404		115	102	143	
		06/14/1990	1399	32.3	43.3	32.3	22.61	16.15	12,405	17,366		115	108	151	
		05/30/1991	1456	37.8	38.5	37.8	26.46	18.9	11,029	15,441		115	96	134	
		06/10/1992	1434	36.7	39.1	36.7	25.69	18.35	11,201	15,682		115	97	136	
		07/29/1993	1172	24.9	47.1	24.9	17.43	12.45	13,493	18,890		115	117	164	
		08/08/1994	1325	29.7	44.6	29.7	20.79	14.85	12,777	17,888		115	111	156	
		07/19/1995	1140	25.6	44.5	25.6	17.92	12.8	12,748	17,848		115	111	155	
		05/23/1996	1130	25.3	44.7	25.3	17.71	12.65	12,806	17,928		115	111	156	
		05/07/1997	1162	25.9	44.9	25.9	18.13	12.95	12,863	18,008		115	112	157	
		06/04/1998	1396	41.4	33.7	41.4	28.98	20.7	9,654	13,516		115	84	118	
		05/10/1999	1030	23	44.8	23	16.1	11.5	12,834	17,968		115	112	156	
		05/21/1999	1030	23	44.8	23	16.1	11.5	12,834	17,968		115	112	156	
		04/21/2000	1257	26.9	46.7	26.9	18.83	13.45	13,379	18,730		115	116	163	
NLF	X3	04/11/1984	802	41	19.6	41	28.7	20.5	5,615	7,861	63,250	115	49	68	550
		05/20/1986	505	53.4	9.5	53.4	37.38	26.7	2,722	3,810		115	24	33	
		10/13/1987	740	40.6	18.2	40.6	28.42	20.3	5,214	7,299		115	45	63	
		09/28/1988	477	45.5	10.5	45.5	31.85	22.75	3,008	4,211		115	26	37	
		07/11/1989	572	61.4	9.3	61.4	42.98	30.7	2,664	3,730		115	23	32	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		05/29/1990	444	47.5	9.3	47.5	33.25	23.75	2,664	3,730		115	23	32	
		04/18/1991	475	48.6	9.8	48.6	34.02	24.3	2,807	3,930		115	24	34	
		06/04/1992	587	46.1	12.7	46.1	32.27	23.05	3,638	5,094		115	32	44	
		07/22/1993	496	54	9.2	54	37.8	27	2,636	3,690		115	23	32	
		07/18/1994	465	52.2	8.9	52.2	36.54	26.1	2,550	3,570		115	22	31	
		07/03/1995	490	49.4	9.9	49.4	34.58	24.7	2,836	3,971		115	25	35	
		05/14/1996	449	53.9	8.3	53.9	37.73	26.95	2,378	3,329		115	21	29	
		04/23/1997	485	53.8	9	53.8	37.66	26.9	2,578	3,610		115	22	31	
		05/06/1998	531	47.9	11.1	47.9	33.53	23.95	3,180	4,452		115	28	39	
		05/04/1999	493	43.2	11.4	43.2	30.24	21.6	3,266	4,572		115	28	40	
		05/21/1999	493	43.2	11.4	43.2	30.24	21.6	3,266	4,572		115	28	40	
		04/21/2000	513	43.2	11.9	43.2	30.24	21.6	3,409	4,773		115	30	42	

Notes:

E = well efficiency

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-2

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Central Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	I	**05/23/1984**	**993**	**8.7**	**114.1**	**8.7**	**6.09**	**4.35**	**32,687**	**45,762**	**22,500**	**130**	**251**	**352**	**375**
		06/09/1986	**1058**	**9.6**	**110.2**	**9.6**	**6.72**	**4.8**	**31,570**	**44,198**	**22,500**	**130**	**243**	**340**	**375**
		02/03/1992	140	73	1.9	73	51.1	36.5	544	762		130	4	6	
		07/06/1994	129	86.2	1.5	86.2	60.34	43.1	430	602		130	3	5	
		08/01/1994	129	86.2	1.5	86.2	60.34	43.1	430	602		130	3	5	
VWC	K2	**01/29/1992**	**1563**	**7.1**	**220.1**	**7.1**	**4.97**	**3.55**	**63,054**	**88,275**	**54,375**	**145**	**435**	**609**	**375**
		05/13/1994	1365	7.1	192.3	7.1	4.97	3.55	55,090	77,126		145	380	532	
		04/17/1996	1650	8.6	191.9	8.6	6.02	4.3	54,975	76,965		145	379	531	
		07/11/1997	**1333**	**6.3**	**211.6**	**6.3**	**4.41**	**3.15**	**60,619**	**84,866**	**54,375**	**145**	**418**	**585**	**375**
		12/30/1998	1409	6.7	210.3	6.7	4.69	3.35	60,246	84,345		145	415	582	
VWC	L2	04/26/1984	2197	28.3	77.6	28.3	19.81	14.15	22,231	31,123	54,375	145	153	215	375
		11/21/1991	1400	19	73.7	19	13.3	9.5	21,113	29,559		145	146	204	
		01/29/1992	1466	26.1	56.2	26.1	18.27	13.05	16,100	22,540		145	111	155	
		05/13/1994	1256	32.8	38.3	32.8	22.96	16.4	10,972	15,361		145	76	106	
		04/17/1996	1210	29.6	40.9	29.6	20.72	14.8	11,717	16,404		145	81	113	
		07/14/1997	851	17.6	48.4	17.6	12.32	8.8	13,866	19,412		145	96	134	
		12/11/1998	931	24.5	38	24.5	17.15	12.25	10,886	15,241		145	75	105	
VWC	N	08/05/1969	1891	31.6	59.8	31.6	22.12	15.8	17,131	23,984	54,375	145	118	165	375
		08/27/1970	1787	27	66.2	27	18.9	13.5	18,965	26,551		145	131	183	
		07/21/1977	1427	15.2	93.9	15.2	10.64	7.6	26,900	37,660		145	186	260	
		05/23/1978	1448	14.6	99.2	14.6	10.22	7.3	28,419	39,786		145	196	274	
		11/05/1979	1427	15.4	92.7	15.4	10.78	7.7	26,557	37,179		145	183	256	
		11/17/1980	1450	21.8	66.5	21.8	15.26	10.9	19,051	26,671		145	131	184	
		10/26/1981	1427	26	54.9	26	18.2	13	15,728	22,019		145	108	152	
		06/10/1982	1427	24.1	59.2	24.1	16.87	12.05	16,960	23,743		145	117	164	
		02/04/1985	1562	22.9	68.2	22.9	16.03	11.45	19,538	27,353		145	135	189	
		08/07/1986	1450	23	63	23	16.1	11.5	18,048	25,267		145	124	174	
		04/25/1988	1404	23.3	60.3	23.3	16.31	11.65	17,275	24,184		145	119	167	
		02/01/1990	1380	22.5	61.3	22.5	15.75	11.25	17,561	24,586		145	121	170	
		05/30/1990	1350	21	64.3	21	14.7	10.5	18,421	25,789		145	127	178	
		11/21/1991	1320	19.5	67.7	19.5	13.65	9.75	19,395	27,152		145	134	187	
		01/30/1992	1378	20.8	66.3	20.8	14.56	10.4	18,994	26,591		145	131	183	
		05/13/1994	1328	16.9	78.6	16.9	11.83	8.45	22,517	31,524		145	155	217	
		04/18/1996	1320	16.8	78.6	16.8	11.76	8.4	22,517	31,524		145	155	217	
		07/11/1997	927	10.2	90.9	10.2	7.14	5.1	26,011	36,457		145	180	251	
		12/01/1998	1086	11.5	94.4	11.5	8.05	5.75	27,044	37,861		145	187	261	
VWC	N3	**11/21/1991**	**1550**	**8**	**193.8**	**8**	**5.6**	**4**	**55,519**	**77,727**	**79,750**	**145**	**383**	**536**	**550**
		05/12/1994	1520	11.3	134.5	11.3	7.91	5.65	38,531	53,944		145	266	372	
		04/18/1996	1294	7	184.9	7	4.9	3.5	52,970	74,158		145	365	511	
		07/14/1997	1121	6.5	172.5	6.5	4.55	3.25	49,417	69,184		145	341	477	
		12/11/1998	1319	8.5	155.2	8.5	5.95	4.25	44,461	62,246		145	307	429	
VWC	N4	**11/21/1991**	**1510**	**5.5**	**274.5**	**5.5**	**3.85**	**2.75**	**78,638**	**110,094**	**54,375**	**145**	**542**	**759**	**375**
		01/28/1992	1474	6.5	226.8	6.5	4.55	3.25	64,973	90,963		145	448	627	
		05/12/1994	1303	6.3	206.8	6.3	4.41	3.15	59,244	82,941		145	409	572	
		04/17/1996	1384	5.3	261.1	5.3	3.71	2.65	74,799	104,719		145	516	722	
		07/14/1997	1171	5	234.2	5	3.5	2.5	67,093	93,930		145	463	648	
		12/11/1998	1249	4.6	271.5	4.6	3.22	2.3	77,779	108,890		145	536	751	

TABLE B-2

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	Q2	02/17/1955	2343	24.2	96.8	24.2	16.94	12.1	27,731	38,824		145	191	268	
		03/09/1955	2310	23.5	98.3	23.5	16.45	11.75	28,161	39,425		145	194	272	
		10/21/1955	2103	21.5	97.8	21.5	15.05	10.75	28,018	39,225		145	193	271	
		08/01/1957	1589	28.9	55	28.9	20.23	14.45	15,756	22,059		145	109	152	
		11/18/1958	1696	26.3	64.5	26.3	18.41	13.15	18,478	25,869		145	127	178	
		07/26/1960	1073	17.9	59.9	17.9	12.53	8.95	17,160	24,024		145	118	166	
		06/27/1962	1349	34.6	39	34.6	24.22	17.3	11,173	15,642		145	77	108	
		06/19/1963	1920	25.5	75.3	25.5	17.85	12.75	21,572	30,201		145	149	208	
		09/21/1964	1611	24.3	66.3	24.3	17.01	12.15	18,994	26,591		145	131	183	
		09/17/1965	1414	17.7	79.9	17.7	12.39	8.85	22,890	32,045		145	158	221	
		07/26/1967	1806	16	112.9	16	11.2	8	32,343	45,281		145	223	312	
		10/05/1970	1711	15.6	109.7	15.6	10.92	7.8	31,427	43,997		145	217	303	
		08/16/1971	1880	17.2	109.3	17.2	12.04	8.6	31,312	43,837		145	216	302	
		07/03/1974	2022	25.9	78.1	25.9	18.13	12.95	22,374	31,324		145	154	216	
		10/21/1975	1552	37.9	40.9	37.9	26.53	18.95	11,717	16,404		145	81	113	
		08/03/1976	1688	19.7	85.7	19.7	13.79	9.85	24,551	34,372		145	169	237	
		06/14/1977	1688	19.7	85.7	19.7	13.79	9.85	24,551	34,372		145	169	237	
		05/24/1978	1626	20.5	79.3	20.5	14.35	10.25	22,718	31,805		145	157	219	
		12/03/1979	1542	29.4	52.4	29.4	20.58	14.7	15,011	21,016		145	104	145	
		11/13/1980	1752	33.2	52.8	33.2	23.24	16.6	15,126	21,176		145	104	146	
		06/09/1982	1898	43.5	43.6	43.5	30.45	21.75	12,490	17,487		145	86	121	
		02/25/1985	1960	54.8	35.8	54.8	38.36	27.4	10,256	14,358		145	71	99	
		08/07/1986	1804	72.4	24.9	72.4	50.68	36.2	7,133	9,987		145	49	69	
		04/28/1988	**2297**	**18.4**	**124.8**	**18.4**	**12.88**	**9.2**	**35,752**	**50,053**	**79,750**	**145**	**247**	**345**	**550**
		02/01/1990	1965	19.5	100.8	19.5	13.65	9.75	28,877	40,428		145	199	279	
		05/29/1990	1890	18	105	18	12.6	9	30,080	42,112		145	207	290	
		03/19/1992	1874	19	98.6	19	13.3	9.5	28,247	39,545		145	195	273	
		05/24/1994	1637	15.3	107	15.3	10.71	7.65	30,653	42,914		145	211	296	
		04/05/1996	1466	15.9	92.2	15.9	11.13	7.95	26,413	36,979		145	182	255	
		07/23/1997	1206	14	86.1	14	9.8	7	24,666	34,532		145	170	238	
		12/17/1998	1225	19.1	64.1	19.1	13.37	9.55	18,363	25,709		145	127	177	
NLF	R2	07/23/1941	1730	29.5	58.6	29.5	20.65	14.75	16,788	23,503		90	187	261	
		06/21/1945	1520	8	190	8	5.6	4	54,431	76,203		90	605	847	
		12/18/1946	1352	6	225.3	6	4.2	3	64,544	90,361		90	717	1,004	
		10/29/1947	**1680**	**6.4**	**262.5**	**6.4**	**4.48**	**3.2**	**75,201**	**105,281**	**22,050**	**90**	**836**	**1,170**	**245**
		06/20/1949	**1672**	**9**	**185.8**	**9**	**6.3**	**4.5**	**53,228**	**74,519**	**22,050**	**90**	**591**	**828**	**245**
		05/23/1950	1152	45.5	25.3	45.5	31.85	22.75	7,248	10,147		90	81	113	
		10/16/1950	672	8.1	83	8.1	5.67	4.05	23,778	33,289		90	264	370	
		01/19/1951	1310	6	218.3	6	4.2	3	62,538	87,553		90	695	973	
		09/28/1951	328	4	82	4	2.8	2	23,491	32,888		90	261	365	
		06/06/1952	1200	11	109.1	11	7.7	5.5	31,255	43,757		90	347	486	
		01/15/1955	1010	19.5	51.8	19.5	13.65	9.75	14,840	20,775		90	165	231	
		03/03/1955	1119	19.1	58.6	19.1	13.37	9.55	16,788	23,503		90	187	261	
		10/18/1955	620	38.7	16	38.7	27.09	19.35	4,584	6,417		90	51	71	
		09/19/1956	588	22.4	26.3	22.4	15.68	11.2	7,534	10,548		90	84	117	
		08/01/1957	429	8.3	51.7	8.3	5.81	4.15	14,811	20,735		90	165	230	
		09/24/1957	600	28	21.4	28	19.6	14	6,131	8,583		90	68	95	
		08/18/1959	660	34.7	19	34.7	24.29	17.35	5,443	7,620		90	60	85	
		08/18/1960	538	32.4	16.6	32.4	22.68	16.2	4,756	6,658		90	53	74	
		09/11/1961	362	7.6	47.6	7.6	5.32	3.8	13,636	19,091		90	152	212	

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		06/13/1962	660	11.6	56.9	11.6	8.12	5.8	16,301	22,821		90	181	254	
		05/06/1963	880	14.6	60.3	14.6	10.22	7.3	17,275	24,184		90	192	269	
		09/21/1964	725	16.4	44.2	16.4	11.48	8.2	12,662	17,727		90	141	197	
		08/05/1965	491	12.1	40.6	12.1	8.47	6.05	11,631	16,283		90	129	181	
		10/12/1967	523	10.2	51.3	10.2	7.14	5.1	14,696	20,575		90	163	229	
		08/07/1968	588	8.5	69.2	8.5	5.95	4.25	19,824	27,754		90	220	308	
		08/16/1971	545	2.1	259.5	2.1	1.47	1.05	74,341	104,078		90	826	1,156	
		06/21/1972	548	1.9	288.4	1.9	1.33	0.95	82,620	115,668		90	918	1,285	
		10/20/1975	460	1.8	255.6	1.8	1.26	0.9	73,224	102,513		90	814	1,139	
		04/07/1977	714	3.4	210	3.4	2.38	1.7	60,160	84,225		90	668	936	
		09/30/1980	708	2.7	262.2	2.7	1.89	1.35	75,115	105,160		90	835	1,168	
NLF	S	08/25/1937	1220	15	81.3	15	10.5	7.5	23,291	32,607		145	161	225	
		08/01/1938	1113	10.9	102.1	10.9	7.63	5.45	29,249	40,949		145	202	282	
		08/03/1938	1195	12	99.6	12	8.4	6	28,533	39,947		145	197	275	
		07/17/1940	1052	11.3	93.1	11.3	7.91	5.65	26,671	37,340		145	184	258	
		09/25/1940	1173	13	90.2	13	9.1	6.5	25,840	36,176		145	178	249	
		07/23/1941	1278	12	106.5	12	8.4	6	30,510	42,714		145	210	295	
		06/28/1945	1183	14.5	81.6	14.5	10.15	7.25	23,377	32,727		145	161	226	
		07/01/1946	1135	23.5	48.3	23.5	16.45	11.75	13,837	19,372		145	95	134	
		12/18/1946	**1028**	**5**	**205.6**	**5**	**3.5**	**2.5**	**58,900**	**82,460**	**54,375**	**145**	**406**	**569**	**375**
		10/17/1947	1400	22.5	62.2	22.5	15.75	11.25	17,819	24,947		145	123	172	
		09/15/1948	1350	26	51.9	26	18.2	13	14,868	20,816		145	103	144	
		06/17/1949	1415	24	59	24	16.8	12	16,902	23,663		145	117	163	
		05/24/1950	1385	25	55.4	25	17.5	12.5	15,871	22,219		145	109	153	
		10/03/1950	1120	29.5	38	29.5	20.65	14.75	10,886	15,241		145	75	105	
		07/17/1952	1146	24.5	46.8	24.5	17.15	12.25	13,407	18,770		145	92	129	
		07/07/1953	913	13.5	67.6	13.5	9.45	6.75	19,366	27,112		145	134	187	
		05/14/1954	1320	24	55	24	16.8	12	15,756	22,059		145	109	152	
		02/23/1955	1101	20.8	52.9	20.8	14.56	10.4	15,155	21,217		145	105	146	
		03/07/1955	1293	21	61.6	21	14.7	10.5	17,647	24,706		145	122	170	
		11/14/1955	457	7.6	60.1	7.6	5.32	3.8	17,217	24,104		145	119	166	
		07/03/1958	1330	12	110.8	12	8.4	6	31,742	44,439		145	219	306	
		10/15/1958	726	7.5	96.8	7.5	5.25	3.75	27,731	38,824		145	191	268	
		07/23/1959	731	8.1	90.2	8.1	5.67	4.05	25,840	36,176		145	178	249	
		07/26/1960	695	7.8	89.1	7.8	5.46	3.9	25,525	35,735		145	176	246	
		08/17/1961	669	6.8	98.4	6.8	4.76	3.4	28,189	39,465		145	194	272	
		05/29/1962	721	6.2	116.3	6.2	4.34	3.1	33,317	46,644		145	230	322	
		04/22/1963	726	6.4	113.4	6.4	4.48	3.2	32,487	45,481		145	224	314	
		08/19/1964	658	6.4	102.8	6.4	4.48	3.2	29,450	41,230		145	203	284	
		08/18/1965	674	6.2	108.7	6.2	4.34	3.1	31,140	43,596		145	215	301	
		10/12/1967	638	5.6	113.9	5.6	3.92	2.8	32,630	45,682		145	225	315	
		08/06/1968	716	6.2	115.5	6.2	4.34	3.1	33,088	46,324		145	228	319	
		09/10/1968	721	6.4	112.7	6.4	4.48	3.2	32,286	45,201		145	223	312	
		08/06/1969	783	6.8	115.1	6.8	4.76	3.4	32,974	46,163		145	227	318	
		08/24/1970	1047	8.8	119	8.8	6.16	4.4	34,091	47,727		145	235	329	
		08/19/1971	1021	8.6	118.7	8.6	6.02	4.3	34,005	47,607		145	235	328	
		06/21/1972	1139	10.8	105.5	10.8	7.56	5.4	30,223	42,313		145	208	292	
		08/14/1973	**1169**	**9**	**129.9**	**9**	**6.3**	**4.5**	**37,214**	**52,099**	**54,375**	**145**	**257**	**359**	**375**
		01/14/1975	1082	9	120.2	9	6.3	4.5	34,435	48,209		145	237	332	
		05/13/1976	1115	44.2	25.2	44.2	30.94	22.1	7,219	10,107		145	50	70	

TABLE B-2

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Central Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		04/07/1977	1011	9.4	107.6	9.4	6.58	4.7	30,825	43,155		145	213	298	
		08/15/1978	1035	45.5	22.7	45.5	31.85	22.75	6,503	9,104		145	45	63	
		09/24/1981	937	11.4	82.2	11.4	7.98	5.7	23,549	32,968		145	162	227	
		08/19/1982	1078	9.5	113.5	9.5	6.65	4.75	32,515	45,521		145	224	314	
NLF	S2	09/20/1940	2630	26	101.2	26	18.2	13	28,992	40,588	54,375	145	200	280	375
		07/24/1941	3055	32.2	94.9	32.2	22.54	16.1	27,187	38,061		145	187	262	
		06/12/1945	2775	50.4	55.1	50.4	35.28	25.2	15,785	22,099		145	109	152	
		07/24/1946	2630	28	93.9	28	19.6	14	26,900	37,660		145	186	260	
		12/17/1946	2380	49.8	47.8	49.8	34.86	24.9	13,694	19,171		145	94	132	
		03/31/1947	2940	40	73.5	40	28	20	21,056	29,479		145	145	203	
		10/18/1947	2630	48	54.8	48	33.6	24	15,699	21,979		145	108	152	
		09/15/1948	2130	54	39.4	54	37.8	27	11,287	15,802		145	78	109	
		06/17/1949	2090	46	45.4	46	32.2	23	13,008	18,209		145	90	126	
		05/24/1950	1970	41	48	41	28.7	20.5	13,751	19,251		145	95	133	
		10/03/1950	1420	45.3	31.3	45.3	31.71	22.65	8,967	12,553		145	62	87	
		01/19/1951	2130	50	42.6	50	35	25	12,204	17,086		145	84	118	
		05/15/1954	2040	32.5	62.8	32.5	22.75	16.25	17,991	25,187		145	124	174	
		02/16/1955	1466	28.3	51.8	28.3	19.81	14.15	14,840	20,775		145	102	143	
		03/07/1955	1692	27.3	62	27.3	19.11	13.65	17,762	24,866		145	122	171	
		11/04/1955	1201	31	38.7	31	21.7	15.5	11,087	15,521		145	76	107	
		12/30/1955	1950	20	97.5	20	14	10	27,932	39,104		145	193	270	
		09/27/1956	1448	43.5	33.3	43.5	30.45	21.75	9,540	13,356		145	66	92	
		08/02/1957	1337	35.9	37.2	35.9	25.13	17.95	10,657	14,920		145	73	103	
		10/09/1957	1605	43	37.3	43	30.1	21.5	10,686	14,960		145	74	103	
		07/03/1958	1800	44	40.9	44	30.8	22	11,717	16,404		145	81	113	
		10/10/1958	1485	39.4	37.7	39.4	27.58	19.7	10,800	15,120		145	74	104	
		07/23/1959	1305	39.6	33	39.6	27.72	19.8	9,454	13,235		145	65	91	
		07/19/1960	1120	31	36.1	31	21.7	15.5	10,342	14,479		145	71	100	
		08/17/1961	1178	27	43.6	27	18.9	13.5	12,490	17,487		145	86	121	
		06/14/1962	1225	30.9	39.6	30.9	21.63	15.45	11,345	15,882		145	78	110	
		04/22/1963	1406	30	46.9	30	21	15	13,436	18,810		145	93	130	
		07/28/1964	1016	29	35	29	20.3	14.5	10,027	14,037		145	69	97	
		08/18/1965	1142	24.8	46	24.8	17.36	12.4	13,178	18,449		145	91	127	
		01/09/1967	1748	26	67.2	26	18.2	13	19,251	26,952		145	133	186	
		10/12/1967	1634	26	62.8	26	18.2	13	17,991	25,187		145	124	174	
		08/05/1968	1455	24.8	58.7	24.8	17.36	12.4	16,816	23,543		145	116	162	
		08/06/1969	1490	30.6	48.7	30.6	21.42	15.3	13,951	19,532		145	96	135	
		08/24/1970	2194	29.8	73.6	29.8	20.86	14.9	21,085	29,519		145	145	204	
		08/19/1971	2308	32.2	71.7	32.2	22.54	16.1	20,540	28,757		145	142	198	
		07/26/1972	2206	30.6	72.1	30.6	21.42	15.3	20,655	28,917		145	142	199	
		08/14/1973	1783	18	99.1	18	12.6	9	28,390	39,746		145	196	274	
		01/15/1975	2251	52.2	43.1	52.2	36.54	26.1	12,347	17,286		145	85	119	
		05/13/1976	1554	47.6	32.6	47.6	33.32	23.8	9,339	13,075		145	64	90	
		04/06/1977	2001	22	91	22	15.4	11	26,070	36,497		145	180	252	
		06/21/1978	2613	48	54.4	48	33.6	24	15,584	21,818		145	107	150	
		09/24/1981	1824	21.8	83.7	21.8	15.26	10.9	23,978	33,570		145	165	232	
		07/27/1982	1790	21.9	81.7	21.9	15.33	10.95	23,405	32,767		145	161	226	
		05/30/1984	1813	22.2	81.7	22.2	15.54	11.1	23,405	32,767		145	161	226	

TABLE B-2

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Central Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	S3	04/11/1951	939	57	16.5	57	39.9	28.5	4,727	6,618		145	33	46	
		07/07/1953	766	72.3	10.6	72.3	50.61	36.15	3,037	4,251		145	21	29	
		07/23/1954	844	57	14.8	57	39.9	28.5	4,240	5,936		145	29	41	
		03/03/1955	928	45.5	20.4	45.5	31.85	22.75	5,844	8,182		145	40	56	
		03/07/1955	871	45	19.4	45	31.5	22.5	5,558	7,781		145	38	54	
		11/04/1955	736	53.5	13.8	53.5	37.45	26.75	3,953	5,535		145	27	38	
		08/03/1956	700	60.5	11.6	60.5	42.35	30.25	3,323	4,652		145	23	32	
		07/24/1957	674	57.5	11.7	57.5	40.25	28.75	3,352	4,693		145	23	32	
		10/02/1957	594	82	7.2	82	57.4	41	2,063	2,888		145	14	20	
		08/16/1961	576	58.1	9.9	58.1	40.67	29.05	2,836	3,971		145	20	27	
		06/14/1962	695	50.8	13.7	50.8	35.56	25.4	3,925	5,495		145	27	38	
		06/06/1963	786	31.2	25.2	31.2	21.84	15.6	7,219	10,107		145	50	70	
		08/19/1964	716	36.5	19.6	36.5	25.55	18.25	5,615	7,861		145	39	54	
		08/18/1965	720	35.2	20.5	35.2	24.64	17.6	5,873	8,222		145	41	57	
		09/11/1968	**945**	**7.3**	**129.5**	**7.3**	**5.11**	**3.65**	**37,099**	**51,939**	**79,750**	**145**	**256**	**358**	**550**
		08/06/1969	1033	8.4	123	8.4	5.88	4.2	35,237	49,332		145	243	340	
		08/24/1970	1047	8.8	119	8.8	6.16	4.4	34,091	47,727		145	235	329	
		08/19/1971	1040	8.4	123.8	8.4	5.88	4.2	35,466	49,652		145	245	342	
		06/12/1972	1042	8.8	118.4	8.8	6.16	4.4	33,919	47,487		145	234	327	
		08/14/1973	1045	8.8	118.8	8.8	6.16	4.4	34,034	47,647		145	235	329	
		01/14/1975	**1016**	**7.9**	**128.6**	**7.9**	**5.53**	**3.95**	**36,841**	**51,578**	**79,750**	**145**	**254**	**356**	**550**
		04/14/1977	1007	8.6	117.1	8.6	6.02	4.3	33,547	46,965		145	231	324	
		06/21/1978	587	6.1	96.2	6.1	4.27	3.05	27,559	38,583		145	190	266	
		09/24/1981	632	6.8	92.9	6.8	4.76	3.4	26,614	37,259		145	184	257	
		07/26/1982	649	6	108.2	6	4.2	3	30,997	43,396		145	214	299	
		05/29/1984	649	6.9	94.1	6.9	4.83	3.45	26,958	37,741		145	186	260	
		05/22/1986	639	8	79.9	8	5.6	4	22,890	32,045		145	158	221	
		06/14/1990	433	5	86.6	5	3.5	2.5	24,809	34,733		145	171	240	
		06/04/1991	520	6.1	85.2	6.1	4.27	3.05	24,408	34,171		145	168	236	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-3

Specific Capacity Data from Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Lower Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	Stadium	07/20/1965	812	8.3	97.8	8.3	5.81	4.15	28,018	39,225		90	311	436	
		06/06/1972	531	1.6	331.9	1.6	1.12	0.8	95,082	133,115		90	1,056	1,479	
		03/19/1974	**1046**	**2.8**	**373.6**	**2.8**	**1.96**	**1.4**	**107,028**	**149,840**	**63,250**	**90**	**1,189**	**1,665**	**550**
		04/10/1975	**965**	**2.8**	**344.6**	**2.8**	**1.96**	**1.4**	**98,720**	**138,209**	**63,250**	**90**	**1,097**	**1,536**	**550**
		04/12/1976	901	3.4	265	3.4	2.38	1.7	75,917	106,283		90	844	1,181	
		07/11/1977	836	4	209	4	2.8	2	59,874	83,824		90	665	931	
		05/10/1978	942	3.9	241.5	3.9	2.73	1.95	69,184	96,858		90	769	1,076	
		04/01/1979	930	3.1	300	3.1	2.17	1.55	85,943	120,321		90	955	1,337	
		09/01/1979	**937**	**3.1**	**302.3**	**3.1**	**2.17**	**1.55**	**86,602**	**121,243**	**63,250**	**90**	**962**	**1,347**	**550**
		09/22/1998	945	3.6	262.5	3.6	2.52	1.8	75,201	105,281		90	836	1,170	
VWC	U4	07/27/1967	1383	13.1	105.6	13.1	9.17	6.55	30,252	42,353		115	263	368	
		08/07/1968	1686	12.4	136	12.4	8.68	6.2	38,961	54,545		115	339	474	
		08/18/1969	**2621**	**10.2**	**257**	**10.2**	**7.14**	**5.1**	**73,625**	**103,075**	**63,250**	**115**	**640**	**896**	**550**
		08/13/1973	**2679**	**8**	**334.9**	**8**	**5.6**	**4**	**95,942**	**134,318**	**63,250**	**115**	**834**	**1,168**	**550**
		10/31/1979	1021	3.8	268.7	3.8	2.66	1.9	76,977	107,767		115	669	937	
		11/10/1980	1123	4.1	273.9	4.1	2.87	2.05	78,466	109,853		115	682	955	
		06/08/1982	1144	4.4	260	4.4	3.08	2.2	74,484	104,278		115	648	907	
		01/29/1985	962	3.8	253.2	3.8	2.66	1.9	72,536	101,551		115	631	883	
		08/18/1986	941	3.9	241.3	3.9	2.73	1.95	69,127	96,778		115	601	842	
		04/21/1988	1080	4.2	257.1	4.2	2.94	2.1	73,654	103,115		115	640	897	
		02/01/1990	1073	3.5	306.6	3.5	2.45	1.75	87,834	122,968		115	764	1,069	
		05/29/1990	1073	3.5	306.6	3.5	2.45	1.75	87,834	122,968		115	764	1,069	
		01/23/1992	978	4.5	217.3	4.5	3.15	2.25	62,252	87,152		115	541	758	
		06/14/1994	1057	4.2	251.7	4.2	2.94	2.1	72,107	100,949		115	627	878	
		04/04/1996	958	3.5	273.7	3.5	2.45	1.75	78,409	109,773		115	682	955	
		07/17/1997	919	3.3	278.5	3.3	2.31	1.65	79,784	111,698		115	694	971	
		12/29/1998	**1198**	**5.3**	**226**	**5.3**	**3.71**	**2.65**	**64,744**	**90,642**		**115**	**563**	**788**	
VWC	U3	07/27/1967	1389	9	154.3	9	6.3	4.5	44,204	61,885		115	384	538	
		08/07/1968	784	9	87.1	9	6.3	4.5	24,952	34,933		115	217	304	
		08/15/1973	**1997**	**4.7**	**424.9**	**4.7**	**3.29**	**2.35**	**121,725**	**170,414**	**63,250**	**115**	**1,058**	**1,482**	**550**
		10/21/1975	1087	3	362.3	3	2.1	1.5	103,791	145,307		115	903	1,264	
		08/02/1976	997	2.9	343.8	2.9	2.03	1.45	98,491	137,888		115	856	1,199	
		06/13/1977	907	4.1	221.2	4.1	2.87	2.05	63,369	88,717		115	551	771	
		05/31/1978	1074	4.3	249.8	4.3	3.01	2.15	71,562	100,187		115	622	871	
		10/31/1979	939	3.5	268.3	3.5	2.45	1.75	76,862	107,607		115	668	936	
		11/10/1980	898	3.4	264.1	3.4	2.38	1.7	75,659	105,922		115	658	921	
		06/08/1982	1181	4	295.3	4	2.8	2	84,597	118,436		115	736	1,030	
		01/28/1985	**1276**	**4**	**319**	**4**	**2.8**	**2**	**91,387**	**127,941**	**63,250**	**115**	**795**	**1,113**	**550**
		08/18/1986	961	3.2	300.3	3.2	2.24	1.6	86,029	120,441		115	748	1,047	
		04/21/1988	**1249**	**3.6**	**346.9**	**3.6**	**2.52**	**1.8**	**99,379**	**139,131**	**63,250**	**115**	**864**	**1,210**	**550**
		02/01/1990	**1253**	**3**	**417.7**	**3**	**2.1**	**1.5**	**119,662**	**167,527**	**63,250**	**115**	**1,041**	**1,457**	**550**
		05/29/1990	1162	3	387.3	3	2.1	1.5	110,953	155,334		115	965	1,351	
		01/24/1992	1078	5.2	207.3	5.2	3.64	2.6	59,387	83,142		115	516	723	
		07/18/1994	1217	3.9	312.1	3.9	2.73	1.95	89,410	125,174		115	777	1,088	
		04/04/1996	979	2.9	337.6	2.9	2.03	1.45	96,715	135,401		115	841	1,177	
		07/17/1997	861	2.6	331.2	2.6	1.82	1.3	94,882	132,834		115	825	1,155	
		01/18/1999	**1224**	**3.6**	**340**	**3.6**	**2.52**	**1.8**	**97,403**	**136,364**	**63,250**	**115**	**847**	**1,186**	**550**
SCWC	Honby	07/23/1965	613	26.4	23.2	26.4	18.48	13.2	6,646	9,305		90	74	103	
		06/02/1972	712	4	178	4	2.8	2	50,993	71,390		90	567	793	
		06/05/1972	781	14.4	54.2	14.4	10.08	7.2	15,527	21,738		90	173	242	
		04/02/1974	684	14.6	46.8	14.6	10.22	7.3	13,407	18,770		90	149	209	
		04/16/1975	654	14.2	46.1	14.2	9.94	7.1	13,207	18,489		90	147	205	

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Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		04/13/1976	623	3.5	178	3.5	2.45	1.75	50,993	71,390		90	567	793	
		05/03/1976	674	13.8	48.8	13.8	9.66	6.9	13,980	19,572		90	155	217	
		07/28/1977	801	16.5	48.5	16.5	11.55	8.25	13,894	19,452		90	154	216	
		08/25/1977	702	7.2	97.5	7.2	5.04	3.6	27,932	39,104		90	310	434	
		05/11/1978	**970**	**8.2**	**118.3**	**8.2**	**5.74**	**4.1**	**33,890**	**47,447**	**49,500**	**90**	**377**	**527**	**550**
		05/25/1978	835	18.4	45.4	18.4	12.88	9.2	13,006	18,209		90	145	202	
		04/01/1979	1065	13.7	77.7	13.7	9.59	6.85	22,259	31,163		90	247	346	
		09/01/1979	**1080**	**8.9**	**121.3**	**8.9**	**6.23**	**4.45**	**34,750**	**48,650**	**49,500**	**90**	**386**	**541**	**550**
		08/19/1980	**1178**	**12**	**98.2**	**12**	**8.4**	**6**	**28,132**	**39,385**	**49,500**	**90**	**313**	**438**	**550**
		08/22/1980	914	29.6	30.9	29.6	20.72	14.8	8,852	12,393		90	98	138	
		11/18/1981	919	48	19.1	48	33.6	24	5,472	7,660		90	61	85	
		12/01/1981	1277	13.4	95.3	13.4	9.38	6.7	27,301	38,222		90	303	425	
		03/14/1983	868	35	24.8	35	24.5	17.5	7,105	9,947		90	79	111	
		08/24/1983	1287	16.7	77.1	16.7	11.69	8.35	22,087	30,922		90	245	344	
		07/24/1984	832	48.1	17.3	48.1	33.67	24.05	4,956	6,939		90	55	77	
		08/02/1984	1232	14.5	85	14.5	10.15	7.25	24,351	34,091		90	271	379	
		10/22/1985	756	46.2	16.4	46.2	32.34	23.1	4,698	6,578		90	52	73	
		10/24/1985	1217	15.1	80.6	15.1	10.57	7.55	23,090	32,326		90	257	359	
		09/22/1998	904	10.2	88.6	10.2	7.14	5.1	25,382	35,535		90	282	395	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-4

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Upper Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	N. Oaks West	06/05/1972	1245	17.8	69.9	17.8	12.46	8.9	20,025	28,035		90	222	311	
		08/05/1972	1527	18.6	82.1	18.6	13.02	9.3	23,520	32,928		90	261	366	
		03/20/1974	1578	17.8	88.7	17.8	12.46	8.9	25,411	35,575		90	282	395	
		04/07/1975	1407	12.6	111.7	12.6	8.82	6.3	32,000	44,799		90	356	498	
		04/15/1976	1232	10.6	116.2	10.6	7.42	5.3	33,289	46,604		90	370	518	
		08/24/1977	578	7.2	80.3	7.2	5.04	3.6	23,004	32,206		90	256	358	
		06/07/1978	1392	12	116	12	8.4	6	33,231	46,524		90	369	517	
		04/01/1979	1298	10.8	120.2	10.8	7.56	5.4	34,435	48,209		90	383	536	
		09/01/1979	1185	9.7	122.2	9.7	6.79	4.85	35,008	49,011		90	389	545	
		08/02/1980	1317	11.4	115.5	11.4	7.98	5.7	33,088	46,324		90	368	515	
		12/01/1981	1598	13.4	119.3	13.4	9.38	6.7	34,177	47,848		90	380	532	
		03/07/1983	**1598**	**12.5**	**127.8**	**12.5**	**8.75**	**6.25**	**36,612**	**51,257**	**49,500**	**90**	**407**	**570**	**550**
		07/31/1984	**1558**	**12**	**129.8**	**12**	**8.4**	**6**	**37,185**	**52,059**	**49,500**	**90**	**413**	**578**	**550**
		10/23/1985	**1538**	**11.4**	**134.9**	**11.4**	**7.98**	**5.7**	**38,646**	**54,104**	**49,500**	**90**	**429**	**601**	**550**
		09/17/1998	1405	11.7	120.1	11.7	8.19	5.85	34,406	48,168		90	382	535	
SCWC	N. Oaks Central	03/26/1974	989	3.8	260.3	3.8	2.66	1.9	74,570	104,398		90	829	1,160	
		04/07/1975	823	3	274.3	3	2.1	1.5	78,581	110,013		90	873	1,222	
		04/13/1976	861	3.3	260.9	3.3	2.31	1.65	74,742	104,639		90	830	1,163	
		07/14/1977	759	4.5	168.7	4.5	3.15	2.25	48,329	67,660		90	537	752	
		05/18/1978	1023	3.6	284.2	3.6	2.52	1.8	81,417	113,984		90	905	1,266	
		04/01/1979	953	3.7	257.6	3.7	2.59	1.85	73,797	103,316		90	820	1,148	
		09/01/1979	930	1.3	715.4	1.3	0.91	0.65	204,947	286,925		90	2,277	3,188	
		08/27/1980	1021	3.5	291.7	3.5	2.45	1.75	83,566	116,992		90	929	1,300	
		11/19/1981	1078	3.8	283.7	3.8	2.66	1.9	81,274	113,783		90	903	1,264	
		03/07/1983	1139	3.4	335	3.4	2.38	1.7	95,970	134,358		90	1,066	1,493	
		07/26/1984	1164	3.5	332.6	3.5	2.45	1.75	95,283	133,396		90	1,059	1,482	
		10/23/1985	1087	3	362.3	3	2.1	1.5	103,791	145,307		90	1,153	1,615	
		09/17/1998	**1450**	**4.8**	**302.1**	**4.8**	**3.36**	**2.4**	**86,545**	**121,163**	**49,500**	**90**	**962**	**1,346**	**550**
SCWC	N. Oaks East	11/27/1963	1099	8.9	123.5	8.9	6.23	4.45	35,380	49,532		90	393	550	
		08/24/1965	707	42.1	16.8	42.1	29.47	21.05	4,813	6,738		90	53	75	
		06/02/1972	1169	8.5	137.5	8.5	5.95	4.25	39,391	55,147		90	438	613	
		03/20/1974	1016	6.5	156.3	6.5	4.55	3.25	44,777	62,687		90	498	697	
		04/15/1975	842	4.8	175.4	4.8	3.36	2.4	50,248	70,348		90	558	782	
		04/13/1976	873	5.3	164.7	5.3	3.71	2.65	47,183	66,056		90	524	734	
		07/14/1977	699	6.3	111	6.3	4.41	3.15	31,799	44,519		90	353	495	
		06/07/1978	750	4.4	170.5	4.4	3.08	2.2	48,845	68,382		90	543	760	
		04/01/1979	578	3.1	186.5	3.1	2.17	1.55	53,428	74,799		90	594	831	
		09/01/1979	510	2.2	231.8	2.2	1.54	1.1	66,406	92,968		90	738	1,033	
		08/25/1980	531	3.2	165.9	3.2	2.24	1.6	47,527	66,537		90	528	739	
		11/19/1981	1312	10.6	123.8	10.6	7.42	5.3	35,466	49,652		90	394	552	
		03/23/1983	**1312**	**7.6**	**172.6**	**7.6**	**5.32**	**3.8**	**49,446**	**69,225**	**49,500**	**90**	**549**	**769**	**550**
		07/30/1984	1261	8	157.6	8	5.6	4	45,149	63,209		90	502	702	
		11/18/1985	1143	7.3	156.6	7.3	5.11	3.65	44,862	62,807		90	498	698	
		09/17/1998	1091	18.4	59.3	18.4	12.88	9.2	16,988	23,783		90	189	264	

TABLE B-4

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer in Upper Soledad Canyon, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft^2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
SCWC	Sierra	**03/20/1974**	**1679**	**5.7**	**294.6**	**5.7**	**3.99**	**2.85**	**84,396**	**118,155**	**49,500**	**90**	**938**	**1,313**	**550**
		04/08/1975	1425	5.3	268.9	5.3	3.71	2.65	77,034	107,848		90	856	1,198	
		04/14/1976	1418	5.8	244.5	5.8	4.06	2.9	70,044	98,061		90	778	1,090	
		07/12/1977	1291	8.9	145.1	8.9	6.23	4.45	41,568	58,195		90	462	647	
		05/16/1978	**1574**	**5.4**	**291.5**	**5.4**	**3.78**	**2.7**	**83,508**	**116,912**	**49,500**	**90**	**928**	**1,299**	**550**
		04/01/1979	1538	4.9	313.9	4.9	3.43	2.45	89,926	125,896		90	999	1,399	
		09/01/1979	1507	5.5	274	5.5	3.85	2.75	78,495	109,893		90	872	1,221	
		08/25/1980	1558	4.6	338.7	4.6	3.22	2.3	97,030	135,842		90	1,078	1,509	
		11/30/1981	1448	4.2	344.8	4.2	2.94	2.1	98,778	138,289		90	1,098	1,537	
		03/15/1983	**1950**	**5.5**	**354.5**	**5.5**	**3.85**	**2.75**	**101,557**	**142,179**	**49,500**	**90**	**1,128**	**1,580**	**550**
		07/26/1984	1860	16.8	110.7	16.8	11.76	8.4	31,713	44,398		90	352	493	
		10/29/1985	**1840**	**6.4**	**287.5**	**6.4**	**4.48**	**3.2**	**82,362**	**115,307**	**49,500**	**90**	**915**	**1,281**	**550**
		09/16/1998	851	3.3	257.9	3.3	2.31	1.65	73,883	103,436		90	821	1,149	
SCWC	Mitchell	07/19/1965	536	11.4	47	11.4	7.98	5.7	13,464	18,850		90	150	209	
		08/07/1972	1250	6.5	192.3	6.5	4.55	3.25	55,090	77,126		90	612	857	
		03/26/1974	627	2.8	223.9	2.8	1.96	1.4	64,142	89,799		90	713	998	
		04/08/1975	529	2.6	203.5	2.6	1.82	1.3	58,298	81,618		90	648	907	
		08/25/1977	**709**	**5**	**141.8**	**5**	**3.5**	**2.5**	**40,623**	**56,872**	**49,500**	**90**	**451**	**632**	**550**
		07/25/1978	613	7.7	79.6	7.7	5.39	3.85	22,804	31,925		90	253	355	
		04/01/1979	653	8.7	75.1	8.7	6.09	4.35	21,515	30,120		90	239	335	
		09/01/1979	660	9	73.3	9	6.3	4.5	20,999	29,398		90	233	327	
		08/25/1980	602	9.8	61.4	9.8	6.86	4.9	17,590	24,626		90	195	274	
		11/23/1981	664	11	60.4	11	7.7	5.5	17,303	24,225		90	192	269	
		05/23/1983	674	12.3	54.8	12.3	8.61	6.15	15,699	21,979		90	174	244	
		08/02/1984	689	25.8	26.7	25.8	18.06	12.9	7,649	10,709		90	85	119	
		10/24/1985	694	39	17.8	39	27.3	19.5	5,099	7,139		90	57	79	
		09/22/1998	593	14.3	41.5	14.3	10.01	7.15	11,889	16,644		90	132	185	
SCWC	Lost Canyon 2	04/01/1979	743	17.3	42.9	17.3	12.11	8.65	12,290	17,206	36,000	90	137	191	400
		09/01/1979	885	28	31.6	28	19.6	14	9,053	12,674		90	101	141	
		09/16/1998	799	22.1	36.2	22.1	15.47	11.05	10,371	14,519		90	115	161	
SCWC	Lost Canyon 2A	10/29/1997	834	12.4	67.3	12.4	8.68	6.2	19,280	26,992	36,000	90	214	300	400
SCWC	Sand Canyon	07/02/1975	648	2.7	240	2.7	1.89	1.35	68,755	96,257		90	764	1,070	
		04/01/1979	540	2.5	216	2.5	1.75	1.25	61,879	86,631		90	688	963	
		09/01/1979	**825**	**2.6**	**317.3**	**2.6**	**1.82**	**1.3**	**90,900**	**127,259**	**36,000**	**90**	**1,010**	**1,414**	**400**
		08/22/1980	709	3.2	221.6	3.2	2.24	1.6	63,484	88,877		90	705	988	
		11/18/1981	684	3.4	201.2	3.4	2.38	1.7	57,639	80,695		90	640	897	
		05/23/1983	714	3.2	223.1	3.2	2.24	1.6	63,913	89,479		90	710	994	
		07/24/1984	**774**	**4.2**	**184.3**	**4.2**	**2.94**	**2.1**	**52,798**	**73,917**	**36,000**	**90**	**587**	**821**	**400**
		10/22/1985	658	3.3	199.4	3.3	2.31	1.65	57,124	79,973		90	635	889	
		09/16/1998	**1147**	**9.3**	**123.3**	**9.3**	**6.51**	**4.65**	**35,323**	**49,452**	**36,000**	**90**	**392**	**549**	**400**
NCWD	Pinetree1	04/02/1999	297	13.7	21.7	13.7	9.59	6.85	6,217	8,703	31,500	90	69	97	350
NCWD	Pinetree3	**04/02/1999**	**554**	**4.7**	**117.9**	**4.7**	**3.29**	**2.35**	**33,776**	**47,286**	**31,500**	**90**	**375**	**525**	**350**
NCWD	Pinetree4	**04/02/1999**	**497**	**4.8**	**103.5**	**4.8**	**3.36**	**2.4**	**29,650**	**41,511**	**31,500**	**90**	**329**	**461**	**350**

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
VWC	D	05/29/1984	503	6	83.8	6	4.2	3	24,007	33,610		100	240	336	
		04/27/1988	**1171**	**10.1**	**115.9**	**10.1**	**7.07**	**5.05**	**33,203**	**46,484**	**35,000**	**100**	**332**	**465**	**350**
		05/29/1990	990	9.5	104.2	9.5	6.65	4.75	29,851	41,791		100	299	418	
		07/06/1994	**1119**	**9.6**	**116.6**	**9.6**	**6.72**	**4.8**	**33,403**	**46,765**	**35,000**	**100**	**334**	**468**	**350**
		04/29/1996	1105	9.8	112.8	9.8	6.86	4.9	32,315	45,241		100	323	452	
		09/15/1997	1135	9.7	117	9.7	6.79	4.85	33,518	46,925		100	335	469	
		11/03/1998	**1086**	**9.6**	**113.1**	**9.6**	**6.72**	**4.8**	**32,401**	**45,361**	**35,000**	**100**	**324**	**454**	**350**
		11/13/1998	1086	9.6	113.1	9.6	6.72	4.8	32,401	45,361		100	324	454	
NLF	E	**04/10/1984**	**1726**	**7.8**	**221.3**	**7.8**	**5.46**	**3.9**	**63,398**	**88,757**	**35,000**	**100**	**634**	**888**	**350**
		05/21/1986	1613	7.1	227.2	7.1	4.97	3.55	65,088	91,123		100	651	911	
		10/14/1987	1151	15.6	73.8	15.6	10.92	7.8	21,142	29,599		100	211	296	
		10/05/1988	766	11	69.6	11	7.7	5.5	19,939	27,914		100	199	279	
		07/11/1989	877	8.2	107	8.2	5.74	4.1	30,653	42,914		100	307	429	
		05/30/1990	1291	13.9	92.9	13.9	9.73	6.95	26,614	37,259		100	266	373	
		04/17/1991	1187	15.8	75.1	15.8	11.06	7.9	21,515	30,120		100	215	301	
		06/03/1992	**1732**	**7.9**	**219.2**	**7.9**	**5.53**	**3.95**	**62,796**	**87,914**	**35,000**	**100**	**628**	**879**	**350**
		07/20/1993	1613	7.4	218	7.4	5.18	3.7	62,452	87,433		100	625	874	
		07/20/1994	1603	7.6	210.9	7.6	5.32	3.8	60,418	84,586		100	604	846	
		07/12/1995	1644	7.4	222.2	7.4	5.18	3.7	63,655	89,118		100	637	891	
		05/14/1996	1613	7.9	204.2	7.9	5.53	3.95	58,499	81,898		100	585	819	
		04/23/1997	1583	9.9	159.9	9.9	6.93	4.95	45,808	64,131		100	458	641	
		05/06/1998	1501	6.8	220.7	6.8	4.76	3.4	63,226	88,516		100	632	885	
		05/04/1999	1501	6.9	217.5	6.9	4.83	3.45	62,309	87,233		100	623	872	
		05/21/1999	1501	6.9	217.5	6.9	4.83	3.45	62,309	87,233		100	623	872	
		04/21/2000	1378	11.4	120.9	11.4	7.98	5.7	34,635	48,489		100	346	485	
NLF	E2	07/29/1938	1921	20.7	92.8	20.7	14.49	10.35	26,585	37,219		100	266	372	
		08/05/1938	1625	18.5	87.8	18.5	12.95	9.25	25,153	35,214		100	252	352	
		08/11/1938	1630	18.2	89.6	18.2	12.74	9.1	25,668	35,936		100	257	359	
		07/25/1939	1530	15.7	97.5	15.7	10.99	7.85	27,932	39,104		100	279	391	
		08/01/1939	1846	19.1	96.6	19.1	13.37	9.55	27,674	38,743		100	277	387	
		06/13/1941	1905	13.2	144.3	13.2	9.24	6.6	41,339	57,874		100	413	579	
		07/16/1945	**1635**	**9.9**	**165.2**	**9.9**	**6.93**	**4.95**	**47,326**	**66,257**	**35,000**	**100**	**473**	**663**	**350**
		12/18/1946	**1819**	**10**	**181.9**	**10**	**7**	**5**	**52,110**	**72,955**	**35,000**	**100**	**521**	**730**	**350**
		10/28/1947	1760	16.2	108.6	16.2	11.34	8.1	31,112	43,556		100	311	436	
		06/23/1949	1225	12.5	98	12.5	8.75	6.25	28,076	39,305		100	281	393	
		06/07/1950	1070	11	97.3	11	7.7	5.5	27,874	39,024		100	279	390	
		04/11/1951	1095	37.7	29	37.7	26.39	18.85	8,308	11,631		100	83	116	
		08/07/1953	1103	22.4	49.2	22.4	15.68	11.2	14,095	19,733		100	141	197	
		02/10/1955	1481	14.9	99.4	14.9	10.43	7.45	28,476	39,866		100	285	399	
		08/12/1955	1103	22.4	49.2	22.4	15.68	11.2	14,095	19,733		100	141	197	
		09/20/1956	998	28.2	35.4	28.2	19.74	14.1	10,141	14,198		100	101	142	
		07/16/1957	938	29.2	32.1	29.2	20.44	14.6	9,196	12,874		100	92	129	
		10/09/1957	828	11	75.3	11	7.7	5.5	21,572	30,201		100	216	302	
		07/25/1958	1582	12.5	126.6	12.5	8.75	6.25	36,268	50,775		100	363	508	
		10/24/1958	1532	16.6	92.3	16.6	11.62	8.3	26,442	37,019		100	264	370	
		09/03/1959	1329	24.8	53.6	24.8	17.36	12.4	15,355	21,497		100	154	215	
		07/29/1960	1084	39.2	27.7	39.2	27.44	19.6	7,935	11,110		100	79	111	
		08/03/1961	888	20.2	44	20.2	14.14	10.1	12,605	17,647		100	126	176	
		07/17/1962	1503	18.5	81.2	18.5	12.95	9.25	23,262	32,567		100	233	326	
		05/07/1963	1487	16.2	91.8	16.2	11.34	8.1	26,299	36,818		100	263	368	

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
		07/16/1964	759	47.8	15.9	47.8	33.46	23.9	4,555	6,377		100	46	64	
		08/05/1965	652	34.2	19.1	34.2	23.94	17.1	5,472	7,660		100	55	77	
		11/01/1966	536	60.1	8.9	60.1	42.07	30.05	2,550	3,570		100	25	36	
		08/10/1967	842	9.6	87.7	9.6	6.72	4.8	25,124	35,174		100	251	352	
		09/26/1968	1161	62.5	18.6	62.5	43.75	31.25	5,328	7,460		100	53	75	
		06/23/1972	1345	12.8	105.1	12.8	8.96	6.4	30,109	42,152		100	301	422	
		07/08/1974	1287	17.3	74.4	17.3	12.11	8.65	21,314	29,840		100	213	298	
		05/06/1976	1065	25.5	41.8	25.5	17.85	12.75	11,975	16,765		100	120	168	
		03/14/1977	1056	43.7	24.2	43.7	30.59	21.85	6,933	9,706		100	69	97	
		08/10/1978	725	4.8	151	4.8	3.36	2.4	43,258	60,561		100	433	606	
		12/21/1989	1086	34.6	31.4	34.6	24.22	17.3	8,995	12,594		100	90	126	
		05/30/1990	1205	36.1	33.4	36.1	25.27	18.05	9,568	13,396		100	96	134	
		04/17/1991	1056	48.5	21.8	48.5	33.95	24.25	6,245	8,743		100	62	87	
		06/03/1992	1235	22.9	53.9	22.9	16.03	11.45	15,441	21,618		100	154	216	
		07/20/1993	**1312**	**8.3**	**158.1**	**8.3**	**5.81**	**4.15**	**45,292**	**63,409**	**35,000**	**100**	**453**	**634**	**350**
		07/21/1994	**1305**	**6.3**	**207.1**	**6.3**	**4.41**	**3.15**	**59,330**	**83,061**	**35,000**	**100**	**593**	**831**	**350**
		07/12/1995	**1395**	**6.2**	**225**	**6.2**	**4.34**	**3.1**	**64,458**	**90,241**	**35,000**	**100**	**645**	**902**	**350**
		06/05/1996	**1473**	**5.8**	**254**	**5.8**	**4.06**	**2.9**	**72,765**	**101,872**	**35,000**	**100**	**728**	**1,019**	**350**
		04/23/1997	1087	6.4	169.8	6.4	4.48	3.2	48,644	68,102		100	486	681	
		06/26/1998	1055	8.3	127.1	8.3	5.81	4.15	36,411	50,976		100	364	510	
		05/04/1999	1079	6.6	163.5	6.6	4.62	3.3	46,839	65,575		100	468	656	
		05/21/1999	1079	6.6	163.5	6.6	4.62	3.3	46,839	65,575		100	468	656	
		04/21/2000	1052	6.7	157	6.7	4.69	3.35	44,977	62,968		100	450	630	
WHR	8	04/10/1969	849	5.8	146.4	5.8	4.06	2.9	41,940	58,717	35,000	100	419	587	350
WHR	16	10/06/1955	1205	8.3	145.2	8.3	5.81	4.15	41,597	58,235		100	416	582	
		11/13/1957	1052	7.6	138.4	7.6	5.32	3.8	39,649	55,508		100	396	555	
		05/28/1959	810	6.3	128.6	6.3	4.41	3.15	36,841	51,578		100	368	516	
		06/19/1959	**1436**	**9.9**	**145.1**	**9.9**	**6.93**	**4.95**	**41,568**	**58,195**	**35,000**	**100**	**416**	**582**	**350**
		06/26/1962	**1150**	**7**	**164.3**	**7**	**4.9**	**3.5**	**47,068**	**65,896**	**35,000**	**100**	**471**	**659**	**350**
		12/04/1963	1073	6.9	155.5	6.9	4.83	3.45	44,547	62,366		100	445	624	
WHR	11	11/10/1954	1401	10.9	128.5	10.9	7.63	5.45	36,812	51,537		100	368	515	
		10/06/1955	**1444**	**10.4**	**138.8**	**10.4**	**7.28**	**5.2**	**39,763**	**55,668**	**35,000**	**100**	**398**	**557**	**350**
		03/07/1962	1125	8.5	132.4	8.5	5.95	4.25	37,930	53,102		100	379	531	
		10/31/1962	1288	10.6	121.5	10.6	7.42	5.3	34,807	48,730		100	348	487	
		12/04/1963	1172	8.2	142.9	8.2	5.74	4.1	40,938	57,313		100	409	573	
WHR	18	01/27/1959	1244	9	138.2	9	6.3	4.5	39,591	55,428		100	396	554	
		05/28/1959	**1369**	**9.3**	**147.2**	**9.3**	**6.51**	**4.65**	**42,170**	**59,037**	**35,000**	**100**	**422**	**590**	**350**
		06/26/1962	1262	8	157.8	8	5.6	4	45,206	63,289		100	452	633	
		12/04/1963	940	6	156.7	6	4.2	3	44,891	62,848		100	449	628	
WHR	17	**10/06/1955**	**576**	**3.2**	**180**	**3.2**	**2.24**	**1.6**	**51,566**	**72,193**	**35,000**	**100**	**516**	**722**	**350**
		03/06/1962	539	3.3	163.3	3.3	2.31	1.65	46,782	65,495		100	468	655	
		10/31/1962	536	3.2	167.5	3.2	2.24	1.6	47,985	67,179		100	480	672	
		12/04/1963	**595**	**3.3**	**180.3**	**3.3**	**2.31**	**1.65**	**51,652**	**72,313**	**35,000**	**100**	**517**	**723**	**350**
WHR	10	10/06/1955	442	18.5	23.9	18.5	12.95	9.25	6,847	9,586	35,000	100	68	96	350
		03/06/1962	452	11.1	40.7	11.1	7.77	5.55	11,660	16,324		100	117	163	
		10/31/1962	480	15	32	15	10.5	7.5	9,167	12,834		100	92	128	
		12/03/1963	508	23.6	21.5	23.6	16.52	11.8	6,159	8,623		100	62	86	
		11/13/1964	467	27.1	17.2	27.1	18.97	13.55	4,927	6,898		100	49	69	

TABLE B-5

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer Along Castaic Creek, Santa Clarita Valley

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
WHR	15	10/06/1955	815	3.6	226.4	3.6	2.52	1.8	64,859	90,802		100	649	908	
		11/13/1957	1231	6.6	186.5	6.6	4.62	3.3	53,428	74,799		100	534	748	
		06/18/1958	1353	6.8	199	6.8	4.76	3.4	57,009	79,813		100	570	798	
		05/28/1959	**1655**	**9.6**	**172.4**	**9.6**	**6.72**	**4.8**	**49,389**	**69,144**	**35,000**	**100**	**494**	**691**	**350**
		06/18/1958	1353	6.8	199	6.8	4.76	3.4	57,009	79,813		100	570	798	
		06/26/1962	1260	6	210	6	4.2	3	60,160	84,225		100	602	842	
		12/05/1963	1180	7.6	155.3	7.6	5.32	3.8	44,490	62,286		100	445	623	
WHR	5	03/06/1962	684	9.7	70.5	9.7	6.79	4.85	20,197	28,275	35,000	100	202	283	350
		12/03/1963	693	8.8	78.8	8.8	6.16	4.4	22,574	31,604		100	226	316	
NCWD	Castaic1	03/31/1986	580	51.6	11.2	51.6	36.12	25.8	3,209	4,492	25,200	100	32	45	315
		04/23/1999	644	55.2	11.7	55.2	38.64	27.6	3,352	4,693		100	34	47	
NCWD	Castaic4	04/23/1999	271	87.6	3.1	87.6	61.32	43.8	888	1,243	25,200	100	9	12	315
NCWD	Castaic3	04/23/1999	470	41.3	11.4	41.3	28.91	20.65	3,266	4,572	25,200	100	33	46	315
NCWD	Castaic2	04/01/1986	428	37.9	11.3	37.9	26.53	18.95	3,237	4,532	25,200	100	32	45	315

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

TABLE B-6

Specific Capacity Data From Edison Tests, and Transmissivity and Hydraulic Calculations: Alluvial Aquifer In Tributary Canyons, Santa Clarita Valley, CA

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	Test Date	Pumping Rate (gpm)	Measured Drawdown (ft)	Specific Capacity (gpm/ft)	Formation Drawdown (ft) (E=100%)	Formation Drawdown (ft) (E=70%)	Formation Drawdown (ft) (E=50%)	T (ft^2/day) (E=70%)	T (ft^2/day) (E=50%)	Modeled T (ft2/day)	Typical Saturated Thickness (ft)	Kh (ft/day) (E=70%)	Kh (ft/day) (E=50%)	Modeled Kh (ft/day)
NLF	W4	02/05/1992	592	9.4	63	9.4	6.58	4.7	18,048	25,267		100	180	253	
		08/12/1994	**957**	**10.8**	**88.6**	**10.8**	**7.56**	**5.4**	**25,382**	**35,535**	**10,500**	**100**	**254**	**355**	**105**
VWC	W6	11/22/1991	720	36	20	36	25.2	18	5,730	8,021		100	57	80	
		01/27/1992	636	40.5	15.7	40.5	28.35	20.25	4,498	6,297		100	45	63	
		05/11/1994	504	75	6.7	75	52.5	37.5	1,919	2,687		100	19	27	
		04/23/1996	531	71.3	7.4	71.3	49.91	35.65	2,120	2,968		100	21	30	
		07/15/1997	539	69.5	7.8	69.5	48.65	34.75	2,235	3,128		100	22	31	
		12/28/1998	468	83.2	5.6	83.2	58.24	41.6	1,604	2,246		100	16	22	
VWC	W9	04/23/1996	946	10.1	93.7	10.1	7.07	5.05	26,843	37,580		100	268	376	
		07/15/1997	958	10.5	91.2	10.5	7.35	5.25	26,127	36,578		100	261	366	
		12/28/1998	**990**	**10.2**	**97.1**	**10.2**	**7.14**	**5.1**	**27,817**	**38,944**	**10,500**	**100**	**278**	**389**	**105**
SCWC	Guida	**03/18/1974**	**1016**	**6.4**	**158.8**	**6.4**	**4.48**	**3.2**	**45,493**	**63,690**	**12,600**	**90**	**505**	**708**	**140**
		04/17/1975	990	6.2	159.7	6.2	4.34	3.1	45,751	64,051		90	508	712	
		04/19/1976	940	5.6	167.9	5.6	3.92	2.8	48,100	67,340		90	534	748	
		07/06/1977	890.7	5.2	171.3	5.2	3.64	2.6	49,074	68,703		90	545	763	
		05/09/1978	915	5.5	166.4	5.5	3.85	2.75	47,670	66,738		90	530	742	
		04/01/1979	990	6.5	152.3	6.5	4.55	3.25	43,631	61,083		90	485	679	
		09/01/1979	990	3.6	275	3.6	2.52	1.8	78,782	110,294		90	875	1,225	
		08/20/1980	1000	7	142.9	7	4.9	3.5	40,938	57,313		90	455	637	
		11/24/1981	1009	7.2	140.1	7.2	5.04	3.6	40,136	56,190		90	446	624	
		03/15/1983	1024	6.9	148.4	6.9	4.83	3.45	42,513	59,519		90	472	661	
		07/25/1984	**1014**	**6.4**	**158.4**	**6.4**	**4.48**	**3.2**	**45,378**	**63,529**	**12,600**	**90**	**504**	**706**	**140**
		10/28/1985	1044	7.8	133.8	7.8	5.46	3.9	38,331	53,663		90	426	596	
		09/23/1998	1066	9.4	113.4	9.4	6.58	4.7	32,487	45,481		90	361	505	
SCWC	Clark	**06/06/1972**	**814**	**4**	**203.5**	**4**	**2.8**	**2**	**58,298**	**81,618**	**22,050**	**90**	**648**	**907**	**245**
		03/18/1974	587	3.8	154.5	3.8	2.66	1.9	44,261	61,965		90	492	689	
		05/27/1975	541	3.7	146.2	3.7	2.59	1.85	41,883	58,636		90	465	652	
		04/12/1976	490	3.3	148.5	3.3	2.31	1.65	42,542	59,559		90	473	662	
		07/06/1977	500.3	3	166.8	3	2.1	1.5	47,785	66,898		90	531	743	
		05/08/1978	488	3.1	157.4	3.1	2.17	1.55	45,092	63,128		90	501	701	
		04/01/1979	600	3	200	3	2.1	1.5	57,296	80,214		90	637	891	
		09/01/1979	600	2.6	230.8	2.6	1.82	1.3	66,119	92,567		90	735	1,029	
		08/20/1980	573	2.9	197.6	2.9	2.03	1.45	56,608	79,251		90	629	881	
		11/24/1981	602	2.7	223	2.7	1.89	1.35	63,885	89,439		90	710	994	
		03/08/1983	608	2.6	233.8	2.6	1.82	1.3	66,979	93,770		90	744	1,042	
		07/25/1984	608	2.3	264.3	2.3	1.61	1.15	75,716	106,003		90	841	1,178	
		09/23/1998	677	4.4	153.9	4.4	3.08	2.2	44,089	61,725		90	490	686	

Notes:

Kh = horizontal hydraulic conductivity

T = transmissivity

Bold font indicates tests that are least affected by well efficiency issues and therefore provide the best estimate of aquifer parameter values at the given well location.

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APPENDIX C

Surface Water Routing Model

A Surface Water Routing Model (SWRM) was developed to support groundwater flow modeling efforts in the Santa Clarita Valley of Southern California. The SWRM was developed as a pre- and post-processor for the Santa Clarita Valley Groundwater Model (hereafter called the Regional Model), which was constructed by the Upper Basin Water Purveyors. The Regional Model will be briefly described in this appendix; however, the reader should refer to the main body of this report for a more detailed description of the Regional Model.

C.1 Introduction

The Regional Model simulates monthly groundwater conditions from 1980 through 1999 over a 120 square mile (mi^2) area within a portion of the Santa Clara River Valley East Groundwater Subbasin. This subbasin lies within the Upper Santa Clara River Hydrologic Area, which is a watershed of approximately 460 mi^2 that lies in northwest Los Angeles County and a small portion of eastern Ventura County (Figure C-1).

The outer limits of the Regional Model correspond to the outer limits of the Santa Clarita Valley's groundwater systems, which consist of the Alluvial Aquifer and the Saugus Formation. These aquifers lie in the south-central portion of the hydrologic area, and the watershed extends upstream beyond the outer limits of the groundwater systems. Geologic formations located within the watershed, but outside of the Regional Model area, consist of bedrock and do not transmit significant quantities of groundwater flow due to their low permeability. However, an understanding of the availability of surface water runoff and infiltration within and upstream of the Regional Model area is critical to accurately simulate the water budget through time within the Regional Model area. Therefore, a surface water routing tool was developed to estimate, on a monthly basis, the location, magnitude, and timing of surface water infiltration to groundwater within the Regional Model boundary.

The SWRM was written in the Visual Basic Editor within Microsoft® Excel 97. The remainder of this appendix is organized as follows:

a. A list of the sources of recharge that are evaluated by the SWRM

b. The design of the SWRM

c. Detailed discussions of the calculations of magnitudes of each surface water source and its associated infiltration rate to groundwater

C.2 Sources of Recharge

The sources of recharge to the groundwater system in the Santa Clarita Valley are:

a. Infiltration of applied water for urban and industrial outdoor uses and for irrigating golf courses. Sources of urban and golf course irrigation water are groundwater pumping from the Alluvial Aquifer and the Saugus Formation, and import of water from the State Water Project (SWP).

b. Infiltration of water that is used for agricultural irrigation within the Regional Model area. This source of water consists exclusively of groundwater pumping from the Alluvial Aquifer.

c. Infiltration of direct precipitation within the Regional Model area, which is derived from precipitation data.

d. Infiltration of stormwater and anthropogenic streamflows. These sources include the following:

    1. Surface water runoff and infiltration from portions of the Upper Santa Clara River Hydrologic Area located outside of the Regional Model boundary

    2. Santa Clara River flows that enter the valley from the east

    3. Water released from Castaic Lagoon into Castaic Creek by the California Department of Water Resources

    4. Treated water discharged into the Santa Clara River from two Los Angeles County Sanitation District (LACSD) water reclamation plants (WRP)

C.3 SWRM Design

At every node in the grid that forms the Regional Model domain, the SWRM estimates groundwater recharge terms using the following three basic steps:

1. Calculate the monthly volume of surface water from each water source within and upstream of the Regional Model area.

2. Calculate the monthly volume of water in a stream that leaks through the streambed and collects on the water table, based on an assigned streambed leakage rate at each Regional Model stream node.

3. Calculate the monthly volume of water in a stream that does not infiltrate because of gaining stream conditions (i.e., rejected stream leakage). Rejected stream leakage remains as surface water as it passes the mouth of the stream and flows into the next stream system. For the Santa Clara River, rejected stream leakage eventually exits the Regional Model area at the west end of the valley, at the County Line stream gage.

Flow volumes in streams and rates of infiltration to groundwater from all water sources vary both geographically and over time based on sets of rules programmed into the SWRM. One of the most significant rules in the SWRM is that the infiltration rates to groundwater are not allowed to exceed the total amount of water generated by all surface water sources

in a given month. The magnitude of each potential source of groundwater recharge is based on local hydrologic measurements that have been recorded over time.

Following are discussions of the data and methods that were used to estimate the source water volumes and the amount of infiltration from each of these sources.

C.4 Infiltration of Applied Water (Urban Use, Excluding Golf Courses)

A significant portion of water that is used outdoors goes to plant uptake and direct evaporation, and a smaller portion infiltrates to the underlying aquifer system. The magnitude of infiltration was estimated using recent water use and land use data (Figure C-2) for developed areas within the Santa Clarita Valley.

The average annual water demand provided by the Upper Basin Water Purveyors was approximately 49,000 acre-feet per year (AF/yr) from 1994 through 1998. On a long-term basis, outdoor water use in urbanized areas is approximately 66 percent of the total annual water demand, as indicated by records of total water demands and WRP flows (see Table C-1). Within urbanized areas that are industrial and retail land uses, the outdoor water use is estimated to be approximately 30 percent of the total water use. For all urbanized areas excluding golf courses, it was assumed that 10 percent of the applied water in areas of urban development could potentially recharge groundwater. This assumption means that a total of 90 percent of the applied water goes to evapotranspiration (ET) demands, surface runoff, and return flow to surface water.

Aerial photographs of the valley taken in 1999 were used to identify land uses in developed areas, and a geographic information system (GIS) was used to determine the acreage of each land use type. Table C-2 summarizes the derivation of estimated values of infiltration for urban irrigation water from land use and water use data. The table shows the average annual water use volumes, the land use acreage, and the calculated depths of annual infiltration to groundwater. As shown in the table, infiltration of urban irrigation water is estimated to be approximately 1 inch per year (in/yr) for retail and industrial land uses, and 2.2 in/yr for suburban residential land use and recreational land use (parks). These values were used as direct specified input to the SWRM and were not varied during calibration of the Regional Model.

An attempt was made to vary over time, the locations at which urban applied water was specified in the Regional Model. However, electronic records of historical land use data were unavailable. Consequently, to ensure that the total infiltration volume in urbanized areas reflected the increase in development and water use that occurred throughout the 1980s and 1990s, this infiltration was applied to the 1999 urbanized area, but at rates that were adjusted upward or downward in a given year according to the difference between water uses in that year and in 1999. Tables C-3 and C-4 show the actual rates that were applied to the 1999 urbanized area to account for the gradual increase in water use from 1980 through 1999.

C.5 Infiltration of Applied Water (Golf Course Irrigation)

From 1994 through 1998, the average annual water use for golf course irrigation was approximately 500 AF/yr. The majority of this water use was for irrigation and was specified in the SWRM as 100 percent of the total water use for the golf course.

The amount of return flow to groundwater resulting from golf course irrigation was estimated to be 30 percent of applied water, which is three times higher than the assumed rate for other urbanized areas. This estimate was based on information suggesting that golf courses irrigate beyond the water demand requirements of grassy areas to maintain the quality of the greens. As shown in Table C-2, this resulted in an estimated annual average infiltration rate of 4.6 in/yr. As with urban irrigation, the golf course irrigation was increased gradually from 1980 through 1999 to account for the increased population growth and urban water use in the urbanized Santa Clarita Valley (see Table C-5).

C.6 Infiltration of Applied Water (Agricultural)

Aerial photographs of the valley taken in 1999 indicate that approximately 877 acres are currently irrigated for agricultural uses in the model study area. Approximately 90 percent of these irrigated lands are underlain by the Alluvial Aquifer, while the remaining 10 percent lie on the terrace deposits or in areas where the Saugus Formation is exposed at the ground surface. The total area of irrigated agriculture has diminished substantially since the 1960s as a result of development in the area.

Agricultural land in the Santa Clarita Valley is used primarily to grow row crops. A review was performed of detailed records of agricultural pumping, crop types, the acreage of each crop type, and the water use requirements for each crop type (as listed in the California Irrigation Management Information System). This review was performed for the period 1996 through 2000 to estimate the amount of applied irrigation water that infiltrates to groundwater beneath irrigated agricultural lands. Figure C-3 shows the analysis, which compares crop water use requirements with applied water volumes and identifies the difference as being equal to the infiltration volume to groundwater. For the period 1996 through 2000, Figure C-3 shows the following:

a. The average applied water volume was 7,038 AF/yr

b. The average amount of water that was not consumptively used (and which therefore infiltrated to groundwater) was 2,583 AF/yr, which is approximately 37 percent of the applied water volume

c. The equivalent average infiltration rate over the 877-acre area was 2.9 AF/acre/yr (which is equivalent to 2.9 ft/yr)

The infiltration rate of 2.9 ft/yr corresponds to the 7,038 AF/yr average water use during 1996 through 2000. A higher infiltration rate would be expected during years of higher water use and lower rate during years of reduced water use. Table C-6 shows the corresponding infiltration rates for each year, based on the water use each year. The 500-foot spacing of the Regional Model grid resulted in slight over-estimation of the acreage within

the model (1,205 acres) compared with the actual irrigated acreage (877 acres). This adjustment is also shown in Table C-6.

C.7 Infiltration of Direct Precipitation

As water falls onto the land surface or onto a body of water, it follows the three following natural pathways:

1. **Evapotranspiration.** This is the process by which water passes from a liquid to a vapor state via direct evaporation and through transpiration by plants (crops, urban landscaping, and native vegetation).
2. **Surface water runoff.** This represents water occurring as overland flow or water flowing in a stream.
3. **Infiltration.** This is the process by which water moves from the land surface downward through the upper soil layers. The process of infiltration increases the soil moisture content. If the soil moisture content reaches its field capacity, then any additional infiltration that takes place displaces water in the vadose zone and collects on the water table as groundwater recharge (deep percolation of precipitation). For the sake of clarity, references to infiltration in the rest of Appendix C will be synonymous with deep percolation of precipitation.

To estimate the infiltration rate, an understanding of the spatial pattern of precipitation must first be developed. To estimate the total volume of precipitation that falls onto the watershed, one would ideally like to have long-term precipitation data from several active rain gages located on a fairly consistent spacing throughout the watershed. However, due to the expense and maintenance required to operate a rain gage, such an extensive network of rain gages within a single watershed is typically not available for an extended period in most watersheds, as is the case for the Santa Clarita Valley.

C.7.1 Precipitation Data

The SWRM used precipitation data from the rain gage at the Newhall County Water District (NCWD) office, which is located south of Newhall Creek, approximately 1.3 miles south of the Newhall-Soledad rain gage (Figure C-4). Table C-7 lists the monthly precipitation at the NCWD gage from 1980 through 1999.

Because data from a single rain gage is not ideal for estimating the total volume of precipitation that falls within the entire watershed area, an isohyet map of California was also used. Figure C-4 shows contours of long-term average annual rainfall (isohyets) based on data compiled by the U.S. Geological Survey (USGS), the California Department of Water Resources, the California Geologic Survey (formerly the California Division of Mines and Geology), and where available, county and/or other local agencies. The source maps that were used to create the isohyet map are based primarily on U.S. Weather Service data from approximately 800 precipitation stations statewide. The U.S. Weather Service data were supplemented with county and local agency precipitation data in the Los Angeles area. The precipitation data were collected by these agencies over a sixty-year period from 1900 to

1960. Further information on the source of the isohyet data is available at the California Spatial Information Library.[1]

Because these isohyet data represent long-term hydrologic conditions from 1900 to 1960, a methodology was developed to estimate monthly precipitation throughout the Upper Santa Clara River Hydrologic Area using the NCWD gage data and the isohyets. For each month during the 1980 through 1999 Regional Model calibration period, this was done both within the Regional Model area and in the portions of the watershed lying outside the Regional Model area. The long-term average annual precipitation distribution shown in Figure C-4 was electronically draped over the nodes that comprise the Regional Model grid using the ESRI® ArcMap™/ArcInfo™ 8.3 GIS software. The annual precipitation rates at the NCWD rain gage from 1980 through 1999 were computed and compared with the value presented on the 1900 to 1960 isohyet map at that same location. The percent difference between the annual precipitation value and the isohyet value was computed for the NCWD rain gage location and applied to all isohyet values assigned to the Regional Model nodes, to estimate the average spatial distribution of precipitation for that particular calendar year. For example, the 1900-1960 isohyet value at the NCWD rain gage was 20.50 inches, but the 1980 annual precipitation data indicate 31.95 inches fell that year. Therefore, the adjustment factor for the isohyet values at all Regional Model nodes for 1980 was 31.95 divided by 20.50 or 1.559. This adjustment factor was then multiplied by the isohyet values at all Regional Model node locations to estimate the spatial distribution of annual precipitation during 1980.

The derivation of infiltration rates from direct precipitation within the Regional Model boundary is described in Section C.7.2. The derivation of streamflow rates from precipitation occurring outside the regional model boundary is discussed in Section C.8.1.

C.7.2 Infiltration Within the Regional Model Area

Because the Regional Model is a groundwater flow model, it does not directly input precipitation data. Instead, the monthly component of infiltration is estimated by the SWRM and used as input for the Regional Model. The infiltration rate is computed by the SWRM, within the Regional Model area, as described in the following paragraphs.

Annual precipitation infiltration volumes within the Regional Model domain were estimated from annual precipitation data using a variation of the Turner (1986) method. Turner empirically derived a power-function equation that described the relationship between annual rainfall and ET rates, based on the measured yields from 68 different watersheds located throughout California. Rainfall that does not go to ET is available for surface water runoff and infiltration to groundwater. During the largest storm events, some of this water leaves the basin before it has a chance to infiltrate to groundwater. However, during all but the largest storm events, precipitation that is not consumed by ET eventually infiltrates to groundwater, as defined by the following equation (Turner, 1986):

$$\text{Infiltration} + \text{Runoff} = \text{Precipitation} - 2.32(\text{Precipitation})^{0.66} \qquad \text{(C-1)}$$

[1] http://gis.ca.gov/meta.epl?oid=286

Equation C-1 is plotted on Figure C-5 for a range of annual precipitation values expressed in units of inches. Because this expression was empirically derived based on a best-fit to data from 68 watersheds throughout California, it is not necessarily representative of the conditions in an individual watershed. Therefore, the two power-function coefficients were adjusted during the process of calibrating the Regional Model. A final set of power-function coefficients for the Regional Model produced the following relationship for the Santa Clarita Valley:

$$\text{Infiltration} + \text{Runoff} = \text{Precipitation} - 6.20(\text{Precipitation})^{0.33} \qquad \text{(C-2)}$$

Equation C-2 (Figure C-5) was then applied to the annual precipitation-adjusted isohyet values to estimate the annual rate of infiltration from 1980 through 1999. Finally, based on the percentage of annual precipitation that fell each month during that calendar year at the NCWD rain gage, the annual infiltration rates were converted into monthly rates for every node in the Regional Model.

C.8 Infiltration From Streams

The natural sources of water to streams within the Santa Clarita Valley are surface water runoff from portions of the Upper Santa Clara River Hydrologic Area watershed that lie outside of the Regional Model boundary, and flow in the Santa Clara River where it enters the valley. Additionally, DWR releases water into Castaic Creek from Castaic Lagoon in some years, and treated water is discharged into the river from two WRPs on a continual basis. Following are discussions of the volumes of these water sources and the method used to determine infiltration rates in stream beds, based on the magnitude of flow in each stream.

C.8.1 Surface Water Runoff Volume Outside the Regional Model Area

For the Regional Model to honor the water budget for the entire watershed, a method was developed to estimate the monthly availability of surface water runoff and subsurface inflow from areas that are tributary to the Regional Model boundary. To do this, GIS software was used to provide specific input data to the SWRM as follows:

a. First, GIS software was used to delineate the extents of selected subwatersheds within the Upper Santa Clara River Hydrologic Area, using 30-meter digital elevation model data obtained from the USGS. Figure C-6 depicts the extents of these subwatersheds. The extents of the subwatersheds were important to delineate because precipitation rates vary spatially (see Figure C-4); therefore, at any given time, each sub-watershed receives different magnitudes of precipitation, and yields different quantities of surface water runoff and subsurface inflow into the Regional Model area.

b. Once the selected subwatersheds were delineated, the spatial areas were computed by GIS software for the entire subwatershed and for the portion of the subwatershed lying outside the Regional Model boundary. The GIS software also computed the mean of the 1900 to 1960 precipitation (isohyet) distribution within each subwatershed. The areas and the 1900 to 1960 mean precipitation values for each subwatershed are listed in Table C-8. The means of the 1900-1960 precipitation data were then multiplied by the precipitation adjustment factor (discussed in Section C.7.1) for each calendar year to

estimate the average magnitude of precipitation that fell within each sub-watershed during that calendar year.

c. Equation C-2 was then applied to the adjusted annual precipitation values for each sub-watershed to estimate the annual rate of surface water runoff from 1980 through 1999. This provided an estimate of the annual volume of water from subwatersheds that is then available as potential groundwater recharge within the stream reach that lies within the Regional Model domain. These annual estimates were then converted to monthly estimates by multiplying by the monthly percentage of precipitation that fell at the Newhall County Water District rain gage.

C.8.2 Santa Clara River Streamflow at Eastern Regional Model Boundary

The eastern point of the Regional Model, the location at which the Santa Clara River enters the model area, marks the approximate location of the Lang gage (Figure C-6). Streamflow was measured at this gage by the USGS and Los Angeles County for a discontinuous period of 36 years starting in 1949. The gaging station was removed from service in October 1989. Because the Santa Clara River flow into the model domain is a critical boundary condition for the Regional Model, it was necessary to estimate this streamflow beginning in October 1989.

The following paragraphs describe the method used to estimate the monthly streamflow at the Lang gage. This process used the Lang gage data through September 1989 and monthly precipitation data from a rain gage in the Acton groundwater basin, which is immediately east and upgradient of the Regional Model area. Using a multiple linear regression method described below, a good correlation between monthly precipitation data from the U.S Forest Service's Acton rain gage and the Lang stream gage was achieved. The resulting regression equation was used to generate estimates of streamflow during the period that streamflow data were unavailable (October 1989 through December 1999).

C.8.2.1 Data Sources

Monthly precipitation data for 1949 to 2001 were obtained for the Acton, California rain gage maintained by the U.S. Forest Service from the Western Regional Climate Data Center. This gage was determined to be the closest rain gage to the center of the Acton watershed with a long enough period of record to complete the regression analysis. Average rainfall at the Acton rain gage was 10.3 inches during the period of record, which is approximately 58 percent of the 17.83-inch average measured from 1883 through 2000 at the Newhall-Soledad gage.

C.8.2.2 Streamflow Estimation Method

The streamflow estimation procedure for the Lang gage site assumed that a predictable relationship exists between streamflows at the Lang gage and precipitation at the Acton rain gage. This assumption was used to develop a multiple linear regression relationship and to test the quality of that relationship using historical data. A simple mathematical model was established in which the streamflow at the Lang gage during a given month was estimated from the precipitation during the prior month. A Microsoft® Excel spreadsheet was used to perform the multiple linear regression calculations and to determine the regression coefficients for each monthly rainfall value.

The regression model was calibrated using monthly streamflow data for the Lang gage during water years 1949 to 1956. The calibration was verified using streamflow and precipitation data for water years 1957 to 1989. Numerous iterations using different rainfall periods and durations were attempted before achieving a good correlation. The final regression model bases the streamflow estimates on the previous six monthly rainfall values to predict each monthly streamflow value at the Lang gage.

The final regression equation was of the form:

$$\text{Streamflow at the Lang gage} = C1*Rain_{month1} + C2*Rain_{month2} + \ldots + C6*Rain_{month6} \quad \text{(C-3)}$$

where C1, C2, ...C6 are the regression constants.

C.8.2.3 Accuracy of Streamflow Estimates

Once a regression equation is developed and its predictions are verified, streamflows are commonly estimated by applying the equation to any set of precipitation data that are similar in magnitude to those which were used to develop the regression relationship (in this case, the historic values at the Acton rain gage). To verify that the regression equations produced accurate streamflow predictions, streamflow rates calculated from the regression equations were plotted and compared against measured streamflow rates for the period of record at the Lang gage. Figure C-7 shows a comparison plot using the results of this analysis, along with the final regression equation. The plotted data indicate that the regression equation produced streamflow estimates that closely matched measured streamflows. Where differences are apparent between computed and measured streamflows, this results from one or more of the following influences:

a. **System Operation.** The effects of streamflow diversions, pump stations, and wet weather bypasses are not consistent from storm to storm, and can result in irregular streamflows under similar precipitation events.

b. **Rainfall Distribution.** The regression equations were generated from the rain gage that was thought to best represent the precipitation distributed over the entire Acton basin. However, variability of rainfall volume and intensity is normal across basins, resulting in differences in streamflow volume and timing.

c. **Gage Data.** It is common to have intermittent problems with streamflow measurement devices, particularly because of changes in the depth-versus-streamflow relationship at the gaging station over time. The regression equation was produced from storm events during periods where the Acton precipitation data appeared to be the most reliable. These data are reasonable and appropriate for the uses of this study.

d. **Antecedent Conditions.** Streamflow predicted by the regression equation will be most accurate when applied to periods when storm intensity, duration, and antecedent conditions are similar to those used to generate the regression equations. If the antecedent conditions differ significantly from those present in the historical record, then the ability to forecast streamflow characteristics may be hindered.

As Figure C-7 shows, the relationship between monthly precipitation at the Acton rain gage and streamflow at the Lang gage is fairly predictable and has been consistent over time. This

mathematical relationship would be expected to remain consistent unless significant changes occur within the basin to affect streamflows, such as major land use changes.

The Acton rain gage was removed from service at the end of August 2000, therefore streamflow predictions cannot be made beyond this date using the calibrated regression model parameters described above. Table C-9 lists the combined set of measured and computed monthly streamflow values for the Lang gage from 1980 through 1999.

The monthly availability of streamflows at the Lang gage were input into the SWRM and allowed to infiltrate based on the specified maximum stream leakage rate, as Section C.8.5 of this appendix will discuss.

C.8.3 Releases from Castaic Lake

As described in Section 2.6.3.4 in the main body of this report, Castaic Creek occasionally receives surface water releases from Castaic Lagoon (i.e., Castaic Lake). The SWRM treats this surface water as it would any other available surface water in a stream. Based on the volume of available water during each monthly stress period, that water is allowed to infiltrate the Castaic Creek streambed and recharge the underlying groundwater system at a rate equal to or less than the streambed infiltration capacity (see Section C.8.5). Table C-10 lists the monthly releases of state surface water into Castaic Creek.

C.8.4 Treated Wastewater

Another anthropogenic source of recharge to the groundwater system is treated wastewater from the two LACSD WRPs in the valley, Plant No. 32 near Valencia, known as the Valencia WRP, and Plant No. 26 near Bouquet Canyon known, as the Saugus WRP. Tables C-11 and C-12 list the monthly volumes of treated wastewater that are discharged to the Santa Clara River from the Valencia WRP and the Saugus WRP, respectively.

The SWRM treats this surface water component as it would any other available surface water in a simulated stream. The volume of available treated wastewater during each monthly stress period is simulated to infiltrate the Santa Clara River streambed and recharge the groundwater system at a rate equal to or less than the streambed infiltration capacity (see Section C.8.5).

C.8.5 Assignment of Stream Leakage

Once the monthly streamflows were established for the Santa Clara River and each of its selected tributaries, a method had to be developed to determine the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system. The following paragraphs describe this method.

C.8.5.1 Stream Connectivity and Ranking System

For the SWRM to assign stream leakage rates accurately, a stream ranking convention was adopted (Figure C-8) as follows:

1. Santa Clara River
2. All modeled streams that merge with the Santa Clara River (2nd order streams)

3. All modeled streams that merge with the 2nd order streams (3rd order streams)
4. All modeled streams that merge with the 3rd order streams (4th order streams)
5. All modeled streams that merge with the 4th order streams (5th order streams)

For the entire model domain, the SWRM processes the assignment of stream leakage beginning with the highest ranking stream nodes and progressing sequentially downstream to the lowest ranking stream nodes for each subwatershed. This ensures a correct accounting of available stream leakage throughout the stream network in the Regional Model domain. Within a given stream, the connectivity relationships between each Regional Model grid node in that stream were established by ordering the Regional Model stream node number from upgradient nodes to downgradient nodes (Figure C-8). Additionally, the last stream node of a given stream was assigned a "next node number," which indicated the nearest node for the next downstream (lower ranking) stream that could receive any surface flows that remained in the higher ranking stream. This "next node number" attribute allowed the SWRM to simulate continued surface water infiltration in the lower ranking streams as long as the total volume of available recharge water was not consumed in upstream reaches of the simulated stream.

C.8.5.2 Stream Geometry at Each Node

Another necessary input for specifying infiltration rates from streams was the geometry of each individual stream node, specifically, the length, width, and area of each stream node (Figure C-8). This was required because the groundwater recharge module that was used within the Regional Model requires input in units of feet per day, then internally computes the volumetric groundwater recharge rate (in cubic feet per day) using the nodal area (in square feet). Thus, the SWRM requires input of simulated stream geometry assumptions to ensure that the correct volume of water is being recharged through the simulated streambeds.

C.8.5.3 Streambed Infiltration Capacity at Each Node

The streambed infiltration capacity was specified at each stream node in the SWRM. The streambed infiltration capacity is the maximum volume of water that can infiltrate through streambed sediments, assuming a sufficient volume of water in the stream. The streambed infiltration capacity is measured in cubic feet per second per stream mile and is a function of streambed sediment permeability and wetted width of the stream at any given time.

The wetted width of a stream at any given time will vary as a function of the amount of flow in the stream and will be less than the nodal width for all but the highest streamflows. Additionally, permeability of the streambed sediments will vary spatially and can even vary over time at any given location because of the scouring and deposition that occur during high flow events. Consequently, the streambed infiltration capacity of a stream at any given location can vary over time. For this reason, and because stream widths can vary in the field but not in the Regional Model, streambed infiltration capacity was allowed to vary over time in the SWRM.

A post-processor was written into the SWRM code to aid in the selection of time-varying streambed infiltration rates. The post-processor became a part of the calibration process of the Regional Model, in that differences between measured and simulated groundwater

elevations were used to help determine whether the streambed infiltration capacity of a given stream reach needed to be raised or lowered during any given month. Because this process required groundwater elevation data in the underlying groundwater system (in this case, the Alluvial Aquifer), the post-processor could only be applied along the Santa Clara River and Castaic Creek. Few, if any, records of groundwater elevations exist for the Alluvial Aquifer along the other streams, so streambed infiltration capacities were not varied over time along those streams. A complete description of the Regional Model calibration process and results can be found in Sections 4 and 5 in the main body of this report.

The monthly adjustment of the assumed streambed infiltration capacities during calibration of the Regional Model was performed in an iterative manner, using the following steps (which are also shown in Figure C-9):

1. Initial estimates of the maximum stream leakage rate were specified in the SWRM, which then generated monthly sets of groundwater recharge rates at each Regional Model node along the Santa Clara River and Castaic Creek during the 20-year simulation period.

2. The Regional Model was then run, and simulated groundwater elevations were recorded over time at selected calibration well locations along the Santa Clara River and Castaic Creek.

3. Simulated groundwater elevations were compared with measured elevations at each calibration well, and the differences (head residuals) were used to compute the surplus or deficit of water calculated by the Regional Model. For example, if a set of calibration wells in a particular area along the Santa Clara River indicated that simulated groundwater levels were 10 feet too high during a monthly stress period, then the computation would proceed as follows:

    a. Multiply the head residuals by the specific yield and the adjacent stream node area in the stream reach where the calibration well is located, to obtain the volume of surplus recharge water in the model.

    b. Reduce the assumed maximum stream leakage rate so that the calculated surplus recharge volume of water would not infiltrate in the stream reach associated with the calibration well during that particular monthly stress period. In other words, at a location where the model simulates too much stream leakage, the post-processor computes the volume of surplus recharge that, if eliminated, would allow the simulated groundwater elevations to better match the measured groundwater elevations. In this example, streamflow would be infiltrating the simulated streambed at a slower rate, thereby persisting as streamflow for a longer downstream reach of the stream channel.

4. Using the new values of streambed infiltration capacity, the SWRM was then run again to provide new groundwater recharge rates each month at the nodes where the post-processor was applied. The Regional Model was then run again with the new groundwater recharge rates, and this entire process was repeated until the assumed maximum stream leakage rate and/or the simulated groundwater elevations showed little to no change from one simulation to the next.

The streambed infiltration capacity that is assigned by the SWRM for each month is not necessarily the rate that surface water leaks into the Regional Model at any given location. The specified infiltration capacity simply allows stream leakage to occur as long as streamflows are available. For example, if the selected calibration wells are simulating groundwater elevations too low in comparison with measured groundwater elevations during a drought period, then the post-processor function within the SWRM would try to increase the assumed maximum stream leakage rate. However, during a drought, the availability of surface water is diminished. Therefore, even though the SWRM might increase the streambed infiltration capacity, there would be reaches where streamflows would be too low to allow water to infiltrate at a rate as high as the streambed infiltration capacity. The SWRM can only infiltrate the surface water if it is available, based on the complete water balance within the watershed. This rule allows the SWRM and the Regional Model to honor the watershed water budget.

C.9 Rejected Stream Leakage

As previously mentioned, the SWRM also tracks the volume of surface water in each simulated stream that does not infiltrate during each monthly stress period because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage remains as surface water in the Santa Clara River and eventually exits the Regional Model at the west end of the valley at the County Line stream gage. The monthly volumes of rejected stream leakage (calculated by the SWRM) and groundwater discharges to the river (calculated by the Regional Model) were used during the calibration process to compare these combined flow rates with streamflows measured at the County Line stream gage. This is discussed in detail in Sections 4.4.2 and 5.2.3 of the report.

Table C-13 lists the monthly streamflow measured from 1980 through 1999 at the County Line gage, which is located on the Santa Clara River at the western (downstream) end of the Santa Clarita Valley. Until October 1996, this gage was located just downstream of the Los Angeles-Ventura County line and just upstream of Blue Cut.[2] This gage continued operation through October 21, 1996, at which time it was permanently taken out of service. A new gage (USGS Gage No. 11109000) was put into service beginning on October 1, 1996 approximately 2.5 miles downstream, near Piru Junction, at the Las Brisas Bridge.

[2] Blue Cut is an area where the valley becomes substantially narrower in width and the river begins to bend toward the southern side of the valley. See Figure C-1 for this location.

C.10 References

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Tables

Table C-1

Comparison of WRP Discharges with Urban Water Demands

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	WRP Discharges to the Santa Clara River (AF/yr)	Urban Water Demands (AF/yr)	Percentage of Urban Demand Used Indoors (Routed to WRPs)	Percentage of Urban Demand Used Outdoors
1980	7,374	22,319	33.0	67.0
1981	7,950	24,822	32.0	68.0
1982	8,438	21,912	38.5	61.5
1983	9,422	21,386	44.1	55.9
1984	9,514	27,386	34.7	65.3
1985	9,616	28,482	33.8	66.2
1986	6,020	31,152	19.3	80.7
1987	11,843	33,877	35.0	65.0
1988	12,363	37,634	32.9	67.1
1989	13,560	42,813	31.7	68.3
1990	14,006	43,066	32.5	67.5
1991	14,108	39,793	35.5	64.5
1992	15,702	41,266	38.1	61.9
1993	17,178	43,352	39.6	60.4
1994	16,946	45,988	36.8	63.2
1995	17,823	45,673	39.0	61.0
1996	16,827	50,147	33.6	66.4
1997	15,775	54,173	29.1	70.9
1998	17,691	48,858	36.2	63.8
1999	17,847	57,250	31.2	68.8
1999	17,847	57,250	31.2	68.8
Statistics for 1980 through 1999				
Minimum	**6,020**	**21,386**	**19.3**	**55.9**
Maximum	**17,847**	**57,250**	**44.1**	**80.7**
Average	**13,231**	**38,981**	**34.2**	**65.8**
Median	**14,006**	**41,266**	**33.8**	**66.2**
Statistics for 1980 through 1999, Excluding 1986				
Minimum	**7,374**	**21,386**	**29.1**	**55.9**
Maximum	**17,847**	**57,250**	**44.1**	**70.9**
Average	**13,592**	**39,372**	**34.9**	**65.1**
Median	**14,057**	**42,040**	**34.3**	**65.7**

TABLE C-2
Calculation of Outdoor Irrigation Infiltration Rates to Groundwater for Non-Agricultural Water Uses
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Term	Value	Units	Reference or Calculation Method	Comment
NCWD Annual Water Use, 5-Year Average 1994 through 1998	8,150	AF/yr	Table III-6 in *1999 Annual Basin Report* (Luhdorff and Scalmanini Consulting Engineers, 2000)	16 percent of retailer-supplied water.
SCWD Annual Water Use, 5-Year Average 1994 through 1998	20,920	AF/yr		42 percent of retailer-supplied water.
VWC Total Annual Use, 5-Year Average 1994 through 1998	19,330	AF/yr		40 percent of retailer-supplied water.
LA County 36 Annual Water Use, 5-Year Average 1994 through 1998	570	AF/yr		1 percent of retailer-supplied water.
Valencia Country Club (VCC) Annual Water Use, 5-Year Average 1994 through 1998	490	AF/yr		1 percent of retailer-supplied water.
Annual Water Use, 5-Year Average 1994 through 1998	**49,460**	**AF/yr**		
Area of Water Use (excluding agriculture and undeveloped)	17,691	acres	Aerial photography (1999).	Area where retailer-supplied water is used.
Alluvial Aquifer Area of Water Use (excluding agriculture and undeveloped)	8,000	acres		Alluvial area where retailer-supplied water is used.
Saugus Area of Water Use (excluding agriculture and undeveloped)	9,691	acres		Saugus area where retailer-supplied water is used.
Alluvial Aquifer Lands – Suburban Residential Area	4,765	acres	Aerial photography (1999) and geologic mapping.	60 percent of alluvium area receiving applied water.
Alluvial Aquifer Lands – Retail – Office – Industrial Area	2,900	acres		36 percent of alluvium area receiving applied water.
Alluvial Aquifer Lands – Recreational Area	0	acres		No recreational areas were identified as overlying alluvium.
Alluvial Aquifer Lands – Golf Course Area	335	acres		4 percent of alluvium area receiving applied water.
Saugus Lands – Suburban Residential Area	8,192	acres		85 percent of Saugus area receiving applied water.
Saugus Lands – Retail - Office – Industrial Area	1,411	acres		15 percent of Saugus area receiving applied water.
Saugus Lands – Recreational Area	46	acres		Less than 1 percent of Saugus area receiving applied water.
Saugus Lands -- Golf Course Area	42	acres		Less than 1 percent of Saugus area receiving applied water.
Percent Annual Water Consumption for Outdoor Use -- Suburban Residential	65		Comparison of historical water use records and WRP flow records. See Table C-1.	
Percent Annual Water Consumption for Outdoor Use -- Retail/Office/Industrial	30			
Percent Annual Water Consumption for Outdoor Use -- Recreational	65			
Percent Annual Water Consumption for Outdoor Use -- Golf Course	100			
Percent Applied Water Going to Deep Percolation -- Suburban Residential	10		Assumed irrigation efficiency is 10 percent for all urban land uses where irrigation occurs.	
Percent Applied Water Going to Deep Percolation -- Retail/Office/Industrial	10			
Percent Applied Water Going to Deep Percolation -- Recreational	10			
Percent Applied Water Going to Deep Percolation -- Golf Course	30			
Percent Total Water Use Going to Deep Percolation -- Suburban Residential	6.5		Calculated.	Equals 65 percent times 10 percent.
Percent Total Water Use Going to Deep Percolation -- Retail/Office/Industrial	3.0			Equals 30 percent times 10 percent.
Percent Total Water Use Going to Deep Percolation -- Recreational	6.5			Equals 65 percent times 10 percent
Percent Total Water Use Going to Deep Percolation -- Golf Course	30.0			Equals 100 percent times 30 percent.
Alluvial Aquifer Annual Deep Percolation – Suburban Residential	866	AF/yr	Calculated from total water use (49,460 AF/yr), the area overlying the alluvium for each land use category, and the percentage of total water use going to recharge.	Equals 49,460 AF/yr * (4765 acres / 17691 acres) * 6.5 percent.
Alluvial Aquifer Annual Deep Percolation -- Retail/Office/Industrial	243	AF/yr		Equals 49,460 AF/yr * (2900 acres / 17691 acres) * 3.0 percent.
Alluvial Aquifer Annual Deep Percolation – Recreational	0	AF/yr		No recreational areas overlie alluvium.
Alluvium Annual Deep Percolation -- Golf Course	130	AF/yr		Equals 490 AF/yr * (335 acres / (335+42 acres)) * 30.0 percent.
Alluvial Aquifer Annual Deep Percolation	**1,239**	**AF/yr**		
Alluvial Aquifer 5-Year Deep Percolation (1994 through 1998)	**6,195**	**AF**		
Saugus Annual Deep Percolation – Suburban Residential	1,489	AF/yr	Calculated from total water use (49,460 AF/yr), the area overlying the Saugus for each land use category, and the percentage of total water use going to recharge.	Equals 49,460 AF/yr * (8192 acres / 17691 acres) * 6.5 percent.
Saugus Annual Deep Percolation – Retail/Office/Industrial	118	AF/yr		Equals 49,460 AF/yr * (1411 acres / 17691 acres) * 3.0 percent.
Saugus Annual Deep Percolation – Recreational	8	AF/yr		Equals 49,460 AF/yr * (46 acres / 17691 acres) * 6.5 percent.
Saugus Annual Deep Percolation – Golf Course	16	AF/yr		Equals 490 AF/yr * (42 acres / (335+42 acres) * 30.0 percent.
Saugus Annual Deep Percolation	**1,631**	**AF/yr**		
Saugus 5-Year Deep Percolation (1994 through 1998)	**8,155**	**AF**		
Average Area-Wide Deep Percolation -- Suburban Residential	2.2	in/yr	Calculated from applied water volumes in Alluvial and Saugus samples, as well as combined area in alluvium and Saugus occupied by each land use category.	Equals (12 in/ft)* (866+1,489 AF/yr) / (4,765+8,192 acres).
Average Area-Wide Deep Percolation -- Retail/Office/Industrial	1.0	in/yr		Equals (12 in/ft)* (243+118 AF/yr) / (2,900+1411 acres).
Average Area-Wide Deep Percolation -- Recreational	2.2	in/yr		Equals (12 in/ft)* (0+8 AF/yr) / (0+46 acres).
Average Area-Wide Deep Percolation -- Golf Course	4.6	in/yr		Equals (12 in/ft)* (130+16 AF/yr) / (335+42 acres).

Notes:

Applied water recharge to Saugus includes areas where terrace deposits are present at the ground surface.
in/ft = inches per foot

Table C-3

Irrigation Infiltration Rates over 1999 Suburban Residential Area

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Suburban Residential Area (in/yr)	Ratio Compared with 1999
1980	22,319	0.86	0.391
1981	24,822	0.95	0.432
1982	21,912	0.84	0.382
1983	21,386	0.82	0.373
1984	27,386	1.05	0.477
1985	28,482	1.09	0.495
1986	31,152	1.2	0.545
1987	33,877	1.3	0.591
1988	37,634	1.45	0.659
1989	42,813	1.65	0.75
1990	43,066	1.65	0.75
1991	39,793	1.53	0.695
1992	41,266	1.59	0.723
1993	43,352	1.67	0.759
1994	45,988	1.77	0.805
1995	45,673	1.76	0.8
1996	50,147	1.93	0.877
1997	54,173	2.08	0.945
1998	48,858	1.88	0.855
1999	57,250	2.2	1
2000	60,988	2.34	1.064

Note:

Eq. = equivalent

Table C-4

Irrigation Infiltration Rates over 1999 Retail and Industrial Area

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Retail/Industrial Area (in/yr)	Ratio Compared with 1999
1980	22,319	0.39	0.39
1981	24,822	0.43	0.43
1982	21,912	0.38	0.38
1983	21,386	0.37	0.37
1984	27,386	0.48	0.48
1985	28,482	0.5	0.5
1986	31,152	0.54	0.54
1987	33,877	0.59	0.59
1988	37,634	0.66	0.66
1989	42,813	0.75	0.75
1990	43,066	0.75	0.75
1991	39,793	0.7	0.7
1992	41,266	0.72	0.72
1993	43,352	0.76	0.76
1994	45,988	0.8	0.8
1995	45,673	0.8	0.8
1996	50,147	0.88	0.88
1997	54,173	0.95	0.95
1998	48,858	0.85	0.85
1999	57,250	1	1

Table C-5

Irrigation Infiltration Rates over 1999 Golf Course Areas

Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Total Water Use (AF/yr)	Eq. Infiltration over 1999 Golf Courses Area (in/yr)	Ratio Compared with 1999
1980	22,319	1.79	0.389
1981	24,822	1.99	0.433
1982	21,912	1.76	0.383
1983	21,386	1.72	0.374
1984	27,386	2.2	0.478
1985	28,482	2.29	0.498
1986	31,152	2.5	0.543
1987	33,877	2.72	0.591
1988	37,634	3.02	0.657
1989	42,813	3.44	0.748
1990	43,066	3.46	0.752
1991	39,793	3.2	0.696
1992	41,266	3.32	0.722
1993	43,352	3.48	0.757
1994	45,988	3.7	0.804
1995	45,673	3.67	0.798
1996	50,147	4.03	0.876
1997	54,173	4.35	0.946
1998	48,858	3.93	0.854
1999	57,250	4.6	1

Table C-6
Irrigation Infiltration Rates for Agricultural Lands
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Year	Agricultural Applied Water Volume (AF/yr)	Infiltration Rate (ft/yr)	Infiltration Rate for Modeled Acreage (ft/yr)	Percentage of 1996 through 2000 Average
1980	6,364	2.7	1.9	90
1981	7,433	3.1	2.2	106
1982	5,441	2.3	1.6	77
1983	4,487	1.9	1.3	64
1984	6,311	2.6	1.9	90
1985	5,241	2.2	1.5	74
1986	4,657	1.9	1.4	66
1987	3,662	1.5	1.1	52
1988	3,348	1.4	1.0	48
1989	3,511	1.5	1.0	50
1990	4,623	1.9	1.4	66
1991	3,958	1.7	1.2	56
1992	5,022	2.1	1.5	71
1993	4,508	1.9	1.3	64
1994	5,958	2.5	1.8	85
1995	6,276	2.6	1.8	89
1996	6,728	3.2	2.2	108
1997	7,528	3.0	2.1	102
1998	5,980	2.7	1.9	93
1999	7,479	2.9	2.1	99
2000	7,476	2.9	2.0	98
Average (1996 through 2000)	**7,038**	**2.9**	**2.1**	100

Note:
Actual acreage is 877 acres; modeled acreage is 1,205 acres.

TABLE C-7
Monthly Precipitation Measured at the Newhall County Water District Rain Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
1981	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
1982	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
1983	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
1984	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
1985	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
1986	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
1987	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
1988	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
1989	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
1990	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
1991	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
1992	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
1993	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
1994	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
1995	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
1996	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
1997	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
1998	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
1999	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05

Note:

All precipitation values are measured in inches.

TABLE C-8
Spatial Areas and Means of 1900 to 1960 Precipitation for Subwatersheds
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Canyon/Stream	Subwatershed Area (acres)	Contributing Area to Regional Model (acres)	Mean of Precipitation 1900 to 1960 within Each Contributing Area (in/yr)
Bee Canyon	1,163.38	970.06	11.41
Bouquet Canyon	11,995.90	9,100.66	14.09
Bouquet Canyon Tributary 1	409.84	291.36	12.81
Bouquet Canyon Tributary 2	683.75	577.67	13.25
Bouquet Canyon Tributary 3	459.20	393.53	13.18
Lower Castaic Creek	13,109.20	4,205.12	14.73
Upper Castaic Creek	98,417.60	98,417.60	19.62
Charlie Canyon	6,323.41	5,418.33	15.55
Dry Canyon	4,883.13	2,900.08	14.20
Gavin Canyon	3,608.62	2,913.39	21.32
Haskell Canyon	7,608.26	5,976.49	14.01
Hasley Canyon	5,609.59	385.96	14.25
Iron Canyon	1,734.63	1,401.94	18.92
Marple Canyon	6,031.13	4,980.94	17.09
Mint Canyon	5,711.30	4,155.07	12.45
Mint Canyon Tributary 1	615.56	367.82	12.14
Mint Canyon Tributary 2	1,697.89	1,438.90	12.22
Mint Canyon Tributary 3	304.45	296.87	12.61
Mint Canyon Tributary 4	234.88	231.90	12.93
Mint Canyon Tributary 5	118.01	114.80	13.01
Newhall Canyon	3,191.67	1,625.11	18.98
Oak Spring Canyon	3,628.60	2,721.91	16.21
Pico Canyon	4,404.42	2,853.93	19.47
Placerita Canyon	6,117.92	2,490.47	18.20
Plum Canyon	2,085.00	753.09	13.25
Pole Canyon	1,744.04	1,614.78	15.95
Potrero Canyon	2,865.18	1,074.76	15.88
Railroad Aqueduct Canyon	865.82	198.83	20.27

TABLE C-8
Spatial Areas and Means of 1900 to 1960 Precipitation for Subwatersheds
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Canyon/Stream	Subwatershed Area (acres)	Contributing Area to Regional Model (acres)	Mean of Precipitation 1900 to 1960 within Each Contributing Area (in/yr)
San Francisquito Canyon	31,388.60	26,878.10	16.51
San Martinez Canyon	2,117.60	1,384.49	13.67
Sand Canyon	5,489.51	4,191.58	19.39
Sand Canyon Road Tributary	554.03	508.56	13.12
Sand Canyon Tributary 1	644.26	251.41	15.97
Sand Canyon Tributary 2	338.66	221.79	16.99
Santa Clara River East	12,696.90	2,562.57	14.16
Santa Clara River West	17,105.90	3,169.86	13.76
Santa Clara River Tributary 1	1,278.18	927.13	16.97
Santa Clara River Tributary 2	277.82	264.96	13.64
Santa Clara River Tributary 3	219.50	189.19	13.65
Santa Clara River Tributary 4	101.25	91.84	13.54
Santa Clara River Tributary 5	114.80	106.31	13.44
South Fork Santa Clara River	5,491.11	655.74	17.62
Tapie Canyon	1,260.27	1,235.25	11.39
Texas Canyon	6,956.88	6,659.55	13.59
Tick Canyon	3,662.58	3,428.16	11.57
Tick Canyon Tributary	175.19	154.75	12.09
Towsley Canyon	3,681.64	3,606.56	21.43
Vasquer Canyon	2,743.26	2,151.81	12.66
Whitney Canyon	1,321.58	1,104.38	18.95
Area Totals	**293,241.89**	**217,615.36**	

TABLE C-9
Monthly Streamflows Measured in the Santa Clara River at the Lang Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
1981	594	98	339	240	107	18	18	12	338	321	258	394	2,739
1982	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
1983	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
1984	0	596	405	240	143	166	228	411	154	220	904	578	4,044
1985	483	461	274	215	77	0	0	0	12	179	221	301	2,224
1986	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
1987	117	117	65	31	12	0	0	0	0	0	258	516	1,116
1988	222	209	506	117	77	68	0	0	0	0	12	25	1,236
1989	50	111	60	25	6	0	0	0	102	94	34	18	499
1990	212	276	230	46	46	5	0	0	0	27	36	147	1,025
1991	162	775	879	736	145	142	14	0	45	69	62	263	3,291
1992	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
1993	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
1994	388	493	497	319	163	80	20	7	37	102	193	941	3,239
1995	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
1996	666	896	730	315	151	46	7	0	54	154	307	510	3,836
1997	517	346	140	85	33	5	4	50	66	240	566	809	2,859
1998	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
1999	92	85	204	224	197	107	80	46	52	54	31	80	1,252

Note:

All monthly streamflows are measured in acre-feet.

TABLE C-10
Monthly Releases of Water from Castaic Lagoon to Castaic Creek
Regional Groundwater Flow Model Report for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
1981	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1982	0	0	0	0	0	667	842	735	0	0	0	0	2,244
1983	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1987	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
1988	0	0	809	341	900	0	0	0	0	0	0	0	2,050
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	66	66
1992	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
1993	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
1994	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
1995	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
1996	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
1997	0	0	8701	873	0	0	0	0	0	0	0	310	9,884
1998	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
1999	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830

Note:

All monthly releases are measured in acre-feet.

TABLE C-11
Monthly Treated Wastewater Discharge Measured at the Valencia Water Reclamation Plant
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	266	258	257	239	247	212	219	219	212	228	239	247	2,844
1981	248	220	249	235	244	237	253	255	248	263	285	270	3,006
1982	275	247	284	271	277	269	275	268	254	266	271	284	3,241
1983	286	261	301	288	296	277	287	296	282	286	276	295	3,432
1984	303	281	304	294	321	315	320	317	314	322	315	319	3,723
1985	309	283	316	316	333	331	354	359	348	361	357	341	4,006
1986	350	341	374	359	377	380	415	454	446	440	421	445	4,801
1987	455	415	472	489	550	567	603	594	579	633	600	624	6,582
1988	622	557	588	587	603	537	575	606	587	608	600	602	7,072
1989	622	593	695	666	671	708	714	731	668	678	673	676	8,095
1990	698	644	725	695	666	693	725	714	692	700	658	680	8,290
1991	715	662	702	627	668	646	647	691	709	743	717	748	8,276
1992	777	777	819	813	824	800	853	869	818	828	811	786	9,775
1993	778	733	863	858	869	925	910	846	816	834	818	858	10,107
1994	722	729	809	776	802	761	771	764	739	763	735	760	9,132
1995	889	777	935	887	884	848	853	814	826	834	823	855	10,225
1996	893	838	935	890	902	876	903	891	886	817	810	816	10,456
1997	815	713	866	829	852	879	860	851	824	826	778	775	9,867
1998	778	787	955	955	984	965	1,136	1,139	1,020	993	911	906	11,529
1999	930	868	962	953	985	968	1,003	1,018	961	1,020	1,040	987	11,695

Note:

All monthly releases are measured in acre-feet.

TABLE C-12
Monthly Treated Wastewater Discharge Measured at the Saugus Water Reclamation Plant
Regional Groundwater Flow Model Report for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	362	365	419	414	419	387	362	362	350	362	359	371	4,529
1981	382	337	390	398	444	412	417	429	431	434	412	460	4,945
1982	445	399	456	444	446	434	434	421	415	434	431	438	5,196
1983	460	421	514	541	562	545	520	477	458	481	477	534	5,990
1984	558	505	499	485	476	443	458	456	451	467	474	519	5,791
1985	503	461	505	458	448	444	452	459	452	470	460	498	5,610
1986	498	475	528	501	499	483	481	476	500	511	518	552	6,023
1987	524	475	542	487	425	383	391	403	395	397	411	430	5,264
1988	443	411	439	434	440	430	445	457	435	464	436	460	5,294
1989	462	410	441	450	464	436	476	479	462	471	451	466	5,468
1990	463	403	432	426	483	492	513	504	489	493	508	512	5,718
1991	495	423	479	427	491	516	557	525	486	474	470	493	5,835
1992	488	507	530	472	489	476	493	521	492	498	452	514	5,931
1993	595	534	616	581	615	587	622	604	578	609	567	567	7,075
1994	601	606	694	677	687	644	642	645	619	663	655	685	7,817
1995	657	578	676	705	699	631	641	635	617	613	568	581	7,602
1996	532	504	525	501	517	506	511	525	532	579	558	583	6,375
1997	564	516	515	461	469	417	442	474	475	503	521	553	5,911
1998	529	541	544	511	617	587	426	399	457	501	521	533	6,166
1999	542	485	551	391	544	512	547	532	521	527	487	514	6,153

Note:

All monthly discharges are measured in acre-feet.

TABLE C-13
Monthly Streamflows Measured in the Santa Clara River at the County Line Gage
Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	8,428	43,565	18,125	8,551	3,792	3,963	1,202	1,111	1,668	1,470	1,452	1,884	95,211
1981	3,376	1,533	5,415	1,815	1,662	1,279	942	906	1,139	1,488	2,138	2,539	24,232
1982	2,826	2,358	5,572	7,091	3,909	1,749	1,694	1,392	1,597	1,621	3,449	3,229	36,488
1983	7,787	9,122	67,712	11,240	10,320	3,828	2,102	2,678	2,053	3,443	5,040	5,911	131,236
1984	5,691	3,931	4,084	4,530	2,309	1,607	1,224	1,511	1,464	1,624	3,237	8,067	39,279
1985	3,116	2,561	2,852	1,974	1,694	1,365	1,178	1,365	1,551	1,880	2,102	2,828	24,466
1986	3,955	13,991	10,616	3,328	2,612	1,622	1,454	1,482	1,870	1,896	2,606	2,590	48,024
1987	2,485	2,325	2,575	1,841	1,908	1,710	1,650	1,470	1,412	2,309	2,057	4,457	26,198
1988	3,421	2,981	3,025	3,172	2,636	2,231	1,734	1,494	1,605	1,904	2,027	10,381	36,611
1989	2,644	3,340	2,584	2,055	1,740	1,920	1,732	1,345	1,535	2,146	1,964	1,795	24,799
1990	2,709	3,247	2,269	1,898	1,730	1,545	1,478	1,751	1,668	1,660	1,924	1,593	23,472
1991	2,051	3,219	15,981	1,837	1,519	1,113	1,144	831	912	948	1,014	4,332	34,901
1992	3,737	37,636	9,576	4,439	1,964	1,533	1,377	1,085	1,129	1,329	1,496	3,277	68,577
1993	47,199	44,749	25,738	9,459	4,860	3,324	2,797	2,771	2,949	3,005	2,686	3,247	152,783
1994	3,281	3,437	3,501	3,533	3,519	2,200	1,640	1,400	1,192	1,855	2,263	4,219	32,039
1995	31,125	3,828	19,662	8,452	3,901	2,527	1,843	2,192	1,855	1,716	2,075	3,235	82,409
1996	3,604	10,669	7,678	6,073	3,584	1,678	1,640	1,579	1,509	2,625	1,590	5,701	47,930
1997	5,375	3,913	7,884	3,370	1,680	1,240	1,571	1,371	1,230	1,662	2,636	4,848	36,780
1998	5,875	104,388	25,377	9,378	34,992	5,312	3,935	3,537	2,579	2,450	2,890	4,427	205,139
1999	4,328	4,128	4,322	6,526	4,760	3,590	1,125	1,439	2,164	1,888	2,243	2,434	32,382

Note:

All monthly streamflows are measured in acre-feet.

Figures

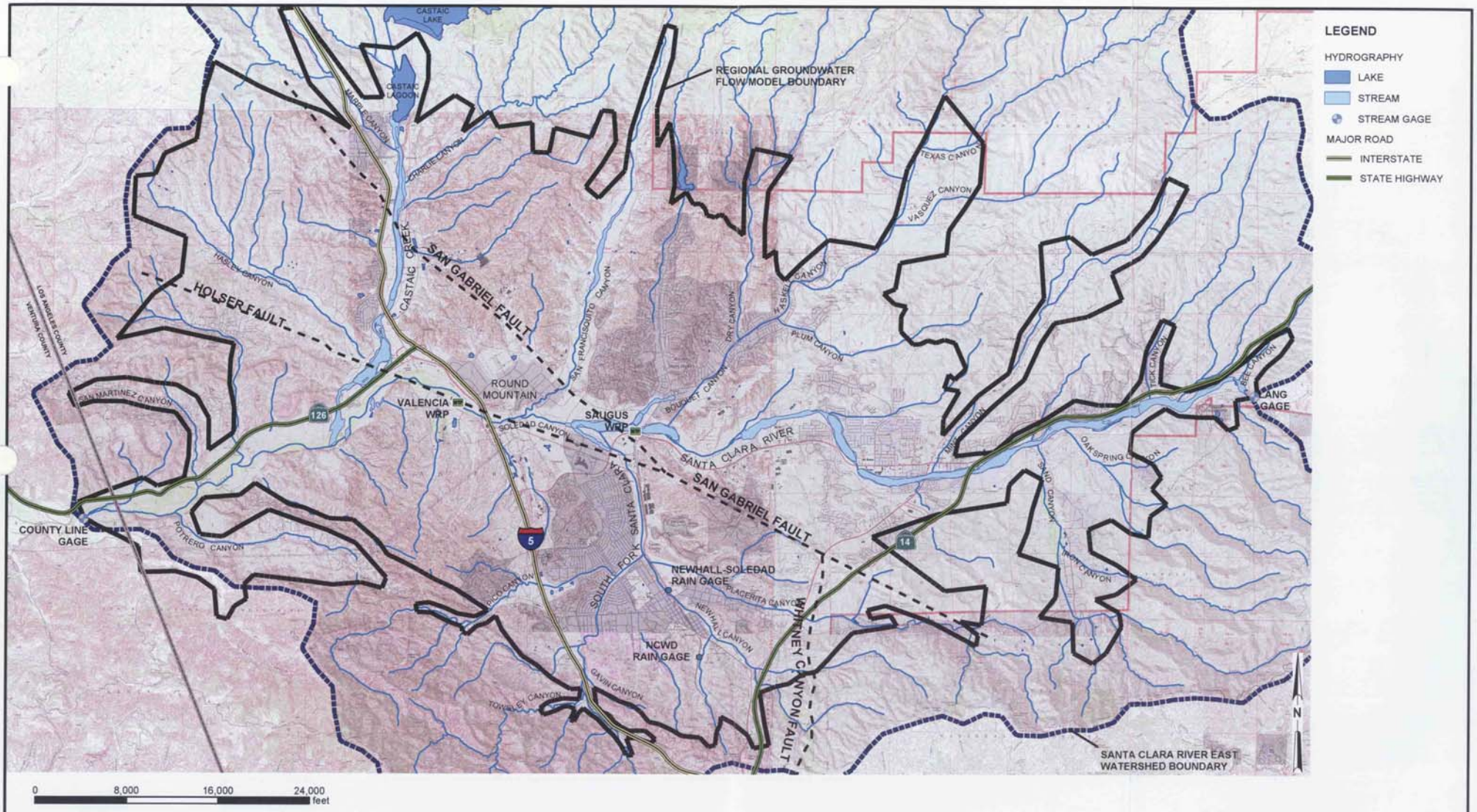

FIGURE C-1
MAP OF STUDY AREA
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIGC-01.MXD FIGC-01.PDF

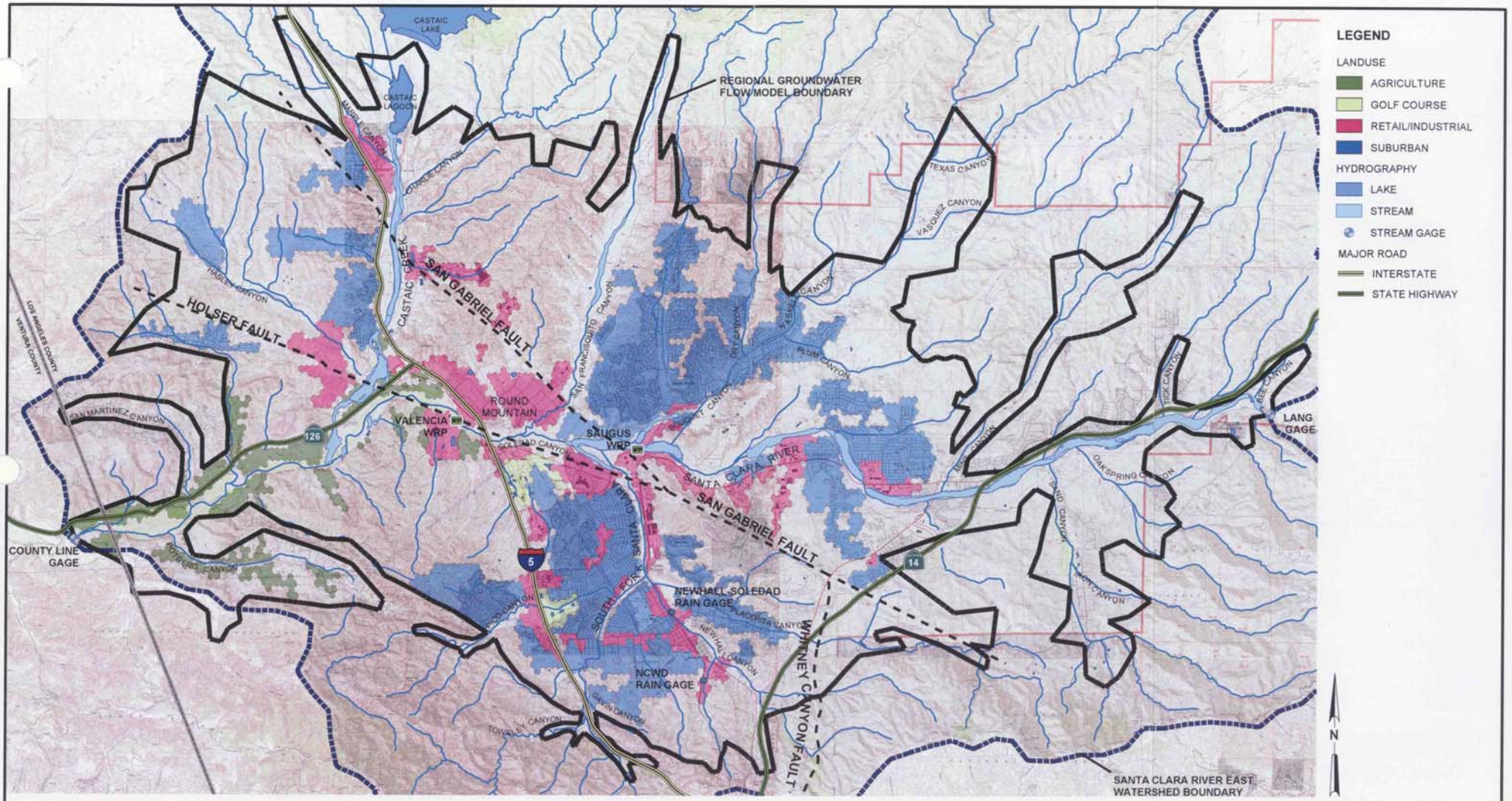

FIGURE C-2
LAND USE MAP
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\FIGC-06.MXD FIGC-02.PDF 02/03/2004 09:36:51

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Year	Acres				Acreage %		
	Alfalfa	Sudan	Vegetables	Total	Alfalfa	Sudan	Vegetables
1996	105	170	537	812	12.9%	20.9%	66.1%
1997	160	103	663	926	17.3%	11.1%	71.6%
1998	115	100	590	805	14.3%	12.4%	73.3%
1999	55	150	709	914	6.0%	16.4%	77.6%
2000	55	150	722	927	5.9%	16.2%	77.9%
Average	**98**	**134.6**	**644.2**	**876.8**	**11.3%**	**15.4%**	**73.3%**

Year	CIMIS AF/yr		
	Alfalfa	Sudan	Vegetables
1996	10.21	10.21	7.3
1997	10.22	10.22	7.3
1998	9.4	9.4	6.71
1999	10.51	10.51	7.51
2000	10.37	10.37	7.41
Average	**10.142**	**10.142**	**7.246**

Year	Water Use (AF/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	1,072	1,736	3,920	6,728
1997	1,635	1,053	4,840	7,528
1998	1,081	940	3,959	5,980
1999	578	1,577	5,325	7,479
2000	570	1,556	5,350	7,476
Average	**987**	**1,372**	**4,679**	**7,038**

Data Source: Appendix 2.5(m) of
Draft Additional Analysis to the Newhall Ranch Specific Plan and Water Reclamation Plant, Final Environmental Impact Report
Impact Sciences, Inc., April 2001)

Crop Efficiency		
Alfalfa	Sudan	Vegetables
50%	50%	70%

Year	Estimated Infiltration (AF/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	536	868	1,176	2,580
1997	818	526	1,452	2,796
1998	541	470	1,188	2,198
1999	289	788	1,597	2,675
2000	285	778	1,605	2,668
Average	**494**	**686**	**1,404**	**2,583**

Year	Estimated Infiltration (AF/acre/yr)			
	Alfalfa	Sudan	Vegetables	Total
1996	5.1	5.1	2.2	3.2
1997	5.1	5.1	2.2	3.0
1998	4.7	4.7	2.0	2.7
1999	5.3	5.3	2.3	2.9
2000	5.2	5.2	2.2	2.9
Average	**5.1**	**5.1**	**2.2**	**2.9**

This represents the average deep percolation on irrigated acreage during the past 5 years, consistent with the water application of an average 7,038 AF/yr during this period. Values are in AF/acre/year, which is equivalent to feet/year.

FIGURE C-3
ANALYSIS OF AGRICULTURAL WATER USE AND ASSOCIATED INFILTRATION TO GROUNDWATER
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-409.xls\FigureC-3

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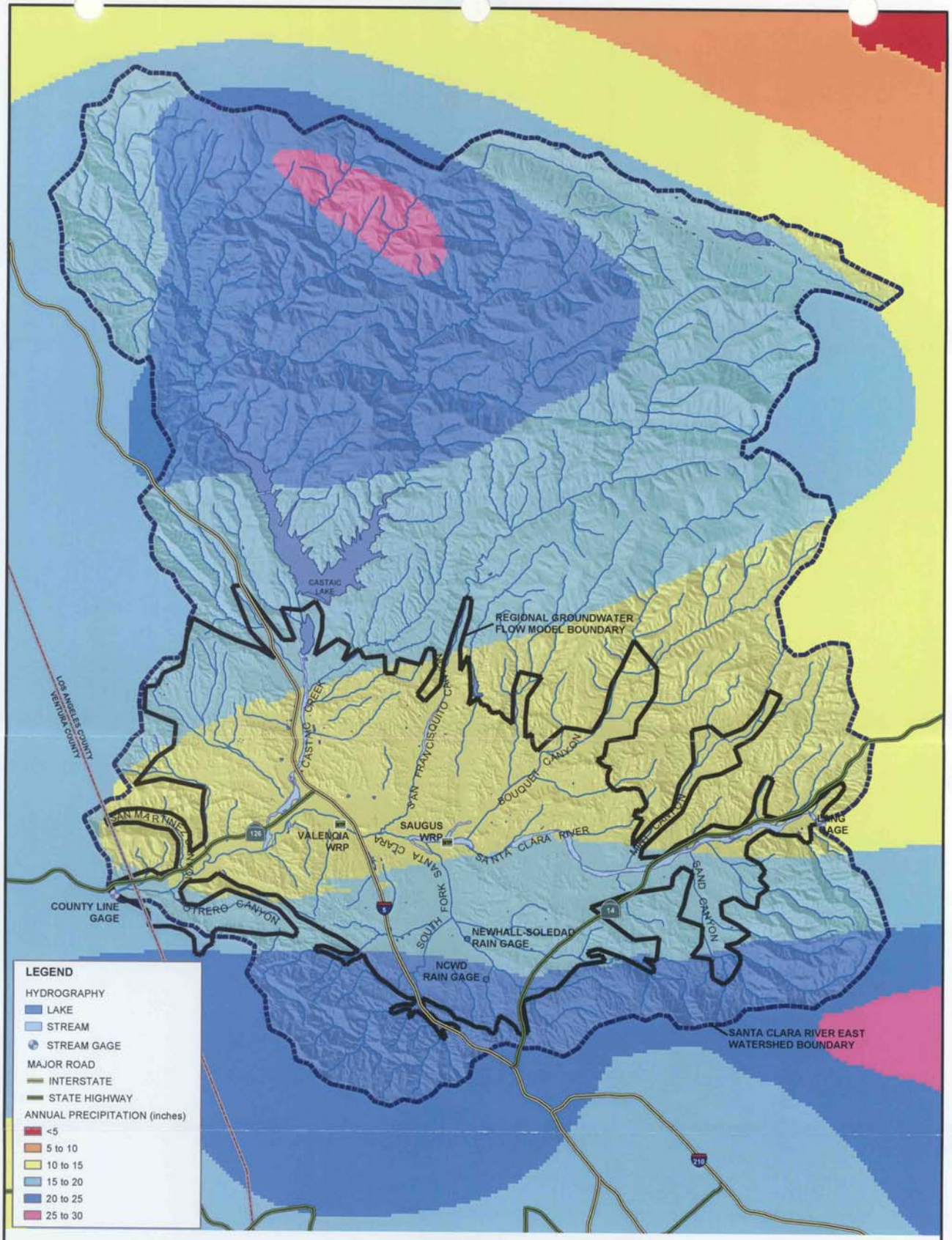

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

N

0 2.5 5 miles

FIGURE C-4
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\ODIN\PROJ\255\SANTACLARITA_MOU\FIGURES\MXD\FIGC-07.MXD FIGC-07.PDF

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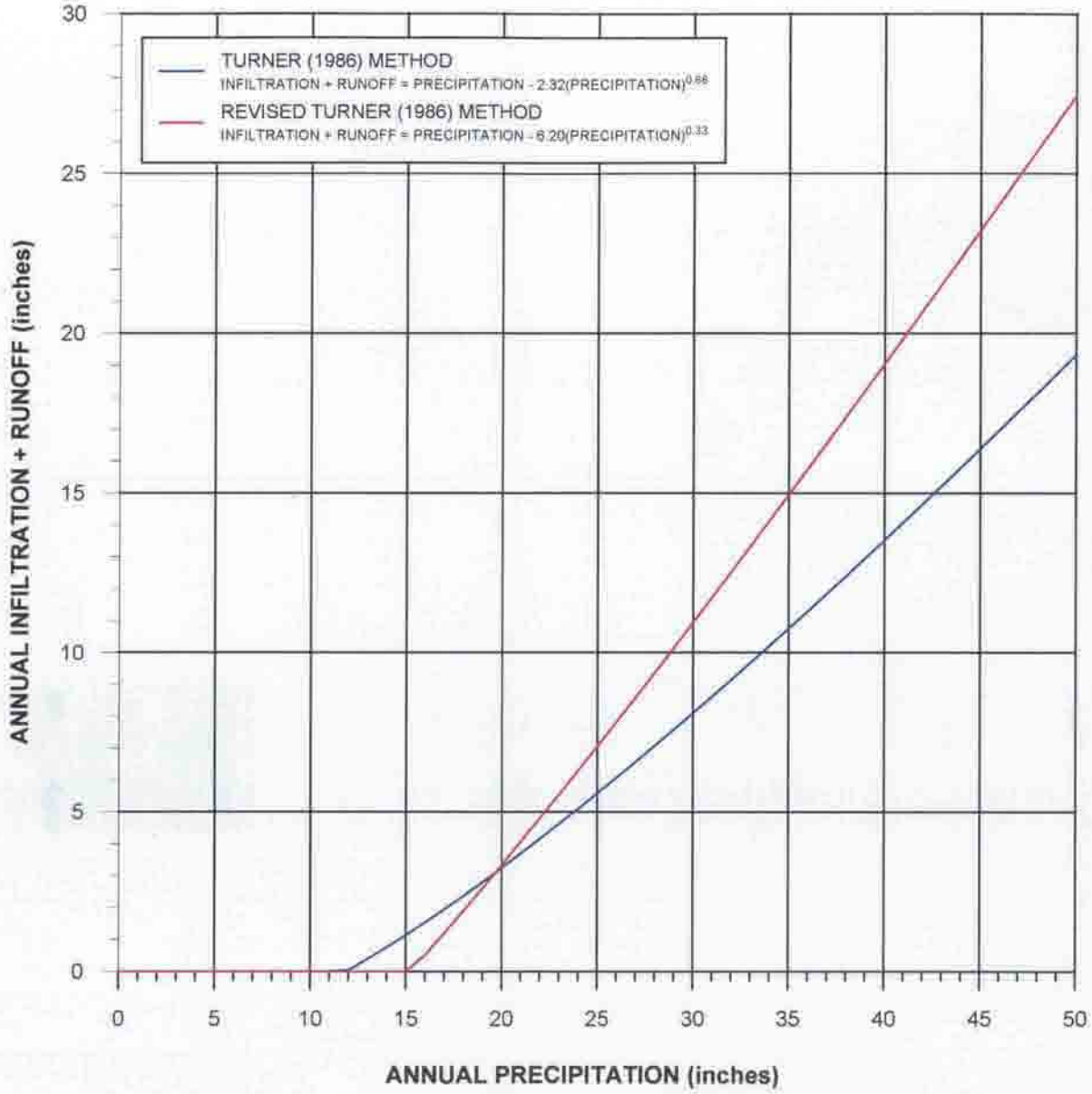

SOURCE:

TURNER, K.M. 1986. WATER LOSS FROM FOREST AND RANGE LANDS IN CALIFORNIA. *IN* PROCEEDINGS OF THE CHAPPARRAL ECOSYSTEMS CONFERENCE, SANTA BARBARA, CALIFORNIA, MAY 16-17, 1986, J. DEVRIES (EDITOR). WATER RESOURCES CENTER, REPORT 62, UNIVERSITY OF CALIFORNIA-DAVIS, CALIFORNIA, PP. 63-66.

FIGURE C-5
INFILTRATION AND RUNOFF AS A FUNCTION OF PRECIPITATION
REGIONAL GROUNDWATER MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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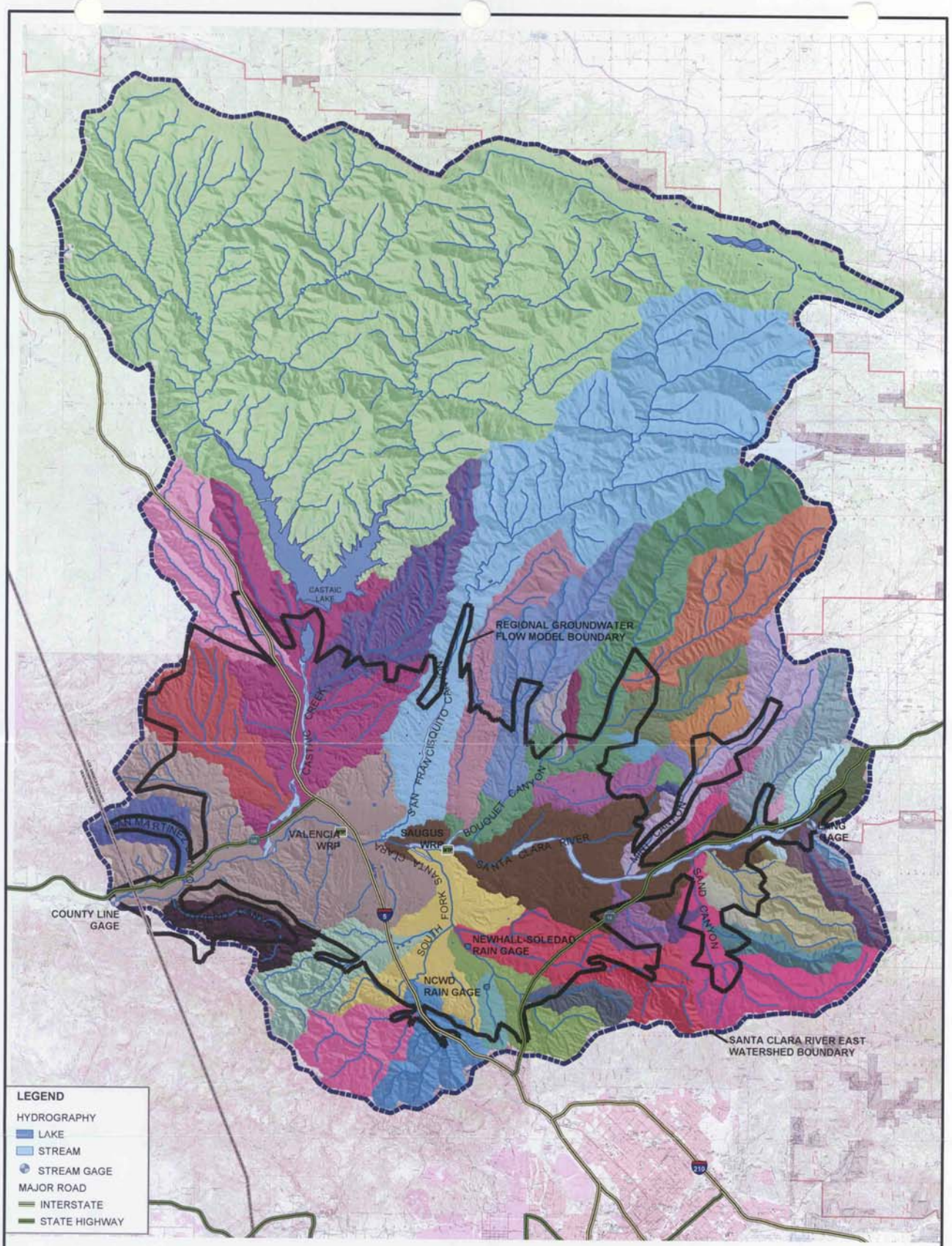

FIGURE C-6
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
REGIONAL GROUNDWATER FLOW MODEL
REPORT FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

RDD \\RCD31\0025405\SANTACLARITA_MOU\FIGURES\MXD\FIGC-06.MXD FIGC-06.PDF 01/22/2004 08:19:58

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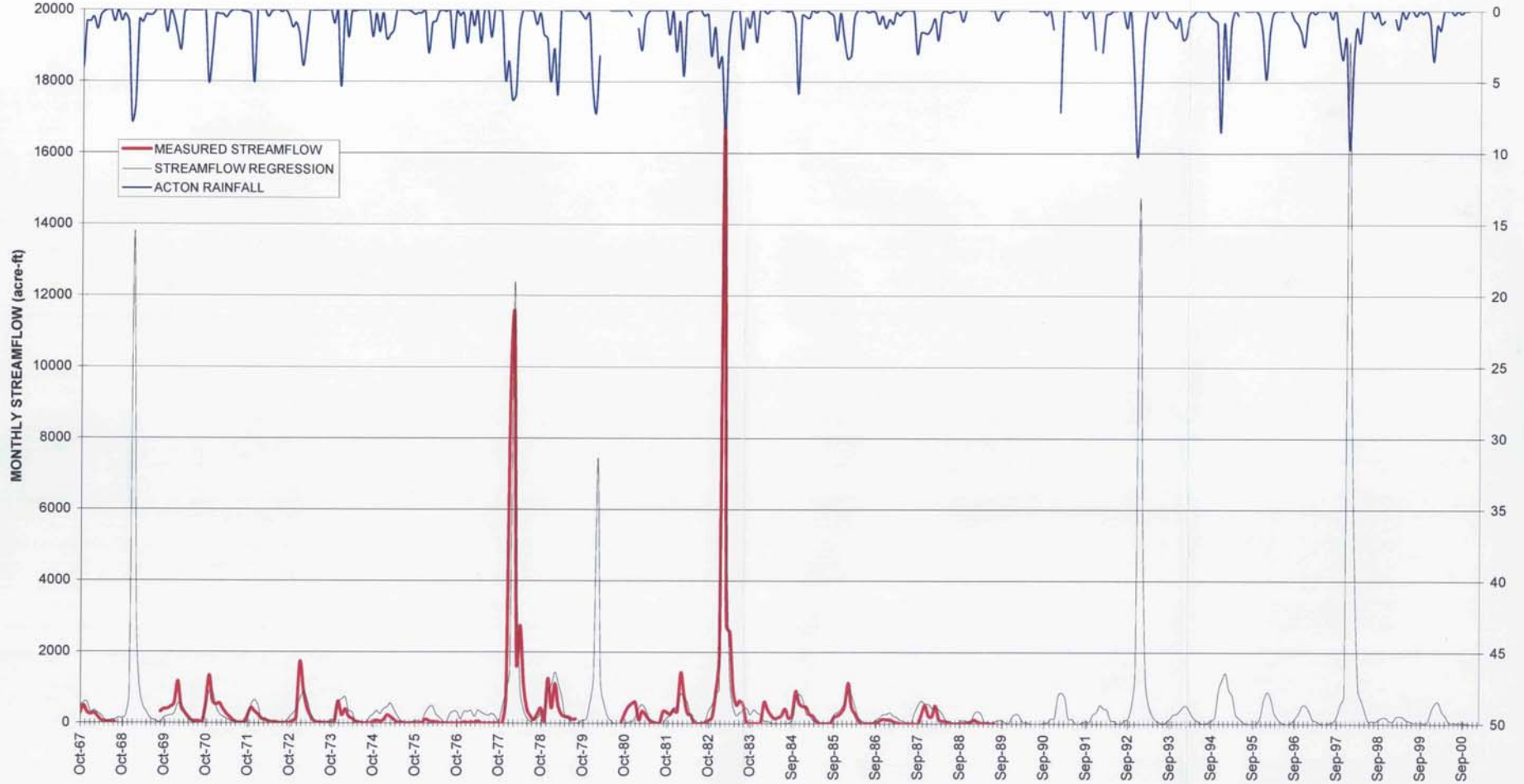

REGRESSION EQUATION:
MONTHLY STREAMFLOW AT LANG = 90.00*1 mo + 120.00*2 mo + 100.00*3 mo + 20.00*4 mo + 20.00*5 mo + 2.00*6 mo

FIGURE C-7
SANTA CLARA RIVER STREAMFLOW REGRESSION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-408.xls/FIG C-7

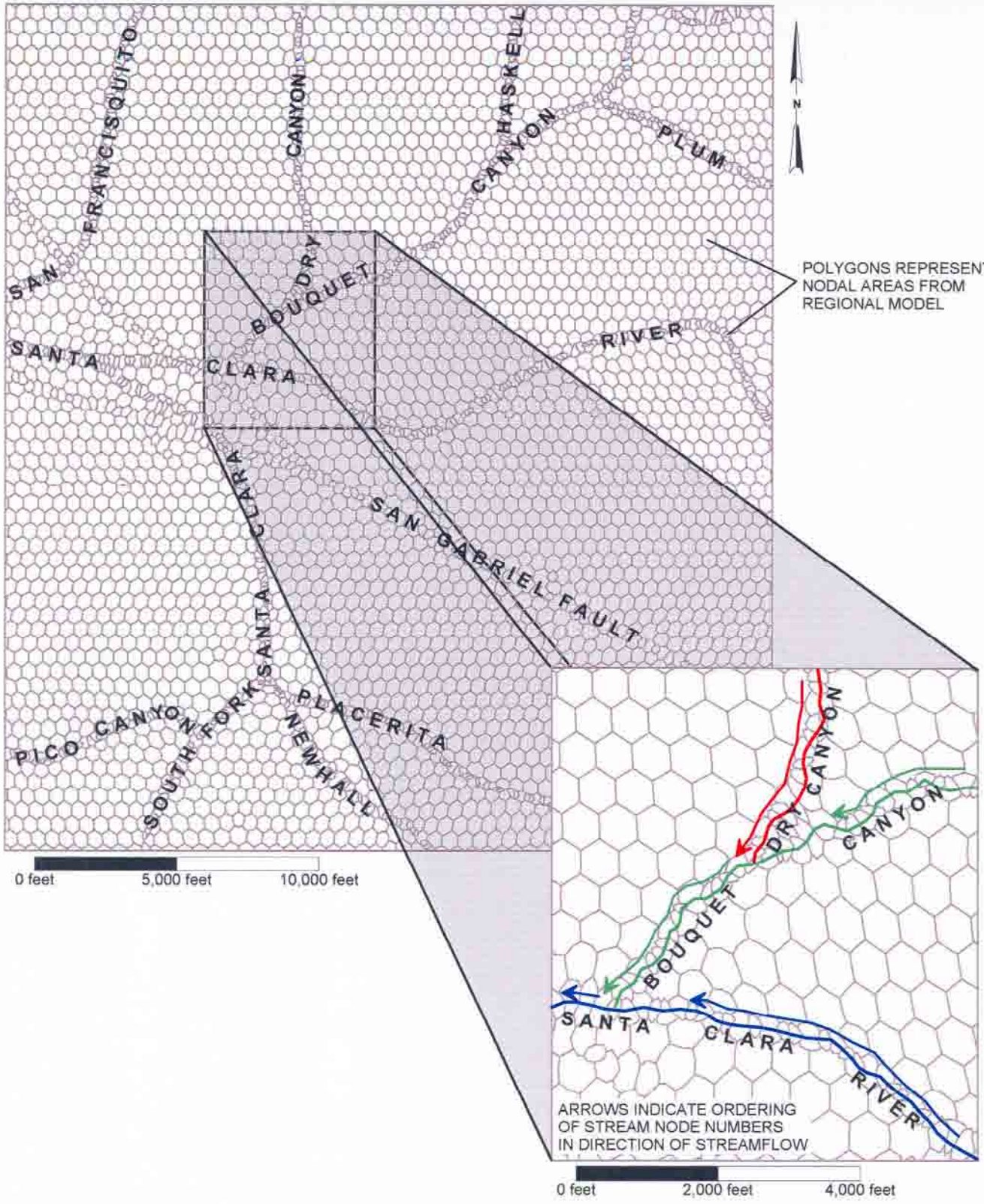

FIGURE C-8
MAP SHOWING EXAMPLE OF STREAM RANKING
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

CH2MHILL

178973-401.SRF

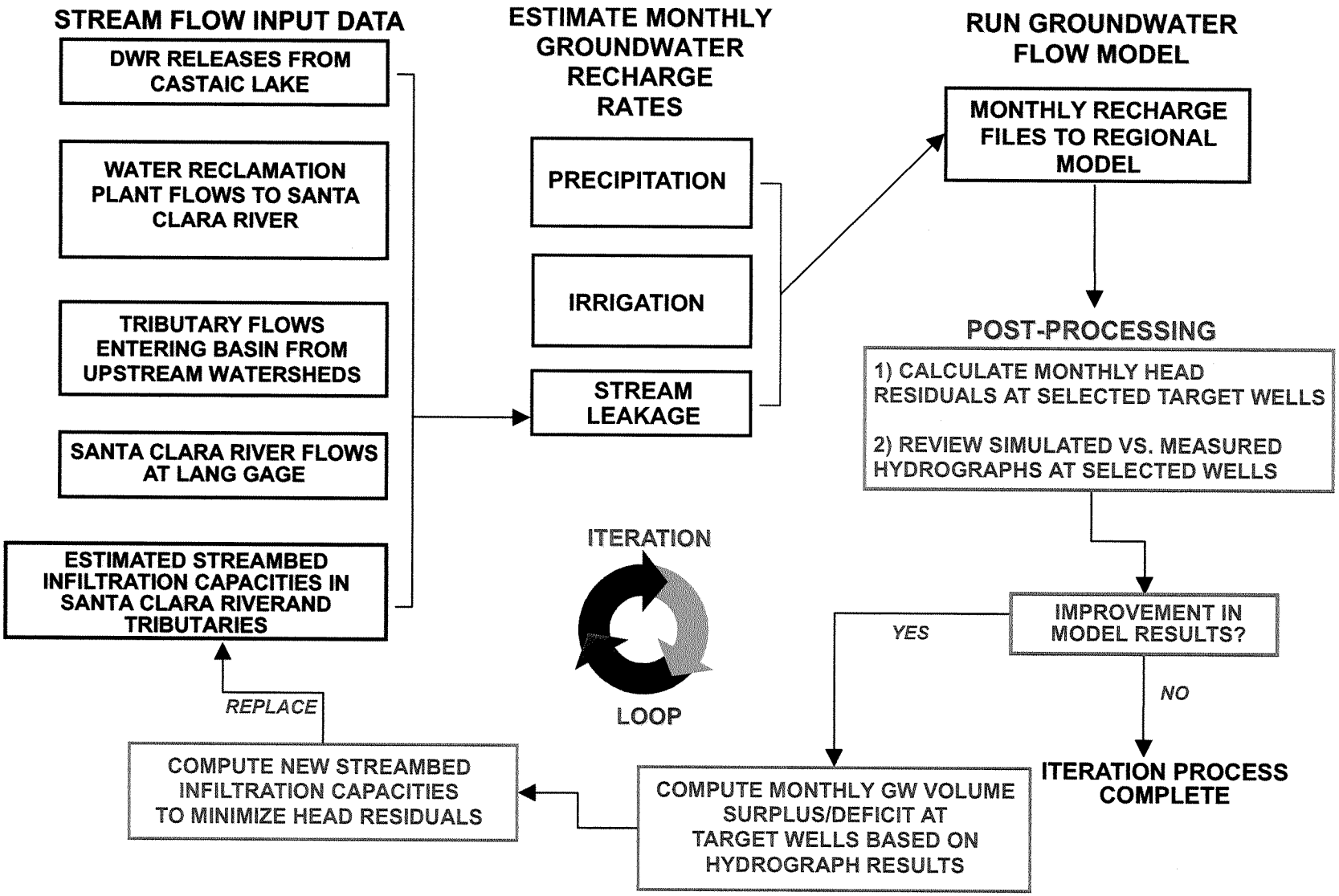

FIGURE C-9
FLOW CHART SHOWING ITERATIVE PROCESS USED TO VARY STREAMBED INFILTRATION CAPACITIES DURING MODEL CALIBRATION
REGIONAL GROUNDWATER FLOW MODEL
FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-002.FH9

CH2MHILL

Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

PREPARED FOR: The Santa Clarita Valley Water Purveyors

PREPARED BY: John Porcello/CH2M HILL
Nate Brown, P.G./CH2M HILL

DATE: August 2005

PROJECT NUMBER: 178973.A4.02

Introduction

The Santa Clarita Valley Regional Groundwater Flow Model (hereafter referred to as the Regional Model) is a three-dimensional, numerical model of groundwater flow in the Santa Clara River Valley Groundwater Basin, East Subbasin, which is located in the northwestern portion of Los Angeles County, California. As shown on Figure 1, the Regional Model simulates groundwater flow for the area occupied by the local groundwater aquifers, which consist of the shallow Alluvial Aquifer and the deeper Saugus Formation (tables and figures are located at the end of this technical memorandum). The Regional Model was developed as part of the work scope contained in an August 2001 Memorandum of Understanding that was entered into by the Upper Basin Water Purveyors (hereafter referred to as the Purveyors[1]) and the United Water Conservation District, located downstream in Ventura County.

The construction and calibration of the Regional Model are described in detail in the *Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California* (CH2M HILL, 2004a). As discussed in that report, calibration of the Regional Model was performed for the period 1980 through 1999. This technical memorandum describes a recent extension of the model to simulate observed conditions in the basin during the period from January 2000 through February 2005. The purpose of the simulations was to update and test the model's calibration against an independent data set consisting of the recently observed hydrologic and pumping conditions in the basin. Following are discussions of the design of the simulation for this extended period and the findings.

[1]The Upper Basin Water Purveyors consist of the Castaic Lake Water Agency (CLWA), the Santa Clarita Water Division of CLWA (formerly called the Santa Clarita Water Company [SCWC]), the Newhall County Water District (NCWD), and the Valencia Water Company (VWC).

Simulation Design

The calibration update process consisted of transient modeling that simulated monthly variations in pumping from, and recharge to, the Alluvial Aquifer and the Saugus Formation during the period January 2000 through February 2005. As with the original calibration effort, simulation results were compared to measured fluctuations in groundwater elevations and streamflows in the Santa Clara River.

Hydrologic input data for the calibration update simulation were as follows:

1. Groundwater pumping data were provided by the Purveyors for each production well. Tables 1 and 2 show annual pumping for the Alluvial Aquifer and Saugus Formation, respectively, from 1980 through 2004. As with the initial model calibration effort, the monthly distribution of pumping was defined from information on the monthly distribution of urban and agricultural water demands, as listed in Table 3.

2. Groundwater recharge was defined using a Surface Water Routing Model (SWRM) that was written specifically for the Regional Model during the original model development effort (see Appendix C of CH2M HILL, 2004a). The SWRM defined recharge from applied water use (i.e., irrigation)[2]; direct precipitation within the model domain (see Table 4); Santa Clara River flows into the valley as measured at the Lang stream gage (see Table 5); SWRM-estimated stormwater inflows into the model domain along ephemeral streams that are tributaries to the Santa Clara River; measured volumes of treated water discharge into the Santa Clara River from two Los Angeles County Sanitation District water reclamation plants (WRP) (see Tables 6 and 7); and water released from Castaic Lagoon into Castaic Creek by the California Department of Water Resources (see Table 8).

As discussed in two recent reports (CH2M HILL, 2004b and 2005) that were prepared after the model development report (CH2M HILL, 2004a) was completed, the boundary condition in the Alluvial Aquifer at the Lang gage was converted to a constant-head boundary shortly after completion of the model development report. This change was made based on field reconnaissance that was performed in April and May 2004, when the Santa Clara River was dry at the Lang gage. At that time, groundwater was locally discharging from the bed of the Santa Clara River in isolated locations where the riverbed intersects the water table, then seeping back into the riverbed nearby. Significant phreatophyte growth was also present along the riverbed in this same area (just downstream of the Lang gage). Additionally, water was present and actively flowing in the river east (upstream) of the Santa Clarita Valley, in the area between the Santa Clarita Valley and the upstream Acton Basin. Based on these observations, a specified groundwater elevation of 1,746 feet was established in the Alluvial Aquifer at the eastern boundary of the Regional Model to simulate subsurface flow beneath the channel of the Santa Clara River at the Lang gage. This specified elevation was held constant throughout the simulation period. Because of this change to the Regional Model, the simulation was performed for the entire calibration period (January 1980 through February 2005).

[2]Infiltration of applied water was simulated in the same locations as in the original model calibration effort, and at the 1999 rates described in the model development report (CH2M HILL, 2004a). These rates were 24.7 inches per year (in/yr) for irrigated agricultural land, 2.2 in/yr for residential areas, and 1.0 in/yr for retail/industrial lands and golf courses.

The simulation results were compared with hydrographs of measured groundwater elevations at production wells and other wells with long-term groundwater elevation data; measured flows in the Santa Clara River at the west end of the basin (at the County Line gage; see Table 9); and estimated volumes of groundwater discharge to the Santa Clara River (see Table 10). These comparisons are discussed in the following section.

Simulated and Measured Groundwater Elevations Trends

Simulated groundwater elevation trends were compared with data collected at specific Alluvial Aquifer wells (see Figure 2) and Saugus Formation wells (see Figure 3) where long-term records of groundwater elevations were available. These wells are referred to herein as target wells. As discussed in the model development report (CH2M HILL, 2004a), the calibration goal at target wells was to simulate groundwater elevations that were higher than the pumping elevations and as close as possible to the static elevations. Therefore, the hydrographs show the model-simulated groundwater elevations, the measured static groundwater elevations, and, for production wells, the measured pumping groundwater elevations. Additionally, the comparison of time-varying simulated and measured groundwater elevations was equally focused on the slopes of the hydrographs, not just the absolute values of the groundwater elevations at any given time.

Figures 4 through 8 show simulated and measured groundwater elevation hydrographs at target wells in specific geographic areas where the Alluvial Aquifer is present. The hydrographs and principal observations about the calibration quality in each area are as follows:

1. Along the Santa Clara River, west of Interstate 5, Figure 4 shows that simulated groundwater elevations were generally stable in this area during both the original calibration period (1980 through 1999) and the calibration update period (January 2000 through February 2005). However, few groundwater elevation measurements are available in this area for evaluating calibration quality during the latter period.

2. Along the Santa Clara River between Interstate 5 and Soledad Canyon, Figure 5 shows that the Regional Model closely simulates the trends at the three wells where data were collected before and after January 2000 (wells VWC-I, VWC-N, and VWC-Q2). This includes the general decline in groundwater elevations from 1998 through 2003, the more stable elevations in late 2003 and much of 2004, and the steep rise in elevations that began at the end of 2004.

3. Along the Santa Clara River in Soledad Canyon, Figure 6 shows that in the western portion of the canyon, the Regional Model simulates somewhat less decline in water levels during 2003 and 2004 than was observed at three wells (SCWC-Stadium, SCWC-Honby, and VWC-T2). However, the Regional Model simulates the steep declines seen elsewhere in the canyon in most of the production wells (such as SCWC-Mitchell and SCWC-Lost Canyon 2), including at the production wells where pumping has historically been reduced when groundwater elevations decreased during local drought periods. At these wells, the hydrographs show that the Regional Model closely simulates the slopes in the groundwater elevation hydrographs during dry and wet periods, and does not overestimate groundwater elevations during droughts.

4. Along Castaic Creek, Figure 7 shows that the Regional Model simulates groundwater elevations that are too high in early 2001 at three wells located in the upper reaches of the valley (production well NWCD-Castaic3 and other wells 6980E and 6981D). However, the subsequent declines in simulated groundwater elevations at these wells are similar to observed declines. In the lower reach of the valley, the simulated groundwater elevations and elevation trends at well VWC-D closely match the measured data.

5. In other tributary canyons to the Santa Clara River, Figure 8 shows a good match between simulated and measured groundwater elevations at well VWC-W6 in San Francisquito Canyon through May 2002, when data collection ended at this well. In Bouquet Canyon, the simulated groundwater elevations are too high in production well SCWC-Clark beginning in 1997, but agree more closely with observations at well 7066D, located farther downstream in the canyon. Farther east, well 7188A in Sand Canyon shows agreement between simulated and measured groundwater elevations and elevation trends.

In the Saugus Formation, the target wells are located along the South Fork Santa Clara River, as shown on Figure 3. Figure 9 shows the simulated and measured hydrographs for the Saugus Formation target wells. In general, the Regional Model simulates the trends in groundwater elevations quite well at each Saugus production and monitoring well. The trends (hydrograph slopes) are particularly close in the NCWD wellfield at observation well 5851 and NCWD production wells 10 through 13. Farther downgradient, the Regional Model tends to slightly over-predict groundwater elevations in the VWC and SCWC production wells (VWC-157, VWC-201, SCWC-Saugus1, and SCWC-Saugus2). However, the Regional Model closely simulates the groundwater elevation trends at each of these locations, which is the primary consideration for evaluating the quality of the transient calibration process in the Saugus Formation.

Simulated and Measured Flows in the Santa Clara River

Figure 10 compares the simulated and measured total flows of the Santa Clara River at the County Line gage. The figure contains both a linear and a semi-logarithmic plot to better illustrate how the simulated and measured flows compare during low-flow periods in the river. The figure shows that the Regional Model adequately replicates seasonal cycles of low and high river flows during the calibration update period (January 2000 through February 2005), as it did for the original calibration period (1980 through 1999), although seasonal low flows during the summer months are slightly over-predicted.

Figure 11 compares the model-simulated groundwater discharges to the river with the discharges that have been estimated from hydrograph separation techniques (see Section 2.6.2.5 of the model development report [CH2M HILL, 2004a]). Because of uncertainty in the amount of treated water that infiltrates the streambed, Figure 11 displays a range for the estimated values, varying according to how much treated Saugus WRP water is estimated to infiltrate to groundwater as it travels down the Santa Clara River. As with the analysis in the model development report, it was estimated that the infiltration could be negligible (blue line) and would be unlikely to exceed 75 percent of the Saugus WRP discharge (green line). As shown on Figure 11, the Regional Model predicts higher rates of

groundwater discharge during the driest months of the year than those estimated from the County Line gage data. However, the Regional Model simulated the predominantly low total river flow (Figure 10) and groundwater discharge (Figure 11) that occurred from mid-1998 through most of 2004. As discussed in the model development report, it is likely that differences between modeled and measured total river flows and measured versus estimated groundwater discharges result from uncertainties in both the Regional Model and the gage data at the County Line during periods of low river flows.

Water Budget

Table 11 summarizes the groundwater budget for each year of the 25-year transient model simulation period (1980 through 2004). Figures 12 and 13 show the annual groundwater recharge and groundwater discharge rates, respectively. Figure 14 shows the change in groundwater storage each year, and Figure 15 shows the cumulative change in groundwater storage during the simulation period. The plots show that groundwater recharge from rainfall and stream leakage were generally less during the calibration update period than during the mid-1980s and several years during the 1990s. Year-to-year fluctuations in groundwater discharge continued to be less variable than year-to-year fluctuations in groundwater recharge. The volume of groundwater in storage generally declined from mid-1998 through 2004 because of the below-normal rainfall that occurred during this period.

Conclusions

The Regional Model calibration was extended an additional 62 months (from January 2000 through February 2005) to update and test the model's calibration against an independent data set consisting of recently observed hydrologic and pumping conditions in the basin. Additionally, the simulation was repeated for the initial calibration period (January 1980 through December 1999) because of a change in the boundary condition at the east end of the basin in the Alluvial Aquifer.

Examination of groundwater elevation hydrographs for the Alluvial Aquifer and the Saugus Formation indicates that the Regional Model has a similar overall ability to simulate conditions during the calibration update period as for the preceding 20-year period to which it was originally calibrated. Specifically, the transient model simulates trends in groundwater elevations and Santa Clara River flows that are generally well matched with observed trends. In Soledad Canyon, where local droughts have sometimes affected the Upper Basin Water Purveyors' ability to pump groundwater from the Alluvial Aquifer, the Regional Model simulates the trends in groundwater elevations particularly well and does not over-predict groundwater elevations. In the Saugus Formation, the groundwater elevations and elevation trends are closely matched at most wells where data are available. Consequently, the process of updating the Regional Model's calibration for the most recent 5-year period has confirmed that the model is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies.

References

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Tables

TABLE 1

Annual Groundwater Pumping from the Alluvial Aquifer

Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
NCWD	Castaic1	244	257	253	189	251	274	295	450	520	478	444	561	515	458	496	401	385	535	166	426	118	345	385	561	456
	Castaic2	124	48	0	0	0	0	380	535	324	678	0	0	0	477	518	380	327	268	257	331	289	166	0	123	403
	Castaic3	0	108	136	172	240	301	0	0	324	0	660	532	488	0	0	0	0	0	0	0	0	0	0	0	0
	Castaic4	0	0	0	0	0	0	0	0	0	39	0	0	0	0	0	0	0	95	57	6	7	100	47	56	80
	Pinetree1	346	326	355	242	148	273	8	0	2	152	0	47	16	247	154	79	64	89	227	403	245	164	0	0	0
	Pinetree2	58	84	209	112	154	113	206	309	351	348	31	0	283	326	218	165	70	0	0	0	0	0	0	0	0
	Pinetree3	398	527	225	432	753	655	719	756	758	672	801	724	682	450	607	595	624	812	716	505	494	566	544	525	643
	Pinetree4	0	0	0	0	3	28	234	77	4	0	0	0	10	19	232	55	333	510	338	5	355	300	5	0	0
NLF	161	317	370	271	223	314	220	170	0	0	0	120	82	401	753	791	0	0	0	0	123	328	496	485	2,021	1,834
	B10	0	0	0	0	0	0	0	0	0	0	0	291	1,225	452	1,406	894	1,045	930	1,244	1,155	1,446	1,240	534	344	589
	B11	186	217	159	133	184	138	60	0	0	127	445	311	0	136	51	127	151	30	250	212	87	205	232	271	338
	B5	1,218	1,423	1,041	858	1,208	772	1,178	1,002	1,481	1,928	1,893	1,880	860	989	1,950	1,921	1,649	1,756	1,273	1,748	2,008	1,680	2,280	1,582	2,166
	B6	858	1,002	733	604	850	543	946	788	165	96	137	263	615	283	808	1,359	1,421	1,602	1,572	2,133	870	1,312	2,175	1,766	1,356
	B7	0	0	0	0	0	0	60	0	0	127	0	0	400	180	581	373	56	286	176	444	461	474	584	402	71
	C	723	845	618	510	717	575	660	387	418	557	338	226	756	1,024	417	1,324	715	1,126	598	716	1,034	1,319	1,720	1,373	1,202
	C3	196	229	168	138	195	140	254	63	130	71	134	48	197	259	582	333	397	355	378	619	441	93	192	186	59
	C4	260	304	222	183	258	196	137	25	30	7	213	225	166	12	108	150	293	483	609	819	1,078	1,028	809	764	274
	C5	459	536	392	323	455	359	328	191	198	154	147	250	428	414	394	472	676	894	628	685	605	680	850	622	649
	C6	203	237	174	143	201	166	161	103	117	77	59	123	0	0	0	360	229	226	128	154	164	231	241	108	119
	C7	575	671	491	405	570	354	195	192	318	337	339	220	427	279	625	778	582	779	779	1,167	503	741	866	443	369
	C8	0	0	0	0	0	0	0	0	0	0	0	0	126	254	166	199	458	432	179	236	241	286	593	408	390
	E	2,067	2,416	1,767	1,457	2,051	3,342	1,842	1,180	812	624	965	498	1,325	1,513	1,022	1,366	2,542	1,949	1,522	2,506	2,084	1,691	16	28	0
	E2	174	203	149	123	173	138	103	0	0	251	1,284	830	560	584	555	115	669	525	426	138	125	141	55	14	463
	E3	0	0	0	0	0	0	0	0	0	0	0	0	0	15	138	0	0	0	0	0	0	0	0	0	0
	E4	1,011	1,181	864	712	1,003	639	716	83	566	392	553	284	376	16	0	381	140	339	80	281	66	0	0	0	0
	E5	0	0	0	0	0	0	0	0	0	0	0	0	65	274	0	142	514	598	42	0	47	172	679	537	284
	E7	0	0	0	0	0	0	0	0	0	0	0	0	116	80	105	88	79	2	0	0	0	0	0	0	0
	E9	96	113	82	68	96	78	117	288	476	411	339	596	252	187	435	319	12	142	170	42	38	238	814	47	609
	G45	324	378	277	228	321	179	153	98	123	99	143	146	165	82	144	137	159	180	144	231	197	291	283	60	0
	Q	441	515	377	311	438	159	360	382	312	185	15	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	R	0	0	0	0	0	0	0	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	R2	159	186	136	112	158	71	104	47	0	0	0	87	0	0	0	0	0	0	0	0	0	0	0	0	0
	S	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	S2	293	342	250	206	290	95	0	958	0	0	503	0	0	0	0	0	0	0	0	276	237	0	0	0	0
	S3	655	765	560	461	649	327	124	0	0	0	29	37	52	99	87	109	97	55	10	3	0	0	0	0	0
	Topco 1	0	0	0	0	0	0	0	0	0	0	0	0	75	0	0	0	0	0	0	0	0	0	0	0	0
	Topco 2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	W4	303	354	259	213	300	138	60	1	0	300	157	252	1	0	36	5	128	29	20	3	0	46	1	0	0
	W5	553	646	472	389	548	191	315	205	308	192	0	175	0	0	0	0	0	0	0	21	17	276	104	23	0
	X3	260	304	222	183	258	508	244	314	497	308	412	215	350	135	205	222	8	108	22	112	10	12	0	0	6
SCWC	Clark	303	228	131	137	194	200	208	342	248	301	407	542	662	635	572	662	1,027	873	697	878	747	696	782	712	728
	Guida	1,058	795	457	477	677	698	221	569	158	530	676	801	978	895	942	744	1,252	1,479	1,274	1,556	853	1,047	1,320	1,230	1,432
	Honby	594	447	257	268	381	392	193	391	462	216	930	893	731	1,393	476	553	352	814	532	1,162	815	721	696	874	707
	Lost Canyon 2	1,083	814	468	489	693	714	765	923	787	588	601	404	465	692	669	773	678	792	757	946	708	741	730	644	785
	Lost Canyon 2A	0	0	0	0	0	0	0	0	0	0	293	832	1,284	1,080	1,383	1,230	1,370	1,055	973	890	998	1,034	905	593	756
	Methodist	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Mitchell	1,189	893	515	537	761	785	444	582	485	435	264	3	474	663	564	610	598	633	482	913	439	407	293	19	54
	N.Oaks Central	488	367	211	220	313	322	304	361	153	329	525	704	701	1,403	1,313	965	851	870	1,490	1,682	1,145	822	1,646	1,641	669
	N.Oaks East	601	451	260	271	385	396	863	972	776	914	454	194	588	1,233	1,473	1,295	900	1,033	1,407	695	1,483	1,234	448	485	595
	N.Oaks West	643	483	278	290	412	424	874	465	842	413	275	78	634	866	972	795	663	952	934	1,894	1,663	898	1,123	31	858
	Sand Canyon	721	542	312	325	461	477	514	466	498	1,115	458	49	661	918	781	842	1,211	1,533	1,622	1,629	1,317	930	705	195	562
	Sierra	2,780	2,089	1,202	1,255	1,780	1,834	856	220	459	730	772	719	1,050	1,413	1,433	1,092	1,034	597	814	1,158	640	846	87	0	0
	Stadium	0	0	0	0	0	0	167	291	211	214	328	374	60	825	418	656	509	637	444	338	721	565	778	0	0

TABLE 1
Annual Groundwater Pumping from the Alluvial Aquifer
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
VWC	D	289	269	164	163	240	41	0	305	588	614	510	680	239	173	494	403	454	1,134	1,209	921	880	646	772	687	833
	I	214	200	122	121	177	181	95	0	91	132	73	108	1	0	1	0	0	0	0	0	0	0	0	0	0
	K2	0	0	0	0	0	0	0	0	0	0	0	982	1,134	1,708	2,089	1,155	1,305	1,076	1,489	1,420	861	669	954	364	0
	L2	9	8	5	5	7	91	0	0	0	0	0	838	526	996	1,236	818	961	308	190	532	494	349	490	71	0
	N	1,475	1,376	840	833	1,223	1,093	1,472	1,420	1,473	1,177	792	976	697	66	0	24	263	808	768	1,036	935	591	700	622	587
	N3	0	0	0	0	0	0	0	0	0	0	0	10	999	1,536	29	943	1,325	1,034	1,093	1,057	778	226	857	255	0
	N4	5	5	3	3	4	65	0	0	0	0	0	847	248	133	911	1,329	1,328	1,185	772	894	710	458	909	248	0
	N7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	N8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Q2	440	411	251	248	367	461	838	893	512	1,483	1,398	1,783	335	548	1,348	1,126	1,385	1,462	1,655	1,288	1,387	923	1,167	1,451	1,096
	S6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	515	1,490	1,320	2,134	2,301
	S7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	111	564	419	1,095	471
	S8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	79	327	190	409	153
	T2	621	580	354	351	515	704	894	913	1,007	1,030	643	662	379	0	3	280	733	837	941	726	984	700	696	1,014	822
	T4	160	150	91	91	133	54	167	0	0	0	0	163	687	3	1	975	1,258	804	523	892	625	690	831	799	747
	U3	1,476	1,378	841	834	1,225	1,278	1,033	638	323	823	1,254	1,199	369	1	2	765	987	851	560	702	1,126	956	572	823	0
	U4	1,306	1,220	744	738	1,084	665	668	606	696	567	551	584	42	3	2	7	742	789	529	828	1,073	942	796	934	625
	W6	0	0	0	0	0	0	0	146	145	0	0	217	260	204	224	365	615	493	355	416	445	182	0	0	0
	W9	0	0	0	0	0	0	0	0	0	0	11	902	699	444	507	508	1,077	915	627	1,111	1,176	806	939	764	566
	W10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	36	1,537
	W11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	123
WHR	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	10	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,842	1,229	1,376	772	1,104	1,204	1,352	760	614	1,229	1,131	1,010	1,000	1,000	1,000	2,000
	11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	15	137	137	137	137	137	137	137	137	137	137	91	102	57	82	89	100	56	46	91	84	75	74	72	173	74
	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	17	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	1,021	680	762	427	612	666	748	421	340	680	627	559	530	530	1,100	1,031
	18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	1A	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Pumping (NCWD)		1,170	1,350	1,178	1,147	1,549	1,644	1,842	2,127	2,283	2,367	1,936	1,864	1,994	1,977	2,225	1,675	1,803	2,309	1,761	1,676	1,508	1,641	981	1,265	1,582
Total Pumping (SCWC)		9,460	7,109	4,091	4,269	6,057	6,242	5,409	5,582	5,079	5,785	5,983	5,593	8,288	12,016	10,996	10,217	10,445	11,268	11,426	13,741	11,529	9,941	9,513	6,424	7,146
Total Pumping (VWC)		5,995	5,597	3,415	3,387	4,975	4,633	5,167	4,921	4,835	5,826	5,232	9,951	6,615	5,815	6,847	8,698	12,433	11,696	10,711	11,823	12,179	10,519	11,612	11,706	9,861
Total Pumping (All Purveyors)		16,625	14,056	8,684	8,803	12,581	12,519	12,418	12,630	12,197	13,978	13,151	17,408	16,897	19,808	20,068	20,590	24,681	25,273	23,898	27,240	25,216	22,101	22,106	19,395	18,589
Total Pumping (NLF)		11,331	13,237	9,684	7,983	11,237	9,328	8,287	6,512	5,951	6,243	8,225	7,039	8,938	8,020	10,606	11,174	12,020	12,826	10,250	13,824	12,087	12,652	13,513	10,999	10,778
Total Pumping (WHR)		3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	3,000	2,000	2,240	1,256	1,798	1,959	2,200	1,237	1,000	2,000	1,842	1,644	1,604	1,602	2,273	3,105
Total Pumping (Others)		500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	500	932	932	932	932	953	890	909	1,071
Total Alluvial Aquifer Pumping		31,456	30,793	21,868	20,286	27,318	25,347	24,205	22,642	21,648	23,721	23,876	27,187	27,591	30,126	33,133	34,464	38,438	40,031	37,080	43,838	39,879	37,310	38,111	33,576	33,543

Notes:

All pumping volumes are listed in acre-feet and are from records maintained by the Upper Basin Water Purveyors.

N. = north

WHR = Wayside Honor Rancho, owned by the Los Angeles County Waterworks District

TABLE 2

Annual Groundwater Pumping from the Saugus Formation

Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Owner	Well Name	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
NCWD	7	404	396	350	348	355	384	271	260	332	242	242	274	180	268	321	364	332	288	280	172	0	0	0	0	0
	4	440	449	319	385	315	369	222	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	9	0	0	0	0	119	227	115	138	1	0	5	1	1	0	4	1	1	0	1	0	0	0	0	0	0
	10	790	906	1,287	1,300	1,007	997	731	888	613	453	644	343	351	61	0	1	0	0	2	0	0	0	0	0	0
	11	729	870	716	754	1,159	1,278	2,209	2,371	1,265	1,280	1,252	1,034	428	730	614	522	353	81	14	0	0	0	0	0	0
	12	0	0	0	0	0	0	0	0	1,830	2,713	2,603	3,342	2,807	1,956	1,918	2,264	2,140	1,798	1,909	1,155	1,767	1,242	1,758	1,013	1,833
	13	0	0	0	0	0	0	0	0	0	0	0	0	1,393	2,053	2,246	1,623	2,045	3,001	2,351	1,295	419	1,190	1,637	1,500	1,906
NLF	156	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374	300	211	122	268
SCWC	Saugus1	0	0	0	0	0	0	0	0	31	0	0	1,690	437	1,226	1,333	0	410	451	0	0	0	0	0	0	0
	Saugus2	0	0	0	0	0	0	0	0	32	0	40	3,091	2,476	1,675	2,530	1,726	1,766	617	0	0	0	0	0	0	0
VWC	157	635	604	529	239	387	314	581	483	1,223	1,146	635	1,005	570	436	616	403	46	80	0	0	0	0	0	0	0
	159	0	0	0	0	0	0	0	0	0	0	3	63	65	74	147	68	3	0	0	0	0	91	0	30	9
	160	1,571	1,725	368	372	467	571	846	822	1,077	1,326	839	1,325	580	920	957	585	206	401	133	95	1,332	707	347	864	1,526
	201	0	0	0	0	0	0	0	0	0	57	2,039	2,249	1,170	752	845	530	71	35	16	11	295	128	495	168	148
	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	101	0	123	511	813
	206	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Pumping (NCWD)		2,363	2,621	2,672	2,787	2,955	3,255	3,548	3,657	4,041	4,688	4,746	4,994	5,160	5,068	5,103	4,775	4,871	5,168	4,557	2,622	2,186	2,432	3,395	2,513	3,739
Total Pumping (SCWC)		0	0	0	0	0	0	0	0	63	0	40	4,781	2,913	2,901	3,863	1,726	2,176	1,068	0	0	0	0	0	0	0
Total Pumping (VWC)		2,206	2,329	897	611	854	885	1,427	1,305	2,300	2,529	3,516	4,642	2,385	2,182	2,565	1,586	326	516	149	106	1,728	926	965	1,573	2,496
Total Pumping (All Purveyors)		4,569	4,950	3,569	3,398	3,809	4,140	4,975	4,962	6,404	7,217	8,302	14,417	10,458	10,151	11,531	8,087	7,373	6,752	4,706	2,728	3,914	3,358	4,360	4,086	6,235
Total Pumping (NLF)		20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	20	266	445	426	479	374	300	211	122	268
Total Pumping (Others)		0	0	501	434	620	555	490	579	504	522	539	480	446	439	474	453	547	548	423	509	513	513	513	513	513
Total Saugus Formation Pumping		4,589	4,970	4,090	3,852	4,449	4,715	5,485	5,561	6,928	7,759	8,861	14,917	10,924	10,610	12,025	8,560	8,186	7,745	5,555	3,716	4,801	4,171	5,084	4,721	7,016

Note:

All pumping volumes are listed in acre-feet and are from records maintained by the Upper Basin Water Purveyors.

TABLE 3

Allocation of Pumping, by Month, for Agricultural and Urban Production Wells

Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Month	% of Annual Water Use, Agricultural	% of Annual Water Use, Urban	% of May through October Water Use, Urban
January	3.8	5.2	
February	5.1	3.7	
March	6.6	5.2	
April	9.1	6.6	
May	10.6	8.7	13.2
June	11.4	10.4	15.8
July	14.1	13.0	19.7
August	12.9	13.6	20.6
September	10.2	10.9	16.5
October	7.5	9.3	14.1
November	5.0	7.1	
December	3.8	6.3	
Total	**100.0**	**100.0**	**100.0**

TABLE 4
Monthly Precipitation Measured at the Newhall County Water District Rain Gage
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
1981	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
1982	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
1983	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
1984	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
1985	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
1986	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
1987	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
1988	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
1989	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
1990	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
1991	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
1992	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
1993	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
1994	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
1995	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
1996	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
1997	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
1998	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
1999	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
2000	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
2001	5.84	10.76	3.38	2.56	0.00	0.00	0.00	0.00	0.00	0.22	3.18	1.30	27.24
2002	1.55	0.51	0.38	0.05	0.12	0.01	0.00	0.00	0.02	0.00	3.01	5.85	11.50
2003	0.00	9.03	2.38	2.35	1.70	0.00	0.02	0.00	0.00	1.10	0.63	2.57	19.78
2004	0.65	8.07	0.37	0.20	0.00	0.00	0.00	0.00	0.00	4.79	0.64	8.54	23.26
2005	17.06	16.69											

Note:

All precipitation values are measured in inches.

TABLE 5
Monthly Streamflows Measured in the Santa Clara River at the Lang Gage
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
1981	594	98	339	240	107	18	18	12	338	321	258	394	2,739
1982	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
1983	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
1984	0	596	405	240	143	166	228	411	154	220	904	578	4,044
1985	483	461	274	215	77	0	0	0	12	179	221	301	2,224
1986	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
1987	117	117	65	31	12	0	0	0	0	0	258	516	1,116
1988	222	209	506	117	77	68	0	0	0	0	12	25	1,236
1989	50	111	60	25	6	0	0	0	102	94	***34***	***18***	***499***
1990	***212***	***276***	***230***	***46***	***46***	***5***	***0***	***0***	***0***	***27***	***36***	***147***	***1,025***
1991	***162***	***775***	***879***	***736***	***145***	***142***	***14***	***0***	***45***	***69***	***62***	***263***	***3,291***
1992	***336***	***534***	***429***	***398***	***117***	***84***	***16***	***5***	***108***	***144***	***498***	***1,446***	***4,115***
1993	***14,709***	***5,336***	***1,194***	***530***	***239***	***110***	***54***	***10***	***64***	***145***	***264***	***281***	***22,937***
1994	***388***	***493***	***497***	***319***	***163***	***80***	***20***	***7***	***37***	***102***	***193***	***941***	***3,239***
1995	***1,211***	***1,421***	***954***	***802***	***268***	***156***	***62***	***8***	***6***	***1***	***27***	***189***	***5,104***
1996	***666***	***896***	***730***	***315***	***151***	***46***	***7***	***0***	***54***	***154***	***307***	***510***	***3,836***
1997	***517***	***346***	***140***	***85***	***33***	***5***	***4***	***50***	***66***	***240***	***566***	***809***	***2,859***
1998	***18,997***	***8,508***	***3,837***	***961***	***667***	***347***	***81***	***91***	***70***	***139***	***190***	***186***	***34,074***
1999	***92***	***85***	***204***	***224***	***197***	***107***	***80***	***46***	***52***	***54***	***31***	***80***	***1,252***
2000	***117***	***117***	***65***	***31***	***12***	***0***	***0***	***0***	***0***	***0***	***258***	***516***	***1,116***
2001	***333***	***1,420***	***785***	***283***	***238***	***0***	***0***	***0***	***0***	***95***	***178***	***855***	***4187***
2002	***50***	***111***	***60***	***25***	***6***	***0***	***0***	***0***	***102***	***94***	***34***	***18***	***500***
2003	***666***	***896***	***730***	***315***	109	0	0	0	0	0	0	0	2,716
2004	0	30	0	0	0	0	0	0	0	23	0	1,849	1,902
2005	***26,052***	***20,243***											

Note:

All monthly streamflows are measured in acre-feet. Values in bold italicized font are estimated from regression techniques, because (1) the Lang gage was out of service from November 1989 through April 2003 and (2) the gage was flooded during several days in January 2005 and February 2005.

TABLE 6
Monthly Treated Water Discharge Measured at the Valencia Water Reclamation Plant
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	266	258	257	239	247	212	219	219	212	228	239	247	2,844
1981	248	220	249	235	244	237	253	255	248	263	285	270	3,006
1982	275	247	284	271	277	269	275	268	254	266	271	284	3,241
1983	286	261	301	288	296	277	287	296	282	286	276	295	3,432
1984	303	281	304	294	321	315	320	317	314	322	315	319	3,723
1985	309	283	316	316	333	331	354	359	348	361	357	341	4,006
1986	350	341	374	359	377	380	415	454	446	440	421	445	4,801
1987	455	415	472	489	550	567	603	594	579	633	600	624	6,582
1988	622	557	588	587	603	537	575	606	587	608	600	602	7,072
1989	622	593	695	666	671	708	714	731	668	678	673	676	8,095
1990	698	644	725	695	666	693	725	714	692	700	658	680	8,290
1991	715	662	702	627	668	646	647	691	709	743	717	748	8,276
1992	777	777	819	813	824	800	853	869	818	828	811	786	9,775
1993	778	733	863	858	869	925	910	846	816	834	818	858	10,107
1994	722	729	809	776	802	761	771	764	739	763	735	760	9,132
1995	889	777	935	887	884	848	853	814	826	834	823	855	10,225
1996	893	838	935	890	902	876	903	891	886	817	810	816	10,456
1997	815	713	866	829	852	879	860	851	824	826	778	775	9,867
1998	778	787	955	955	984	965	1,136	1,139	1,020	993	911	906	11,529
1999	930	868	962	953	985	968	1,003	1,018	961	1,020	1,040	987	11,695
2000	1,010	956	1,027	1,015	1,066	1,076	1,149	1,140	1,009	1,076	1,033	1,011	12,568
2001	964	916	1,044	1,013	1,082	1,049	1,120	1,105	1,059	1,107	1,053	1,064	12,576
2002	1,107	1,001	1,120	1,100	1,186	1,164	1,211	1,246	1,213	1,200	1,141	1,154	13,843
2003	1,159	1,083	1,205	1,311	1,367	1,339	1,416	1,423	1,374	1,346	1,316	1,321	15,660
2004	1,315	1,263	1,345	1,296	1,343	1,331	1,371	1,414	1,284	1,416	1,371	1,397	16,146
2005	1,519	1,468											

Note:

All monthly releases are measured in acre-feet.

TABLE 7
Monthly Treated Water Discharge Measured at the Saugus Water Reclamation Plant
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	362	365	419	414	419	387	362	362	350	362	359	371	4,529
1981	382	337	390	398	444	412	417	429	431	434	412	460	4,945
1982	445	399	456	444	446	434	434	421	415	434	431	438	5,196
1983	460	421	514	541	562	545	520	477	458	481	477	534	5,990
1984	558	505	499	485	476	443	458	456	451	467	474	519	5,791
1985	503	461	505	458	448	444	452	459	452	470	460	498	5,610
1986	498	475	528	501	499	483	481	476	500	511	518	552	6,023
1987	524	475	542	487	425	383	391	403	395	397	411	430	5,264
1988	443	411	439	434	440	430	445	457	435	464	436	460	5,294
1989	462	410	441	450	464	436	476	479	462	471	451	466	5,468
1990	463	403	432	426	483	492	513	504	489	493	508	512	5,718
1991	495	423	479	427	491	516	557	525	486	474	470	493	5,835
1992	488	507	530	472	489	476	493	521	492	498	452	514	5,931
1993	595	534	616	581	615	587	622	604	578	609	567	567	7,075
1994	601	606	694	677	687	644	642	645	619	663	655	685	7,817
1995	657	578	676	705	699	631	641	635	617	613	568	581	7,602
1996	532	504	525	501	517	506	511	525	532	579	558	583	6,375
1997	564	516	515	461	469	417	442	474	475	503	521	553	5,911
1998	529	541	544	511	617	587	426	399	457	501	521	533	6,166
1999	542	485	551	391	544	512	547	532	521	527	487	514	6,153
2000	493	487	501	490	503	467	457	509	585	555	514	596	6,157
2001	592	531	572	510	500	490	485	519	510	527	553	560	6,349
2002	520	459	518	493	491	526	564	551	518	552	556	567	6,315
2003	551	500	528	343	352	332	328	335	325	326	325	352	4,597
2004	360	360	384	373	376	362	378	374	397	406	371	396	4,537
2005	409	359											

Note:

All monthly discharges are measured in acre-feet.

TABLE 8
Monthly Releases of Water from Castaic Lagoon to Castaic Creek
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
1981	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1982	0	0	0	0	0	667	842	735	0	0	0	0	2,244
1983	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
1984	0	0	0	0	0	0	0	0	0	0	0	0	0
1985	0	0	0	0	0	0	0	0	0	0	0	0	0
1986	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
1987	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
1988	0	0	809	341	900	0	0	0	0	0	0	0	2,050
1989	0	0	0	0	0	0	0	0	0	0	0	0	0
1990	0	0	0	0	0	0	0	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	0	0	0	0	66	66
1992	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
1993	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
1994	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
1995	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
1996	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
1997	0	0	8701	873	0	0	0	0	0	0	0	310	9,884
1998	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
1999	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
2000	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
2001	0	389	1,218	0	0	0	0	0	0	0	0	0	1,607
2002	0	0	0	0	0	0	0	0	0	0	0	0	0
2003	0	0	0	2,286	418	315	0	0	0	0	0	0	3,019
2004	0	59	1,004	0	0	0	0	0	0	0	0	60	1,123
2005	32,391	37,514											

Note:

All monthly releases are measured in acre-feet.

TABLE 9

Monthly Streamflows Measured in the Santa Clara River at the County Line Gage

Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1980	8,428	43,565	18,125	8,551	3,792	3,963	1,202	1,111	1,668	1,470	1,452	1,884	95,211
1981	3,376	1,533	5,415	1,815	1,662	1,279	942	906	1,139	1,488	2,138	2,539	24,232
1982	2,826	2,358	5,572	7,091	3,909	1,749	1,694	1,392	1,597	1,621	3,449	3,229	36,488
1983	7,787	9,122	67,712	11,240	10,320	3,828	2,102	2,678	2,053	3,443	5,040	5,911	131,236
1984	5,691	3,931	4,084	4,530	2,309	1,607	1,224	1,511	1,464	1,624	3,237	8,067	39,279
1985	3,116	2,561	2,852	1,974	1,694	1,365	1,178	1,365	1,551	1,880	2,102	2,828	24,466
1986	3,955	13,991	10,616	3,328	2,612	1,622	1,454	1,482	1,870	1,896	2,606	2,590	48,024
1987	2,485	2,325	2,575	1,841	1,908	1,710	1,650	1,470	1,412	2,309	2,057	4,457	26,198
1988	3,421	2,981	3,025	3,172	2,636	2,231	1,734	1,494	1,605	1,904	2,027	10,381	36,611
1989	2,644	3,340	2,584	2,055	1,740	1,920	1,732	1,345	1,535	2,146	1,964	1,795	24,799
1990	2,709	3,247	2,269	1,898	1,730	1,545	1,478	1,751	1,668	1,660	1,924	1,593	23,472
1991	2,051	3,219	15,981	1,837	1,519	1,113	1,144	831	912	948	1,014	4,332	34,901
1992	3,737	37,636	9,576	4,439	1,964	1,533	1,377	1,085	1,129	1,329	1,496	3,277	68,577
1993	47,199	44,749	25,738	9,459	4,860	3,324	2,797	2,771	2,949	3,005	2,686	3,247	152,783
1994	3,281	3,437	3,501	3,533	3,519	2,200	1,640	1,400	1,192	1,855	2,263	4,219	32,039
1995	31,125	3,828	19,662	8,452	3,901	2,527	1,843	2,192	1,855	1,716	2,075	3,235	82,409
1996	3,604	10,669	7,678	6,073	3,584	1,678	1,640	1,579	1,509	2,625	1,590	5,701	47,930
1997	5,375	3,913	7,884	3,370	1,680	1,240	1,571	1,371	1,230	1,662	2,636	4,848	36,780
1998	5,875	104,388	25,377	9,378	34,992	5,312	3,935	3,537	2,579	2,450	2,890	4,427	205,139
1999	4,328	4,128	4,322	6,526	4,760	3,590	1,125	1,439	2,164	1,888	2,243	2,434	32,382
2000	2,470	12,210	6,400	2,910	3,610	5,250	1,890	1,490	1,560	1,950	1,890	2,290	43,920
2001	3,680	5,430	7,370	2,970	2,650	1,890	1,520	1,100	970	1,510	2,310	3,220	34,620
2002	2,980	2,060	2,610	2,390	1,730	1,680	1,600	772	1,010	1,440	2,490	4,330	25,092
2003	2,690	5,540	3,910	5,470	2,810	2,150	1,670	1,280	1,600	2,491	2,688	3,816	36,115
2004	4,046	7,204	4,262	2,003	1,851	1,853	1,339	1,646	1,438				
2005													

Note:

All monthly streamflows are measured in acre-feet. Because reported flows appear highly uncertain beginning in October 2004, they are not listed in this table.

TABLE 10
Estimated Annual Groundwater Discharge to the Santa Clara River
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Flow in Castaic Creek (acre-feet)	Flow at County Line (acre-feet)	Estimated Non-Storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)
1980	16,785	95,211	57,593	7,372	50,221
1981	6,519	24,232	21,172	7,949	13,223
1982	9,102	36,488	32,531	8,436	24,095
1983	67,058	131,236	55,878	9,420	46,458
1984	13,787	39,279	35,215	9,512	25,703
1985	2,619	24,466	24,089	9,614	14,475
1986	4,945	48,024	31,327	10,822	20,505
1987	911	26,198	23,663	11,844	11,819
1988	2,415	36,611	24,934	12,363	12,571
1989	Unavailable	24,799	23,453	13,560	9,893
1990	0	23,472	21,772	14,006	7,766
1991	65	34,901	18,702	14,108	4,594
1992	4,450	68,577	23,601	15,703	7,898
1993	7,725	152,783	65,054	17,179	47,875
1994	Unavailable	32,039	31,239	16,946	14,293
1995	5,611	82,409	51,001	17,824	33,177
1996	5,632	47,930	36,366	16,831	19,535
1997	9,885	36,780	27,521	15,778	11,743
1998	47,803	205,139	81,744	17,695	64,049
1999	5,830	32,382	27,176	17,847	9,329
2000	7,007	43,920	30,131	18,721	11,410
2001	1,607	34,620	27,900	18,925	8,975
2002	0	25,092	23,243	20,158	3,085
2003	3,019	36,115	28,835	20,257	8,578
2004[a]					

[a]Annual volumes of groundwater discharge could not be calculated because of uncertainties in streamflow data at the County Line stream gage in late 2004.

TABLE 11

Annual Water Budgets Calculated by the Calibrated Regional Model for 1980 through 2004

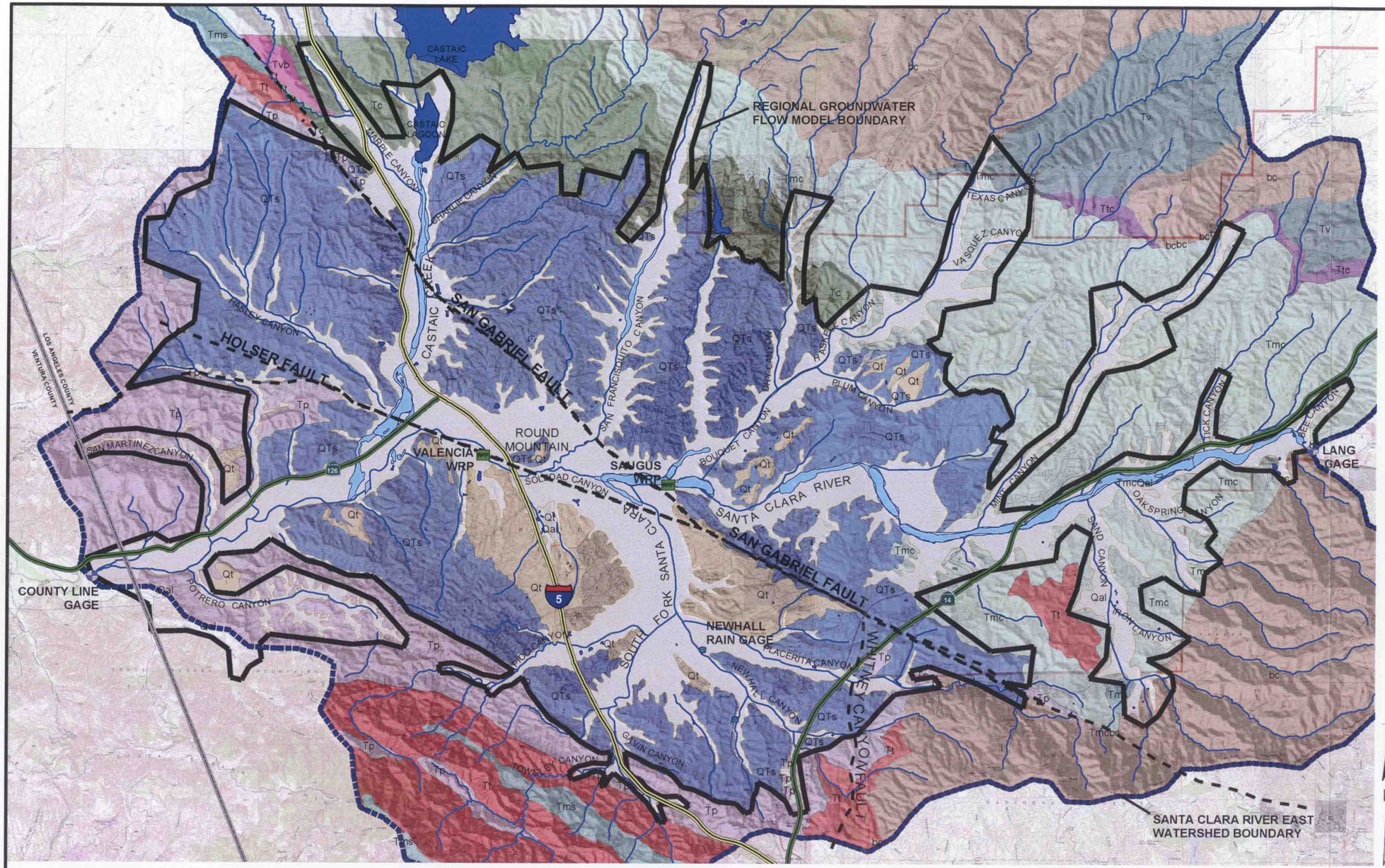
Calibration Update of the Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California

Calendar Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Castaic Dam Underflow	Subsurface Inflow from Acton Basin	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
1980 to 1981	35,608	3,375	46,386	1,705	16,122	103,197	35,542	32,667	16,722	18,362	103,293	-96	-96
1981 to 1982	9,454	3,871	15,958	1,700	16,513	47,497	35,209	22,673	10,589	18,115	86,586	-39,089	-39,185
1982 to 1983	46,064	3,022	46,009	1,700	16,279	113,073	24,918	26,469	13,072	18,367	82,827	30,247	-8,938
1983 to 1984	168,155	2,657	83,635	1,700	15,437	271,584	23,169	56,932	29,067	18,802	127,969	143,615	134,677
1984 to 1985	959	3,606	10,778	1,705	16,281	33,328	30,645	33,670	21,482	18,198	103,995	-70,667	64,010
1985 to 1986	0	3,279	9,123	1,700	16,607	30,709	28,963	25,845	11,466	18,059	84,333	-53,624	10,386
1986 to 1987	37,673	3,211	36,076	1,700	16,398	95,057	28,658	28,066	13,770	18,335	88,828	6,229	16,615
1987 to 1988	9,288	2,991	12,575	1,700	16,947	43,501	27,085	24,232	9,896	18,115	79,327	-35,826	-19,211
1988 to 1989	23,720	3,075	23,369	1,705	16,892	68,761	27,571	23,426	10,431	18,315	79,743	-10,982	-30,193
1989 to 1990	0	3,393	7,925	1,700	17,340	30,358	30,415	20,932	7,499	18,125	76,970	-46,612	-76,805
1990 to 1991	0	3,787	9,073	1,700	17,592	32,152	31,652	18,242	5,055	18,141	73,090	-40,937	-117,742
1991 to 1992	45,055	3,397	36,390	1,700	16,884	103,427	41,067	19,864	7,434	18,238	86,603	16,824	-100,918
1992 to 1993	119,272	3,850	67,935	1,705	16,009	208,772	37,567	30,452	15,003	18,558	101,580	107,192	6,274
1993 to 1994	102,692	3,773	61,563	1,700	15,751	185,479	39,741	45,991	24,538	18,564	128,834	56,645	62,919
1994 to 1995	554	4,415	12,629	1,700	16,466	35,763	44,120	22,265	13,478	18,072	97,935	-62,172	747
1995 to 1996	103,734	4,517	61,628	1,700	15,935	187,514	42,009	38,348	21,081	18,567	120,006	67,507	68,254
1996 to 1997	40,468	5,205	37,922	1,705	16,303	101,602	45,574	26,784	17,501	18,474	108,334	-6,732	61,523
1997 to 1998	14,265	5,267	20,537	1,700	16,547	58,316	47,051	21,205	13,598	18,237	100,091	-41,775	19,748
1998 to 1999	126,481	4,758	86,384	1,700	15,692	235,014	42,043	45,379	26,261	18,678	132,360	102,654	122,402
1999 to 2000	4	5,343	13,716	1,700	16,446	37,209	46,867	24,011	15,442	18,101	104,420	-67,211	55,191
2000 to 2001	692	5,343	17,472	1,705	17,158	42,369	43,664	19,733	10,284	18,247	91,927	-49,558	5,633
2001 to 2002	57,816	5,343	51,538	1,700	16,359	132,755	40,406	23,390	14,233	18,410	96,439	36,317	41,950
2002 to 2003	305	5,343	9,900	1,700	16,969	34,216	42,120	17,517	9,380	18,128	87,144	-52,928	-10,979
2003 to 2004	22,496	5,343	24,812	1,700	17,072	71,423	37,229	19,022	9,214	18,369	83,834	-12,411	-23,390
2004 to 2005	38,619	5,343	38,288	1,705	17,449	101,403	39,545	19,319	10,125	18,523	87,512	13,891	-9,499
Minimum	0	2,657	7,925	1,700	15,437	30,358	23,169	17,517	5,055	18,059	73,090	-70,667	-117,742
Maximum	168,155	5,343	86,384	1,705	17,592	271,584	47,051	56,932	29,067	18,802	132,360	143,615	134,677
Average	40,135	4,140	33,665	1,701	16,538	96,179	36,513	27,457	14,265	18,324	96,559	-380	9,335
Median	23,720	3,850	24,812	1,700	16,466	71,423	37,567	24,011	13,478	18,315	91,927	-10,982	5,633

Note:

All flow volumes are listed in AF/yr.

Figures



LEGEND

GEOLOGY

- UNDIFFERENTIATED ALLUVIUM (Qal)
- TERRACE DEPOSITS (Qt)
- SAUGUS FORMATION (QTs)
- PICO FORMATION (Tp)
- TOWSLEY FORMATION (Tt)
- MODELO FORMATION (Tms)
- CASTAIC FORMATION (Tc)
- VIOLIN BRECCIA (Tvb)
- MINT CANYON FORMATION (Tmc)
- TICK CANYON FORMATION (Ttc)
- VASQUEZ FORMATION (Tv)
- UNDIFFERENTIATED BASEMENT COMPLEX (bc)

HYDROGRAPHY

- LAKE
- STREAM
- STREAM GAGE

MAJOR ROAD

- INTERSTATE
- STATE HIGHWAY

FIGURE 1
BASIN GEOLOGIC MAP
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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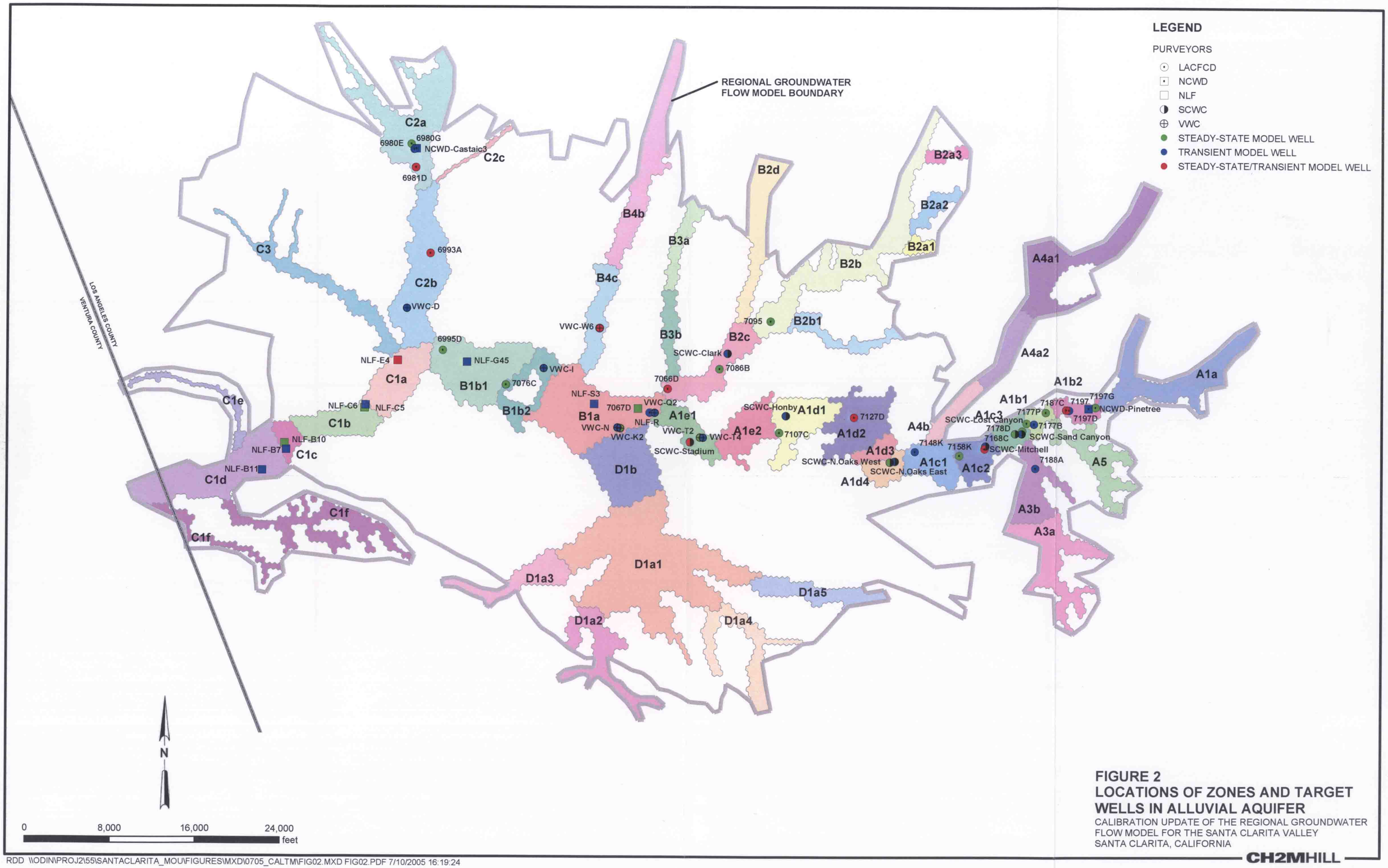

FIGURE 2
LOCATIONS OF ZONES AND TARGET WELLS IN ALLUVIAL AQUIFER
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\0705_CALTM\FIG02.MXD FIG02.PDF 7/10/2005 16:19:24

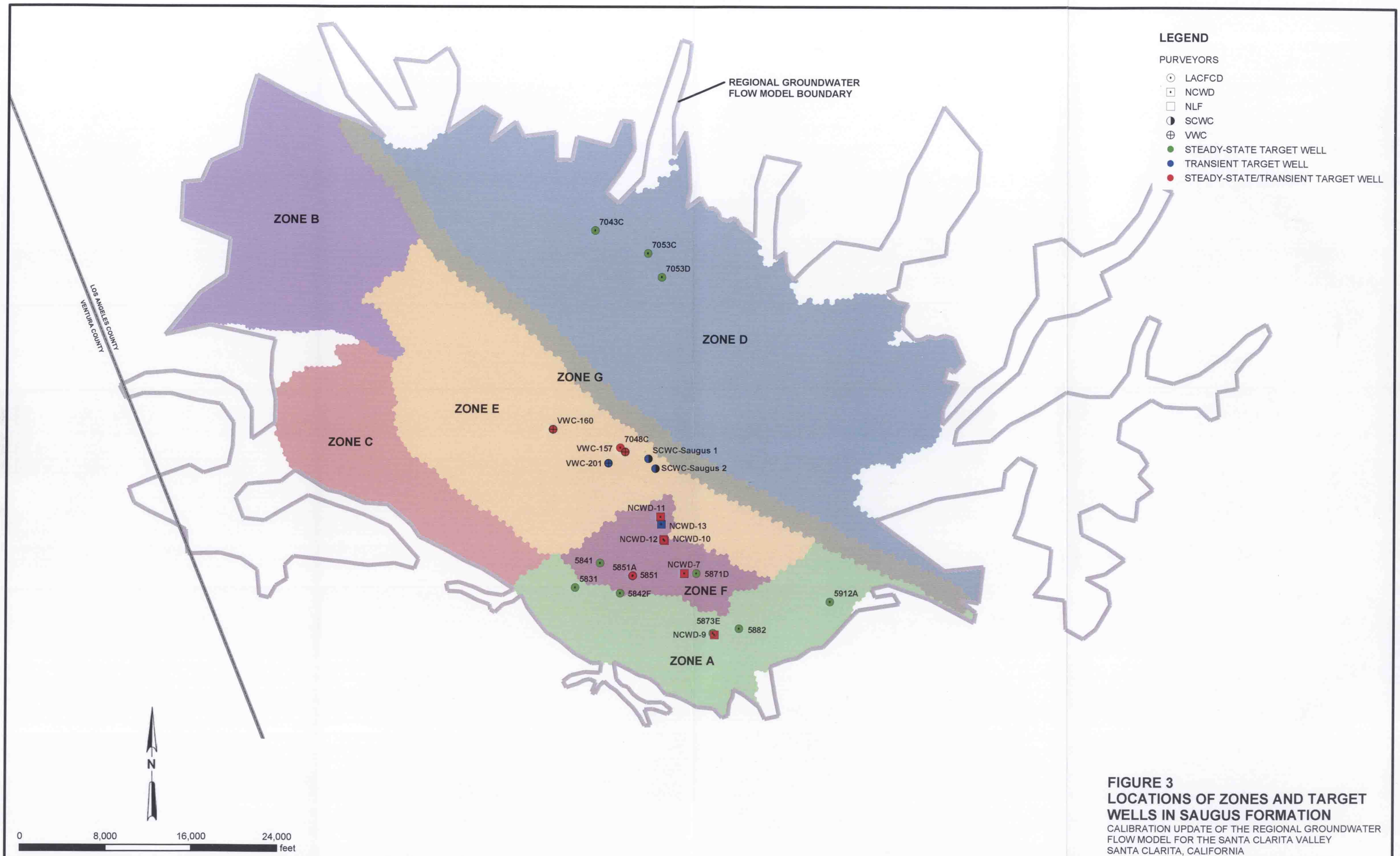

FIGURE 3
LOCATIONS OF ZONES AND TARGET WELLS IN SAUGUS FORMATION
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\0705_CALTM\FIG03.MXD FIG03.PDF 7/10/2005 16:23:06

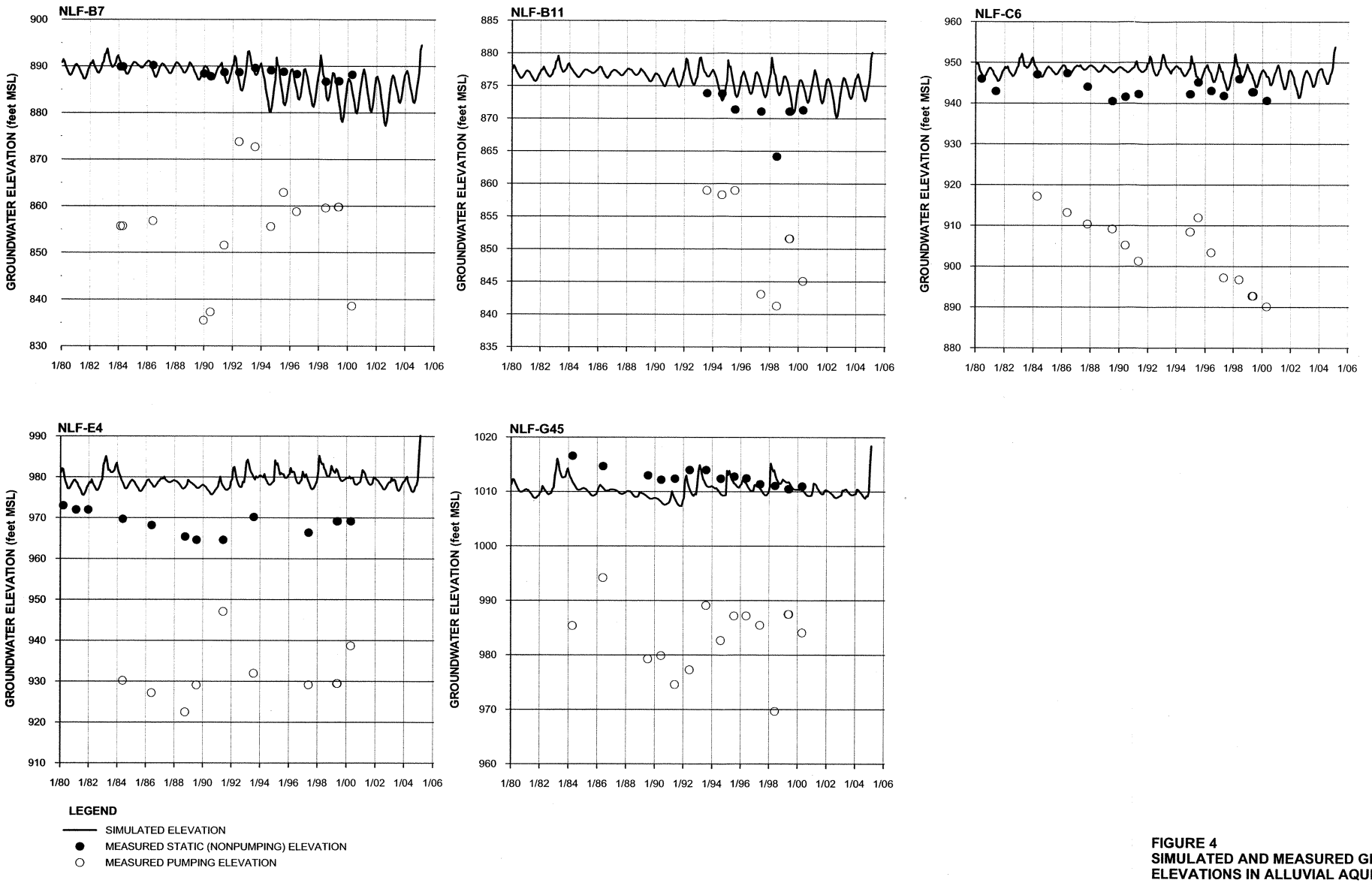

FIGURE 4
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS WEST OF INTERSTATE 5
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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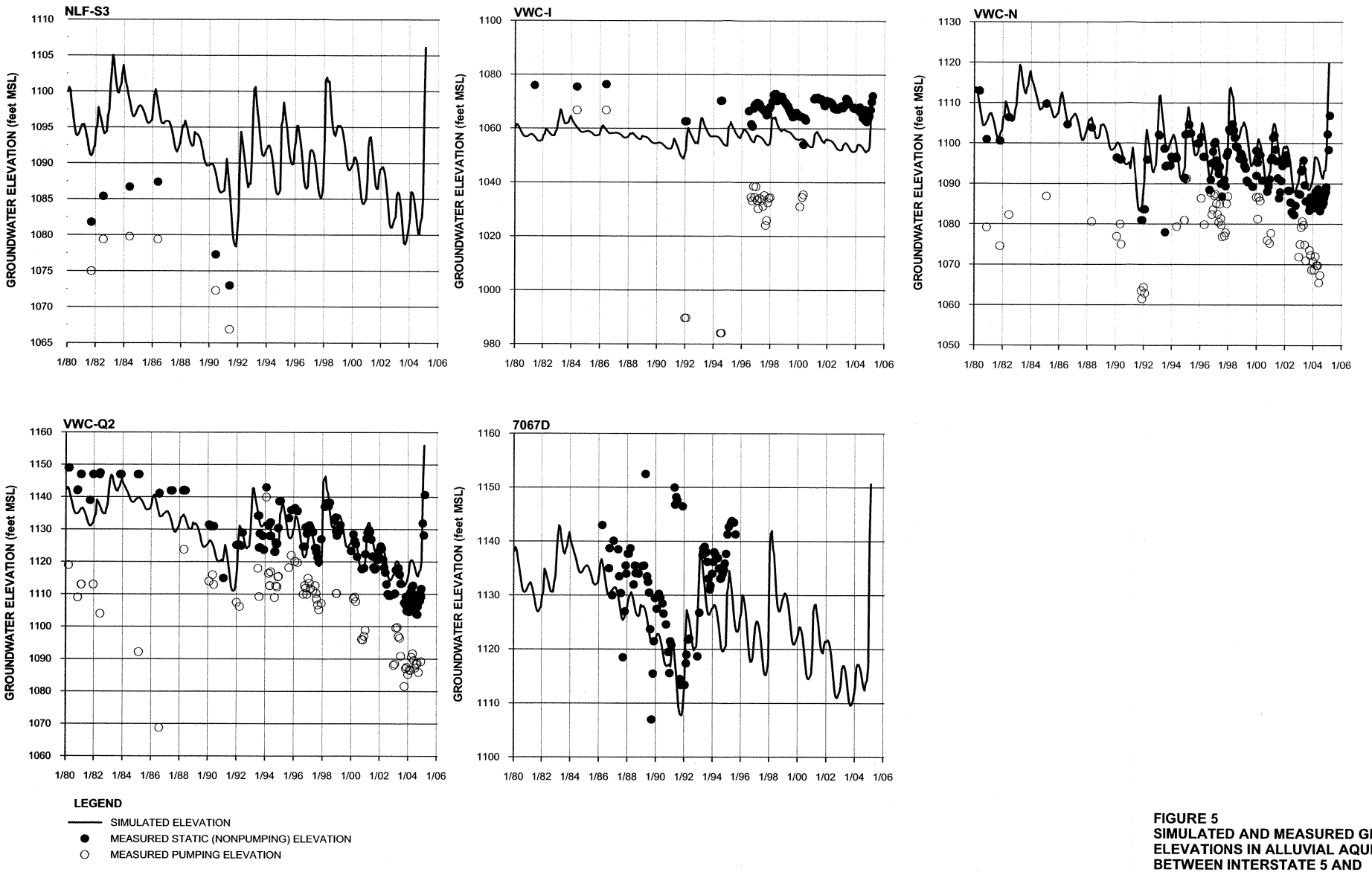

FIGURE 5
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS BETWEEN INTERSTATE 5 AND SOLEDAD CANYON
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

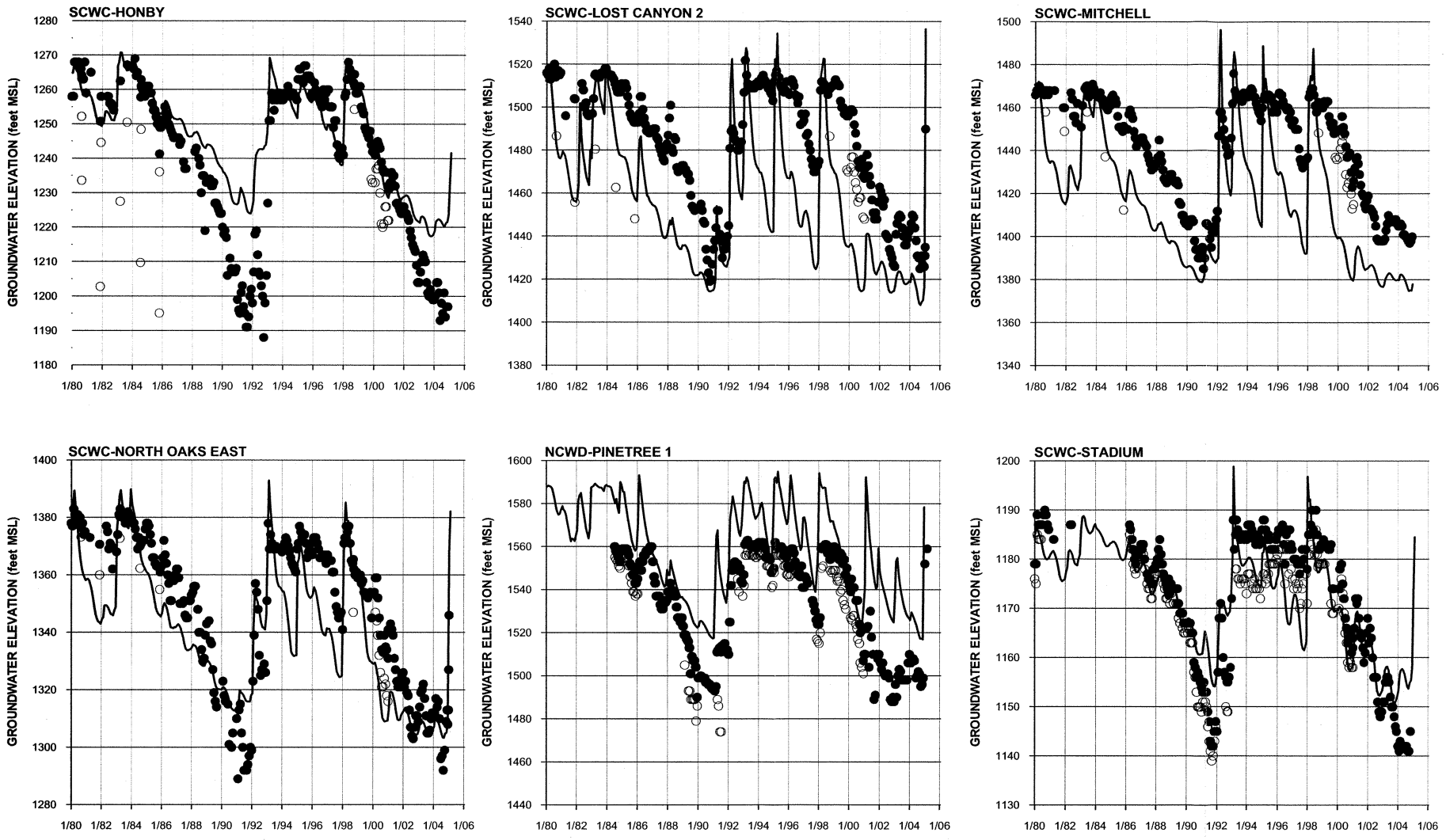

FIGURE 6
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 1 OF 2)
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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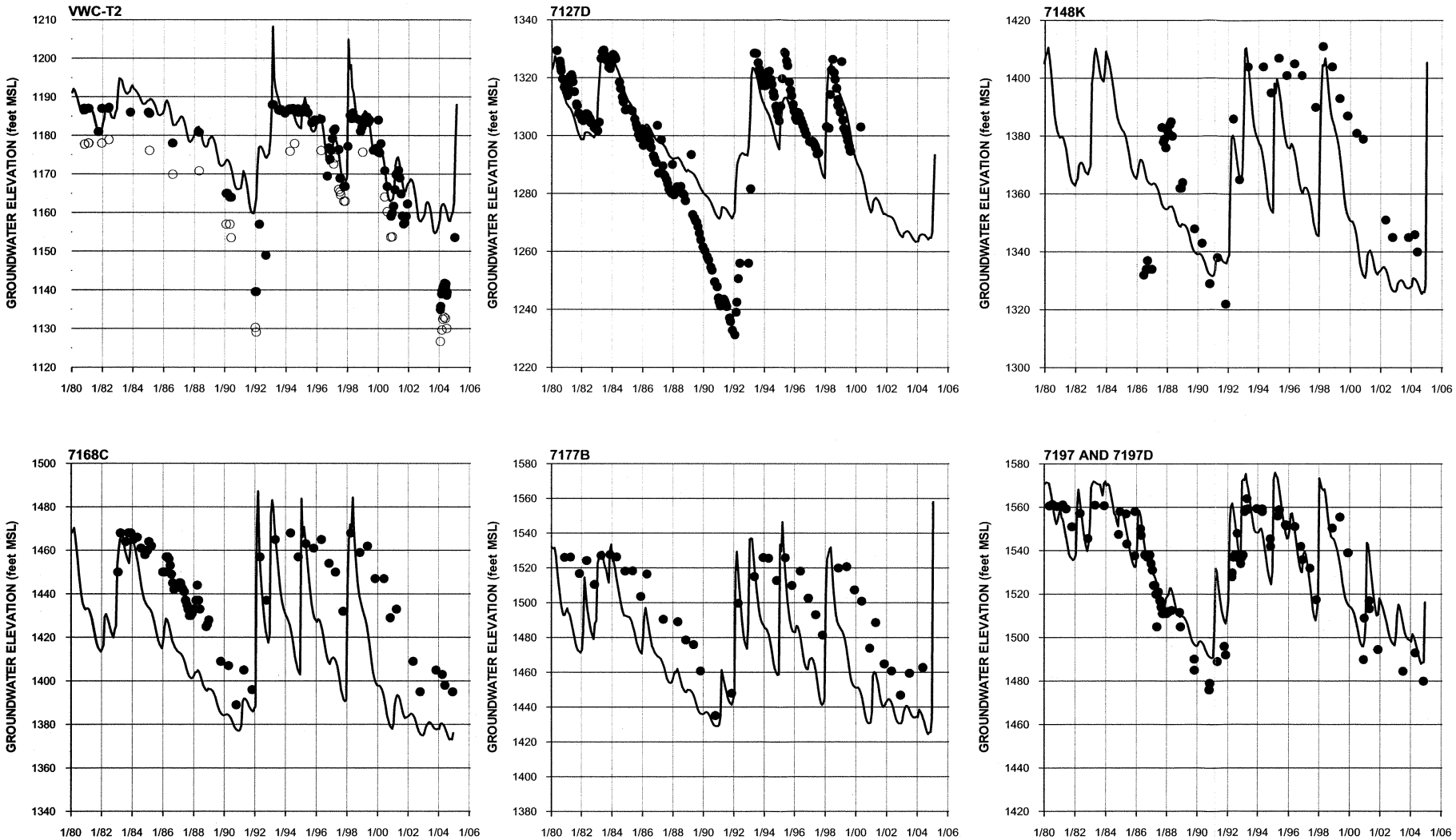

FIGURE 6
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN SOLEDAD CANYON (PAGE 2 OF 2)
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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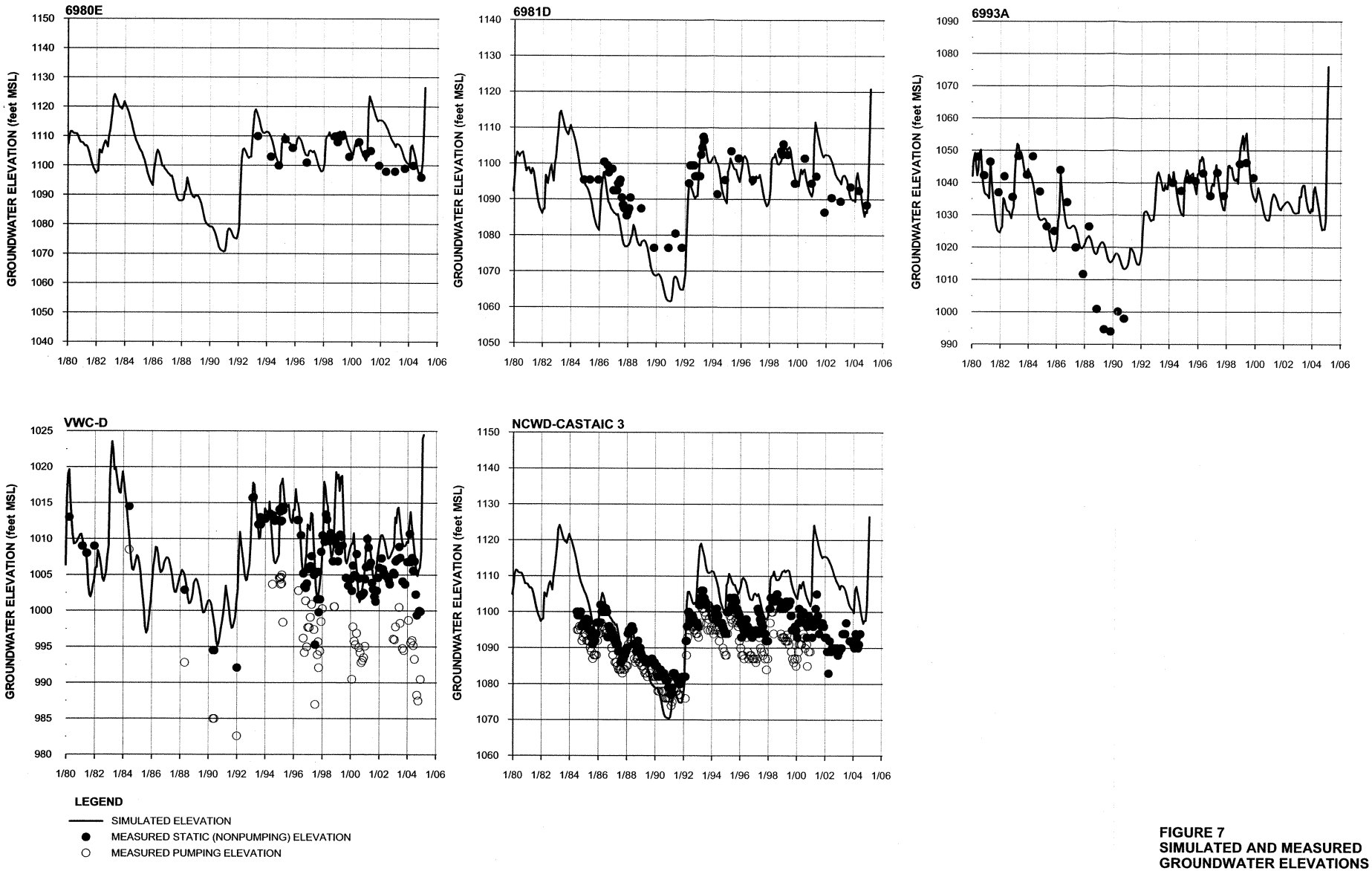

FIGURE 7
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS ALONG CASTAIC CREEK
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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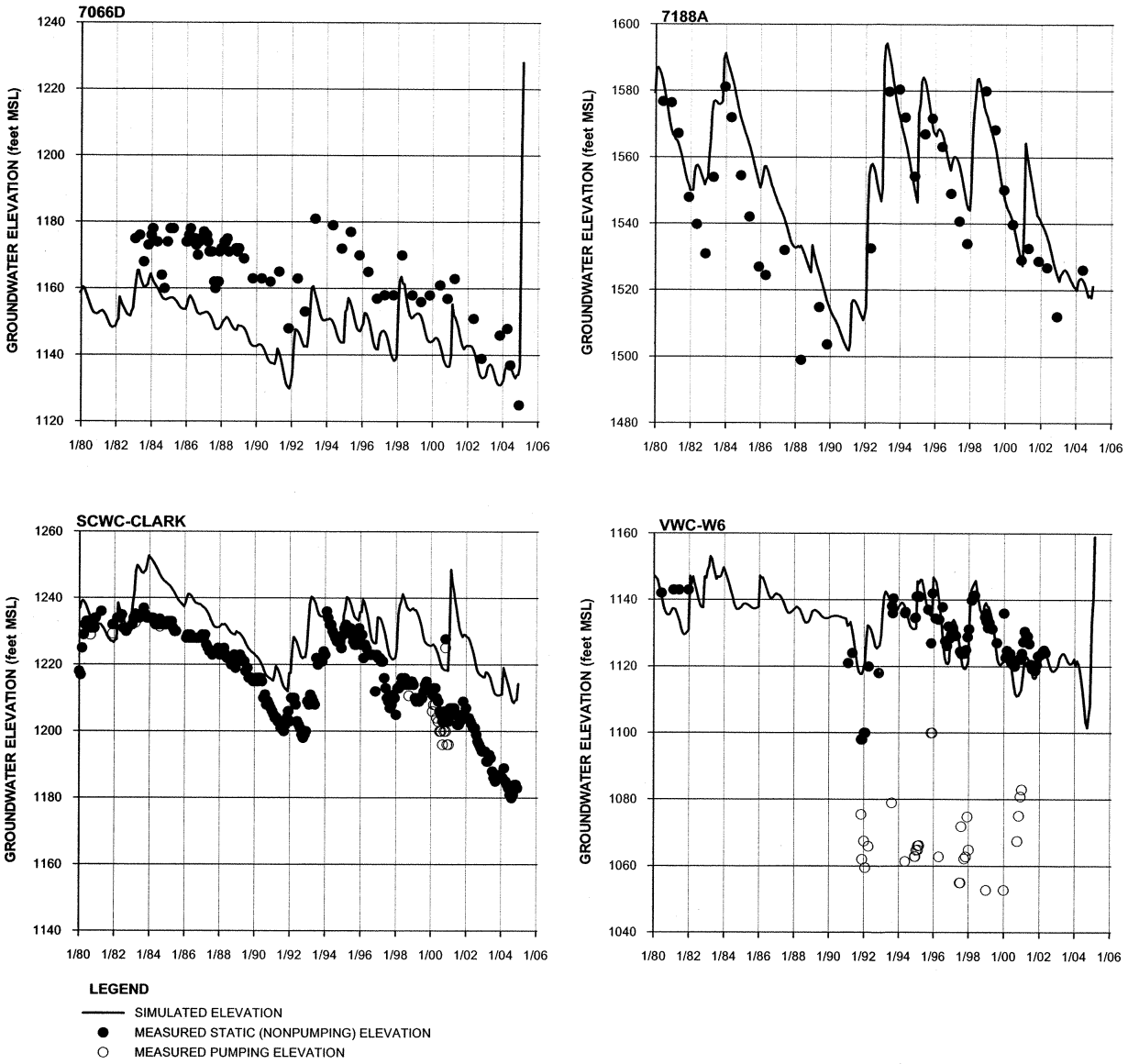

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FIGURE 8
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN ALLUVIAL AQUIFER WELLS IN OTHER TRIBUTARY CANYONS TO THE SANTA CLARA RIVER
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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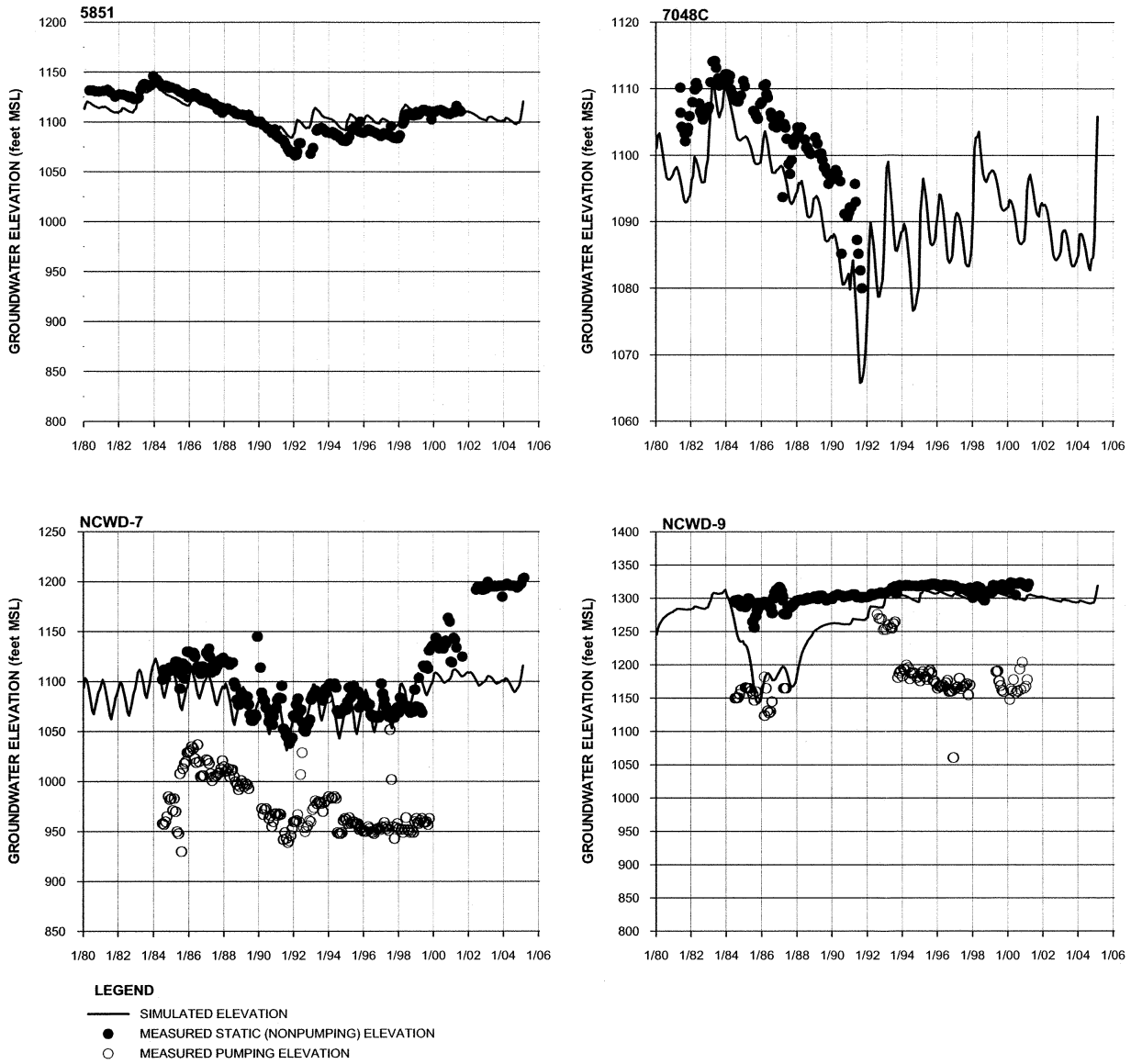

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FIGURE 9
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 1 OF 3)
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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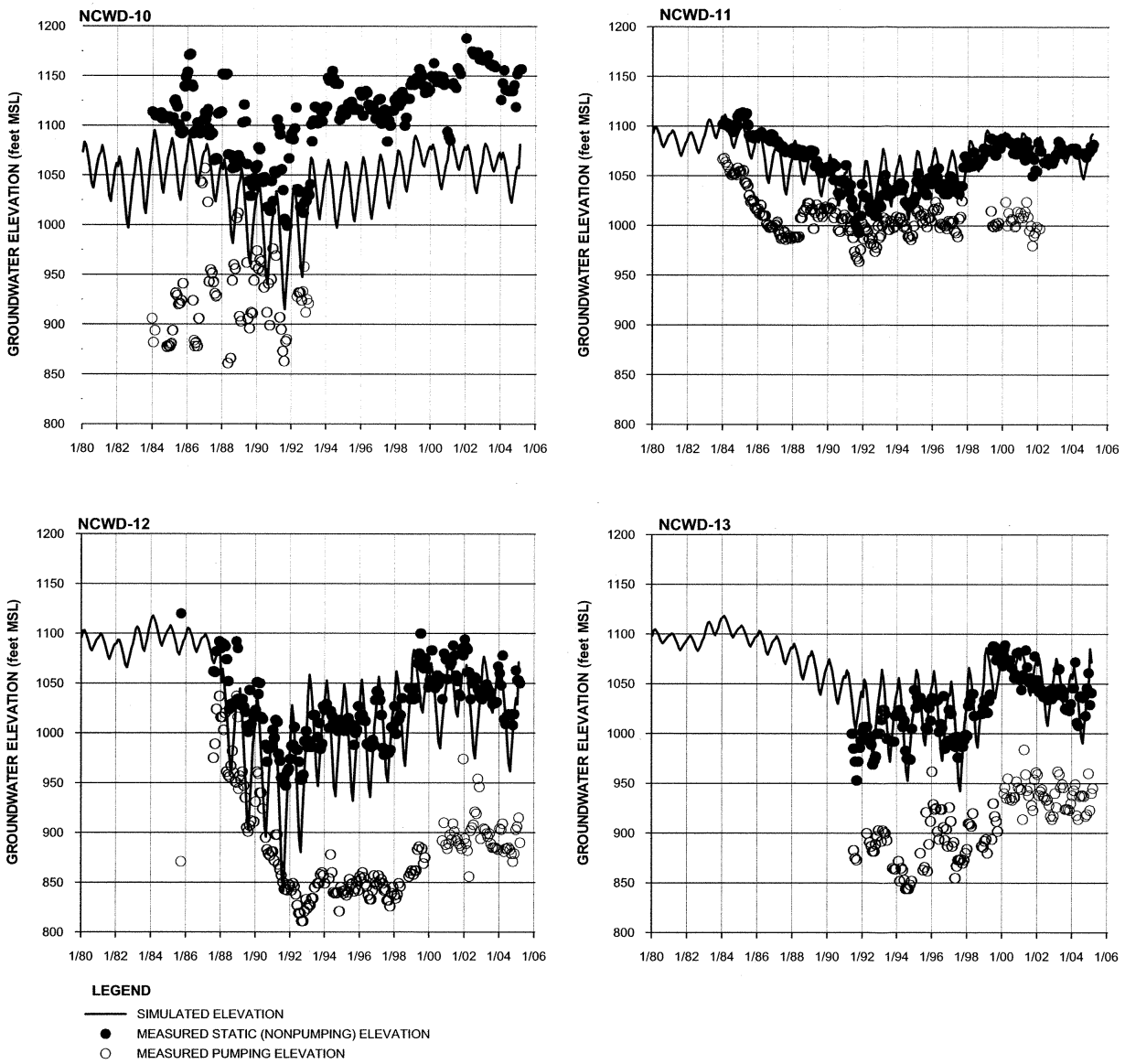

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FIGURE 9
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 2 OF 3)
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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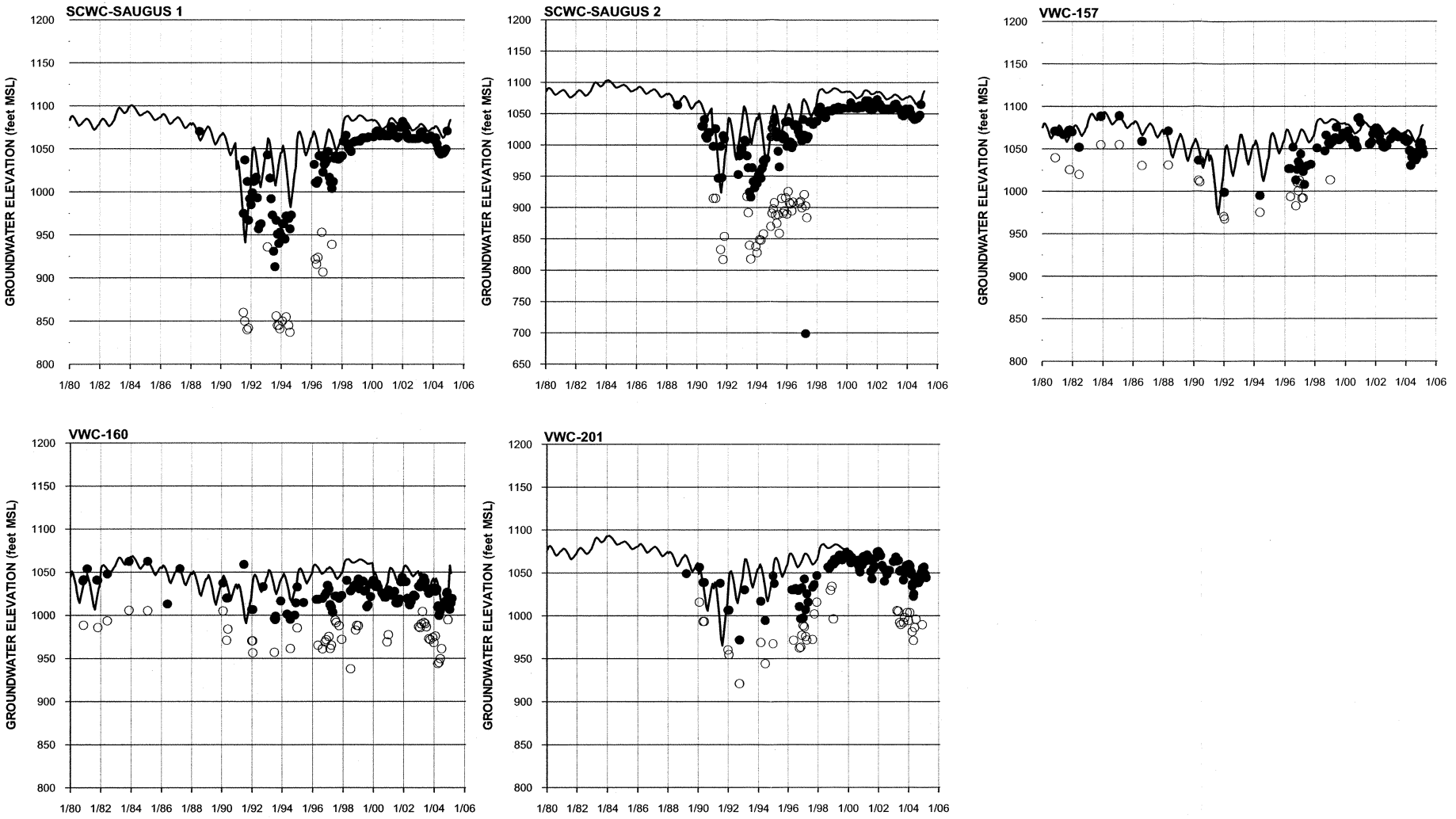

FIGURE 9
SIMULATED AND MEASURED GROUNDWATER ELEVATIONS IN SAUGUS FORMATION WELLS (PAGE 3 OF 3)
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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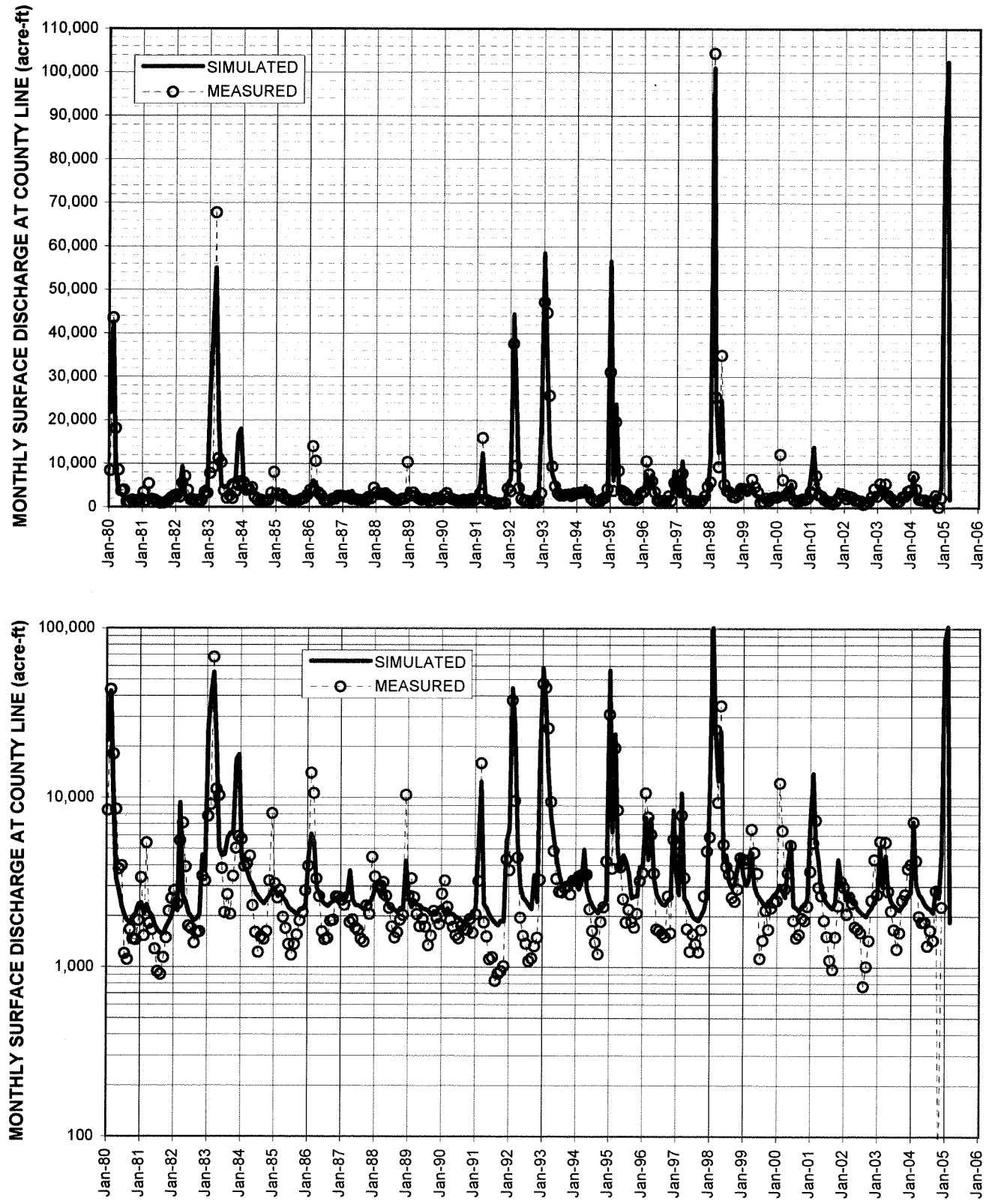

FIGURE 10
SIMULATED VERSUS MEASURED HYDROGRAPHS OF SANTA CLARA RIVER FLOW AT COUNTY LINE
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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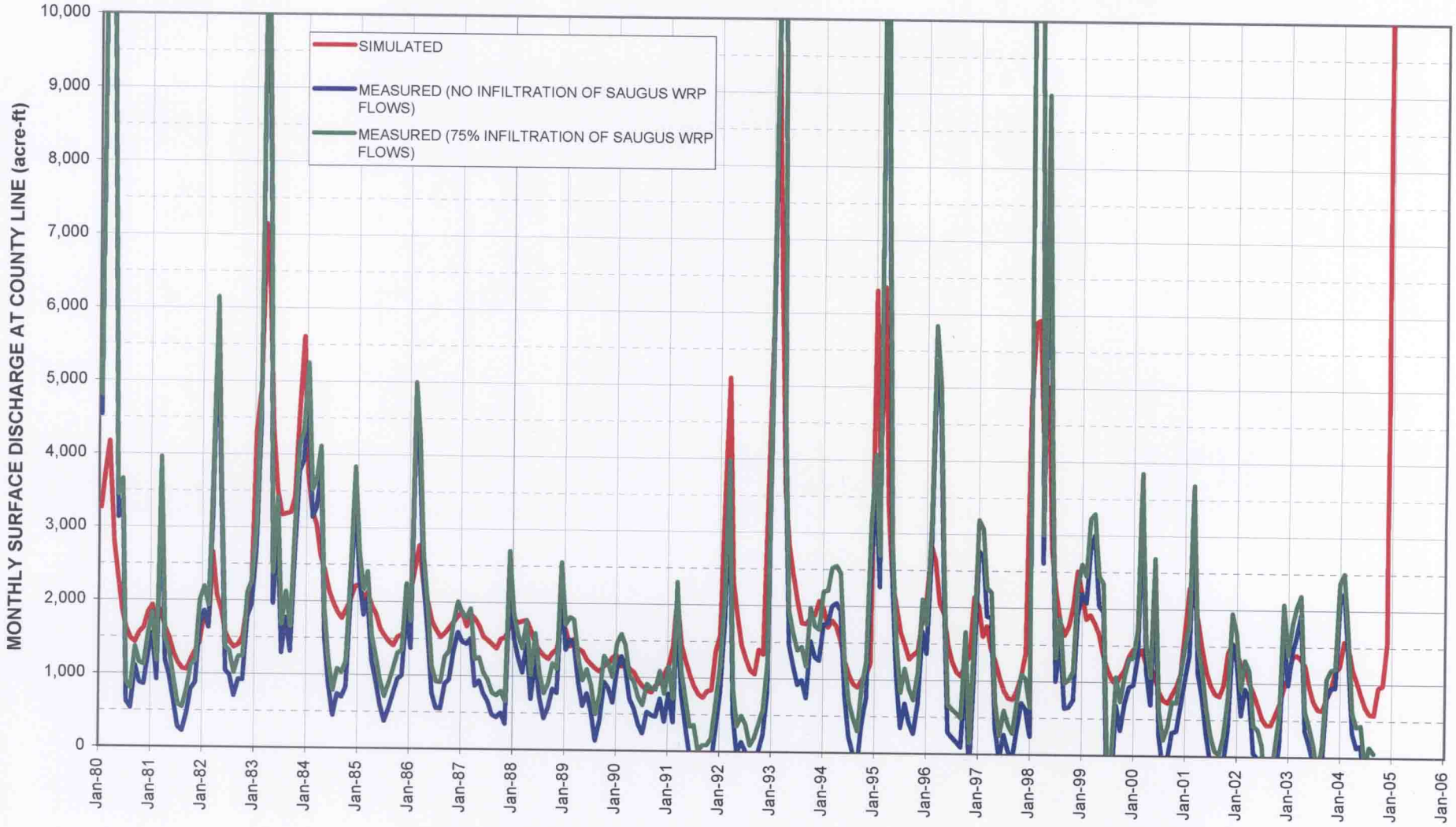

FIGURE 11
SIMULATED VERSUS MEASURED HYDROGRAPH OF GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
CALIBRATION UPDATE OF THE REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

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178973-416.xls\FIG11

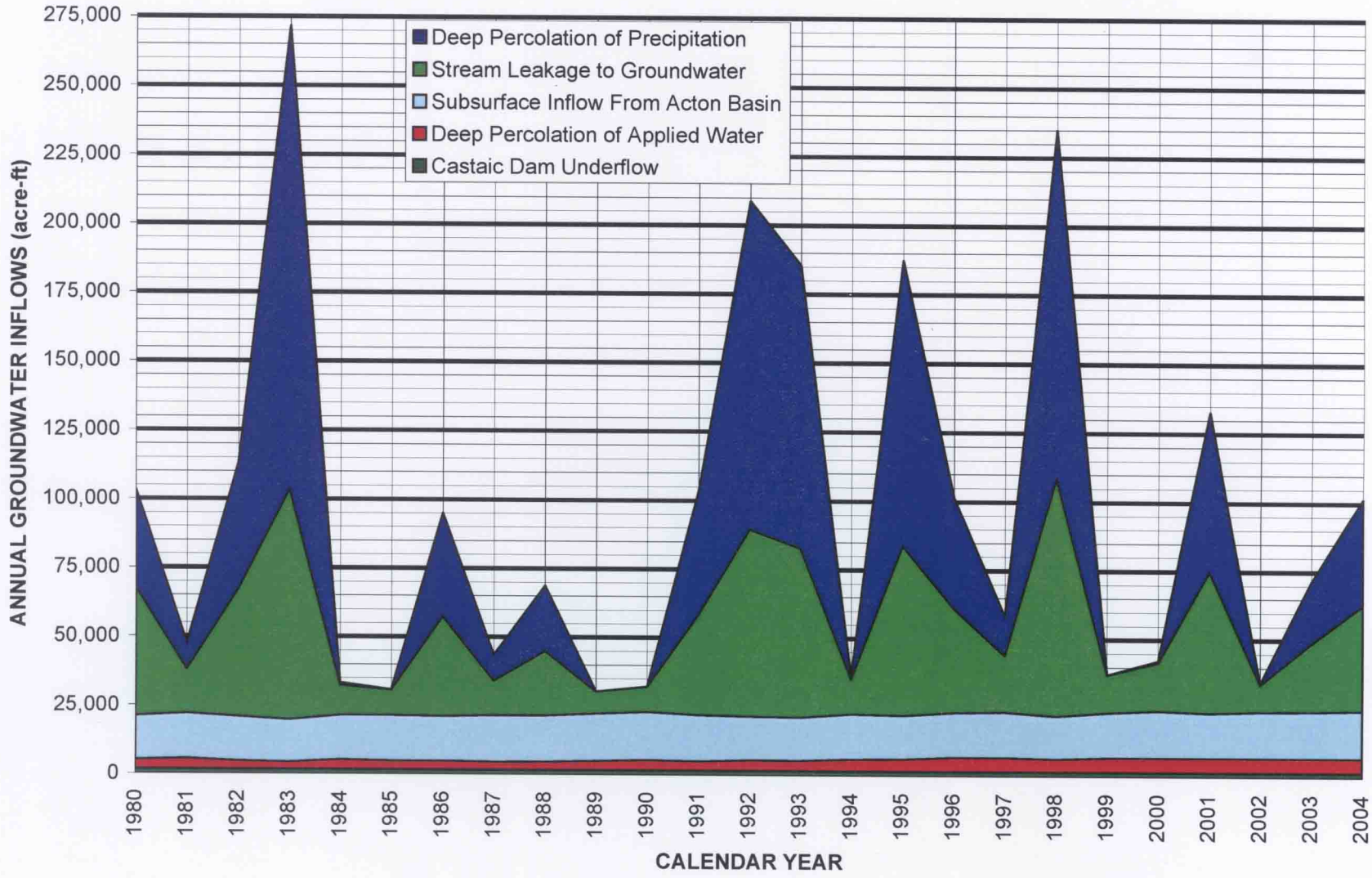

FIGURE 12
SIMULATED ANNUAL GROUNDWATER INFLOWS
CALIBRATION UPDATE OF REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY

178973-417.xls/Fig 12

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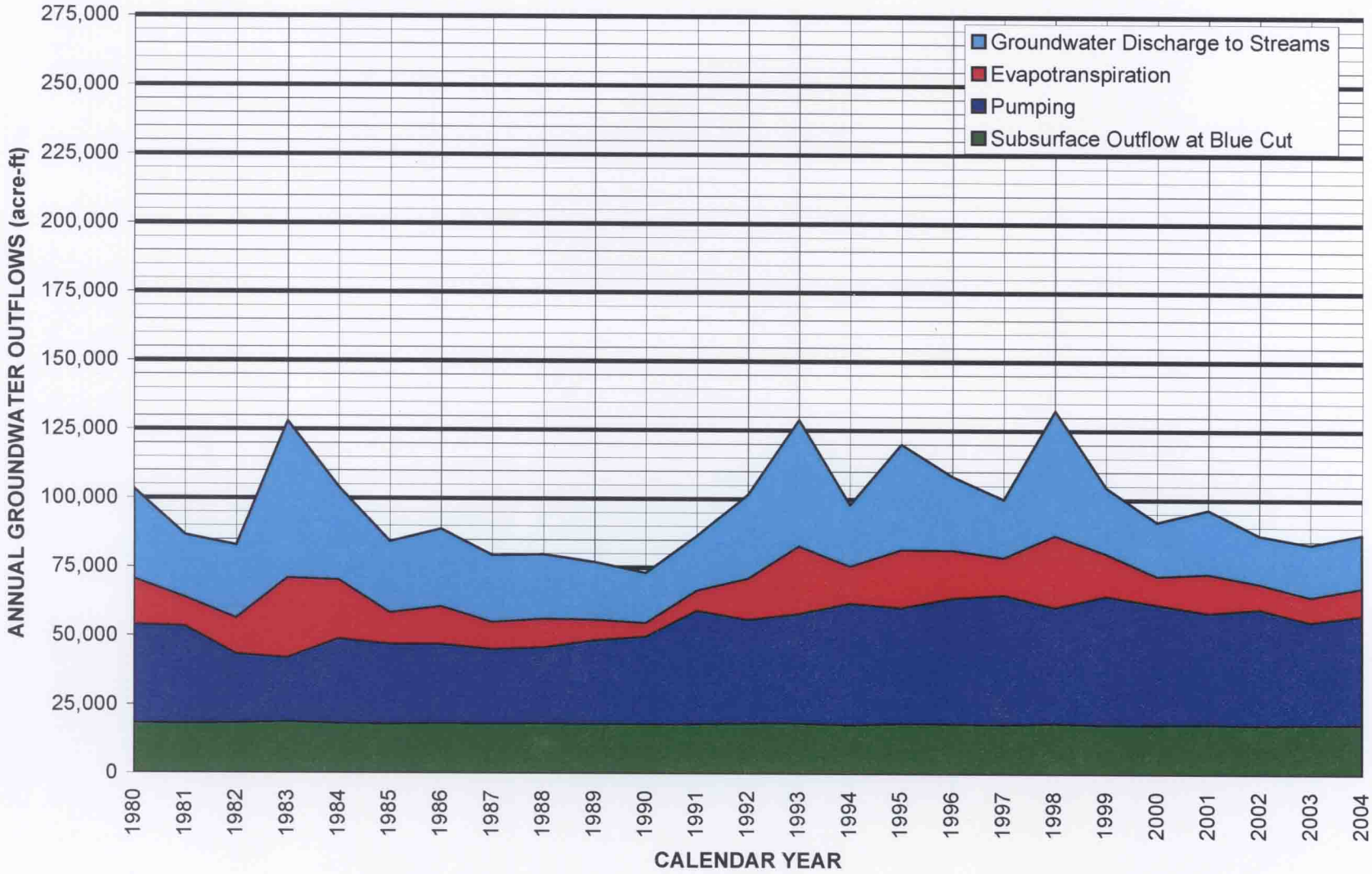

FIGURE 13
SIMULATED ANNUAL GROUNDWATER OUTFLOWS
CALIBRATION UPDATE OF REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-417.xls/Fig 13

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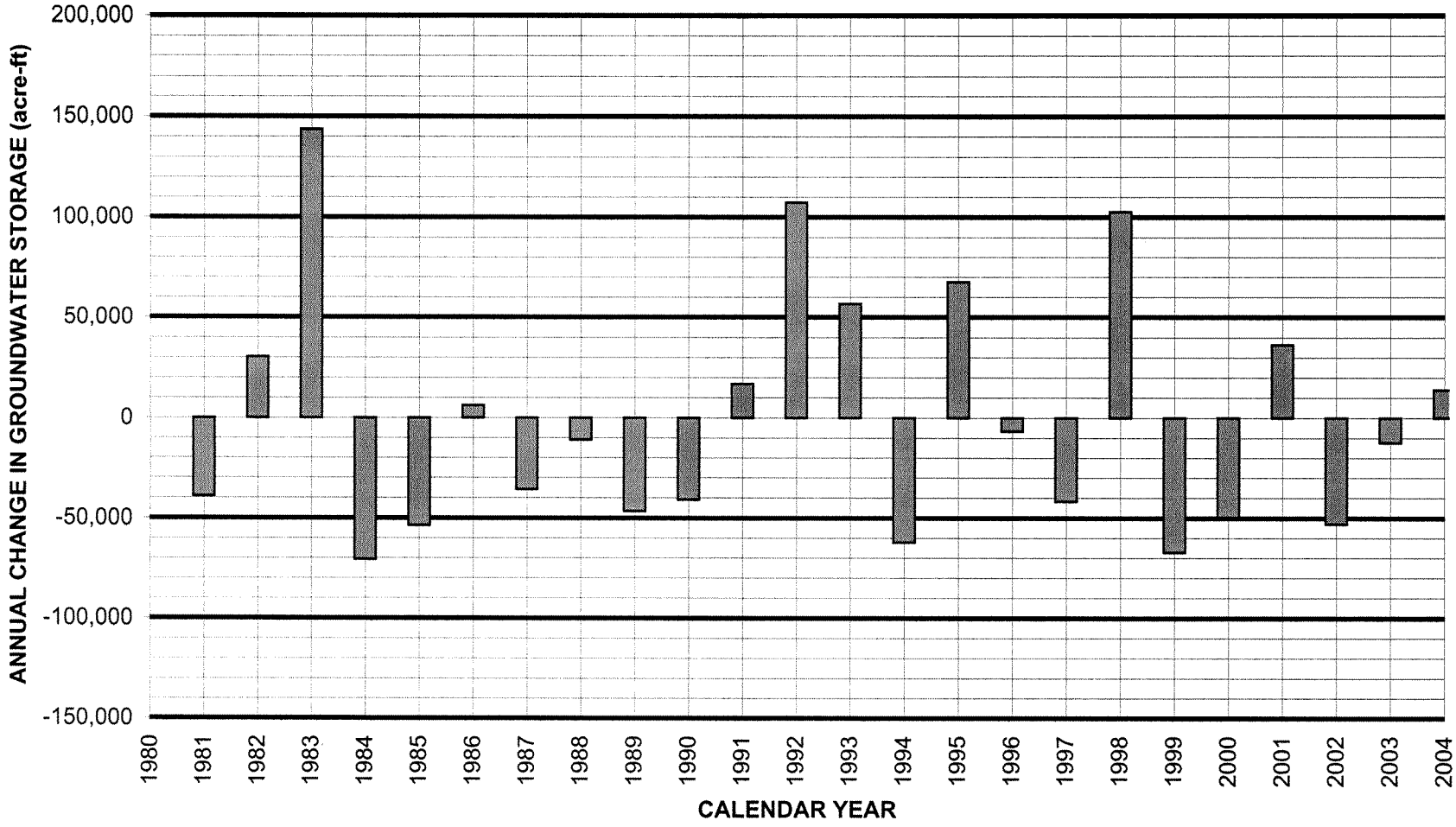

FIGURE 14
ANNUAL CHANGE IN SIMULATED GROUNDWATER STORAGE
CALIBRATION UPDATE OF REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-417.xls/Fig 14

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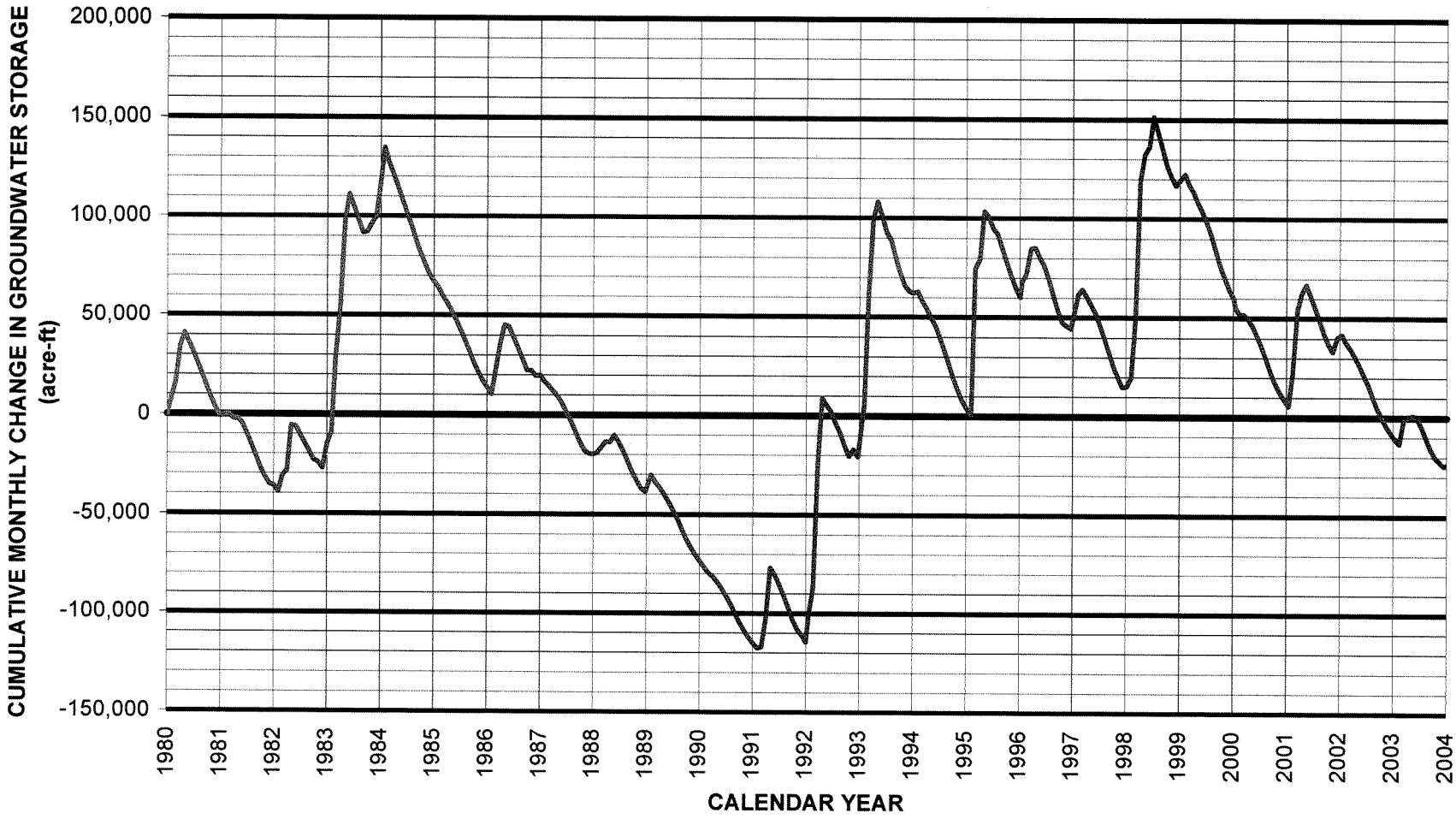

FIGURE 15
CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
CALIBRATION UPDATE OF REGIONAL GROUNDWATER FLOW MODEL FOR THE SANTA CLARITA VALLEY
SANTA CLARITA, CALIFORNIA

178973-417.xls/Fig 15

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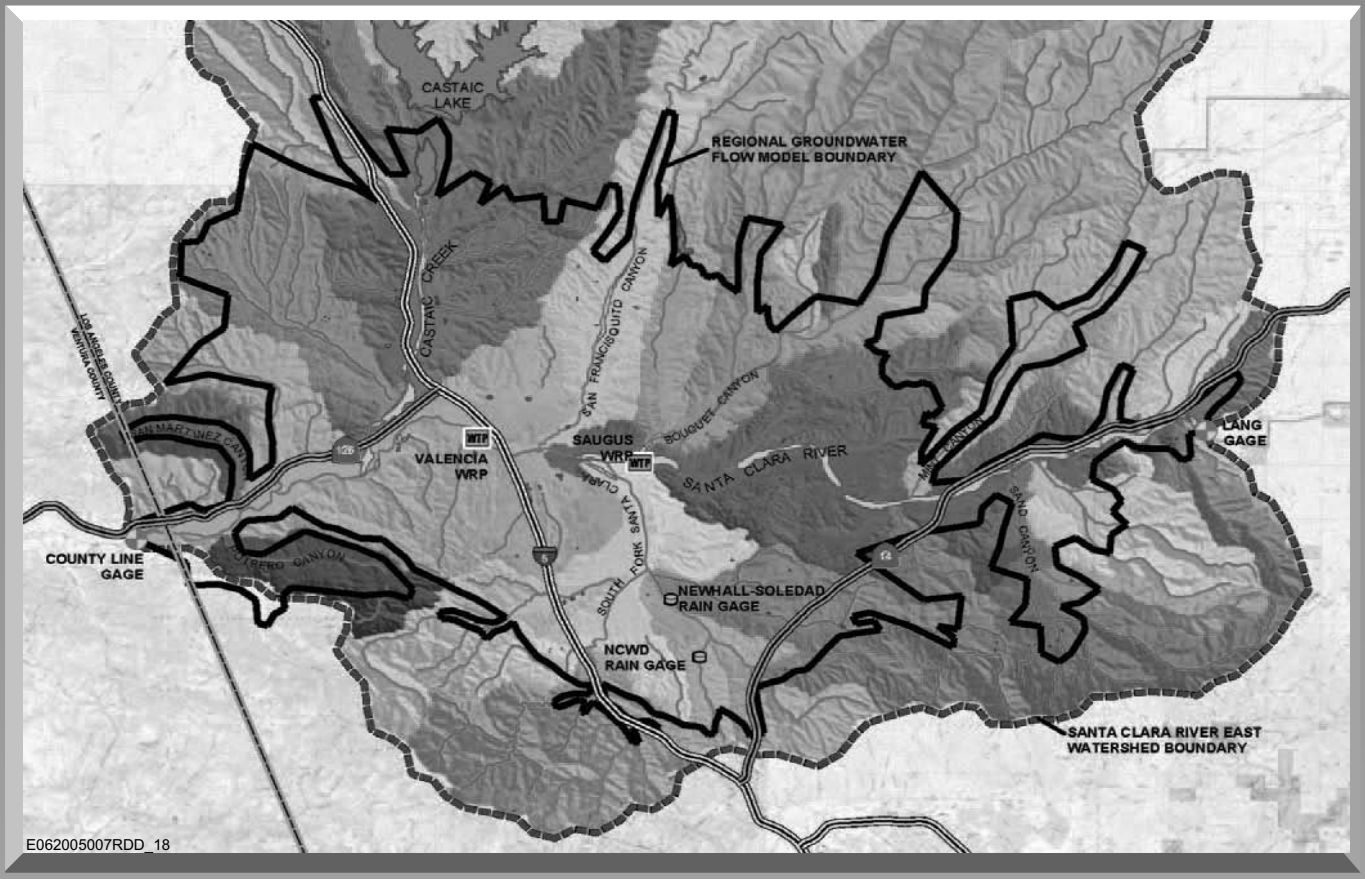
CH2MHill, "Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California" (August 2005)

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District



Prepared by

CH2MHILL

In cooperation with
Luhdorff & Scalmanini Consulting Engineers

August 2005

Prepared for
Upper Basin Water Purveyors:
Castaic Lake Water Agency (CLWA)
Newhall County Water District
Santa Clarita Water Division of CLWA
Valencia Water Company

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September 23, 2005

178973.A4.02

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Valencia Water Company
24631 Rockefeller Avenue
Valencia, California 91385-5904

Mr. Dan Masnada
Castaic Lake Water Agency
27234 Bouquet Canyon Road
Santa Clarita, California 91350-2173

Mr. William Manetta
Santa Clarita Water Division, CLWA
22722 Soledad Canyon Road
Saugus, California 91350

Mr. Steve Cole
Newhall County Water District
P.O. Box 220970
23780 North Pine Street
Santa Clarita, California 91322-0970

Subject: Submittal of Report on Basin Yield Analysis

Dear Mr. DiPrimio, Mr. Masnada, Mr. Manetta, and Mr. Cole:

CH2M HILL is pleased to submit the enclosed report titled *Analysis of Groundwater Basin Yield, Upper Santa Clara River Basin, East Subbasin, Los Angeles County, California*. This report has been developed for the Upper Basin Water Purveyors and is the second of two reports that present and evaluate the groundwater operating plan for water supply wells completed in the Alluvial Aquifer and the Saugus Formation. This work has been performed as part of the August 2001 Memorandum of Understanding between the Santa Clara River Valley Upper Basin Water Purveyors and the United Water Conservation District. The first report, dated April 2004, documented the construction and calibration of a groundwater flow model for the Santa Clarita Valley. The enclosed report presents a modeling analysis of the groundwater operating plan and concludes that the groundwater operating plan is a reliable long-term component of water supply for the valley.

It has been our pleasure to serve the Upper Basin Water Purveyors on this important project. Please call me at 503/235-5022 if you have any questions.

Sincerely,

CH2M HILL

John J. Porcello
Project Manager

Nathan R. Brown, P.G.
Hydrogeologist

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Enclosures

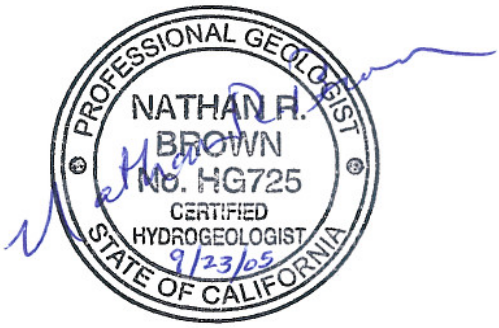
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Prepared in Support of the August 2001 Memorandum of Understanding between the Upper Basin Water Purveyors and the United Water Conservation District

Prepared for

Upper Basin Water Purveyors:

Castaic Lake Water Agency (CLWA)
Newhall County Water District
Santa Clarita Water Division of CLWA
Valencia Water Company



Prepared by

CH2MHILL

In cooperation with

Luhdorff & Scalmanini Consulting Engineers

August 2005

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Acronyms and Abbreviations

µg/L	micrograms per liter
AF/yr	acre-feet per year
AL	State of California's Action Level
Amended 2000 UWMP	2000 Urban Water Management Plan and 2005 amendments
CLWA	Castaic Lake Water Agency
DWR	California Department of Water Resources
ET	evapotranspiration
ft/day	feet per day
ft^2/day	square feet per day
in/yr	inches per year
Kh	horizontal hydraulic conductivity
LACSD	Los Angeles County Sanitation District
LADPW	Los Angeles County Department of Public Works
LSCE	Luhdorff & Scalmanini Consulting Engineers
MOU	Memorandum of Understanding
msl	mean sea level
NCWD	Newhall County Water District
NLF	Newhall Land & Farming Company
OCAP	Operating Criteria and Plan
Purveyors	Upper Basin Water Purveyors
RCS	Richard C. Slade and Associates, LLC
Regional Model	Santa Clarita Valley Regional Groundwater Flow Model
SCWC	Santa Clarita Water Company
SWP	State Water Project
SWRM	Surface Water Routing Model
T	transmissivity
USBR	U.S. Bureau of Reclamation
USGS	U.S. Geological Survey
UWMP	Urban Water Management Plan

VWC	Valencia Water Company
WHR	Wayside Honor Rancho
WRP	water reclamation plant
UWCD	United Water Conservation District

SECTION 1

Introduction

This report presents an evaluation of the long-term sustainability of existing groundwater management practices in the Santa Clarita Valley, located in northwestern Los Angeles County, California. The groundwater system in the Santa Clarita Valley is identified by the California Department of Water Resources (DWR) as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07) and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Groundwater in the basin is pumped from a shallow Alluvial Aquifer and deeper groundwater resources that are present in an older, underlying unit called the Saugus Formation. Most groundwater pumping is by the local water purveyors (the Upper Basin Water Purveyors [herein referred to as the Purveyors[1]]) for municipal uses (in the range of approximately 23,000 to 28,000 acre-feet per year [AF/yr] in recent years), with some continuing pumping by private landowners, primarily for irrigation uses (approximately 15,000 to 16,000 AF/yr in recent years). The Purveyors also have access to other sources of water, including imported State Water Project (SWP) water, groundwater banking outside the basin, recycled water, short-term water exchanges, and dry-year water purchase programs (Luhdorff & Scalmanini Consulting Engineers [LSCE], 2005a). The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, and limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus Formation pumping during years when supplemental imported water supplies are significantly reduced because of drought conditions.

The evaluation of the Purveyors' current groundwater management practices has been performed using a detailed numerical groundwater flow model of the basin. The model, called the Santa Clarita Valley Groundwater Model (Regional Model), simulates the occurrence and flow of groundwater, including its interaction with streams in the area. The Regional Model has been developed for the Purveyors as a tool for the analysis of groundwater management options in the context of future water demands and water supply conditions in the valley. Among the objectives in developing the model were (1) to be able to evaluate the long-term sustainability (yield) of the Alluvial and Saugus aquifer systems under a range of existing and potential future water resource management conditions, and (2) to facilitate general management of water quantity and water quality issues. Figure 1-1 is a map showing the area simulated by the model (tables and figures are located at the end of each section).

1.1 Background

The Regional Model has been developed as part of the work scope contained in an August 2001 Memorandum of Understanding (MOU) that was entered into by the

[1]The Purveyors consist of the Castaic Lake Water Agency (CLWA), the Newhall County Water District, the Santa Clarita Water Division of CLWA, and the Valencia Water Company. The Santa Clarita Water Division of CLWA was acquired by CLWA in 1999. It was formerly called the Santa Clarita Water Company (SCWC).

Purveyors and the United Water Conservation District (UWCD), located downstream in Ventura County. The MOU, which is provided in Appendix A, is a commitment by the Purveyors to expand on previous analyses of groundwater conditions such that the adequacy of the local groundwater supply can be better understood and questions about surface water and groundwater resources can be more readily addressed. The MOU initiated a collaborative and integrated approach to data collection; database management; evaluating groundwater conditions and the sustainability of the Purveyors' operating plan; groundwater flow modeling; annual reporting on basin conditions; and technical reporting focused on geologic and hydrologic aspects of the overall stream-aquifer system.

In 2003, subsequent to the MOU, CLWA prepared and adopted a formal Groundwater Management Plan (CLWA, 2003), which includes 14 elements intended to achieve four management objectives, or goals, for the groundwater basin that were identified in the plan. Those four management objectives were development of local groundwater for water supply; avoidance of overdraft and associated undesirable effects; preservation of groundwater quality; and preservation of interrelated surface water resources. The intent of the Groundwater Management Plan is to ensure that ongoing utilization of local groundwater continues to result in acceptable aquifer conditions, specifically avoidance of overdraft (Element 3 of the plan), no degradation of quality (Element 6 of the plan), no adverse impacts to surface waters (Element 2 of the plan). The plan identified these objectives and elements as being accomplished via continued conjunctive use operations that have been ongoing since the initial importation of supplemental surface water in 1980 (Element 5 of the plan) and via monitoring and interpretation of surface water and groundwater conditions on an ongoing basis (Elements 1 and 2 of the plan).

Both the MOU and the Groundwater Management Plan contain several technical components, including the development and calibration of a regional-scale groundwater flow model and the application of the model to evaluate the sustainability of the Purveyors' current groundwater operating plan. The development and calibration of the model was documented in detail in April 2004 in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a). A summary of the Regional Model's construction and calibration is presented in Appendix B. The analysis of the sustainability of the Purveyor's current groundwater operating plan began in 2004 and is the subject of this report. Consequently, this report and the earlier report on the development and calibration of the model represent the accomplishment of two of the key technical work components that were described in the MOU and in several elements of the Groundwater Management Plan.

The Purveyors prepared the first Urban Water Management Plan (UWMP) for the Santa Clarita Valley in 1985. At about that same time, the Purveyors began studying the local water resources to assess the condition, hydrogeologic character, storage capacity, water budgets, and water quality of the local groundwater aquifers. Some of that work involved evaluating the potential for conjunctive use of groundwater and imported water resources, specifically artificial recharge of the Alluvial Aquifer using spreading basins, and aquifer storage and recovery in the Saugus Formation. An update of the UWMP in December 2000 projected water demands in the valley through 2020 and delineated a number of local and other water supplies, in conjunction with SWP water, to meet those projected water demands. The UWMP also identified a water supply plan that consisted of using alternate

supplies and/or development of future supplies from groundwater storage projects, short-term transfers, local groundwater, and other sources to offset potentially reduced deliveries of SWP water, while meeting demands in a manner that would not cause overdraft conditions in the local aquifer systems. In 2005, CLWA amended the 2000 UWMP to address the adequacy of groundwater supplies in light of perchlorate contamination that had caused the inactivation of five municipal water supply wells. Included in the amendments to the 2000 UWMP (CLWA et al., 2005; hereafter referred to, together with the 2000 UWMP [Black & Veatch, 2000], as the Amended 2000 UWMP) was discussion of the plan currently being implemented to install treatment and restore impacted wells for water supply by 2006. In accordance with the California Urban Water Management Planning Act, the UWMP is currently undergoing a 5-year update that will be completed in late 2005.

The Purveyors and UWCD initially agreed in the MOU, and the Purveyors subsequently committed in the Groundwater Management Plan, to develop and use the Regional Model for the sustainability evaluation of the local groundwater operating plan, in part because (1) the available data showed that no long-term lowering of the water table or degradation of water quality had occurred during the 50 to 60 years of historical groundwater development in the valley, and (2) the various studies and water planning efforts performed up to that time had resulted in a local groundwater operating plan that places future pumping of the Alluvial Aquifer in the same range as historical pumping. However, although the MOU recognized a need to formally analyze the Alluvial Aquifer, it identified that the primary question to evaluate with the Regional Model would be the operational yield of the Saugus Formation, given that the Purveyors' operating plan called for dry-year pumping at rates higher than historically had been pumped. For that reason, the MOU identified that the model would evaluate the effect of the current groundwater operating plan on groundwater conditions in both the Alluvial Aquifer and the Saugus Formation over a multi-year wet/dry cycle. The operational yield was defined in the MOU as an operating plan for the local groundwater basin that would allow continued pumping from the Alluvial Aquifer and Saugus Formation while assuring that groundwater supplies would be adequately replenished from one wet/dry cycle to the next.

Together, the historical development of these plans and the evaluation of their sustainability that is described in this report are grounded in the following objectives, which have been identified by the Purveyors for local groundwater resource management:

1. Prepare a groundwater operating plan for the basin (locations of wells, pumping capacities, and variations in annual pumping volumes) that is integrated with SWP and other imported supplies and recycled water to meet local water demands.

2. Analyze the groundwater operating plan to quantify possible basin responses to the plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows. This includes evaluating the rate of recovery of Saugus Formation groundwater levels after 1 or more years of increased pumping in the Saugus Formation.

3. Evaluate the range of basin responses to the groundwater operating plan to determine whether the plan will result in sustainable groundwater resources and supplies. This includes evaluating the following:

    a. Whether groundwater level declines during future drought periods will continue to arise primarily from local drought conditions, instead of from the groundwater operating plan for the basin; and, more importantly, whether groundwater levels and storage will recover (recharge) in wet periods following dry or drought conditions

    b. Whether groundwater discharges to the Santa Clara River will continue to be relatively stable over time, compared to the year-to-year variations in groundwater recharge that occur in the rest of the basin

To meet these objectives, the Purveyors developed the Regional Model to be an evolving tool for local groundwater resource management. As discussed in the model development report (CH2M HILL, 2004a), specific objectives identified for the Regional Model were as follows:

1. To evaluate the long-term sustainability (yield) of the two aquifer systems in the valley, the Alluvial Aquifer and the Saugus Formation, under a range of existing and potential future water resource management conditions

2. To evaluate artificial recharge for the purpose of increasing the long-term sustainability of the aquifer system, particularly in conjunction with the availability of imported surface water supplies

3. To evaluate the influences of future water management plans and alternatives on groundwater conditions in the valley and on the flows of water into the downstream basins in Ventura County

4. To facilitate general management of water quantity and water quality issues

This report focuses on the application of the Regional Model to meet the first objective.

1.2 Report Organization

The remainder of this report is organized as follows:

- **Section 2** discusses the hydrogeology of the basin and describes the groundwater operating plan.
- **Section 3** describes the process that was used to simulate the groundwater operating plan with the Regional Model and evaluate the modeling results.
- **Section 4** discusses the results of the simulated groundwater operating plan.
- **Section 5** discusses the principal findings from the analyses of historical data and numerical modeling results, and the implications of these findings for long-term water management in the Santa Clarita Valley.
- **Section 6** is the reference list.

Figure

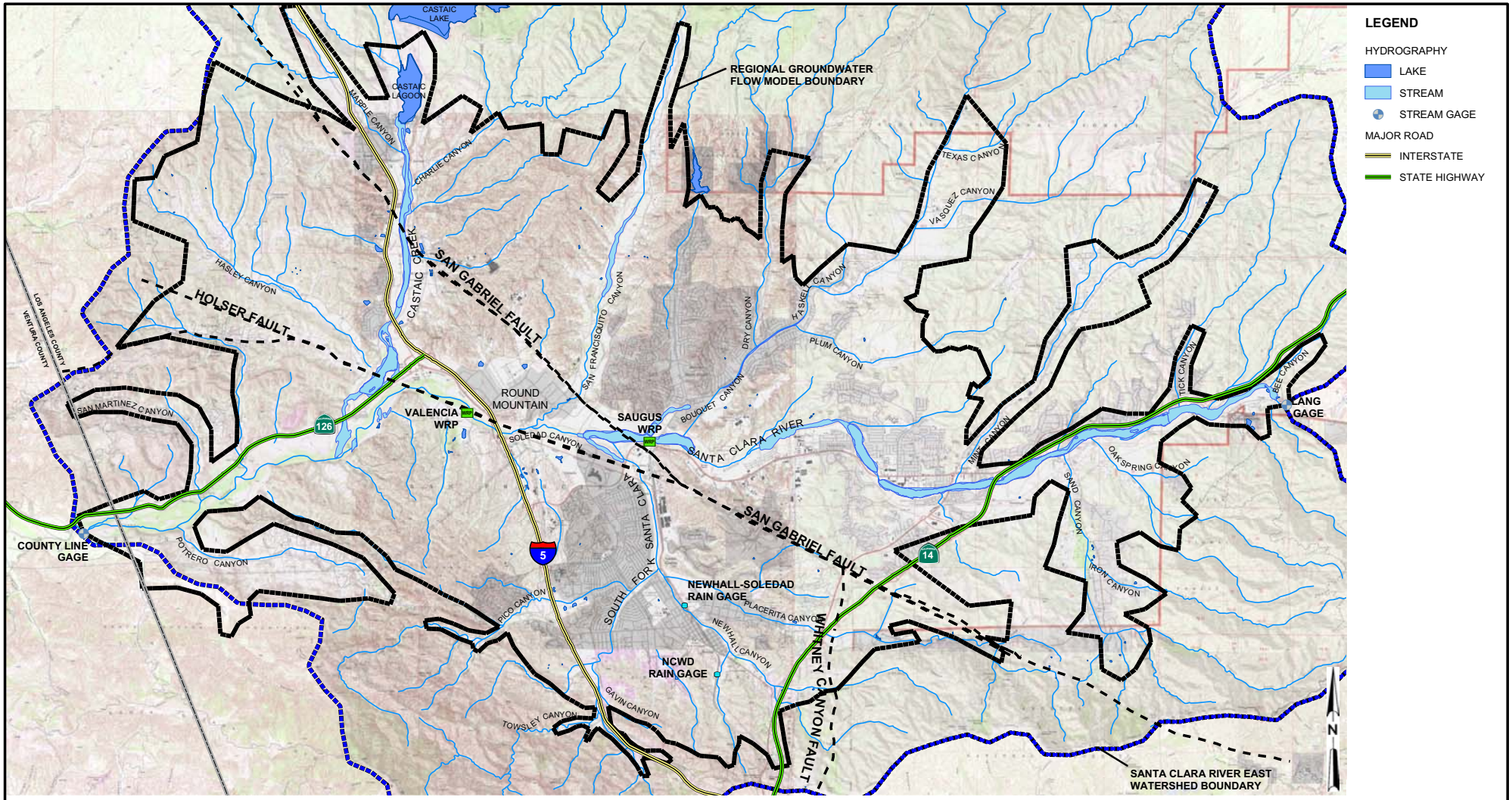

FIGURE 1-1
MAP OF STUDY AREA
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

CH2MHILL

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SECTION 2

Groundwater Hydrology and Operating Plan

2.1 Basin Hydrogeology

The groundwater system in the Santa Clarita Valley is identified by DWR as the Santa Clara River Valley Groundwater Basin, East Subbasin (Basin No. 4-4.07), and lies within the DWR-designated Upper Santa Clara River Hydrologic Area. Figure 2-1 shows the location of this groundwater basin. The basin contains two aquifer systems: the Alluvial Aquifer and the Saugus Formation. Figure 2-2 is a geologic map showing the geographical extent of these and other rock units in and around the basin.

In general, natural groundwater recharge occurs in the eastern portion and at the northern and southern limits of the basin, and natural groundwater discharge occurs in the west-central portion of the basin, in the alluvial valley occupied by the Santa Clara River. Groundwater pumping is an additional groundwater discharge mechanism that occurs in discrete portions of the basin. A schematic representation of the regional-scale geology and hydrologic cycle in the Santa Clarita Valley is shown on Figure 2-3, and the components of the hydrologic cycle for the basin's groundwater and surface water resources are listed in Table 2-1. As indicated by the diagram and the table, groundwater is exchanged between the Alluvial Aquifer and the Saugus Formation, with the Alluvial Aquifer recharging the Saugus Formation in certain portions of the regional recharge areas, and the Alluvial Aquifer receiving groundwater from the Saugus Formation in the regional groundwater discharge areas. Additionally, the aquifer systems are affected by direct rainfall; stream-flows in the Santa Clara River and its tributaries; evapotranspiration (ET) by riparian vegetation along portions of the river; and human influences, which consist of pumping, agricultural and urban irrigation, discharge of treated water into the Santa Clara River from two water reclamation plants (WRP), and occasional releases of water into Castaic Creek from Castaic Lake and Castaic Lagoon.

The Santa Clarita Valley obtains its water supply from local groundwater sources and from imported water supplies. Total water use in the valley is largely for municipal and industrial uses and, to a lesser extent, for agricultural uses. In 2004, approximately 61 percent of groundwater pumping was by the Purveyors (for municipal uses) and 39 percent was by private land owners, primarily for irrigation. Figure 2-4 is a map showing the locations of production wells that are currently present in the Alluvial Aquifer and the Saugus Formation. Prior to the 1960s, agriculture was the predominant land use in the valley. Agricultural water was supplied by production wells, most of which were completed in the Alluvial Aquifer. Pumping from the Alluvial Aquifer during much of the 1950s and early 1960s ranged between approximately 35,000 and 44,000 AF/yr. Pumping from the Alluvial Aquifer dropped gradually from approximately 40,000 AF/yr in the mid-1960s to less than 30,000 AF/yr through the 1980s, and did not rise above 30,000 AF/yr until 1993. Since then, it has ranged between 30,000 and nearly 44,000 AF/yr. In the Saugus Formation, very little pumping occurred before 1960. From 1960 through 1990, total pumping from the Saugus Formation ranged from approximately 2,500 AF/yr to approximately 8,500 AF/yr. As a

result of statewide drought conditions, pumping from the Saugus Formation ranged between 10,000 and 15,000 AF/yr from 1991 through 1994. Saugus pumping was reduced beginning in 1995, as the drought ended and additional water supplies became available.

2.2 Groundwater Operating Plan

The water management practices of the Purveyors call for maximizing the use of Alluvial Aquifer groundwater and SWP water during years of normal or above-normal availability of SWP water supplies and local Alluvial Aquifer groundwater resources. These practices recognize ongoing Alluvial pumping for agricultural water supply as well as other smaller (private) domestic and related water supply, and are intended to maintain overall pumping within sustainable rates. Groundwater pumping is minimized from the Saugus Formation, except during years when SWP water allocations are below normal. These water management practices are based, in part, on observations about the historical hydrology of the basin (described in Section 2.2.1) and form the groundwater operating plan for the basin (described in Section 2.2.2).

2.2.1 Historical Groundwater Conditions

Long-term water level data have been collected over the years at agricultural wells and Purveyor-owned wells in the City of Santa Clarita and along the South Fork Santa Clara River. The data have been collected in pumping wells, and the hydrographs of these wells are steep at certain times, suggesting that the measured water levels are influenced, to a certain degree, by pumping at the well. Nonetheless, the data show general relationships between groundwater elevation trends and changes in groundwater recharge and pumping over time. These relationships have been identified by examining the 50-year period from 1950 through 1999. During this period, the average rainfall was close to the long-term average rainfall observed since 1883. Consequently, long-term changes in the basin's hydrology arising from other factors could be more easily identified because rainfall was near normal for the 50-year period as a whole.

Following are discussions of the observed hydrologic trends in the basin, including rainfall, groundwater elevations in the Alluvial Aquifer and the Saugus Formation, and flows in the Santa Clara River.

2.2.1.1 Historical Trends in Rainfall

Rainfall data have been recorded since 1883 at the Newhall-Soledad gage (Station No. FC32CE), located at the Los Angeles County Department of Public Works (LADPW) Newhall-Soledad Division Headquarters office, on San Fernando Road in the community of Newhall. The average rainfall at this gage was 17.95 inches from 1883 through 2000 and 17.84 inches from 1950 through 2000[2]. Figure 2-5 shows the annual rainfall at the Newhall-Soledad gage for calendar years 1950 through 2000. Figure 2-5 also shows the cumulative departure from the average annual precipitation since 1950. Cumulative departure refers to the cumulative amount of rainfall that is greater than or less than the long-term average rainfall. The slope of the cumulative departure plot shows the temporal trends in rainfall

[2]Annual rainfall values for the Newhall-Soledad gage were derived from monthly values reported by the National Climate Data Center and LADPW.

over successive years. The figure shows the following trends in precipitation within the Santa Clarita Valley:

1. 1950 through 1964: Dry conditions except for single wet years in 1952, 1957, 1958, and 1962 (a nearly continuous decrease in cumulative departure values)
2. 1965 through 1970: Wet conditions (increase in cumulative departure values)
3. 1971 through 1977: Average to dry conditions (flat or declining cumulative departure values)
4. 1978 through 1983: Wet conditions (increase in cumulative departure values)
5. 1984 through 1991: Dry conditions (decrease in cumulative departure values)
6. 1992 through 1999: Highly variable conditions from year to year, but overall increase in cumulative departure values

A second rain gage is located approximately 1.3 miles to the south, at the Newhall County Water District (NCWD) office (see Figure 1-1). Figure 2-6 compares the annual rainfall at the Newhall-Soledad and NCWD gages for calendar years 1950 through 2000. Rainfall at the NCWD gage is usually greater than at the Newhall-Soledad gage, because the NCWD gage is located closer to the hills that form the southern boundary of the watershed and receive a greater amount of orographic precipitation, as shown on Figure 2-7.

2.2.1.2 Historical Trends in Alluvial Aquifer Groundwater Elevations

Figure 2-8 shows trends in groundwater elevations in two Alluvial Aquifer wells located in the basin interior (wells VWC-N and NLF-S, near the mouth of the South Fork Santa Clara River) and two Alluvial Aquifer wells located near the regional groundwater discharge zone at the western end of the basin (wells NLF-C5 and NLF-C7). The figure also shows trends in the following other components of the hydrologic cycle:

1. Precipitation at the Newhall-Soledad rain gage (plotted as the cumulative departure from the average precipitation)
2. Annual pumping volumes from the Alluvial Aquifer and the Saugus Formation
3. Total discharges to the Santa Clara River from two WRPs (which are discussed further in Section 2.2.1.5)
4. Measured flow volume in the Santa Clara River during the lowest flow month of each year

Observations from Figure 2-8 are as follows:

1. Alluvial Aquifer groundwater elevations show greater variability over time within the basin interior (wells VWC-N and NLF-S) than near the basin outlet (wells NLF-C5 and NLF-C7). The range in water levels during the 50-year period of record is approximately 100 feet at the interior wells, but only 20 to 30 feet in the two wells near the basin outlet.
2. The effect of reduced pumping from the Alluvial Aquifer from 1967 through 1989 was to minimize seasonal fluctuations in Alluvial Aquifer water levels near the aquifer's regional discharge zone at the western end of the valley. In this area, fluctuations in

Alluvial Aquifer pumping over time affected Alluvial groundwater elevations only seasonally; year-to-year variations in groundwater elevations were small. This indicates that water levels in this area are controlled less by pumping than by the discharge of Alluvial Aquifer groundwater to the Santa Clara River in the area downstream of Interstate 5.

3. As with the western portion of the Alluvial Aquifer, the central portion of the Alluvial Aquifer has not shown long-term water level declines. During the 1950s and early 1960s, total pumping from the Alluvial Aquifer ranged between approximately 35,000 and 44,000 AF/yr during all but 1 year, and long-term (year-to-year) groundwater elevations were relatively stable (see the hydrographs for wells VWC-N and NLF-S). When pumping from the Alluvial Aquifer decreased beginning in 1967, Alluvial groundwater elevations in this area quickly rose and have been relatively stable since about 1970, despite an increase in Alluvial Aquifer pumping during the 1990s. The hydrographs indicate that after an extended drought and high rates of pumping, Alluvial Aquifer groundwater elevations recover very quickly when normal or above-normal rainfall patterns return.

4. The seasonal low flow in the Santa Clara River at the County Line gage has shown a long-term increase since the mid-1970s and, to some degree, since the late 1960s. Figure 2-5 shows that this increase in flow coincides with increases in the annual discharges of treated water to the Santa Clara River from the two WRPs. Although Alluvial Aquifer pumping increased during the 1980s and 1990s, the seasonal low river flow did not show a long-term decrease during this period. The increases in WRP and Santa Clara River flows and the fluctuations in Alluvial Aquifer pumping have not caused long-term changes in Alluvial Aquifer groundwater elevations at the two wells near the basin outlet.

2.2.1.3 Historical Trends in Saugus Formation Groundwater Elevations

Figures 2-9 and 2-10 compare groundwater elevation trends in the Saugus Formation near the Santa Clara River, below the mouth of the South Fork Santa Clara River, with the same hydrologic components displayed on Figure 2-8. Figure 2-9 shows this information for the period 1950 through 1999, and Figure 2-10 shows this information during the 1990s, when groundwater levels rose in the Saugus Formation. Figures 2-11 and 2-12 show the same information, but for groundwater elevations at Saugus Formation wells located farther away from the Santa Clara River, along the tributary valley containing the South Fork Santa Clara River.

In examining the four Saugus Formation figures, it is difficult to distinguish between the influences of precipitation and pumping trends on changes in Saugus water levels. Although a slight rise in water levels might have occurred at wells VWC-157 and VWC-160 during the late 1960s and early 1970s, it appears to follow the trends in Saugus pumping volumes more closely than the precipitation trends. The data at VWC-157 also suggest that a succession of above-normal precipitation years (e.g., 1978 through 1983) or a year of precipitation that is substantially above normal (e.g., 1983) might have some influence on Saugus water levels. However, the data are limited, and the periods of increased precipitation tend to coincide with periods of decreased pumping, making it difficult to identify the effect of precipitation or pumping on Saugus water levels.

Another observation is that the rise in Saugus Formation water levels in the late 1960s and early 1970s occurred despite an increase in annual pumping volumes from the Alluvial Aquifer. During the late 1980s and 1990s, Saugus pumping increased from slightly less than 6,000 AF/yr (in 1986 and 1987) to approximately 15,000 AF/yr in 1991. When SWP deliveries were substantially reduced in 1991, pumping from the Saugus Formation made up for almost half of the reduction that year. This increased Saugus pumping resulted in short-term declines in groundwater elevations at the pumping wells, particularly from 1991 through 1994, reflecting the use of naturally-stored Saugus groundwater. However, as shown on Figures 2-9 and 2-10, the water levels subsequently rose when pumping declined. This indicates that Saugus water levels are controlled by precipitation and/or Saugus pumping trends, and not by pumping trends in the Alluvial Aquifer.

2.2.1.4 Comparison of Historical Trends in Alluvial and Saugus Groundwater Elevations

Figure 2-13 compares groundwater elevations at Alluvial Aquifer and Saugus Formation wells located near each other along the Santa Clara River, just below the mouth of the South Fork Santa Clara River. At this location, the trends in Alluvial groundwater elevations show no clear relationship with the trends in Saugus groundwater elevations. A moderate overall increase in groundwater elevations was observed in both the Alluvial Aquifer and the Saugus Formation during the late 1960s. However, this similarity in the water level trends might be a coincidence arising from reduced pumping in both aquifers. During the early 1970s, water levels in Saugus well VWC-157 decreased while water levels in the nearby Alluvial Aquifer well (VWC-N) generally increased. During the 1990s, the Alluvial Aquifer groundwater elevations at well VWC-N were generally stable despite (1) increased pumping from the Alluvial Aquifer and (2) a sharp decrease, then increase, in Saugus groundwater elevations, which correlated with the trends in Saugus pumping. In summary, although there might be a relationship between Alluvial and Saugus groundwater elevations near the margins of the groundwater basin, where folding of Saugus beds has brought permeable zones in contact with the alluvium, Figure 2-13 indicates that there is general independence between the Alluvial and Saugus water level trends at this location, which is near the center of the bowl-shaped Saugus Formation structure shown on Figure 2-3.

2.2.1.5 Historical Trends in Santa Clara River Baseflow

Long-term records of flows in the Santa Clara River are available for the eastern and western ends of the basin. The locations of the two gages are shown on Figure 1-1 and Figure 2-3. At the western end of the basin, the County Line gage has recorded Santa Clara River flows leaving the basin for most of the period since 1952, except for a 1-year period during water year 1969 (October 1968 through September 1969). At the eastern end of the basin, the Lang gage has recorded Santa Clara River flows entering the basin from October 1949 through September 1989 and from April 2003 to the present.

Baseflow in the Santa Clara River is perennial in the western portion of the Santa Clarita Valley. The following sources of water contribute to the river's baseflow:

1. **Groundwater discharge from the Alluvial Aquifer to the riverbed.** Groundwater in the Alluvial Aquifer seeps into the riverbed near, and downstream of, Round Mountain (which is located just below the mouth of San Francisquito Canyon).

2. **Discharges from two WRPs.** Treated water is discharged to the Santa Clara River from two Los Angeles County Sanitation District (LACSD) WRPs in the valley. The Saugus WRP (Plant No. 26) is located along the south side of the river near Bouquet Canyon, just above the mouth of the South Fork Santa Clara River. The Valencia WRP (Plant No. 32) is located along the north side of the river, just west of Interstate 5.

3. **Flood Flows in Castaic Creek.** DWR stores SWP water in Castaic Lake. In some years, DWR releases flood flows from Castaic Dam/Lagoon into Castaic Creek during the winter or spring months. Depending on the magnitude of the releases, some of these flows enter the Santa Clara River downstream of the Valencia WRP. As shown on Figure 2-14, these releases have occurred during many, though not all, years since the release program began in the late 1970s.

Hydrograph separation techniques were applied to the daily streamflow data for the County Line gage to estimate historical groundwater discharges (baseflow) to the Santa Clara River within the Santa Clarita Valley. The hydrograph separation was performed for calendar years 1953 through 1999 using the following five steps:

1. For each day, the average daily flow at the County Line gage, in cubic feet per second (cfs), was converted to acre-feet of volumetric flow for the day.

2. The daily flows from Castaic Dam and at the Castaic Creek South gage (located near the mouth of Castaic Creek) were subtracted from the flow at the County Line gage. These data reflect surface water flow from tributaries. Data from the Castaic Creek South gage were used through June 1977. Beginning in July 1977, operational data for Castaic Lagoon, presented in annual reports by DWR, were used to estimate surface flow contributions from Castaic Creek.

3. The discharges of treated water from the two WRPs were subtracted. This step was performed for calendar years 1975 and later, because 1975 was the first year that such records were available.

4. The resulting day-to-day trends in streamflows were scrutinized for days when notably elevated flows occurred suddenly. These days were assumed to be dominated by storm flow. In some cases, the elevated flows lasted for only 2 to 5 days. In other cases, flows remained elevated for several days, but showed steady declines, indicating that only the beginning of the elevated-flow period was dominated by surface runoff.

5. On all other days, storm flow was considered to be minimal or zero, and the flow values calculated for days not dominated by storm flow were assumed to represent river base-flow (that is, groundwater discharge to the river). For each month, an average flow was calculated for these non-storm days. The average flow was then converted to a total flow for the month, and the monthly flow volumes were summed to come up with the total flow for each year.

Table 2-2 presents the annual calculations from the hydrograph separation analysis. Table 2-3 presents summary statistics for the entire 47-year period that was analyzed, as well as for shorter time frames. Tables 2-4 and 2-5 show dry-year, normal-year, and

wet-year statistics for the entire period of record and the shorter time frames. The shorter time frames are as follows:

1. Calendar years 1953 through 1965, which were years of primarily agricultural water use prior to urbanization and construction of WRPs. This 13-year period was also characterized by 5 years of below-normal rainfall.

2. Calendar years 1975 through 1999, which represent 25 years of significant urbanization, including SWP water importation and WRP operations. This 25-year period was characterized by 6 years of below-normal rainfall, although rainfall volumes in general were somewhat higher (19.4 inches per year [in/yr] average, versus 15.5 in/yr average for 1953 through 1965).

3. Calendar years 1953 through 1999, but excluding 8 years (1966 through 1974) when WRP discharges occurred but were not recorded.

The daily streamflow data and the hydrograph separation technique indicate the following:

1. Summary statistics in Table 2-3 for all types of rainfall years (dry, normal, and wet) show that average groundwater discharges to the river from 1953 through 1965 were approximately 2,500 AF/yr (3.5 cfs). Groundwater discharges to the river were typically 14,000 to 22,000 AF/yr (19 to 31 cfs) from 1975 through 1999 because of more rainfall, increasing urbanization, and increasing importation of water from outside the valley.

2. For normal rainfall years only, median and average groundwater discharges to the river were approximately 4,000 and 3,600 AF/yr (5.5 and 5.0 cfs), respectively, from 1953 through 1965 (see Table 2-4); and approximately 12,500 and 14,300 AF/yr (17 and 20 cfs), respectively, during 1975 through 1999 (see Table 2-4).

3. For drought years only, Table 2-4 shows that groundwater discharges to the river ranged from 400 to 4,900 AF/yr (0.5 to 7 cfs) between 1953 and 1965, and from 5,200 to 14,500 AF/yr (7 to 20 cfs) between 1975 and 1999. Table 2-4 also shows that median and average groundwater discharges to the river during drought years were 600 and 1,700 AF/yr (1 and 2 cfs), respectively, from 1953 through 1965, and typically 9,600 and 10,200 AF/yr (13 and 14 cfs), respectively, from 1975 through 1999.

In summary, significant increases in the baseflow of the Santa Clara River have occurred since urbanization of the Santa Clarita Valley began during the late 1960s and early 1970s. Water imports began in 1980, and have increased in volume as urbanization has continued. The imported water has reached the river through releases from Castaic Dam/Lagoon and, more significantly, discharges of treated water into the river. As a result, water is now present in the Santa Clara River on a continuous basis in the western portion of the basin, even during dry years. This is a sharp contrast to conditions prior to the 1970s, when the river would become dry during drought periods.

2.2.2 Historical Estimates of Basin Yield

During the late 1980s, Richard C. Slade, Consulting Groundwater Geologist, now known as Richard C. Slade and Associates, LLC (both hereafter referred to as RCS), conducted hydrogeologic assessments of the two aquifer systems in the basin. RCS performed separate

evaluations for the Alluvial Aquifer in 1986 and the Saugus Formation in 1988, then updated this work in 2002.

The first study of the Alluvial Aquifer (RCS, 1986) identified a "practical or perennial yield" of 31,600 to 32,600 AF/yr. RCS derived these values using the so-called "Pumpage and Change-In-Storage" method, a commonly used method at the time that compares groundwater pumping volumes with changes in the volume of groundwater in storage during a multi-year period when cumulative rainfall is close to average. As RCS discussed in a more recent report (2002), this method works best in aquifers that are fully developed or in overdraft, and where recharge does not play an important role in determining the amount of groundwater in storage. Consequently, as discussed by RCS (2002), this method is not well suited to estimating sustainable pumping rates in this setting because natural recharge and water importation are major influences on the groundwater basin in the Santa Clarita Valley, and the local groundwater resources are not fully developed or in overdraft.

The first study of the Saugus Formation (RCS, 1988) did not identify a practical or perennial yield or a range of pumping rates that were estimated to be sustainable on a long-term basis. Instead, this study first estimated the "usable groundwater in storage," which was defined as the volume of Saugus Formation groundwater that is economically obtainable and of satisfactory quality for beneficial use. RCS estimated the usable groundwater in storage to be 1.41 million acre-feet. Then, using precipitation records and calculations of the exposed area of the Saugus Formation and overlying terrace deposits, and also considering the hydraulic potential for inter-aquifer flow from the overlying Alluvial Aquifer, RCS estimated that the Saugus Formation potentially receives between approximately 11,000 and 22,000 AF/yr of recharge from a combination of direct rainfall and inter-aquifer flow in any given year, depending on local hydrologic conditions. However, RCS did not discuss the relationship of these estimates to long-term pumping from the Saugus Formation. In fact, RCS noted that these assessments "…should not be construed as a rigorous determination of the perennial yield of the Saugus…."

In the *2001 Update Report: Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems* (RCS, 2002), RCS concluded that groundwater levels in the Alluvial Aquifer and Saugus Formation have fluctuated over time, but have shown no long-term progressive declines in the amount of groundwater storage that could be considered indicative of overdraft conditions. From the long-term pumping and water level data, the report concluded that the Alluvial Aquifer can be pumped at rates between 30,000 and 40,000 AF/yr over the long term, and suggested that pumping be between 30,000 and 35,000 AF/yr during local droughts. For the Saugus Formation, the report concluded that pumping can occur at rates between 7,500 and 15,000 AF/yr on a long-term basis, with short-term increases to as much as 35,000 AF/yr toward the end of a multi-year period of reduced availability of imported water supplies.

RCS (2002) referred to these pumping rates for the Alluvial and Saugus aquifer systems as the "operational yield" of both aquifers, a term that was previously described in the August 2001 MOU. The term perennial yield is often interpreted as a "not-to-exceed" volume, with a related potential for pumping above the perennial yield value in any given year to be incorrectly interpreted as "overdraft." Consequently, the MOU advanced the concept of operational yield to deal with the misinterpretations commonly associated with the concept of perennial yield. In the Santa Clarita Valley, operational yield is used today to describe the

flexible use of groundwater that allows increased pumping during dry periods and subsequent recharge (direct or in-lieu) in wet/normal rainfall periods, performed in a manner that protects the aquifer by assuring that groundwater supplies are adequately replenished on a long-term basis from one wet/dry cycle to the next. This concept is the basis for the development of the current groundwater operating plan for the local groundwater basin, which is discussed in the following section.

2.2.3 Development of Current Operating Plan

The groundwater operating plan for the Santa Clarita Valley's groundwater resources has been defined in the Amended 2000 UWMP for the Santa Clarita Valley (Black & Veatch, 2000; CLWA et al., 2005) and in annual water reports that discuss the water demands, water supplies, and surface water and groundwater resources of the valley (including the *Santa Clarita Valley Water Report 2004* [LSCE, 2005a]). These reports provide ranges of values for groundwater extractions from the Alluvial Aquifer and the Saugus Formation during wet/normal years and dry years. The Purveyors have developed the operating plan by considering the water supply needs of the valley, the availability of imported water supplies, and knowledge of the historical recovery of both aquifers (following the peak pumping years that occurred prior to the mid-1960s in the Alluvial Aquifer and during the early 1990s in the Saugus Formation). The plan is summarized in Table 2-6 and is as follows:

1. Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern part of the basin. Under the operating plan, pumping ranges between 30,000 and 40,000 AF/yr during normal and above-normal rainfall years, but, because of operational constraints in the eastern part of the basin, is reduced to between 30,000 and 35,000 AF/yr during locally dry years.

2. Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly imported water from the SWP system. For the Saugus Formation, the operating plan consists of pumping between 7,500 and 15,000 AF/yr during average-year conditions within the SWP system. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 AF/yr during a drought year, and increases to between 21,000 and 25,000 AF/yr if SWP deliveries are reduced for 2 consecutive years, and between 21,000 and 35,000 AF/yr if SWP deliveries are reduced for 3 consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 AF/yr, to further enhance the effectiveness of natural recharge processes that would rapidly recover water levels and groundwater storage volumes in the Saugus Formation, as has been historically experienced.

The Purveyors have developed this plan as part of an overall water supply strategy designed to meet increasing water demands in the Santa Clarita Valley while assuring a reasonable degree of water supply reliability[3] and not exceeding the operational yield of the local aquifer systems on a long-term basis. In particular, this plan employs an integrated use

[3]As discussed in Section ES.5 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a), the Purveyors are in the process of establishing a water reliability policy, for planning purposes, sufficient for meeting projected demands 95 percent of the time over each 20-year period. In the remaining 5 percent of the time, it is planned that the maximum supply shortage will be 10 percent of demand, a level that is based on past experience that a 10 percent water demand reduction is feasible during a drought. (During the last drought, in the early 1990s, voluntary conservation efforts by area residents resulted in a reduction in water demands of approximately 20 percent below demands in preceding years.)

of the Alluvial Aquifer and the Saugus Formation that recognizes the fundamental differences in the hydrogeologic characteristics of these two units[4]. Maintaining the substantial volume of water in the Saugus Formation is an important part of this strategy, to help maintain local groundwater supplies on a long-term basis. In implementing this operating plan, the Purveyors blend groundwater and imported water for area residents to ensure consistent quality and reliability of service. The actual blend of imported water and groundwater in any given year and any given location in the valley is an operational decision, which varies over time according to source availability and the operational capacities of Purveyor-owned facilities. In years when SWP supplies are reduced because of regulatory factors and/or dry weather conditions in the watersheds that provide SWP water supplies, the water demands in the Santa Clarita Valley can be met through a combination of the following alternate supplies:

1. Local groundwater pumping (increased short-term Saugus pumping)
2. Deliveries from CLWA's groundwater banking programs, such as the Semitropic Groundwater Storage Program in Kern County, where CLWA has banked excess SWP water in recent years
3. Deliveries from CLWA's flexible storage account in Castaic Lake Reservoir
4. Participation in DWR dry-year water purchase programs
5. Short-term water exchanges

The Purveyors have emphasized developing water supplies that add diversity in water supply options, especially in years of dry conditions in the Santa Clarita Valley (which can reduce Alluvial Aquifer supplies) and/or reduced availability of SWP imports. Drought periods, local or in the SWP system, can affect water supplies in single and multiple years. Details concerning the nature of local hydrologic variations, which govern Alluvial Aquifer pumping, are presented in Section 2.2.3.1. Section 2.2.3.2 discusses variations in imported water availability, which governs pumping from the Saugus Formation.

2.2.3.1 Variations in Local Hydrology and Alluvial Aquifer Pumping

The rate of pumping from the Alluvial Aquifer in a given year is partly affected by groundwater elevations in the eastern portion of the basin, which is the primary groundwater recharge area for the local groundwater systems. Historically, during dry years, decreases in Alluvial Aquifer pumping occur in the eastern-most Alluvial Aquifer production wells, which are located adjacent to the Santa Clara River in Soledad Canyon, upstream of the mouth of Bouquet Canyon. Reduced groundwater pumping occurs in these areas because of declines in groundwater elevations resulting from reduced groundwater recharge by the Santa Clara River during dry years. Groundwater levels in this area have historically decreased between approximately 50 and 100 feet during multi-year periods of below-normal rainfall and Santa Clara River streamflows. Consequently, the approximate

[4]As discussed in this report and other documents (RCS, 2002; CH2M HILL, 2004a; LSCE, 2005a), the Alluvial Aquifer is more permeable and much thinner than the Saugus Formation. The eastern portion of the Alluvial Aquifer also shows considerably greater short-term (month-to-month) and long-term (year-to-year) fluctuations in groundwater levels than the rest of the Alluvial Aquifer and the Saugus Formation.

5,000 AF/yr reduction in Alluvial Aquifer pumping in dry years that is called for under the operating plan occurs primarily as reduced pumping from wells in eastern Soledad Canyon.

Elsewhere in the Alluvial Aquifer, where groundwater elevations have fluctuated much less during single-year or multi-year dry periods, reductions in pumping rates have been unnecessary. Throughout the Alluvial Aquifer, groundwater elevations have historically recovered fully in response to the normal and above-normal rainfall and stream flows that mark the end of each dry period.

The historical record of rainfall and pumping indicates that the 5,000 AF/yr of dry-year reduction in Alluvial Aquifer pumping typically occurs when rainfall is below 12 in/yr, as measured at the Newhall-Soledad rain gage. Annual rainfall at this gage was below 12 in/yr during 14 years of this 50-year period, as shown on Figure 2-5.

2.2.3.2 Variations in State Water Project Hydrology and Saugus Formation Pumping

The rate of pumping from the Saugus Formation in a given year is governed by the availability of imported water supplies, particularly imported water from the SWP system. CLWA has performed a statistical evaluation of SWP deliveries (Kennedy/Jenks Consultants, 2003) using the 2021B scenario from the CALSIM II model, which was developed by DWR for its SWP Delivery Reliability Report (DWR, 2003). The CALSIM II model and the SWP Delivery Reliability Report were developed to support (1) the preparation of urban water management plans by the water agencies that are SWP contractors, (2) analyses required to comply with Senate Bills 221 and 610, and (3) other water supply planning activities that include the SWP as a supply component. The 2021B scenario simulates the anticipated deliveries of water to the 29 SWP contractors using an historical hydrologic record and anticipated operating and regulatory conditions for the SWP system in 2021. The U.S. Bureau of Reclamation (USBR) has also used CALSIM II to perform biological assessment studies for the Operating Criteria and Plan (OCAP) for the SWP (USBR, 2004). Both the CLWA and the USBR studies, which were made public for review in February 2004, include evaluations of the role and function of an Environmental Water Account (EWA), which consists of water purchased to mitigate the water supply impacts of protection measures for endangered species. These CALSIM II simulations have been performed for the SWP system at a present-day level of development and for the anticipated level of development in 2020. Table 2-7 compares the municipal and industrial water use allocations calculated by CALSIM II for the SWP Reliability Report (DWR, 2003) and for the OCAP (USBR, 2004) for the hydrology that occurred from 1950 through 1993.

CLWA's evaluation reached the following conclusions regarding the deliveries it will receive under this scenario (Kennedy/Jenks Consultants, 2003):

1. A regression analysis indicates that there is a weak relationship between the SWP delivery in a given year and the previous year's delivery.

2. SWP deliveries will equal or exceed 70 percent of CLWA's 95,200 AF/yr Table A water amount during approximately 75 percent of the simulated years. During the remaining years, the deliveries will vary between 20 and 70 percent.

3. A Monte Carlo analysis of projected deliveries during 73 consecutive years indicated that at a 95 percent confidence level, 4 years of a 7-year drought period in the SWP

system (such as was observed from 1988 through 1994) will have sufficiently low deliveries to require short-term pumping of increased groundwater volumes to meet local water demands. This includes a period of 3 consecutive years of increased pumping.

Section 3.3.3 of this report discusses the relationship between SWP hydrology, SWP allocations to the 29 SWP contractors, and corresponding pumping from the Saugus Formation, and how this relationship was built into the modeling analysis of the groundwater operating plan.

Tables

TABLE 2-1
Recharge and Discharge Components of the Hydrologic Cycle in the Upper Santa Clara River Basin
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Recharge	Discharge
Surface Water	
Direct runoff of precipitation	Evapotranspiration of precipitation
Precipitation runoff from upstream watershed areas	Santa Clara River flow to Ventura County
Castaic Lake/Lagoon releases into Castaic Creek	Streamflow seepage to the Alluvial Aquifer
WRP discharges to the Santa Clara River	Evapotranspiration of applied irrigation water
Groundwater seepage into the Santa Clara River	
Irrigation return flows (agricultural and urban)	
Groundwater	
Infiltration of precipitation	Pumping
Infiltration of outdoor applied water (agricultural and urban)	Evapotranspiration of Alluvial Aquifer groundwater by riparian vegetation
Alluvial Aquifer subsurface inflow (Castaic Dam, Lang gage)	Alluvial Aquifer subsurface outflow (western study area boundary)
Streamflow seepage to Alluvial Aquifer	Groundwater seepage into the Santa Clara River

Notes:

The two sources of water for agricultural and municipal water uses in the basin are groundwater pumping and imported water from the SWP.

Because SWP water is stored in Castaic Lake, which is outside the limits of the Alluvial and Saugus aquifers, it is not considered a part of the valley's hydrologic cycle while it is still in storage. However, SWP water that is land-applied or that is discharged from a WRP qualifies as a component of the hydrologic cycle. In addition, subsurface groundwater flow into the Santa Clarita Valley occurs beneath Castaic Creek through water seepage beneath Castaic Dam.

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1953	0	4,986	4,943	0	4,943	4.88	Dry
1954	977	7,316	5,554	0	5,554	15.82	Normal
1955	134	4,795	4,122	0	4,122	13.91	Normal
1956	311	5,429	3,803	0	3,803	14.21	Normal
1957	559	4,782	2,410	0	2,410	22.85	Wet
1958	21,204	38,756	5,344	0	5,344	23.14	Wet
1959	473	3,277	2,206	0	2,206	9.81	Dry
1960	1	777	586	0	586	11.64	Dry
1961	79	804	410	0	410	8.82	Dry
1962	5,101	28,460	2,433	0	2,433	21.22	Wet
1963	32	1,884	1,058	0	1,058	12.79	Normal
1964	1	1,030	646	0	646	10.09	Dry
1965	3,702	35,614	996	0	996	32.28	Wet
1966	5,780	10,101	2,332	No data	---	14.57	Normal
1967	27,819	40,480	8,640	No data	---	23.23	Wet
1968	4,381	7,216	3,895	No data	---	6.90	Dry
1969	46,461	258,660	29,395	No data	---	32.42	Wet
1970	6,597	31,066	14,924	No data	---	23.19	Wet
1971	2,310	15,883	10,843	No data	---	13.75	Normal
1972	2,205	16,027	12,975	No data	---	4.15	Dry
1973	12,671	52,631	26,115	No data	---	19.79	Wet
1974	7,288	25,265	11,918	No data	---	18.04	Wet
1975	2,027	14,770	10,806	5,534	5,272	10.92	Dry
1976	156	10,162	9,754	6,095	3,659	14.02	Normal
1977	1,380	13,454	9,359	6,004	3,355	20.87	Wet
1978	35,378	129,187	60,955	6,982	53,973	42.17	Wet
1979	13,626	57,594	42,448	7,397	35,051	21.47	Wet
1980	16,785	95,211	57,593	7,372	50,221	27.00	Wet
1981	6,519	24,232	21,172	7,949	13,223	13.42	Normal
1982	9,102	36,488	32,531	8,436	24,095	20.20	Wet
1983	67,058	131,236	55,878	9,420	46,458	39.07	Wet

TABLE 2-2
Estimated Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Calendar Year	Total Flow at Mouth of Castaic Creek (acre-feet)[a]	Total Gaged Flow at County Line (acre-feet)[b]	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)[c]	Local Rainfall Condition[d]
1984	13,787	39,279	35,215	9,512	25,703	12.86	Normal
1985	2,619	24,466	24,089	9,614	14,475	8.37	Dry
1986	4,945	48,024	31,327	10,822	20,505	18.02	Wet
1987	911	26,198	23,663	11,844	11,819	14.45	Normal
1988	2,415	36,611	24,934	12,363	12,571	16.92	Wet
1989	Unavailable	24,799	23,453	13,560	9,893	7.56	Dry
1990	0	23,472	21,772	14,006	7,766	6.98	Dry
1991	65	34,901	18,702	14,108	4,594	17.21	Wet
1992	4,450	68,577	23,601	15,703	7,898	32.03	Wet
1993	7,725	152,783	65,054	17,179	47,875	32.72	Wet
1994	Unavailable	32,039	31,239	16,946	14,293	10.27	Dry
1995	5,611	82,409	51,001	17,824	33,177	29.15	Wet
1996	5,632	47,930	36,366	16,831	19,535	15.88	Normal
1997	9,885	36,780	27,521	15,778	11,743	13.35	Normal
1998	47,803	205,139	81,744	17,695	64,049	30.73	Wet
1999	5,830	32,382	27,176	17,847	9,329	8.96	Dry

[a]Values through June 1977 are from the former Castaic Creek South gage (U.S. Geologic Survey [USGS] Gage Station 11108145). Values after June 1977 are derived from records of releases from Castaic Dam/Lagoon into Castaic Creek, as provided by DWR.

[b]Values through September 30, 1996, are from USGS Gage Station 11108500. This gage was located immediately downstream of the Los Angeles-Ventura County Line and was taken permanently out of service after October 21, 1996. Data beginning on October 1, 1996, are from new USGS gage station 11109000, located approximately 2.5 miles farther downstream, near Piru Junction, at the Las Brisas Bridge.

[c]Annual rainfall values are based on monthly records for this gage, as reported by the National Climate Data Center and LADPW.

[d]Defined from median rainfall (14.57 in/yr) from 1950 through 2000. Dry year < 12.38 in/yr (85 percent of median rainfall). Wet year > 16.75 in/yr (115 percent of median rainfall).

TABLE 2-3
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	311	4,795	2,410	0	2,410	13.91
Average	2,506	10,608	2,655	0	2,655	15.50
Maximum	21,204	38,756	5,554	0	5,554	32.28
Statistics for 1975 through 1999						
Minimum	0	10,162	9,359	5,534	3,355	6.98
Median	5,632	36,611	27,521	11,844	14,293	16.92
Average	11,466	57,125	33,894	11,873	22,021	19.38
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	3,161	30,250	22,613	11,844	8,613	15.14
Average	8,230	41,211	23,207	11,873	15,396	18.05
Maximum	67,058	205,139	81,744	17,847	64,049	42.17
Statistics for 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	4,450	28,460	18,702	11,844	8,613	15.82
Average	9,151	43,050	21,338	11,873	15,396	17.92
Maximum	67,058	258,660	81,744	17,847	64,049	42.17

TABLE 2-4
Statistics on Annual Groundwater Discharge to the Santa Clara River, 1953 through 1965 versus 1975 through 1999
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 5 Dry Years during 1953 through 1965						
Minimum	0	777	410	0	410	4.88
Median	1	1,030	646	0	646	9.81
Average	111	2,175	1,758	0	1,758	9.05
Maximum	473	4,986	4,943	0	4,943	11.64
Statistics for 4 Normal Years during 1953 through 1965						
Minimum	32	1,884	1,058	0	1,058	12.79
Median	222	5,112	3,963	0	3,963	14.06
Average	363	4,856	3,634	0	3,634	14.18
Maximum	977	7,316	5,554	0	5,554	15.82
Statistics for 4 Wet Years during 1953 through 1965						
Minimum	559	4,782	996	0	996	21.22
Median	4,402	32,037	2,421	0	2,421	23.00
Average	7,641	26,903	2,796	0	2,796	24.87
Maximum	21,204	38,756	5,344	0	5,344	32.28
Statistics for 6 Dry Years during 1975 through 1999						
Minimum	0	14,770	10,806	5,534	5,272	6.98
Median	2,323	24,633	23,771	13,783	9,611	8.67
Average	2,619	25,322	23,089	12,918	10,171	8.84
Maximum	5,830	32,382	31,239	17,847	14,475	10.92
Statistics for 6 Normal Years during 1975 through 1999						
Minimum	156	10,162	9,754	6,095	3,659	12.86
Median	6,076	31,489	25,592	10,678	12,521	13.72
Average	6,148	30,763	25,615	11,335	14,280	14.00
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 13 Wet Years during 1975 through 1999						
Minimum	65	13,454	9,359	6,004	3,355	16.92
Median	7,725	68,577	42,448	10,822	33,177	27.00
Average	16,642	83,970	42,702	11,639	31,063	26.74
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-5
Statistics on Annual Groundwater Discharge to the Santa Clara River, Including and Excluding 1966 through 1974
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

	Castaic Creek Flows (acre-feet)	Total Gaged Flow at County Line (acre-feet)	Estimated Non-storm Flow at County Line (acre-feet)	WRP Flows (acre-feet)	Estimated Groundwater Discharge to River (acre-feet)	Rainfall at Newhall-Soledad Gage (inches)
Statistics for 13 Dry Years during 1953 through 1999						
Minimum	0	777	410	5,534	410	4.15
Median	473	14,770	10,806	13,783	5,272	8.82
Average	1,601	14,311	12,630	12,918	6,347	8.41
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 12 Normal Years during 1953 through 1999						
Minimum	0	7,316	2,433	6,004	2,433	13.35
Median	5,101	26,198	21,172	11,844	11,743	16.92
Average	5,238	27,883	16,963	10,788	8,671	17.10
Maximum	12,671	52,631	27,521	15,778	13,223	21.22
Statistics for 22 Wet Years during 1953 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	7,507	44,252	25,525	10,822	20,505	23.17
Average	15,807	73,060	29,877	11,639	24,412	25.62
Maximum	67,058	258,660	81,744	17,824	64,049	42.17
Statistics for 11 Dry Years during 1953 through 1965 and 1975 through 1999						
Minimum	0	777	410	5,534	410	4.88
Median	79	14,770	10,806	13,783	5,272	8.96
Average	1,226	14,800	13,393	12,918	6,347	8.94
Maximum	5,830	32,382	31,239	17,847	14,475	11.64
Statistics for 10 Normal Years during 1953 through 1965 and 1975 through 1999						
Minimum	32	1,884	1,058	6,095	1,058	12.79
Median	944	17,197	15,463	10,678	8,649	13.97
Average	3,834	20,400	16,823	11,335	10,022	14.07
Maximum	13,787	47,930	36,366	16,831	25,703	15.88
Statistics for 17 Wet Years during 1953 through 1965 and 1975 through 1999						
Minimum	65	4,782	996	6,004	996	16.92
Median	5,611	48,024	31,327	10,822	20,505	23.14
Average	14,524	70,543	33,312	11,639	24,412	26.30
Maximum	67,058	205,139	81,744	17,824	64,049	42.17

TABLE 2-6
Annual Pumping Rates Specified by the Operating Plan for Santa Clarita Valley Groundwater Resources
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Aquifer	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
Operating Plan Pumping				
Alluvium	30,000 to 40,000	30,000 to 35,000	30,000 to 35,000	30,000 to 35,000
Saugus	7,500 to 15,000	15,000 to 25,000	21,000 to 25,000	21,000 to 35,000
Total	**37,500 to 55,000**	**45,000 to 60,000**	**51,000 to 60,000**	**51,000 to 70,000**
Modeled Pumping				
Alluvium	38,429	33,767	33,767	33,767
Saugus	10,679	15,760	24,346	34,096
Total	**49,108**	**49,527**	**58,113**	**67,863**

Notes:

All pumping volumes are listed in acre-feet.

The operating plan is defined in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005).

In the model simulations, total pumping is different than listed in this table when dry-year pumping conditions in one aquifer coincide with normal-year pumping conditions in the other aquifer (because of differences in the timing of dry conditions locally versus reduced deliveries of SWP water imports).

TABLE 2-7
CALSIM II Calculated State Water Project Municipal and Industrial Allocations
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	OCAP Current EWA[a]	OCAP Future EWA[a]	2020 SWP Reliability[b]
1950	0.88	0.91	0.79
1951	1.00	1.00	0.96
1952	1.00	1.00	1.00
1953	1.00	1.00	0.95
1954	1.00	1.00	0.96
1955	0.44	0.45	0.43
1956	1.00	1.00	1.00
1957	0.94	0.91	0.75
1958	1.00	1.00	1.00
1959	0.84	0.88	0.83
1960	0.51	0.55	0.56
1961	0.68	0.72	0.76
1962	0.93	0.98	0.87
1963	1.00	1.00	1.00
1964	0.84	0.74	0.73
1965	0.87	0.81	0.77
1966	1.00	1.00	0.92
1967	1.00	1.00	1.00
1968	0.89	0.90	0.85
1969	1.00	1.00	1.00
1970	1.00	1.00	0.95
1971	1.00	1.00	1.00
1972	0.76	0.75	0.65
1973	1.00	1.00	0.91
1974	1.00	1.00	1.00
1975	1.00	1.00	1.00
1976	0.78	0.75	0.65
1977	0.03	0.04	0.20
1978	1.00	1.00	1.00
1979	1.00	0.94	0.89
1980	1.00	0.91	0.85
1981	0.90	0.92	0.84
1982	1.00	1.00	1.00
1983	1.00	1.00	1.00
1984	0.66	1.00	0.99
1985	0.97	0.91	0.83
1986	0.74	0.70	0.78
1987	0.70	0.77	0.71
1988	0.12	0.17	0.23
1989	0.96	0.95	0.83
1990	0.24	0.27	0.28
1991	0.24	0.29	0.25
1992	0.39	0.43	0.29
1993	1.00	1.00	1.00

[a]Source: USBR, 2004

[b]Source: DWR, 2003

Figures

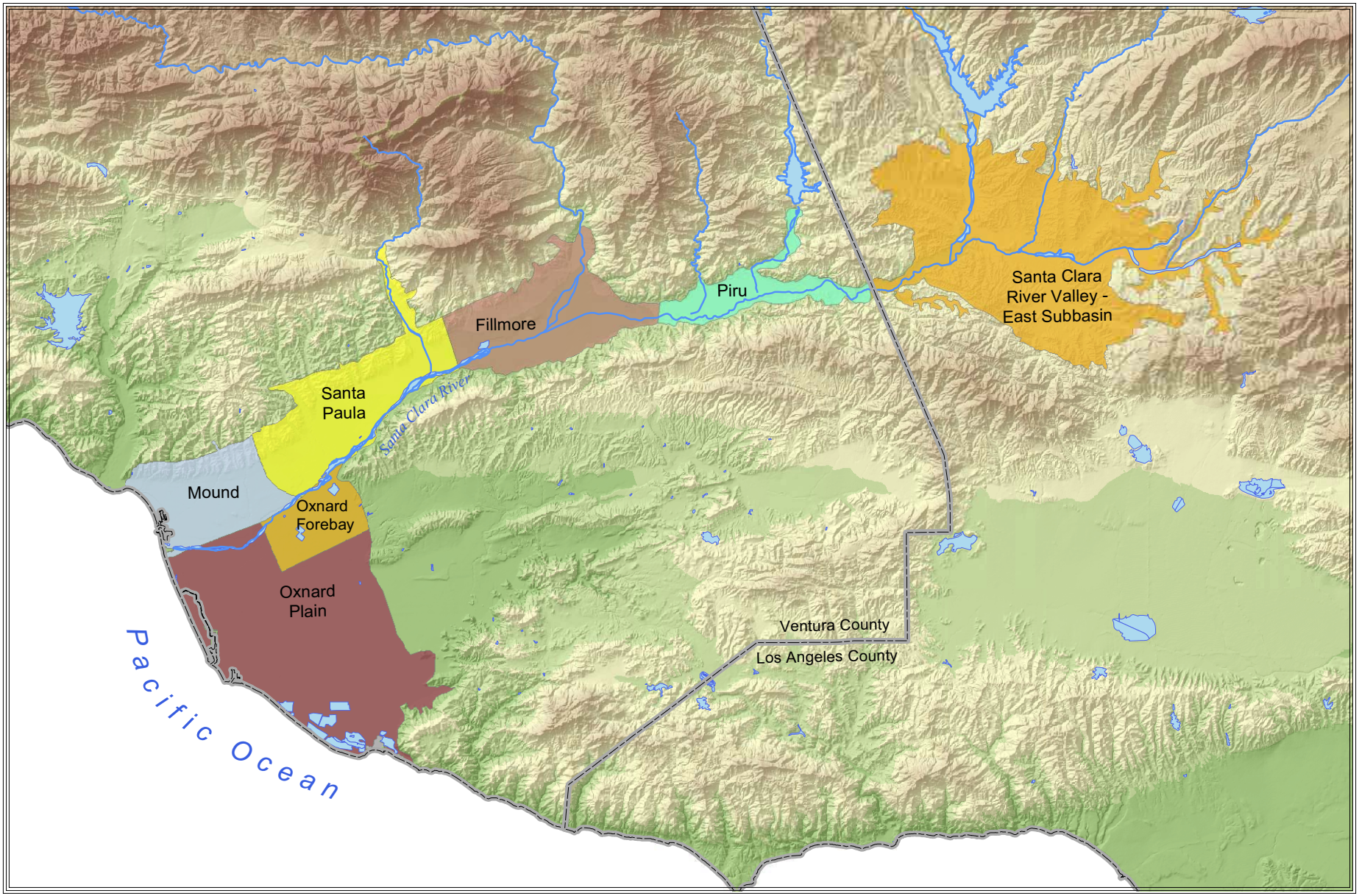

FIGURE 2-1
GROUNDWATER BASINS IN THE SANTA CLARA RIVER DRAINAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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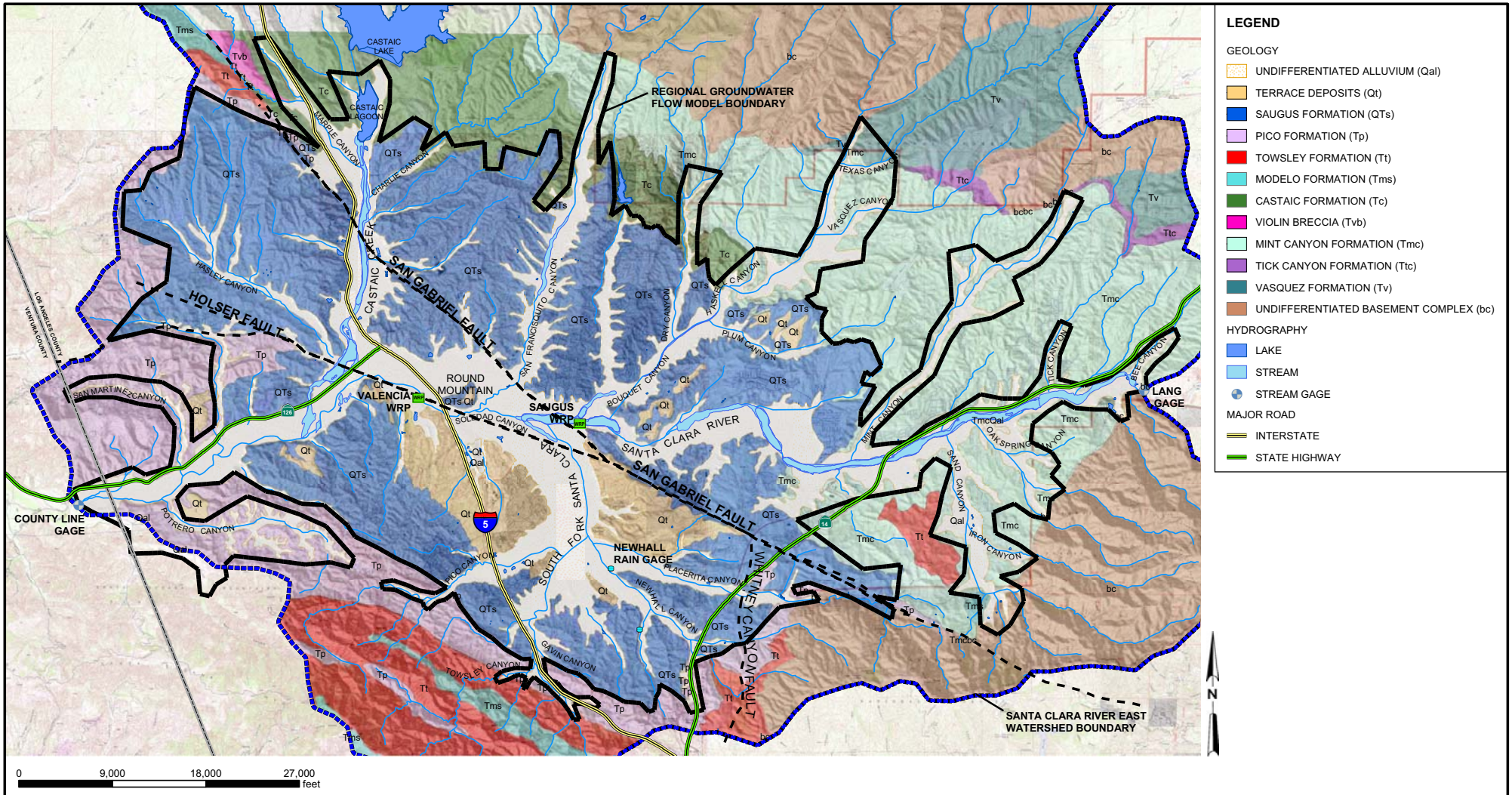

LEGEND

GEOLOGY
- UNDIFFERENTIATED ALLUVIUM (Qal)
- TERRACE DEPOSITS (Qt)
- SAUGUS FORMATION (QTs)
- PICO FORMATION (Tp)
- TOWSLEY FORMATION (Tt)
- MODELO FORMATION (Tms)
- CASTAIC FORMATION (Tc)
- VIOLIN BRECCIA (Tvb)
- MINT CANYON FORMATION (Tmc)
- TICK CANYON FORMATION (Ttc)
- VASQUEZ FORMATION (Tv)
- UNDIFFERENTIATED BASEMENT COMPLEX (bc)

HYDROGRAPHY
- LAKE
- STREAM
- STREAM GAGE

MAJOR ROAD
- INTERSTATE
- STATE HIGHWAY

FIGURE 2-2
BASIN GEOLOGIC MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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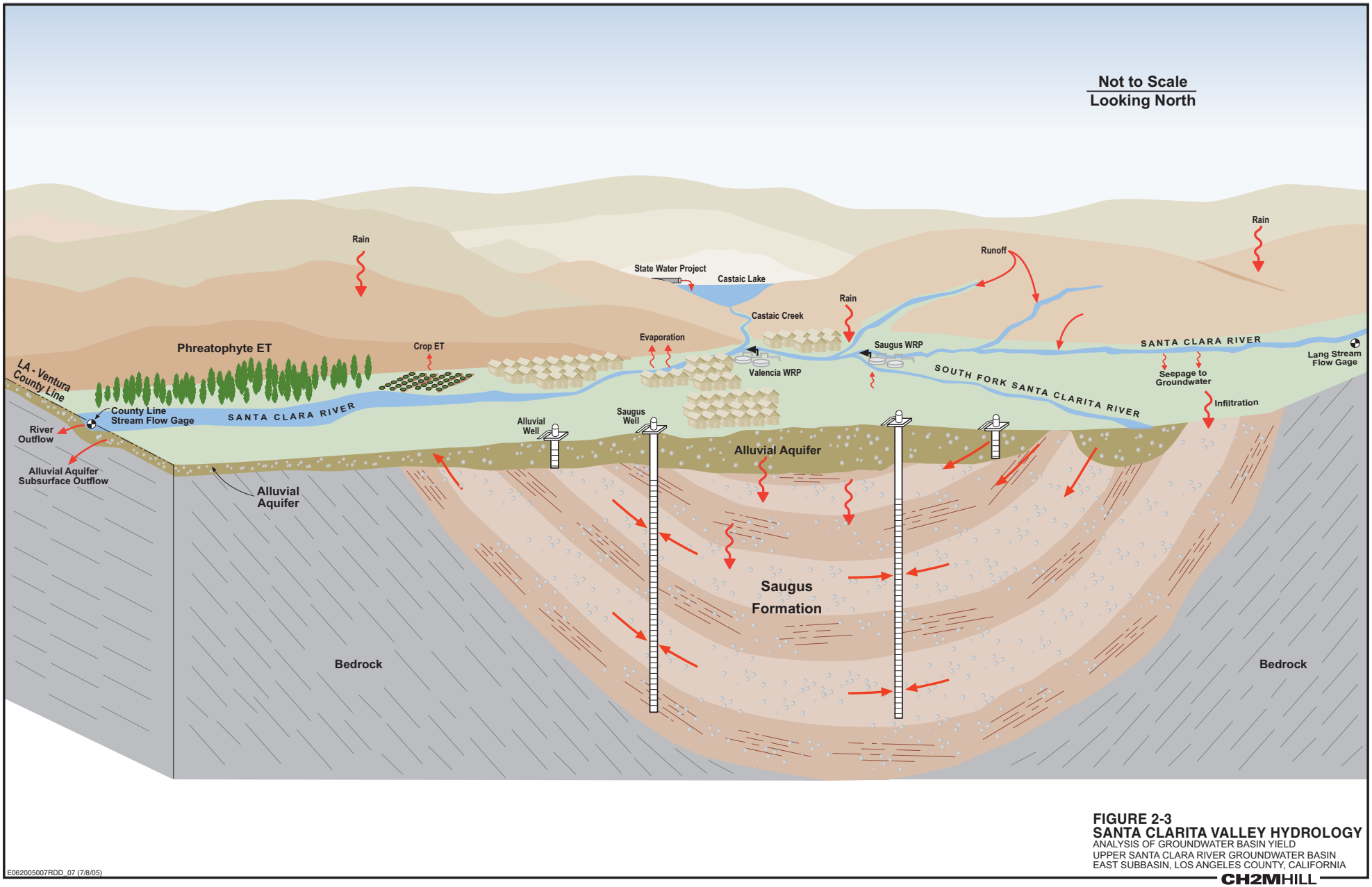

FIGURE 2-3
SANTA CLARITA VALLEY HYDROLOGY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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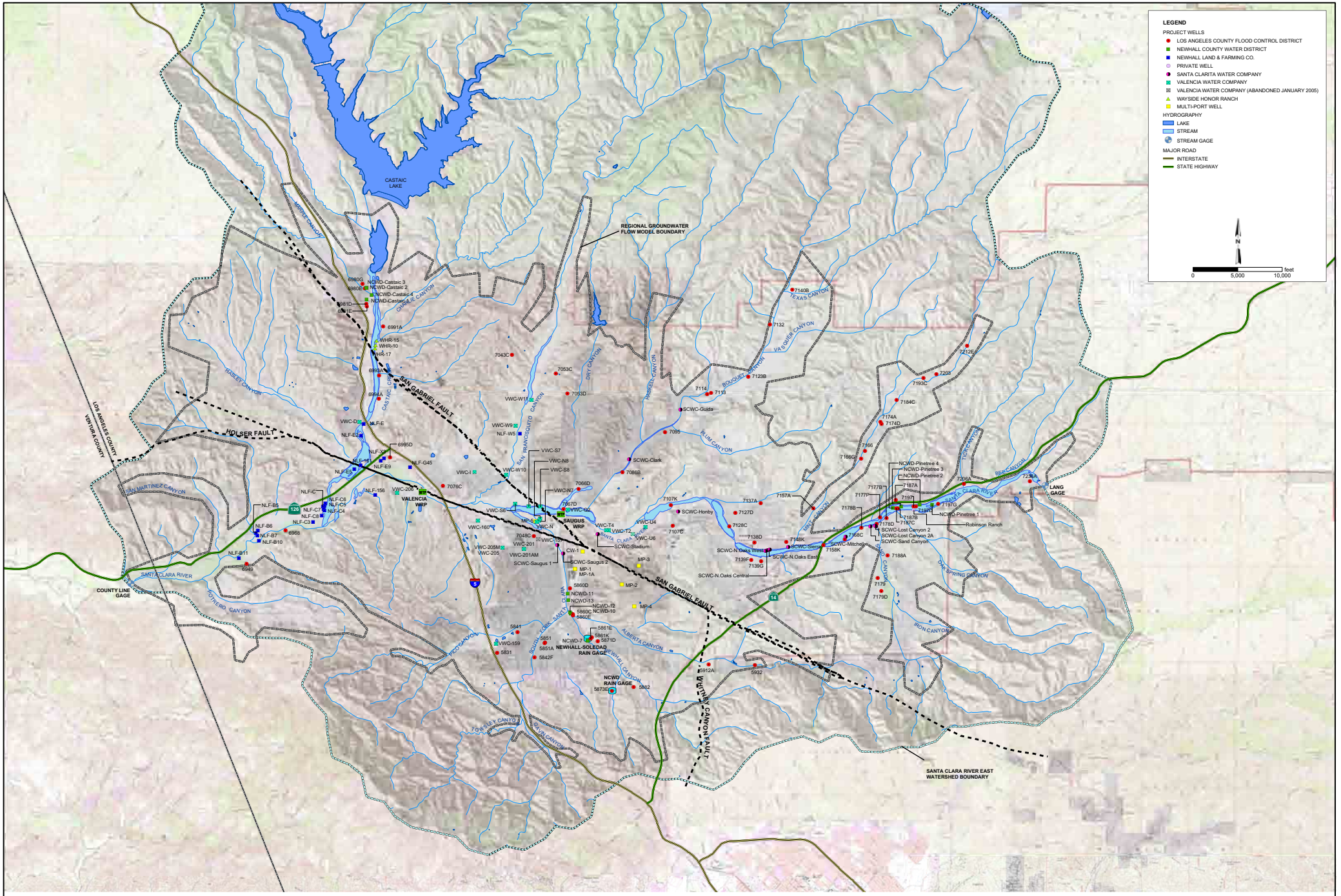

FIGURE 2-4
REGIONAL WELL LOCATION MAP
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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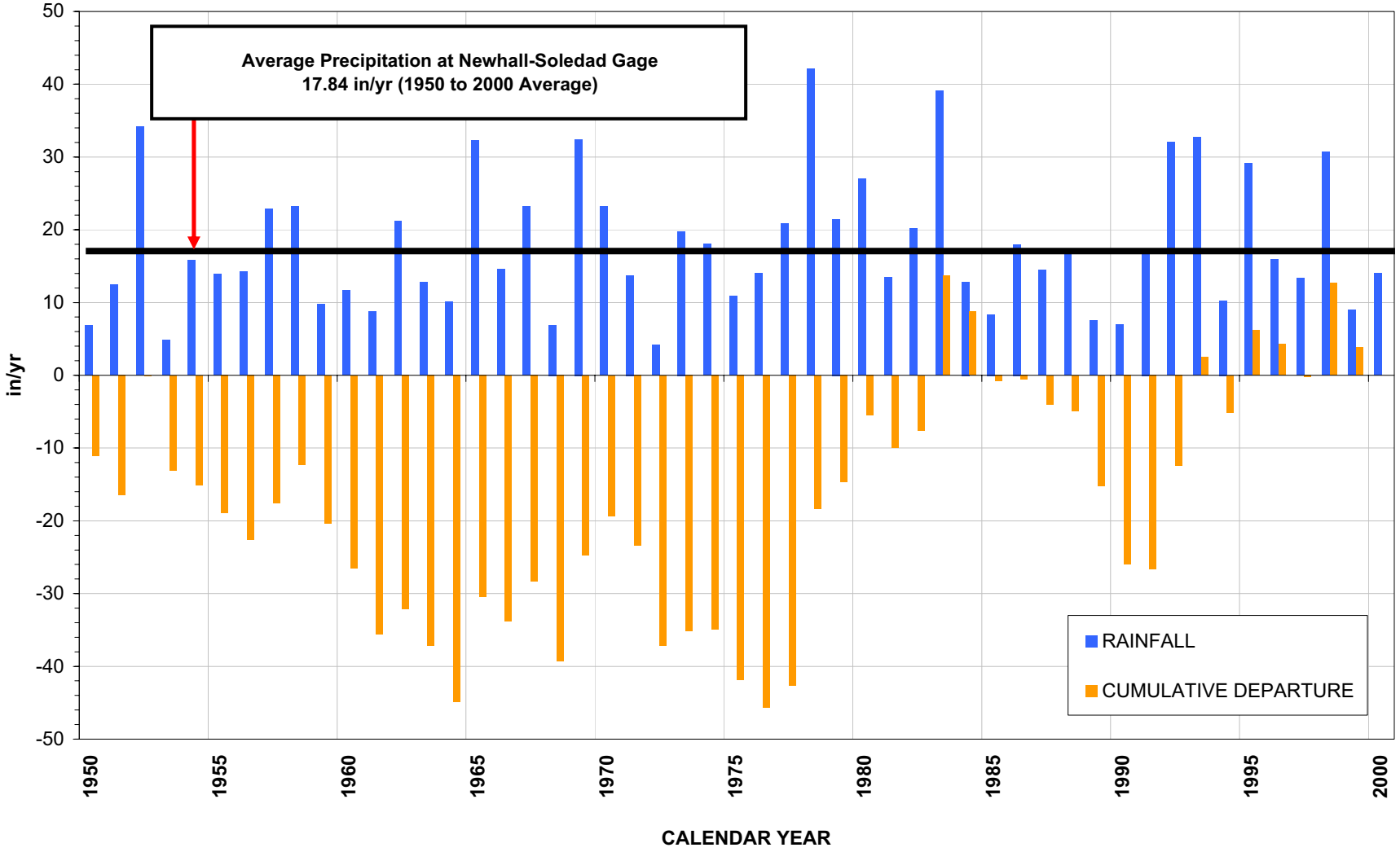

FIGURE 2-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE

ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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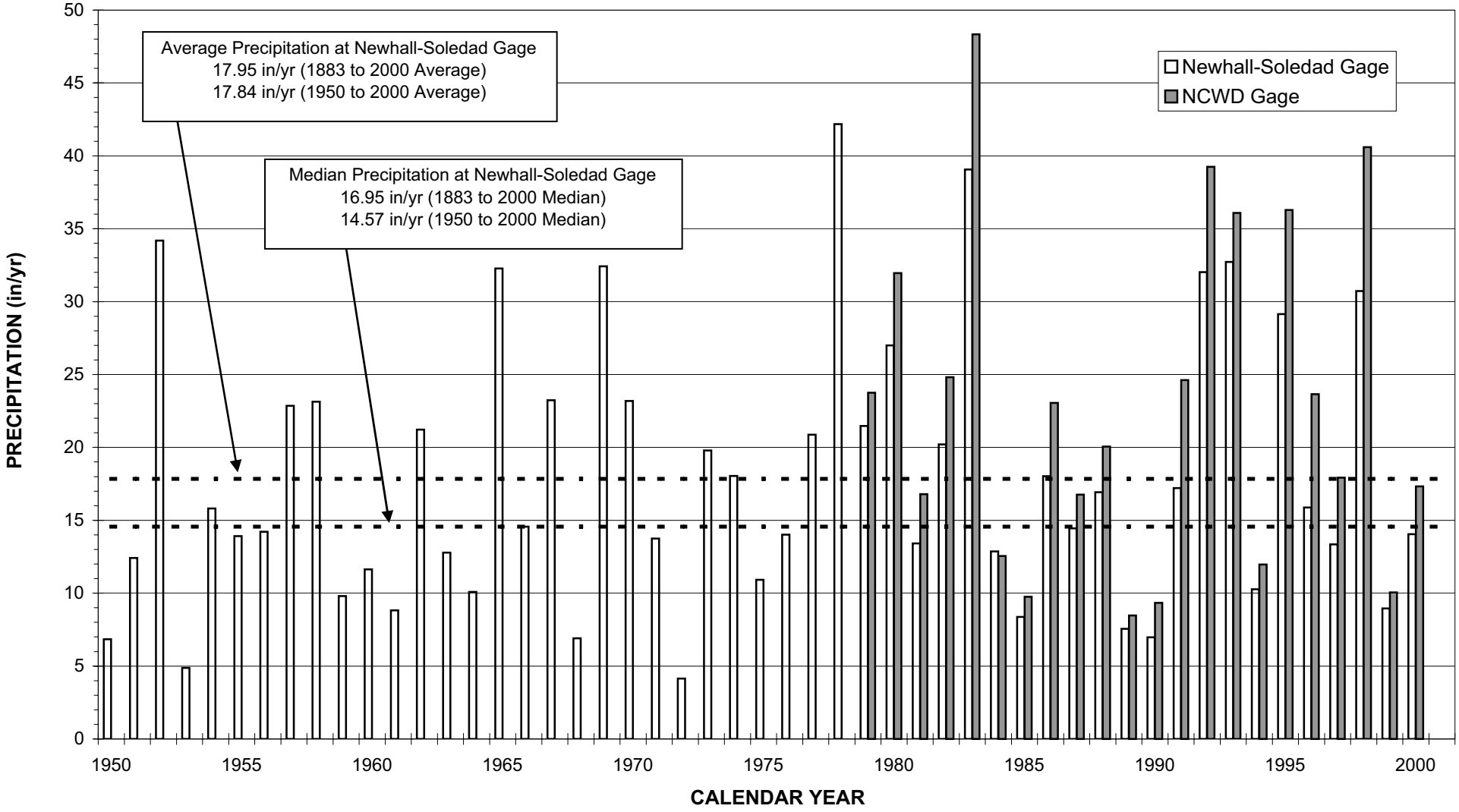

FIGURE 2-6
ANNUAL PRECIPITATION AT THE NEWHALL-SOLEDAD AND NCWD RAIN GAGES SINCE 1950
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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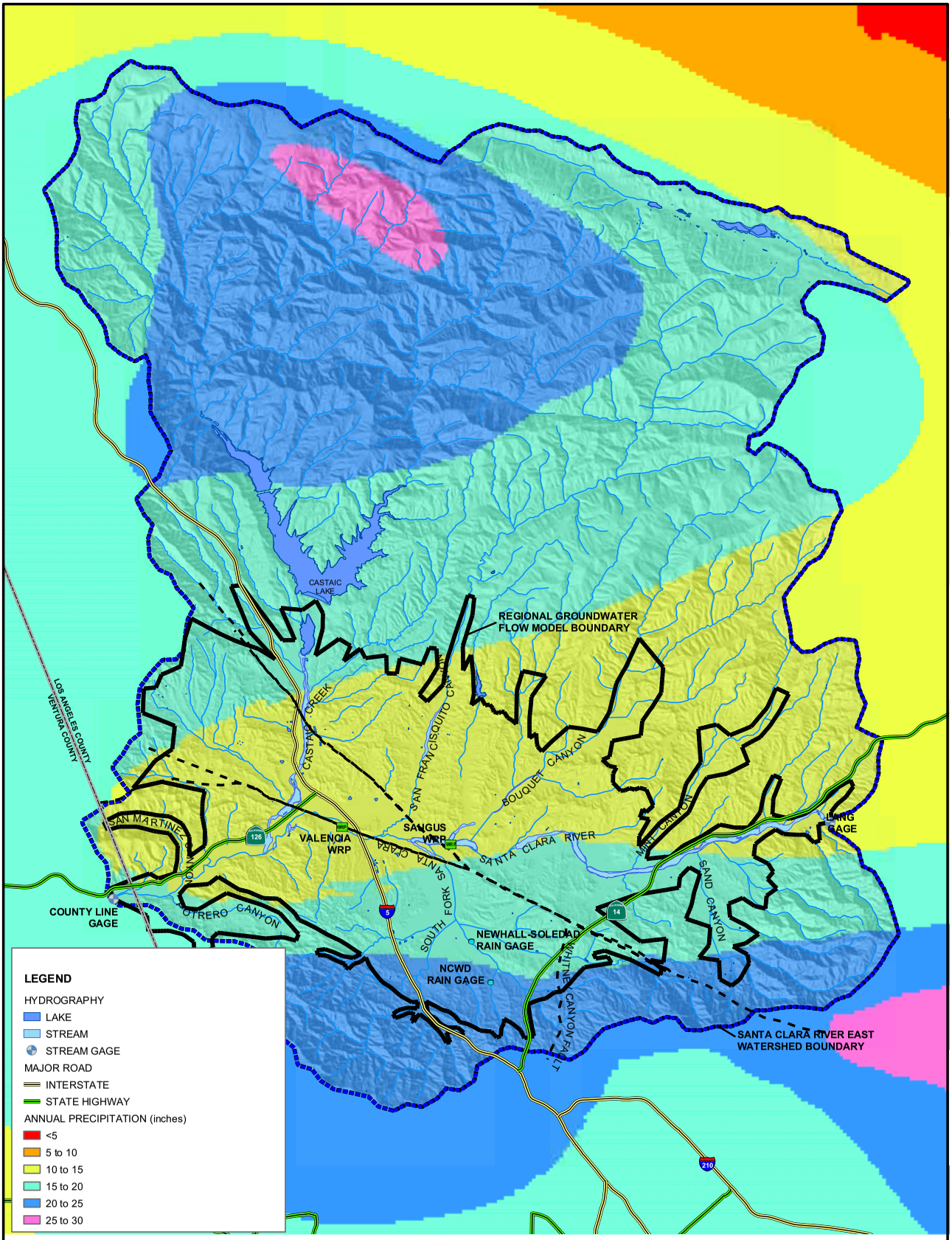

SOURCE: SEE THE INTERNET SITE HTTP://GIS.CA.GOV/META.EPL?OID=286 FOR MORE INFORMATION.

N

0 2.5 5 miles

FIGURE 2-7
ISOHYETAL MAP SHOWING AVERAGE ANNUAL PRECIPITATION PATTERN FROM 1900 TO 1960
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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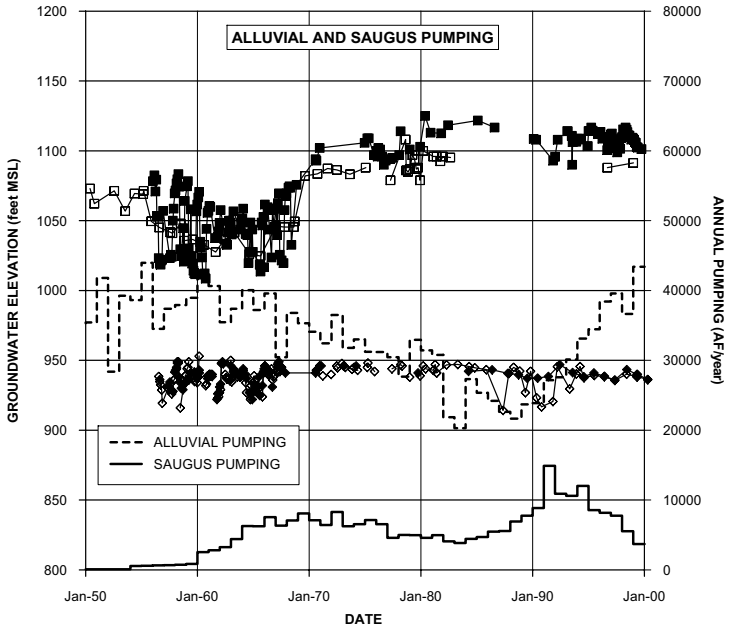

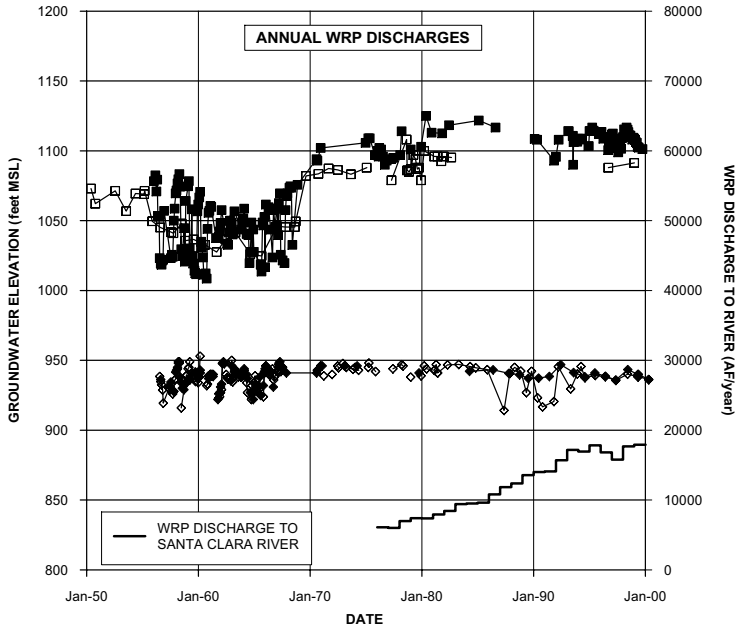

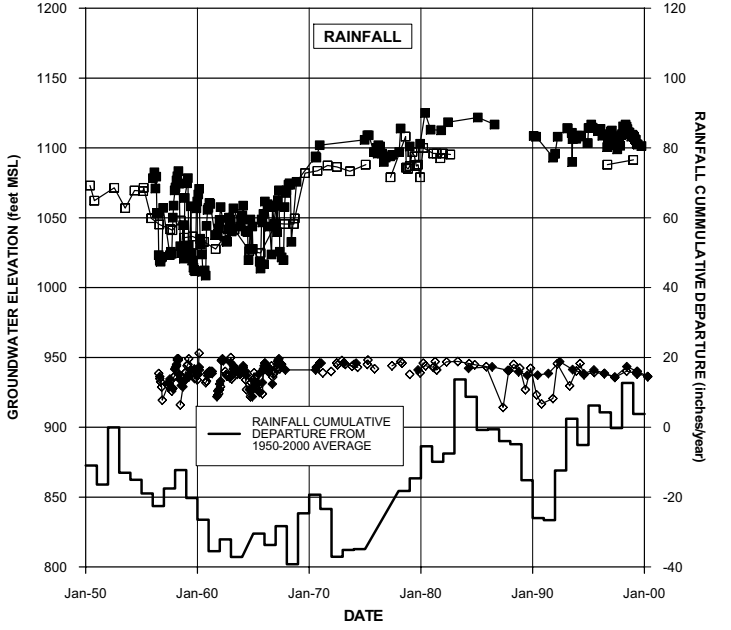

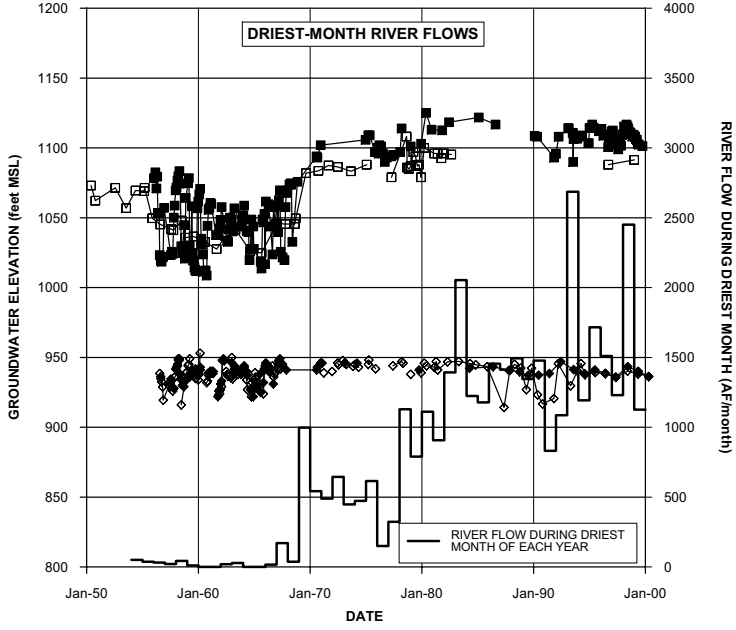

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N
- ELEVATION OF GROUNDWATER IN NLF-S
- ELEVATION OF GROUNDWATER IN NLF-C5
- ELEVATION OF GROUNDWATER IN NLF-C7

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. FORMER WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-8
ALLUVIAL GROUNDWATER ELEVATIONS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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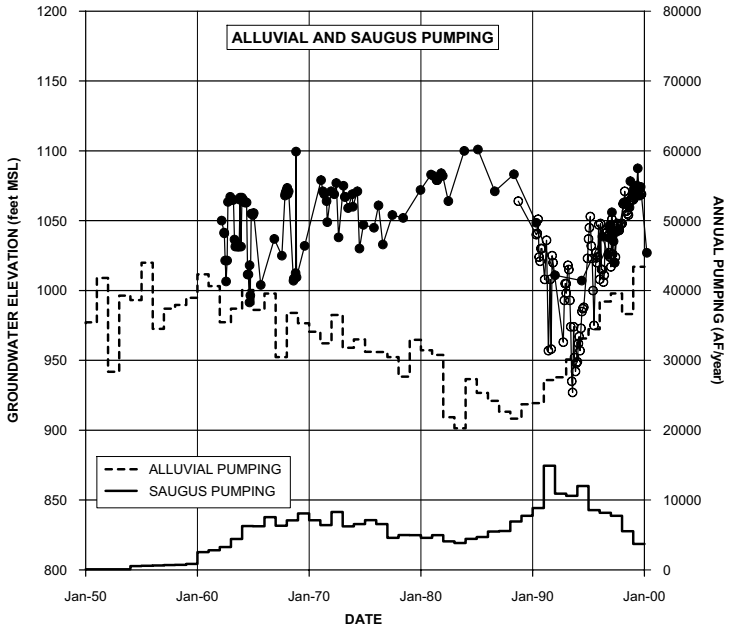

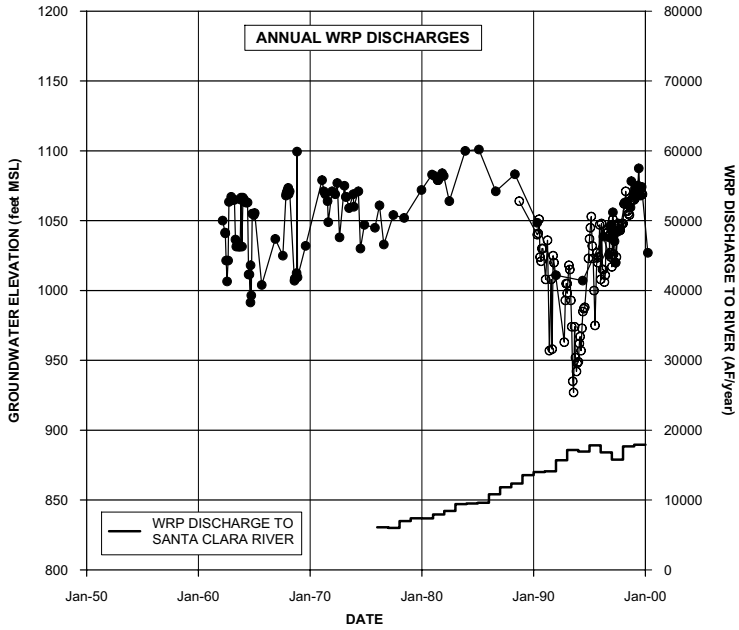

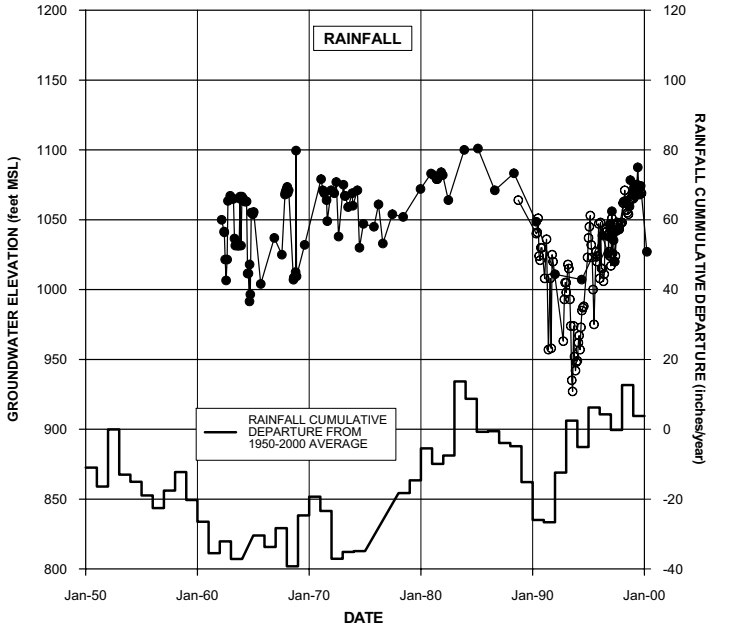

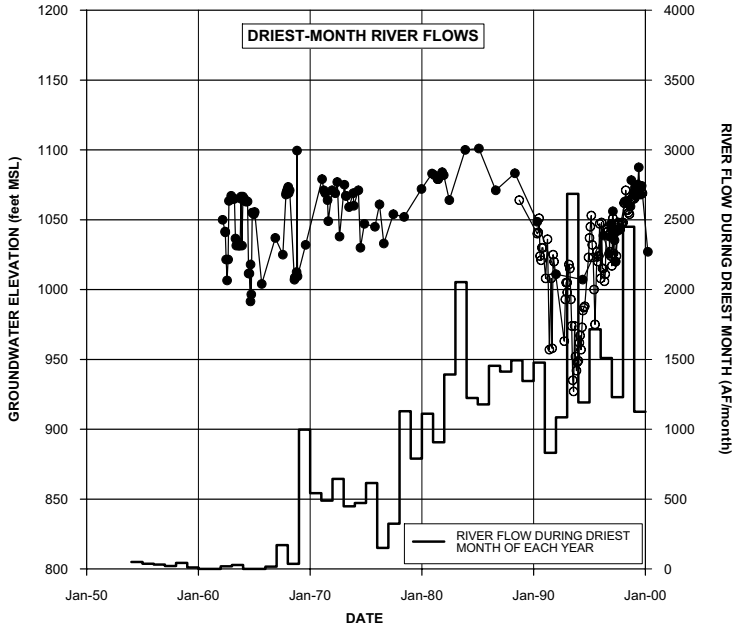

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (DESTROYED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-9
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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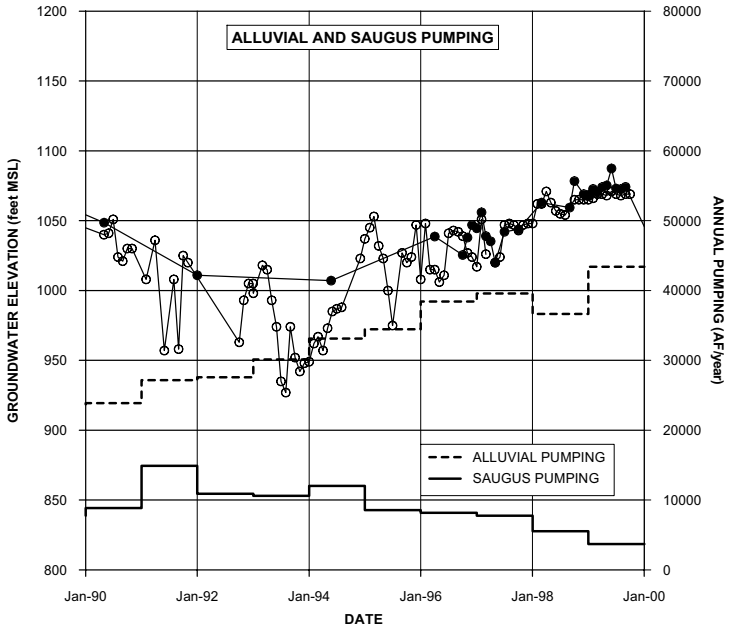

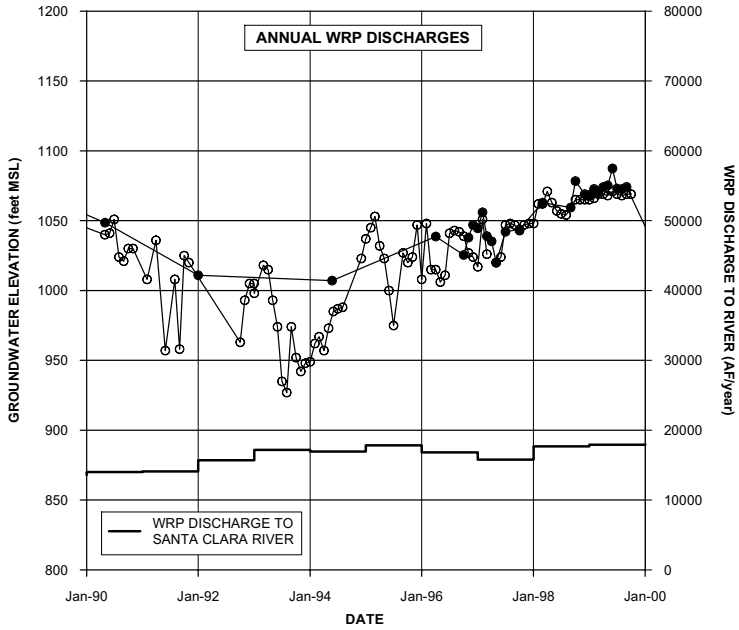

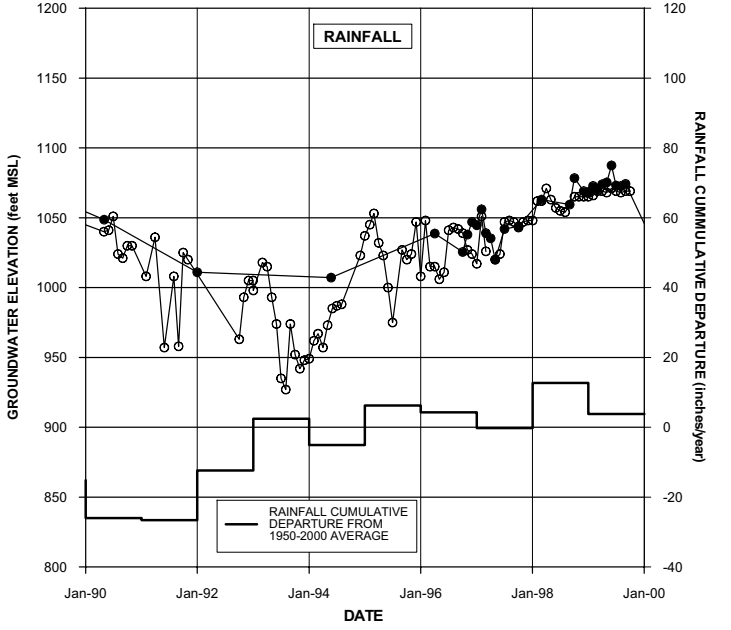

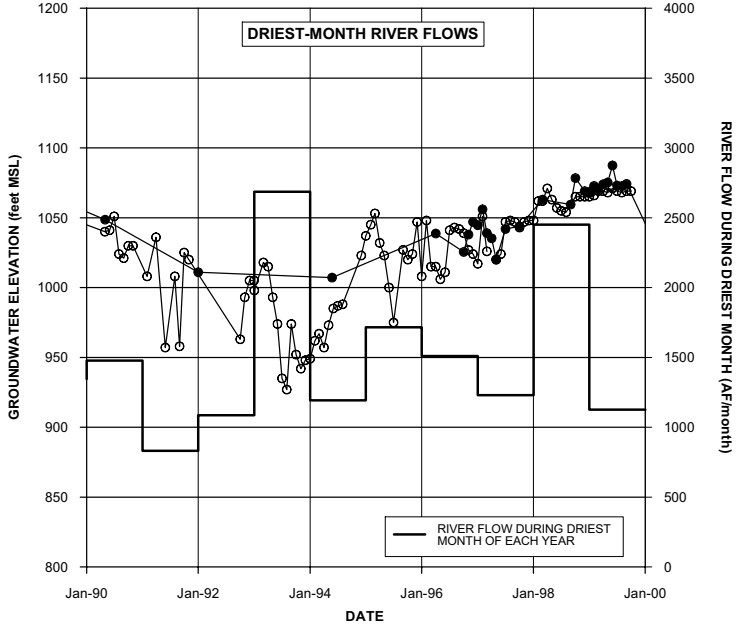

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-157 (ABANDONED JANUARY 2005)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-10
SAUGUS GROUNDWATER ELEVATIONS CLOSEST TO SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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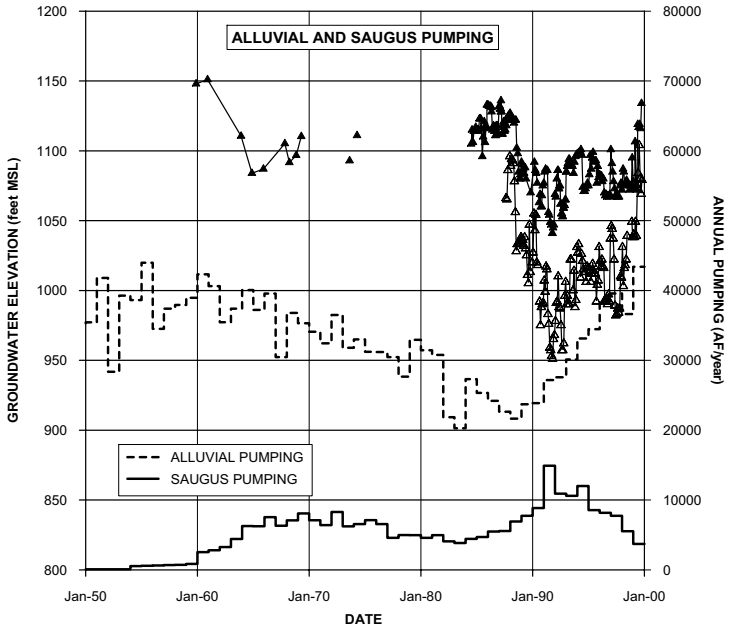

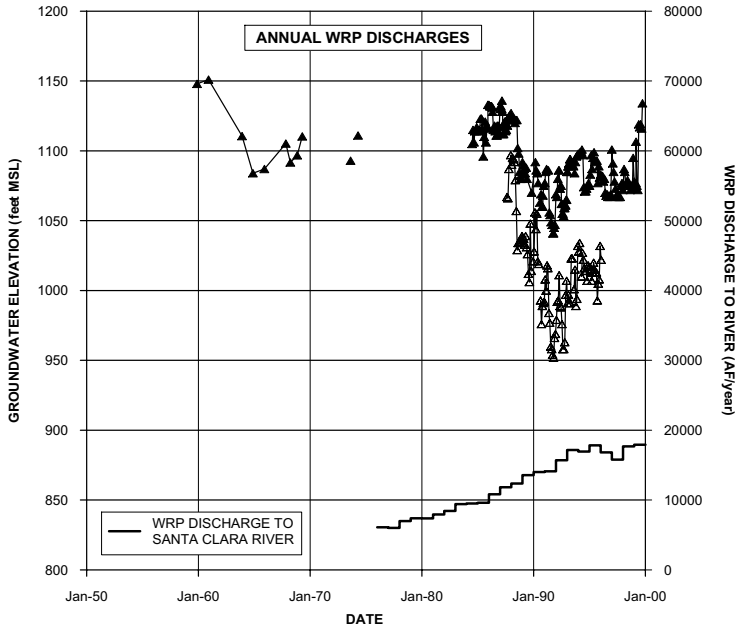

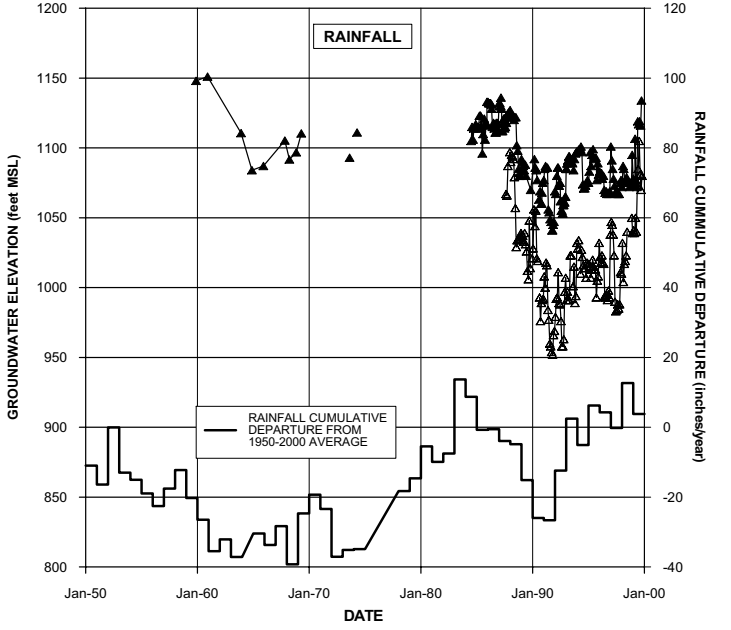

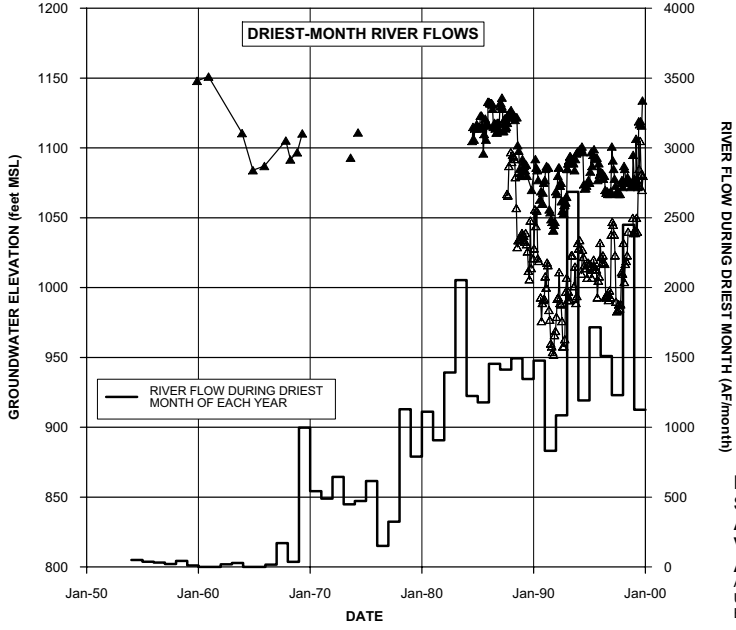

LEGEND

- ELEVATION OF GROUNDWATER IN NCWD-7
- ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-11
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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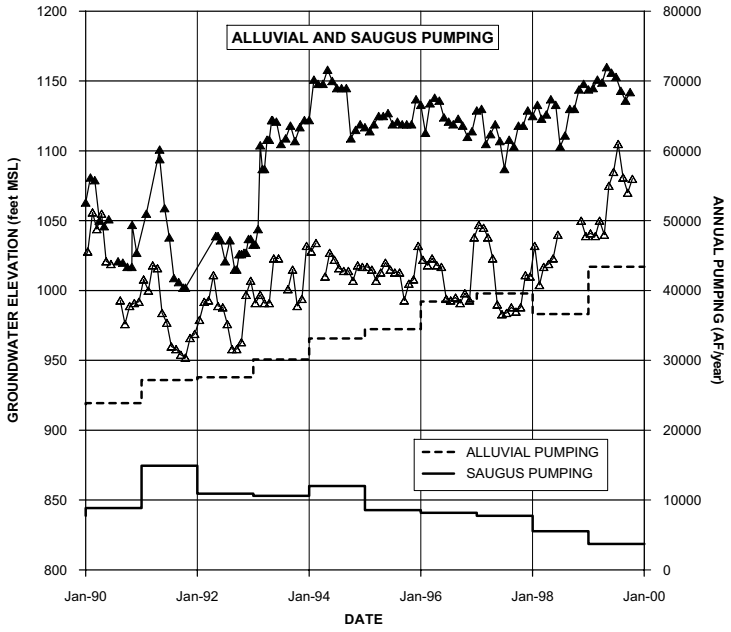

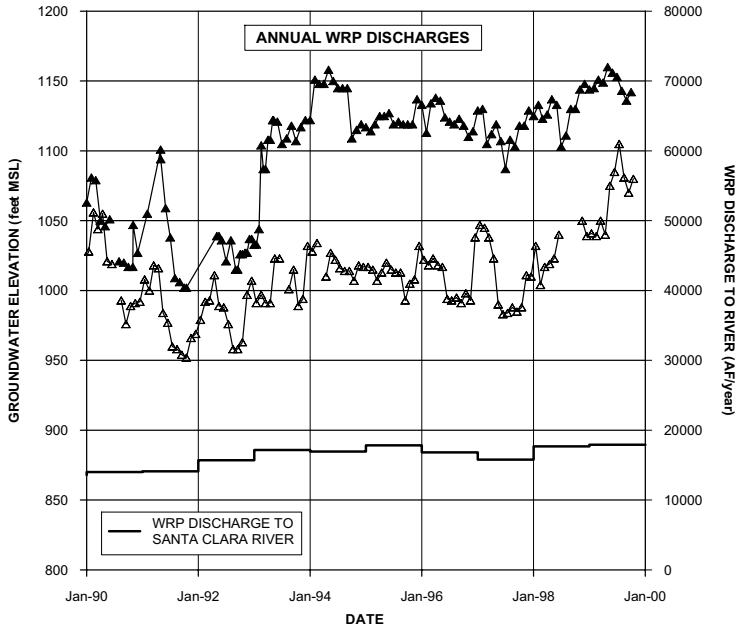

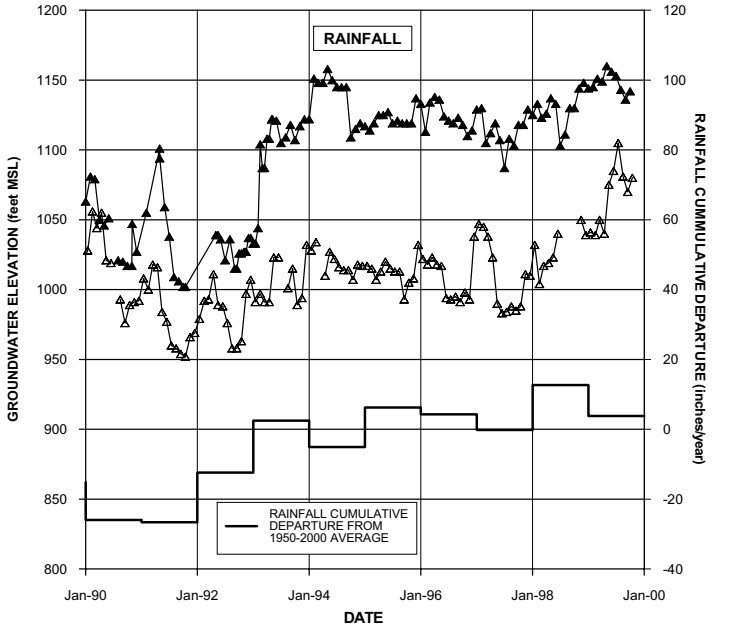

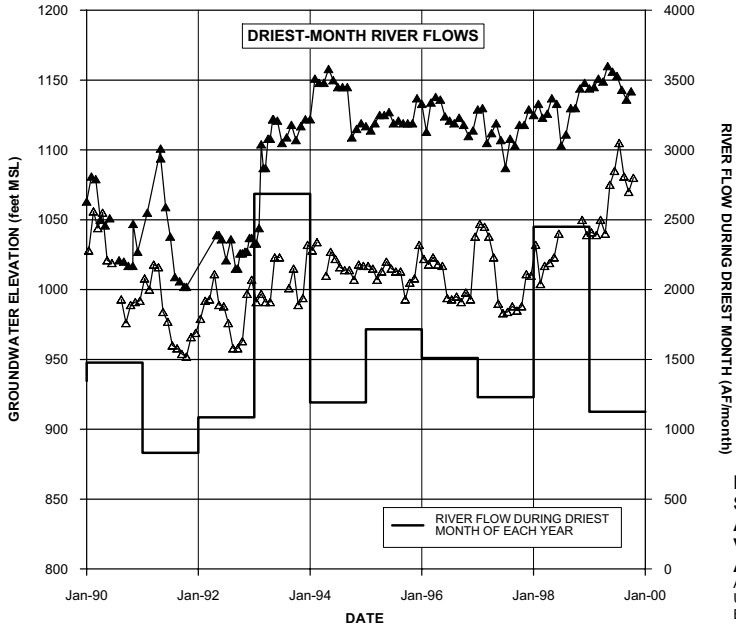

LEGEND

ELEVATION OF GROUNDWATER IN NCWD-10
ELEVATION OF GROUNDWATER IN NCWD-12

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-12
SAUGUS GROUNDWATER ELEVATIONS ALONG THE SOUTH FORK SANTA CLARA RIVER VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1990 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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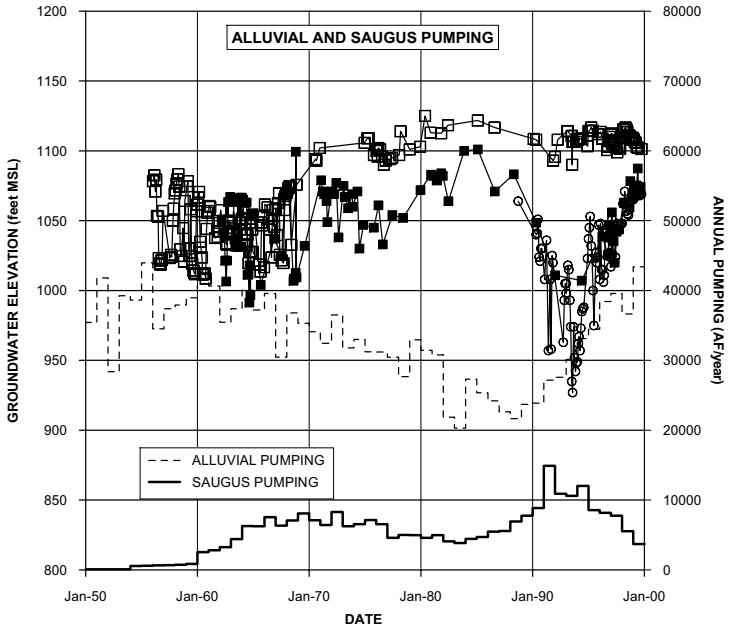

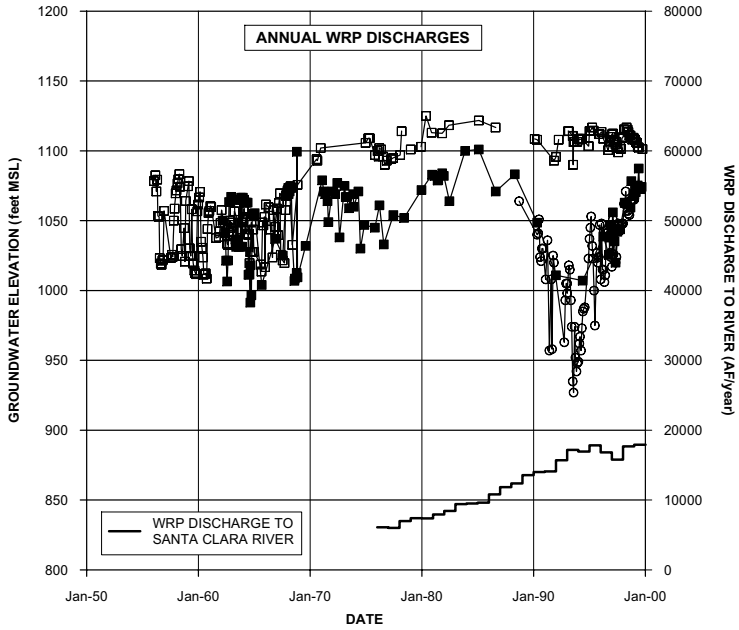

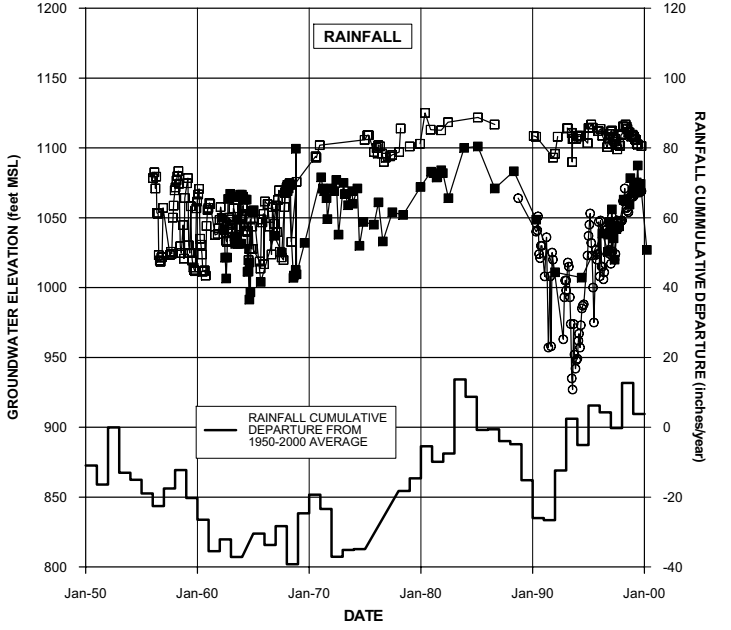

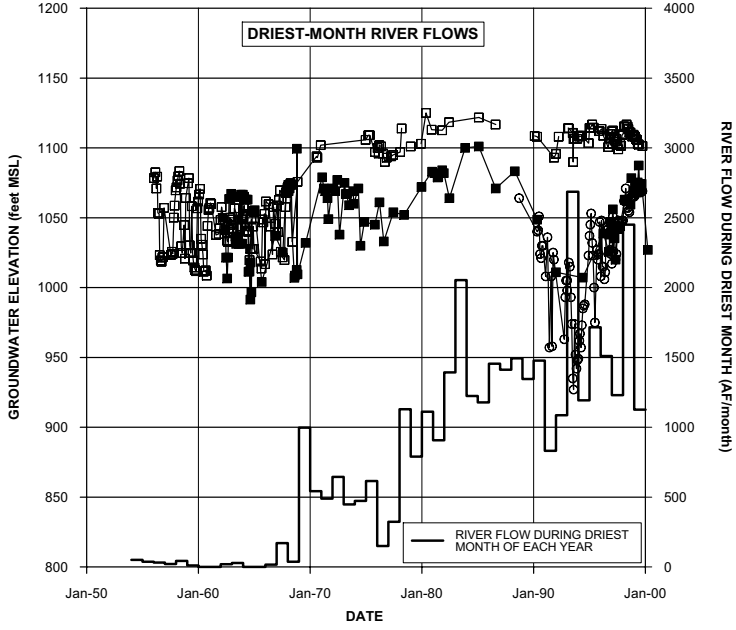

LEGEND

- ELEVATION OF GROUNDWATER IN VWC-N (ALLUVIUM)
- ELEVATION OF GROUNDWATER IN VWC-157 (SAUGUS)
- ELEVATION OF GROUNDWATER IN SCWC-SAUGUS 2 (SAUGUS)

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WRP = WATER RECLAMATION PLANT.

FIGURE 2-13
GROUNDWATER ELEVATIONS IN ADJACENT ALLUVIAL AND SAUGUS WELLS VERSUS GROUNDWATER RECHARGE AND DISCHARGE MECHANISMS (1950 to 2000)
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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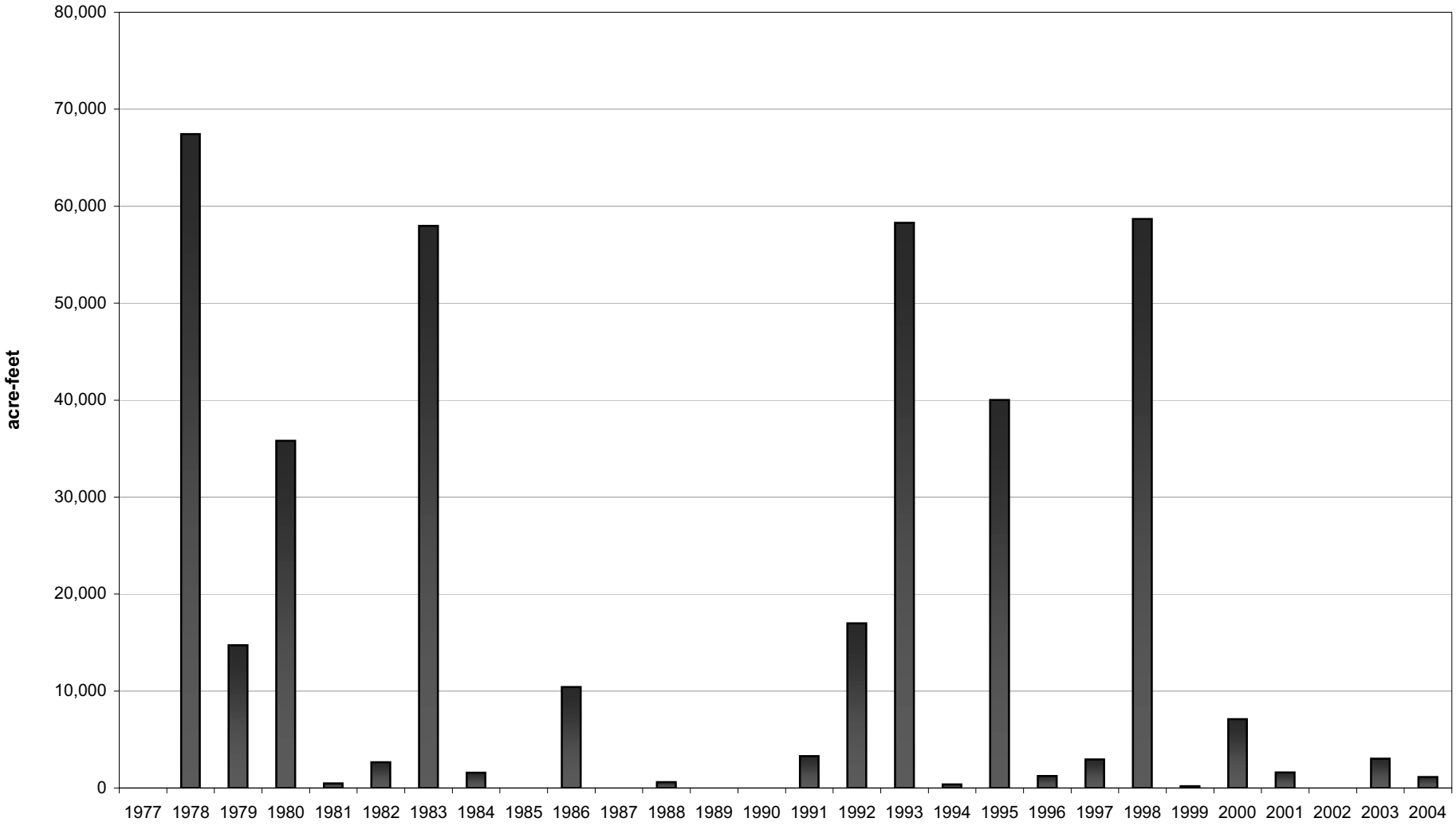

Note:
This chart shows the potential Flood Flows available during water years 1977 through 2004. Water Year 1977 is defined as October 1, 1976, through September 30, 1977, but the water is generally available only from October 1 through April 30.

FIGURE 2-14
HISTORICAL CASTAIC CREEK FLOOD FLOWS AVAILABLE TO DOWNSTREAM USERS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 3

Modeling Approach for Analyzing Basin Yield

The approach to using the Regional Model for the basin yield analysis began with identifying a simulation period spanning several decades to capture short-term (year-to-year) and longer-term (multi-year) variations in pumping from both aquifer systems. Pumping was then assigned in the Regional Model in accordance with historical and current uses of each production well, and in consideration of how the pumping rate assignments are currently impacted by the presence of perchlorate in groundwater in specific areas. Regional Model simulation results were then studied to evaluate short-term and long-term trends in groundwater elevations, groundwater budgets, and river flows. This section presents the design details of this modeling evaluation.

3.1 Model Description

The Regional Model is a three-dimensional, numerical model that uses MicroFEM® finite-element software (Hemker and de Boer, 2003). The Regional Model covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. Figure 3-1 shows the model domain, along with its location relative to the upstream watersheds that contribute runoff into the model study area. The Regional Model's construction and calibration is summarized in Appendix B and discussed in detail in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a).

The Regional Model area largely coincides with the Santa Clara River Valley Groundwater Basin, East Subbasin, delineated by DWR, extending from the Lang stream gage at the eastern end of the valley to the County Line stream gage area in the west. The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. Figure 3-2 shows the spacing of the individual nodes that make up the grid. The upper model layer simulates the Alluvial Aquifer and also the upper portion of the Saugus Formation where the Alluvial Aquifer is not present. The underlying layers simulate the underlying freshwater Saugus Formation and its Sunshine Ranch Member. The layer representation is summarized schematically on Figure 3-3. Figure 3-4 shows the model layering in three cross-sectional views.

The boundary conditions in the model consist of the following:

1. Specified flux boundaries for the following:

    a. Precipitation
    b. Irrigation
    c. Recharge from ephemeral streams
    d. Pumping
    e. Underflow from beneath Castaic Dam

2. Head-dependent flux boundaries for the following:
    a. Groundwater discharges to the perennial reach of the Santa Clara River
    b. Residual drainage of groundwater to the Santa Clara River in the ephemeral reach under high water table conditions
    c. Evapotranspiration (ET) by phreatophyte plants, which extract groundwater from the shallow water table that lies along riparian river corridors
3. Constant-head boundaries for the following:
    a. Subsurface inflow in the Alluvial Aquifer at the eastern end of the valley, at the Lang gage[5]
    b. Subsurface outflow in the Alluvial Aquifer at the western end of the valley, at the County Line gage

Groundwater recharge rates are estimated using precipitation records; streamflow records; watershed maps; topographic maps; and aerial photography. These recharge rates are calculated using a detailed Surface Water Routing Model (SWRM), which was written specifically to provide time-dependent, spatially varying recharge rates as input to the Regional Model. The SWRM relies on streamflow records at the Lang and County Line gages; historical records of rainfall data from the NCWD rain gage (see Figure 1-1 for the location of this gage); spatial variations in rainfall across the basin (see Figure 2-7); and, for the basin yield analysis, the rates and locations of future WRP discharges to the Santa Clara River and irrigation from agricultural and urban water uses.

The depths from which production wells obtain water are defined in the Regional Model from well construction records. The rates and locations of pumping are based on the Purveyors' operating plan for the basin and on the surveyed location of each production well.

3.2 Modeling Approach

The process of designing the modeling analysis of the operating plan for the basin consisted of the following five activities:

1. Selecting a period over which to simulate groundwater conditions resulting from various pumping configurations
2. Defining pumping rates and schedules for each production well in the Santa Clarita Valley, considering the variability in pumping demands that occur due to cycles of drought and nondrought conditions and year-to-year variations in the availability of other water supplies
3. Defining the variation in local hydrology (rainfall, streamflows, and groundwater recharge) on a month-to-month basis throughout the simulation period

[5]A constant-head boundary was established in the Regional Model at this location using recent field conditions that were observed after the model calibration report (CH2M HILL, 2004a) was published. This change improved the Regional Model's calibration in the Alluvial Aquifer in the upper reaches of Soledad Canyon and did not appreciably change the calibration quality elsewhere. See CH2M HILL (2005) for further details.

4. Running the model to calculate time-varying (monthly) groundwater elevations and groundwater discharge terms throughout the multi-year simulation period
5. Evaluating the modeling results by examining forecasted time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the effects of the operating plan in the Alluvial Aquifer, the Saugus Formation, and the Santa Clara River

These activities are described in further detail below.

3.3 Simulation Period

The locations and temporal variation in pumping from the Alluvial Aquifer were defined in the model from the operating plan and from historical records of the year-to-year variability in local hydrology. Simulated pumping from the Saugus Formation was defined from the operating plan, historical pumping records, and operational constraints and historical patterns of SWP water supply availability.

3.3.1 Selection of Simulation Period

Because the operating plan for the Saugus Formation is linked to the hydrology and operational constraints for the SWP system, the year-to-year variability in Saugus Formation pumping is, to a great extent, dependent on the hydrology outside the valley (i.e., in northern California). As shown in Table 3-1, local hydrology is often not a good indicator of local pumping conditions in the Saugus Formation, because local droughts and SWP droughts frequently do not coincide with each other. The following are examples:

1. In 1955, dry conditions in the SWP system coincided with approximately 14 inches of rainfall at the Newhall-Soledad rain gage, which is similar to the long-term median rainfall recorded at this gage.
2. In 1976 and 1977, the SWP system hydrology was critical, while the local hydrology during those years was near normal (1976) and wetter than normal (1977).
3. In 1987 and 1988, the SWP system hydrology was dry (1987) and critical (1988), while the local hydrology during those years was near normal (1987) and wetter than normal (1988).
4. In 1991 and 1992, the SWP system hydrology was in its fifth and sixth consecutive years of dry or critical hydrology, while the local hydrology was wetter than normal both years.
5. In 2001, dry conditions in the SWP system coincided with wetter-than-normal local conditions.

Consequently, it was decided that the model would need to be run over several decades to capture the year-to-year variability in the hydrology of each system, as well as the less frequent times when both systems experience similar hydrologic conditions (as occurred

periodically during the 1960s and in 1994). Historical records were then analyzed to identify a synthetic simulation period that would meet the following criteria:

1. The simulation time should be long enough to include an historical period that accounts for the year-to-year variations in local hydrology that have been observed in the past.
2. The period should be long enough to include longer-term (i.e., on the order of decades) periods of relatively dry conditions and relatively wet conditions.
3. The average rainfall during the simulation period should be similar to the average rainfall of 17.84 in/yr that was observed from 1950 through 2000 at the Newhall-Soledad gage.
4. The period should be sufficiently long to allow simulation of two occurrences of reduced SWP water supplies during the period 1990 through 1992, which corresponds to periods of increased pumping from the Saugus Formation under the operating plan.
5. The frequency of dry-year occurrences in the SWP system, corresponding to increased pumping from the Saugus Formation, should be similar to the historical frequency.
6. If necessary to meet other criteria, the simulation should repeat parts of this sequence before and/or after the historical sequence.

Examination of historical local hydrology and independent simulations of SWP deliveries resulted in the selection of a 78-year period over which the model was run, with monthly time steps. The 78-year period replicates the historical hydrology of the following years:

1. Years 1 through 24 = 1980 through 2003
2. Years 25 through 78 = 1950 through 2003

3.3.2 Relationship of Simulation Period to Variations in Alluvial Aquifer Pumping

Figure 3-5 shows the year-to-year rainfall in the valley and the cumulative departure from average rainfall for each year during the 78-year simulation period. The figure also shows each simulation year's corresponding historical year. The cumulative departure from average rainfall is plotted to show the occurrence of relatively wet versus relatively dry periods. A year-to-year decline in the slope of the cumulative departure curve indicates that conditions are dry, whereas a year-to-year increase indicates that rainfall is above normal. Also plotted are the occurrences of SWP droughts. The figure shows the following:

1. The first 19 years of the simulation period are generally wet, as a whole, though a multi-year drought occurs in years 5 through 12 (1984 through 1991).
2. A prolonged dry period begins in year 20, as indicated by the downward slope in the cumulative departure curve. This period lasts through year 39, as the curve starts to slope upward to the right beginning in year 40[6]. This 20-year period of generally dry conditions corresponds to the historical period 1999 through 2003, followed by 1950 through 1964.

[6]Year 40 is equivalent to historical year 1965, when rainfall was over 32 inches, or 2.2 times the long-term median rainfall and 1.8 times the long-term average rainfall.

3. Rainfall was generally at or above normal from years 40 through 45 (historical years 1965 through 1970), before a drought ensued from years 46 through 51 (historical years 1971 through 1976).

4. Rainfall was then generally above normal during years 52 through 58 (1977 through 1983), followed by the drought years 59 through 66 (1984 through 1991), the wetter-than-normal years 67 through 76 (1992 through 2001), and dry years 77 and 78 (2002 and 2003).

Table 3-2 shows the sequence of local hydrologic conditions and resulting valleywide pumping volumes for the Alluvial Aquifer that have been defined from the groundwater operating plan for the valley. The 78-year simulation period contains the following:

1. Twenty-four years of sporadic dry-year pumping, which is approximately 30 percent of the simulated 78-year period.

2. One drought consisting of 4 consecutive years of below-normal pumping (in years 34 through 37, based on historical hydrology from 1959 through 1962).

3. Two droughts consisting of 3 consecutive years of below-normal pumping (in years 10 through 12 and 64 through 66, both of which are based on historical hydrology from 1989 through 1991).

4. Three years (years 12, 37, and 66) when rainfall is near or above normal, but pumping is assigned at a dry-year rate because the year was preceded by a multi-year local drought.

3.3.3 Relationship of Simulation Period to Variations in Saugus Pumping

Table 3-3 shows the sequence of SWP droughts, SWP allocations, and resulting pumping volumes for the Saugus Formation that have been defined based on the CLWA and USBR analyses. With respect to Saugus Formation pumping, the 78-year period contains the following:

1. Two droughts lasting 2 years
2. Two droughts lasting 3 years
3. A dry year that occurs 2 years before the beginning of each 3-year drought
4. A dry year that begins 1 year after each 3-year drought has ended
5. A total of 18 dry years, or an average of 1 dry year approximately every 4 years
6. Sixty years of normal-year pumping from the Saugus Formation

3.4 Assignment of Pumping Rates

Pumping rates for Purveyor-owned wells and known private pumping wells (owned by the Newhall Land & Farming Company (NLF), the Wayside Honor Rancho, and Robinson Ranch) were assigned in accordance with the groundwater operating plan for the Santa Clarita Valley, which defines ranges of valleywide annual pumping, given the water supply needs of the Purveyors. Pumping rates at individual wells were also assigned using the recent and planned production schedules for each well, information on the depths and lengths of the intake sections (open intervals) of each well, and by incorporating current

plans addressing the presence of perchlorate in specific portions of the Saugus Formation and the Alluvial Aquifer.

As noted in the discussion of the groundwater operating plan in Section 2.2, the water management practices of the Purveyors recognize ongoing Alluvial Aquifer pumping for agricultural water supply, as well as other smaller private domestic and related pumping. For the last 7 years of formal annual water report preparation in the Santa Clarita Valley, those reports have included estimates of the latter private pumping. In recent years, that estimate has been 500 AF/yr. Initially in 2003, during the preparation of the Groundwater Management Plan (CLWA, 2003), and recently, during ongoing preparation of the 2005 UWMP, the Santa Clarita Valley Well Owners' Association submitted limited information about the nature and magnitude of private well pumping. The most notable input from the Well Owners' Association was its detailed estimate of private well pumping in the San Francisquito Canyon portion of the basin: a total of 85 AF/yr by 73 individual private pumpers, or an average of approximately 1.2 AF/yr per private well (equivalent to approximately 0.7 gallon per minute). As a result of that information, there is increased confidence that total private pumping in the basin by smaller users is within the 500 AF/yr estimate presented in recent annual water reports and is, therefore, approximately 1 percent of typical Alluvial Aquifer pumping by the Purveyors and other known private well owners (including agricultural pumpers) combined. However, the small private wells are not explicitly modeled in the basin yield analysis described herein because their locations and operations are not known, and their operation creates a pumping stress that is essentially negligible at the scale of the regional model. Ultimately, as discussed throughout this report, the intent to maintain overall pumping within the operating plan, including private pumping, will result in sustainable groundwater conditions to support the combination of municipal (Purveyor), agricultural, and private groundwater use on an ongoing basis. Thus, private well owners in the basin, like the large municipal and agricultural pumpers, can expect groundwater supplies to continue to be available as they have been in the past, with some fluctuations in water levels through wet and dry periods, but no long-term depletion of supply.

Details of pumping rate assignments for Purveyor-owned wells and known private pumping wells are discussed for the Alluvial Aquifer in Section 3.4.1 and for the Saugus Formation in Section 3.4.2. Section 3.4.3 discusses the monthly distribution of pumping for each well. Section 3.4.4 discusses how the pumping rate assignments relate to the presence of perchlorate in groundwater.

3.4.1 Variations in Alluvial Aquifer Pumping

Pumping rates at specific wells were assigned for normal and dry years using the operating plan and information on the capacity, recent and planned use, and location of each well. Figure 2-4 shows the locations of these wells and other wells in the valley. Table 3-4 compares recent annual pumping volumes at each Alluvial Aquifer well with the assumed future production rates at each well under normal and dry-year conditions. Most Alluvial Aquifer wells were specified to operate at similar rates regardless of year type. However, there were two exceptions, as follows:

1. Wells in the eastern portion of the basin (the NCWD-Pinetree wells, nine wells owned by SCWC, and the privately owned Robinson Ranch well) were assumed to have lower

pumping capacities during dry years than nondrought years because of lower groundwater elevations during dry periods. This assumption was based on historical observations indicating that the eastern portion of the Alluvial Aquifer, in contrast to other parts of the valley, experiences declines in water levels during dry periods.

2. Pumping was also reduced at NCWD's three operating wells in Castaic Valley, in accordance with recent pumping records from those wells.

3.4.2 Variations in Saugus Formation Pumping

Pumping rates at specific Saugus Formation production wells were assigned for each type of year (normal, dry year 1, dry year 2, and dry year 3) using the operating plan for the valley and information on the capacity, recent and planned use, and location of each well. Table 3-5 summarizes the annual pumping volumes at each Saugus Formation well[7]. Significant aspects of the pumping rate selection at each well are as follows:

1. Pumping from most existing Saugus Formation production wells was based on recent and planned use of these wells, as defined by the Purveyors. The simulation included increased dry-year pumping from the Saugus Formation in the western portion of the basin, where it is anticipated that future wells will be installed.

2. Each Saugus Formation production well has an intake section (open interval) that is significantly longer in vertical extent than the thicknesses of the individual layers that represent the Saugus Formation in the Regional Model. Consequently, the Saugus pumping rates were assigned to multiple layers in the model by considering the depths of the intake section of each well and the transmissivity of each model layer. Table 3-6 shows the allocation of pumping in each model layer for each Saugus Formation production well, along with the intake sections of each well and the model-simulated transmissivity in each layer at each well location.

3.4.3 Monthly Allocation of Pumping

Table 3-7 shows the allocation of pumping, by month, for agricultural and urban production wells in both the Saugus Formation and the Alluvial Aquifer. Separate distributions were used because agricultural demands are for exclusively outdoor uses, whereas urban demands are for both indoor and outdoor uses. As discussed in the model development report (CH2M HILL, 2004a), the monthly distribution of agricultural pumping was derived from crop consumptive use requirements published by the California Irrigation Management Information Service. The monthly distribution of urban demand was determined by examining historical monthly flow records for the two LACSD WRPs and monthly demand distributions recorded by the Purveyors during the past several years.

3.4.4 Influence of Perchlorate Contamination on Groundwater Pumping

In 1997, two Saugus Formation production wells owned by CLWA's Santa Clarita Water Division (formerly SCWC) (wells SCWC-Saugus1 and SCWC-Saugus2), one Saugus Formation production well owned by the Newhall County Water District (NCWD)

[7]Table 3-5 only lists wells that are anticipated to be operating in the future. Existing wells that are not listed in this table (such as NCWD-7 and NCWD-10) are currently not in service or pump very limited quantities of groundwater, and, therefore, are not expected to provide significant quantities of water in the future.

(well NCWD-11), and one Saugus Formation production well owned by VWC (well VWC-157) were shut down because perchlorate was detected in groundwater at these wells[8]. In 2002, an Alluvial Aquifer production well owned by SCWC (well SCWC-Stadium) was shut down because of perchlorate detection. In March 2005, an Alluvial Aquifer production well owned by VWC (well VWC-Q2) was shut down because of perchlorate detection. The locations of the six impacted production wells and nearby nonimpacted production wells are shown on Figure 3-6, along with the locations of monitoring wells and exploratory borings that have been installed to investigate the extent of perchlorate contamination. Figure 3-6 also shows perchlorate concentrations at locations where perchlorate has been detected in groundwater. At each of the six production wells, the detected perchlorate concentrations exceeded the State of California's Action Level (AL) for perchlorate at the time of the detection[9].

In 2003, the Purveyors entered into a voluntary cleanup agreement with the California Department of Toxic Substances Control whereby the Department of Toxic Substances Control provides review and oversight of the activities of the Purveyors in response to the perchlorate detections. The Purveyors have also initiated a process for approval by the California Department of Health Services, in accordance with its Policy 97-005, for restoration of water supply from "severely impaired" water sources, such as the perchlorate-impacted wells. Also in 2003, the Purveyors and the responsible party (the Whittaker Corporation) entered into an Interim Settlement Agreement. Activities since execution of the Interim Settlement Agreement have consisted of developing the elements of a remedial strategy that will entail pumping of two impacted wells for containment of perchlorate migration; treatment and subsequent use of the pumped water for water supply; and installation of replacement wells in non-impacted portions of the basin to restore the remainder of groundwater supply impacted by perchlorate. A noteworthy detail of these activities is that the Regional Model was used to identify the design of a pumping scheme that would meet the Purveyors' objectives for perchlorate containment in the Saugus Formation (CH2M HILL, 2004b).

With respect to perchlorate presence in the Alluvial Aquifer, the selection of pumping rates for the basin yield analysis was as follows:

1. Well SCWC-Stadium was simulated as pumping during each year of the 78-year simulation period. The Whittaker Corporation is developing plans to mitigate the source of perchlorate to the portion of the Alluvial Aquifer immediately north and downgradient of the Whittaker-Bermite property. The modeled pumping scenario simulates the possibility that the well will be returned to service in the future and pump at a rate similar to historical volumes after source mitigation activities have reduced perchlorate concentrations to undetectable levels in the Alluvial Aquifer at and near this well.

[8]As part of the ongoing implementation of perchlorate containment and restoration of impacted capacity, well VWC-157 was abandoned in January 2005 and replaced by new well VWC-206. Thus, this analysis includes planned pumping from replacement well VWC-206.

[9]The AL has varied over time. The California Department of Health Services initially established an AL of 18 micrograms per liter (μg/L) in 1997, at the same time the four impacted Saugus Formation production wells were taken offline. In 2002, the Department of Health Services revised the AL to 4 μg/L based on studies by the U.S. Environmental Protection Agency. In March 2004, the AL was revised to 6 μg/L based on a public health goal published by the Office of Environmental Health Hazard Assessment. See http://www.dhs.ca.gov/ps/ddwem/chemicals/perchl/actionlevel.htm for further details.

2. Well VWC-Q2 was simulated as pumping during each year of the 78-year simulation period. VWC and the Whittaker Corporation are currently implementing plans to install perchlorate treatment (ion exchange) facilities at the wellhead to remove perchlorate so that the well can be returned to service (LSCE, 2005b). VWC is working with USFilter to install and maintain this treatment and is preparing an application to amend its water supply permit to allow treatment at this well, which is expected to be returned to service by fall 2005. The perchlorate detected in well VWC-Q2 does not significantly impact the water supplies used to meet demand in the Santa Clarita Valley during the time required to respond to the contamination at this well (LSCE, 2005b).

With respect to perchlorate presence in the Saugus Formation, the Purveyors have developed a hydraulic containment plan for the Saugus Formation that consists of pumping from the SCWC-Saugus1 and SCWC-Saugus2 production wells. The three Saugus wells impacted by perchlorate had produced a combined average of 4,186 AF/yr of water during the 5 years preceding the detection of perchlorate. Restoration of that volume of water is currently planned to be achieved by reactivating wells SCWC-Saugus1 and SCWC-Saugus2, with treatment for removal of perchlorate, and by constructing replacement wells in other parts of the Saugus Formation not impacted by perchlorate. Full restoration of impacted water supply, including implementation of the containment plan, is currently scheduled for 2006. The containment plan will consist of (1) pumping groundwater on a nearly continual basis from production wells SCWC-Saugus1 and SCWC-Saugus2 production wells; (2) treating the pumped water using ion exchange resins followed by chlorine and ammonia disinfection; and (3) pumping the treated water to CLWA's Rio Vista Intake Pump Station for subsequent distribution for municipal water supply. This containment plan was developed to meet the following objectives, which were identified by the Purveyors:

1. Hydraulically contain perchlorate that is migrating westward in the Saugus Formation from the Whittaker-Bermite property toward the impacted production wells
2. Hydraulically contain perchlorate that is present at monitoring well MP-5 and production well VWC-157, which are located downgradient of the impacted wells
3. Protect downgradient production wells that are currently not impacted
4. Restore the annual volumes of water that were pumped from the impacted wells before they were shut down
5. Operate the impacted wells in a manner that is consistent with the groundwater operating plan
6. If possible, pump one or more of the impacted Saugus Formation production wells in a manner that also contains perchlorate migrating in the Alluvial Aquifer from the northern portion of the Whittaker-Bermite property

A detailed analysis of this perchlorate containment plan in the Saugus Formation is presented in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (CH2M HILL, 2004b). The pumping plan described in that report for the SCWC-Saugus1 and SCWC-Saugus2 production wells was also used in the basin yield modeling evaluation. These wells were assumed to operate on a continuous basis to contain perchlorate in this portion of the Saugus Formation. The analysis assumed each well

would be offline 1 month each year for routine maintenance, but would otherwise operate on a continuous basis.

Additionally, for the previous evaluations of the containment plan and for the basin yield analysis, the third impacted production well (NCWD-11) was assumed to operate at a yield of 1,200 gallons per minute for a period of 5 months during the peak-demand season, providing a volume of 811 acre-feet that would be treated prior to entering the distribution system. Consequently, total pumping from the three perchlorate-impacted Saugus Formation production wells that will be returned to service (SCWC-Saugus1, SCWC-Saugus2, and NCWD-11) was simulated as 4,355 AF/yr. Total pumping from NCWD wells completed in the Saugus Formation was simulated as 3,441 AF/yr in normal years and 4,899 AF/yr in dry years, with pumping occurring from NCWD-11 and nearby production wells NCWD-12 and NCWD-13. Because they are closely spaced geographically, the three wells together form a pumping center in the Saugus Formation. Thus, although NCWD may choose to no longer use well NCWD-11, this analysis includes a pumping distribution that examines the sustainability of the Saugus Formation with a conservatively high pumping capacity at this pumping center.

3.5 Simulation Methods for Other Local Hydrologic Processes

In addition to groundwater pumping, infiltration from irrigation (from urban and agricultural lands), precipitation, and streamflows (stormwater and WRP discharges) were also modeled. These other local hydrologic processes were defined using the Surface Water Routing Model (SWRM), which is described in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Key aspects of the derivation of these terms are described in the following sections.

3.5.1 Recharge from Urban Irrigation

Under existing land use and water use conditions, the estimated long-term infiltration rates of applied irrigation water beneath urban areas, under full build-out conditions in the valley, were estimated to be 1.0 in/yr for industrial and retail lands, 2.2 in/yr for residential developments and parks, and 4.6 in/yr for golf courses. These rates were applied during each year (and each month) of the 78-year simulation period. The areas over which these rates were applied were larger than under current conditions. The areas were defined from existing land use data and from LACSD mapping of projected future land uses in the rest of the Santa Clarita Valley under full build-out conditions[10]. Figure 3-7 shows the land use that was simulated in the model for full build-out conditions.

3.5.2 Recharge from Agricultural Irrigation

As discussed in the *Newhall Ranch Updated Water Resources Impact Evaluation* (CH2M HILL, 2002), irrigation of lands owned by NLF results in existing agricultural return flows. The source of most irrigation water is groundwater pumping from the Alluvial Aquifer, with some limited pumping occurring from one Saugus Formation well (NLF-156).

[10]LACSD land use mapping indicates that, including Newhall Ranch, approximately 14,000 acres of currently undeveloped land will be urbanized in the future within the Regional Model simulation area. Additional urbanization will also occur in areas that are within the watershed, but outside the Regional Model's boundaries.

Under full valley build-out conditions, the currently irrigated lands will no longer be irrigated because their water source will be used as part of the water supply for Newhall Ranch. Therefore, under full build-out conditions, no agricultural irrigation will occur within the area simulated by the Regional Model.

3.5.3 Precipitation Recharge

Infiltration from direct precipitation within the Regional Model domain was defined using data from the Newhall-Soledad and NCWD rain gages, an isohyet map of rainfall throughout the watershed, and a power-function equation developed by Turner (1986) that describes the relationship between annual rainfall and ET rates within the valley. Details concerning the derivation of precipitation infiltration rates from these data are contained in Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Table 3-8 lists the simulated monthly precipitation at the NCWD rain gage for the 78-year model period[11].

3.5.4 Stormwater Flows and Recharge from Streams

For each month of the simulation, the SWRM calculated the amounts of stormwater flow and groundwater recharge in all streams, plus the amount of flow and groundwater recharge arising from projected future WRP discharges to the Santa Clara River. For the Santa Clara River, the volume of streamflow was defined from measured and estimated streamflow data at the Lang gage (Table 3-9). For Castaic Creek, the volume of streamflow was defined from historical DWR operations and consideration of the hydrologic year type (Table 3-10). For the remaining Santa Clara River tributaries, streamflow volumes were defined by the SWRM using monthly rainfall data and the Turner (1986) relationship between rainfall, ET, and the subsequent yield from each watershed.

3.5.5 WRP Discharges to the Santa Clara River

Treated water is discharged to the Santa Clara River from two LACSD WRPs. As shown on Figure 1-1, the Saugus WRP discharges to the river immediately above the mouth of the South Fork Santa Clara River, and the Valencia WRP discharges to the river just west of Interstate 5.

Under full valley build-out conditions, future flows into and from WRPs will be higher than historical flows because of increased development and the associated increase in indoor water use volumes. Additionally, a portion of the future treated water will be reclaimed, as described in CLWA's recycled water master plan (Kennedy/Jenks Consultants, 2002). Future inflows to the Saugus and Valencia WRPs were estimated from projected future water demands and from comparisons of historical water use and measured inflows to both WRPs. Table 3-11 shows the derivation of urban water demands outside the Newhall Ranch development (which will be served by a new, separate WRP). Table 3-12 shows the total amount of treated water generated by the Saugus and Valencia WRPs, and the amount of this water that is reclaimed and discharged to the river, by month. The analysis assumes that the reclaimed water volume will be no more than 16,000 AF/yr, to maintain existing flow volumes in the Santa Clara River. For the Newhall Ranch WRP, discharges to the river

[11]The simulated monthly precipitation was defined from measurements at the NCWD gage from 1979 through 2003, as well as by combining the isohyet map with measurements at the Newhall-Soledad gage from 1950 through 1978.

will be 286 AF/yr, occurring primarily in December and January, when demands for reclaimed water are at their seasonal low. The total combined volumes of treated water discharged to the Santa Clara River under full valley build-out conditions (including Newhall Ranch) are summarized, by month, in Table 3-13. These rates were used in each year of the 78-year simulation.

3.5.6 Monthly Assignment and Tracking of Surface Water Budget

The month-by-month assignment of the rates and locations of surface water infiltration to the underlying Alluvial Aquifer system was performed by the SWRM using the procedures described in Section C.8.5 of Appendix C to the Regional Model development and calibration report (CH2M HILL, 2004a). Streambed infiltration capacities were the same as those used in the calibrated model. For each of the 78 years in the model simulation, the streambed infiltration capacity values were selected by matching the year to 1 of the 20 years (1980 through 1999) from the model calibration runs, using rainfall and streamflow data to select the corresponding streambed infiltration rates.

The SWRM also tracked the volume of surface water in each simulated stream that does not infiltrate during each month because of gaining stream conditions (i.e., rejected stream leakage). This rejected stream leakage was calculated to remain as surface water in the Santa Clara River and to eventually exit the Regional Model at the west end of the valley, at the County Line gage.

3.6 Running the Model and Evaluating Results

As discussed in the previous sections, the modeling evaluations were performed by simulating conditions on a monthly basis for the 78-year simulation period. The first step in this process consisted of running the SWRM to calculate the monthly distribution of recharge to the Alluvial Aquifer system (from rainfall, streamflow, irrigation, and WRP discharges) and recharge to the Saugus Formation (from rainfall and irrigation) in areas where the Alluvial Aquifer is not present. The output from the SWRM consisted of monthly files that assigned recharge to each node in the model grid.

The Regional Model was then run using monthly time steps, in which pumping and recharge terms were varied each month. The model was run by solving the groundwater flow equations for three time intervals during each month to improve the accuracy of the calculations. For each sub-interval of time, the model was run with a convergence criterion of 0.0001 foot for groundwater elevations and a water budget convergence criterion of 1 cubic foot per day. The model results were then evaluated by generating time-series plots (hydrographs) of water budget terms and groundwater elevations to evaluate the potential effects of the groundwater operating plan across the basin. The hydrographs were used to evaluate whether the operating plan is consistent with the objective of operating the basin in a manner that maintains long-term stability in groundwater levels and river flows. This analysis and its findings are presented in Section 4.

Tables

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1950	Below Normal	6.84
1951	Above Normal	12.42
1952	Wet	34.19
1953	Wet	4.88
1954	Above Normal	15.82
1955	Dry	13.91
1956	Wet	14.21
1957	Above Normal	22.85
1958	Wet	23.14
1959	Below Normal	9.81
1960	Dry	11.64
1961	Dry	8.82
1962	Below Normal	21.22
1963	Wet	12.79
1964	Dry	10.09
1965	Wet	32.28
1966	Below Normal	14.57
1967	Wet	23.23
1968	Below Normal	6.90
1969	Wet	32.42
1970	Wet	23.19
1971	Wet	13.75
1972	Below Normal	4.15
1973	Above Normal	19.79
1974	Wet	18.04
1975	Wet	10.92
1976	Critical	14.02
1977	Critical	20.87
1978	Above Normal	42.17
1979	Below Normal	21.47
1980	Above Normal	27.00
1981	Dry	13.42
1982	Wet	20.20
1983	Wet	39.07
1984	Wet	12.86

TABLE 3-1
Historical Hydrology in Northern California and the Santa Clarita Valley, 1950 through 2003
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Northern California Hydrology[a]	Local Rainfall[b]
1985	Dry	8.37
1986	Wet	18.02
1987	Dry	14.45
1988	Critical	16.92
1989	Dry	7.56
1990	Critical	6.98
1991	Critical	17.21
1992	Critical	32.03
1993	Above Normal	32.72
1994	Critical	10.27
1995	Wet	29.15
1996	Wet	15.88
1997	Wet	13.35
1998	Wet	30.73
1999	Wet	8.96
2000	Above Normal	14.04
2001	Dry	22.24
2002	Dry	7.90
2003	Above Normal	15.70

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Records are for the Newhall-Soledad rain gage (Station No. FC32CE), in inches. As shown on Figure 2-6, the median and average rainfall at this gage from 1950 through 2002 were 14.57 in/yr and 17.84 in/yr, respectively.

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
1	1980	27.00	35,000-40,000
2	1981	13.42	35,000-40,000
3	1982	20.20	35,000-40,000
4	1983	39.07	35,000-40,000
5	1984	12.86	35,000-40,000
6	1985	8.37	30,000-35,000
7	1986	18.02	35,000-40,000
8	1987	14.45	35,000-40,000
9	1988	16.92	35,000-40,000
10	1989	7.56	30,000-35,000
11	1990	6.98	30,000-35,000
12	1991	17.21	30,000-35,000
13	1992	32.03	35,000-40,000
14	1993	32.72	35,000-40,000
15	1994	10.27	30,000-35,000
16	1995	29.15	35,000-40,000
17	1996	15.88	35,000-40,000
18	1997	13.35	35,000-40,000
19	1998	30.73	35,000-40,000
20	1999	8.96	30,000-35,000
21	2000	14.04	35,000-40,000
22	2001	22.24	35,000-40,000
23	2002	7.90	30,000-35,000
24	2003	15.70	35,000-40,000
25	1950	6.84	30,000-35,000
26	1951	12.42	35,000-40,000
27	1952	34.19	35,000-40,000
28	1953	4.88	30,000-35,000
29	1954	15.82	35,000-40,000
30	1955	13.91	35,000-40,000
31	1956	14.21	35,000-40,000
32	1957	22.85	35,000-40,000
33	1958	23.14	35,000-40,000
34	1959	9.81	30,000-35,000
35	1960	11.64	30,000-35,000
36	1961	8.82	30,000-35,000
37	1962	21.22	30,000-35,000
38	1963	12.79	35,000-40,000
39	1964	10.09	30,000-35,000
40	1965	32.28	35,000-40,000
41	1966	14.57	35,000-40,000

TABLE 3-2
Local Hydrology and Corresponding Pumping from the Alluvial Aquifer for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Model Year	Based on Historical Year	Local Rainfall (inches)[a]	Alluvial Aquifer Pumping under the Groundwater Operating Plan[b,c] (AF/yr)
42	1967	23.23	35,000-40,000
43	1968	6.90	30,000-35,000
44	1969	32.42	35,000-40,000
45	1970	23.19	35,000-40,000
46	1971	13.75	35,000-40,000
47	1972	4.15	30,000-35,000
48	1973	19.79	35,000-40,000
49	1974	18.04	35,000-40,000
50	1975	10.92	30,000-35,000
51	1976	14.02	35,000-40,000
52	1977	20.87	35,000-40,000
53	1978	42.17	35,000-40,000
54	1979	21.47	35,000-40,000
55	1980	27.00	35,000-40,000
56	1981	13.42	35,000-40,000
57	1982	20.20	35,000-40,000
58	1983	39.07	35,000-40,000
59	1984	12.86	35,000-40,000
60	1985	8.37	30,000-35,000
61	1986	18.02	35,000-40,000
62	1987	14.45	35,000-40,000
63	1988	16.92	35,000-40,000
64	1989	7.56	30,000-35,000
65	1990	6.98	30,000-35,000
66	1991	17.21	30,000-35,000
67	1992	32.03	35,000-40,000
68	1993	32.72	35,000-40,000
69	1994	10.27	30,000-35,000
70	1995	29.15	35,000-40,000
71	1996	15.88	35,000-40,000
72	1997	13.35	35,000-40,000
73	1998	30.73	35,000-40,000
74	1999	8.96	30,000-35,000
75	2000	14.04	35,000-40,000
76	2001	22.24	35,000-40,000
77	2002	7.90	30,000-35,000
78	2003	15.70	35,000-40,000

[a]From records at Newhall-Soledad rain gage (Station No. FC32CE).

[b]Alluvial Aquifer pumping rates listed in this column will occur under the operating plan for the valley if the 1950 through 2003 local hydrology repeats itself in the future.

[c]Alluvial Aquifer pumping is set at the dry-year rate in years 12, 37, and 66 because each of these years is the first nondrought year that occurs after a multi-year drought ends.

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
1	Above Normal	90	Normal (7,500-15,000)
2	Dry	90	Normal (7,500-15,000)
3	Wet	100	Normal (7,500-15,000)
4	Wet	100	Normal (7,500-15,000)
5	Wet	100	Normal (7,500-15,000)
6	Dry	95	Normal (7,500-15,000)
7	Wet	70	Normal (7,500-15,000)
8	Dry	75	Normal (7,500-15,000)
9	Critical	15	Dry Year 1 (15,000)
10	Dry	95	Normal (7,500-15,000)
11	Critical	25	Dry Year 1 (15,000)
12	Critical	30	Dry Year 2 (25,000)
13	Critical	45	Dry Year 3 (35,000)
14	Above Normal	100	Normal (7,500-15,000)
15	Critical	50	Dry Year 1 (15,000)
16	Wet	80	Normal (7,500-15,000)
17	Wet	100	Normal (7,500-15,000)
18	Wet	100	Normal (7,500-15,000)
19	Wet	100	Normal (7,500-15,000)
20	Wet	100	Normal (7,500-15,000)
21	Above Normal	90	Normal (7,500-15,000)
22	Dry	39	Dry Year 1 (15,000)
23	Dry	70	Normal (7,500-15,000)
24	Above Normal	90	Normal (7,500-15,000)
25	Below Normal	90	Normal (7,500-15,000)
26	Above Normal	100	Normal (7,500-15,000)
27	Wet	100	Normal (7,500-15,000)
28	Wet	100	Normal (7,500-15,000)
29	Above Normal	100	Normal (7,500-15,000)
30	Dry	45	Dry Year 1 (15,000)
31	Wet	100	Normal (7,500-15,000)
32	Above Normal	90	Normal (7,500-15,000)
33	Wet	100	Normal (7,500-15,000)
34	Below Normal	85	Normal (7,500-15,000)
35	Dry	55	Dry Year 1 (15,000)
36	Dry	70	Dry Year 2 (25,000)
37	Below Normal	95	Normal (7,500-15,000)
38	Wet	100	Normal (7,500-15,000)
39	Dry	75	Dry Year 1 (15,000)
40	Wet	80	Normal (7,500-15,000)
41	Below Normal	100	Normal (7,500-15,000)
42	Wet	100	Normal (7,500-15,000)

TABLE 3-3
State Water Project Allocations and Corresponding Saugus Formation Pumping for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	SWP Hydrology[a]	SWP Allocations[b] (%)	Simulated Saugus Pumping Conditions (AF/yr)
43	Below Normal	90	Normal (7,500-15,000)
44	Wet	100	Normal (7,500-15,000)
45	Wet	100	Normal (7,500-15,000)
46	Wet	100	Normal (7,500-15,000)
47	Below Normal	75	Normal (7,500-15,000)
48	Above Normal	100	Normal (7,500-15,000)
49	Wet	100	Normal (7,500-15,000)
50	Wet	100	Normal (7,500-15,000)
51	Critical	75	Dry Year 1 (15,000)
52	Critical	4	Dry Year 2 (25,000)
53	Above Normal	100	Normal (7,500-15,000)
54	Below Normal	95	Normal (7,500-15,000)
55	Above Normal	90	Normal (7,500-15,000)
56	Dry	90	Normal (7,500-15,000)
57	Wet	100	Normal (7,500-15,000)
58	Wet	100	Normal (7,500-15,000)
59	Wet	100	Normal (7,500-15,000)
60	Dry	95	Normal (7,500-15,000)
61	Wet	70	Normal (7,500-15,000)
62	Dry	75	Normal (7,500-15,000)
63	Critical	15	Dry Year 1 (15,000)
64	Dry	95	Normal (7,500-15,000)
65	Critical	25	Dry Year 1 (15,000)
66	Critical	30	Dry Year 2 (25,000)
67	Critical	45	Dry Year 3 (35,000)
68	Above Normal	100	Normal (7,500-15,000)
69	Critical	50	Dry Year 1 (15,000)
70	Wet	80	Normal (7,500-15,000)
71	Wet	100	Normal (7,500-15,000)
72	Wet	100	Normal (7,500-15,000)
73	Wet	100	Normal (7,500-15,000)
74	Wet	100	Normal (7,500-15,000)
75	Above Normal	90	Normal (7,500-15,000)
76	Dry	39	Dry Year 1 (15,000)
77	Dry	70	Normal (7,500-15,000)
78	Above Normal	90	Normal (7,500-15,000)

[a]Defined by water year, using DWR's Sacramento Valley Unimpaired Runoff Index: wet = wettest; critical = driest.

[b]Defined from simulations performed by CLWA (Kennedy/Jenks Consultants, 2003) and USBR (2004) using the CALSIM II model. This condition is for the year 2020 level of development. In any given year, the allocation may be made up, in part, of carryover water from the prior year.

TABLE 3-4

Recent and Simulated Future Annual Groundwater Pumping Volumes from the Alluvial Aquifer

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

		Historical Pumping			UWMP Pumping	
Well Name	**Location**[a]	**2001**	**2002**	**2003**	**Normal Years**	**Dry Years**
NCWD-Castaic 1	Castaic Valley	345	385	561	385	345
NCWD-Castaic 2	Castaic Valley	166	0	123	166	125
NCWD-Castaic 3	Castaic Valley	0	0	0	0	0
NCWD-Castaic 4	Castaic Valley	100	47	56	100	45
NCWD-Pinetree 1	Mint Canyon	164	0	0	164	0
NCWD-Pinetree 2	Mint Canyon	0	0	0	0	0
NCWD-Pinetree 3	Mint Canyon	566	544	525	545	525
NCWD-Pinetree 4	Mint Canyon	300	5	0	300	0
NCWD Total		**1,641**	**981**	**1,265**	**1,660**	**1,040**
NLF-161	Downstream of Valencia WRP	496	485	2,021	485	485
NLF-B10	Downstream of Valencia WRP	1,240	534	344	344	344
NLF-B11	Downstream of Valencia WRP	205	232	271	232	232
NLF-B5	Downstream of Valencia WRP	1,680	2,280	1,582	1,582	1,582
NLF-B6	Downstream of Valencia WRP	1,312	2,175	1,766	1,766	1,766
NLF-B7	Downstream of Valencia WRP	474	584	402	584	584
NLF-C	Downstream of Valencia WRP	1,319	1,720	1,373	1,373	1,373
NLF-C3	Downstream of Valencia WRP	93	192	186	192	192
NLF-C4	Downstream of Valencia WRP	1,028	809	764	809	809
NLF-C5	Downstream of Valencia WRP	680	850	622	850	850
NLF-C6	Downstream of Valencia WRP	231	241	108	241	241
NLF-C7	Downstream of Valencia WRP	741	866	443	866	866
NLF-C8	Downstream of Valencia WRP	293	594	408	594	594
NLF-E	Castaic Valley	1,691	16	28	16	16
NLF-E2	Castaic Valley	141	55	14	55	55
NLF-E4	Downstream of Valencia WRP	0	0	0	0	0
NLF-E5	Downstream of Valencia WRP	172	679	537	679	679
NLF-E9	Downstream of Valencia WRP	238	814	47	814	814
NLF-G45	Downstream of Valencia WRP	291	283	60	283	283
NLF-W4	San Francisquito Canyon[b]	46	1	0	0	0
NLF-W5	San Francisquito Canyon	276	104	23	107	107
NLF-X3	Downstream of Valencia WRP	12	0	0	0	0
NLF Total		**12,659**	**13,514**	**10,999**	**11,872**	**11,872**
SCWD-Clark	Bouquet Canyon	696	782	712	782	700
SCWD-Guida	Bouquet Canyon	1,047	1,320	1,230	1,320	1,230
SCWD-Honby	Above Saugus WRP	721	696	874	696	870
SCWD-Lost Canyon 2	Mint Canyon	741	730	644	741	640
SCWD-Lost Canyon 2A	Mint Canyon	1,034	905	593	1,034	590
SCWD-Mitchell #5A	Mint Canyon	407	143	19	0	0
SCWD-Mitchell #5B	Mint Canyon	0	150	0	557	0
SCWD-N. Oaks Central	Mint Canyon	822	1,646	1,641	822	1,640
SCWD-N. Oaks East	Mint Canyon	1,234	448	485	1,234	485
SCWD-N. Oaks West	Mint Canyon	898	1,123	31	898	0
SCWD-Sand Canyon	Mint Canyon	930	705	195	930	195
SCWD-Sierra	Mint Canyon	846	87	0	846	0
SCWD-Stadium	Above Saugus WRP	565	778	0	800	800
SCWD Total		**9,941**	**9,513**	**6,424**	**10,660**	**7,150**

TABLE 3-5
Simulated Annual Groundwater Pumping from the Saugus Formation for the 78-year Simulation
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Owner	Well Name	Normal Years	Dry Year 1	Dry Year 2	Dry Year 3
NCWD	11	811	811	811	811
	12	1,315	2,044	2,044	2,044
	13	1,315	2,044	2,044	2,044
Total Pumping (NCWD)		**3,441**	**4,899**	**4,899**	**4,899**
NLF	156	369	369	369	369
Total Pumping (NLF)		**369**	**369**	**369**	**369**
SCWC	Saugus1	1,772	1,772	1,772	1,772
	Saugus2	1,772	1,772	1,772	1,772
Total Pumping (SCWC)		**3,544**	**3,544**	**3,544**	**3,544**
VWC	159	50	50	50	50
	160 (Municipal)	500	830	830	830
	160 (Valencia Country Club)	500	500	500	500
	201	100	100	3,577	3,577
	205	1,000	2,734	3,827	3,827
	206	1,175	2,734	3,500	3,500
Total Pumping (VWC)		**3,325**	**6,948**	**12,284**	**12,284**
To Be Determined	Future #1	0	0	3,250	3,250
	Future #2	0	0	0	3,250
	Future #3	0	0	0	3,250
	Future #4	0	0	0	3,250
Total Pumping (Future)		**0**	**0**	**3,250**	**13,000**
Total Saugus Formation Pumping		**10,679**	**15,760**	**24,346**	**34,096**

Notes:

All pumping volumes are listed in acre-feet.

Wells VWC-157 and NCWD-7, 8, 9, and 10 are assumed to no longer operate in the future.

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
NCWD-11	2	200	1,075	300	10	3,000	72.3
	3			500	2	1,000	24.1
	4			75	2	150	3.6
NCWD-12	2	485	1,280	15	10	150	8.8
	3			500	2	1,000	58.5
	4			280	2	560	32.7
NCWD-13	2	420	750	80	10	800	61.5
	3			250	2	500	38.5
NLF-156	2	320	1,800	180	10	1,800	21.8
	3			500	6.5	3,250	39.4
	4			500	4	2,000	24.2
	5			300	4	1,200	14.5
SCWC-Saugus1	2	490	1,620	10	10	100	1.8
	3			500	6.5	3,250	59.9
	4			500	4	2,000	36.8
	5			20	4	80	1.5
SCWC-Saugus2	2	490	1,591	10	10	100	1.7
	3			500	6.5	3,250	56.9
	4			500	4	2,000	35.0
	5			91	4	364	6.4
VWC-159	3	662	1,900	338	0.025	8.45	27.3
	4			500	0.025	12.5	40.4
	5			400	0.025	10	32.3
VWC-160	3	950	2,000	50	6.5	325	7.6
	4			500	4	2,000	46.2
	5			500	4	2,000	46.2
VWC-201	3	540	1,670	460	6.5	2,990	52.7
	4			500	4	2,000	35.3
	5			170	4	680	12.0
VWC-205	3	820	1,930	180	6.5	1,170	23.9
	4			500	4	2,000	40.9
	5			430	4	1,720	35.2
VWC-206	3	500	2,000	500	6.5	3,250	44.8
	4			500	4	2,000	27.6
	5			500	4	2,000	27.6

TABLE 3-6

Allocation of Pumping by Layer for Wells Completed in the Saugus Formation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Well Owner - Well Name	Model Layer	Depth to Open Interval (feet) Top	Depth to Open Interval (feet) Bottom	Length of Open Interval in Model Layer (feet)	Kh (ft/day)	T in Open Interval (ft^2/day)	Percentage of Yield from Model Layer
Future Wells	3	820	1,930	180	6.5	1,170	23.9
Near VWC-206	4			500	4	2,000	40.9
(Assumed)	5			430	4	1,720	35.2

Notes:

Existing wells NCWD-7 and NCWD-10 are assumed to no longer operate in the future.

Kh = horizontal hydraulic conductivity
T = transmissivity
ft/day = feet per day
ft^2/day = square feet per day

TABLE 3-7
Allocation of Pumping, by Month, for Agricultural and Urban Production Wells
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Percent of Annual Water Use, Agricultural	Percent of Annual Water Use, Urban	Percent of May through October Water Use, Urban
January	3.75	5.2	
February	5.10	3.7	
March	6.60	5.2	
April	9.10	6.6	
May	10.55	8.7	13.2
June	11.40	10.4	15.8
July	14.10	13.0	19.7
August	12.95	13.6	20.6
September	10.20	10.9	16.6
October	7.50	9.3	14.1
November	5.00	7.1	
December	3.75	6.3	
Total	**100.0**	**100.0**	**100.0**

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
2	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
3	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
4	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
5	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
6	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
7	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
8	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
9	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
10	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
11	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
12	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
13	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
14	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
15	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
16	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
17	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
18	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
19	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
20	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
21	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
22	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
23	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
24	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47
25	2.58	1.69	1.27	0.86	0.01	0.00	0.00	0.00	0.32	0.36	0.73	0.21	8.03
26	2.96	0.93	1.16	1.69	0.09	0.00	0.00	0.05	0.00	0.49	1.33	5.88	14.57
27	17.68	0.61	10.30	1.80	0.00	0.00	0.00	0.00	0.12	0.00	4.52	5.09	40.12
28	0.80	0.02	0.21	1.64	0.69	0.00	0.00	0.00	0.00	0.00	2.32	0.04	5.73
29	6.38	3.36	4.86	0.12	0.00	0.00	0.00	0.00	0.00	0.00	2.38	1.47	18.56
30	5.69	1.69	0.21	3.38	1.91	0.00	0.00	0.00	0.00	0.00	1.43	2.01	16.32
31	7.55	1.00	0.00	5.90	1.82	0.00	0.11	0.00	0.00	0.15	0.00	0.15	16.68
32	7.22	2.71	3.05	1.16	1.06	0.25	0.00	0.00	0.00	2.68	0.40	8.30	26.81
33	2.11	10.42	5.82	7.18	0.00	0.00	0.00	0.00	0.04	1.35	0.23	0.00	27.15
34	3.70	5.47	0.00	0.59	0.00	0.00	0.00	0.00	0.08	0.00	0.00	1.68	11.51
35	4.17	2.21	0.20	2.05	0.00	0.00	0.00	0.00	0.00	0.00	4.96	0.07	13.66
36	1.88	0.00	0.76	0.33	0.09	0.00	0.07	0.00	0.11	0.00	4.12	2.99	10.35
37	3.86	19.44	1.53	0.00	0.02	0.00	0.00	0.00	0.00	0.05	0.00	0.00	24.90
38	0.99	3.63	4.10	2.23	0.06	0.43	0.00	0.00	0.77	0.50	2.29	0.01	15.01
39	2.95	0.00	1.88	2.41	0.04	0.12	0.00	0.00	0.00	0.52	1.47	2.48	11.84
40	0.25	0.07	1.65	9.14	0.00	0.02	0.26	0.16	0.95	0.00	17.49	7.89	37.88
41	1.42	1.55	0.33	0.00	0.09	0.00	0.00	0.00	0.09	0.11	7.56	5.95	17.10

TABLE 3-8

Simulated Monthly Precipitation at the Newhall County Water District Rain Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	6.76	0.22	3.23	5.41	0.19	0.00	0.00	0.00	0.50	0.00	9.36	1.58	27.26
43	0.86	0.93	2.91	0.97	0.07	0.00	0.00	0.38	0.00	0.39	0.35	1.24	8.10
44	19.53	13.89	0.82	1.16	0.05	0.05	0.18	0.00	0.00	0.00	2.32	0.05	38.04
45	0.94	6.63	4.33	0.00	0.00	0.00	0.00	0.00	0.00	0.13	8.86	6.33	27.21
46	1.23	1.41	0.48	0.94	0.15	0.00	0.00	0.00	0.47	0.50	0.38	10.57	16.14
47	0.00	0.12	0.00	0.02	0.05	0.05	0.00	0.06	0.00	0.05	3.45	1.08	4.87
48	5.19	11.74	3.29	0.00	0.00	0.00	0.00	0.00	0.00	0.15	1.83	1.03	23.22
49	10.58	0.02	4.30	0.06	0.00	0.00	0.02	0.00	0.00	1.17	0.12	4.89	21.17
50	0.28	3.02	6.04	2.96	0.00	0.00	0.00	0.00	0.00	0.39	0.04	0.09	12.81
51	0.00	7.39	1.47	0.46	0.15	0.35	0.01	0.00	3.40	0.22	2.09	0.90	16.45
52	5.75	0.12	2.15	0.00	5.27	0.00	0.00	2.68	0.02	0.05	0.06	8.40	24.49
53	10.74	13.23	17.10	2.72	0.00	0.00	0.00	0.00	1.23	0.01	2.70	1.76	49.49
54	12.44	3.20	6.01	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.89	1.19	23.75
55	10.36	14.63	4.84	0.36	0.40	0.00	0.00	0.00	0.00	0.00	0.00	1.36	31.95
56	4.76	1.66	5.50	0.46	0.00	0.00	0.00	0.00	0.00	0.58	3.62	0.22	16.80
57	3.33	1.21	9.50	1.09	0.13	0.00	0.00	0.00	1.02	0.25	5.34	2.95	24.82
58	8.67	6.85	13.07	4.61	0.20	0.00	0.00	1.17	1.85	1.74	5.04	5.13	48.33
59	0.00	0.00	0.27	0.07	0.00	0.00	0.00	0.00	0.05	0.16	3.87	8.13	12.55
60	0.78	1.20	1.04	0.14	0.07	0.00	0.06	0.00	0.12	0.54	5.11	0.70	9.76
61	5.84	6.65	5.39	0.88	0.00	0.00	0.05	0.00	1.78	0.68	1.55	0.24	23.06
62	2.10	0.61	1.69	0.14	0.00	0.00	0.09	0.02	0.00	3.47	3.84	4.80	16.76
63	3.27	3.39	1.16	3.98	0.09	0.00	0.00	0.00	0.10	0.00	0.92	7.14	20.05
64	0.89	4.13	1.30	0.30	0.00	0.00	0.00	0.00	0.62	0.86	0.37	0.00	8.47
65	2.89	4.23	0.22	0.48	0.88	0.00	0.00	0.00	0.00	0.00	0.63	0.01	9.34
66	1.11	5.72	11.33	0.00	0.00	0.00	0.00	0.00	0.00	0.50	0.00	5.95	24.61
67	3.28	16.64	9.73	0.15	0.34	0.00	0.30	0.00	0.00	1.55	0.00	7.25	39.24
68	17.11	11.73	4.27	0.00	0.00	0.65	0.00	0.00	0.00	0.57	0.75	1.00	36.08
69	0.48	5.31	2.33	0.42	0.00	0.00	0.00	0.00	0.00	0.78	0.71	1.94	11.97
70	21.98	1.93	8.30	0.72	0.26	0.76	0.00	0.00	0.00	0.00	0.00	2.33	36.28
71	2.97	6.73	2.08	0.13	0.68	0.00	0.00	0.00	0.00	1.30	1.06	8.70	23.65
72	6.67	0.23	0.00	0.00	0.00	0.00	0.05	0.00	0.53	0.00	3.73	6.72	17.93
73	3.49	22.00	3.98	2.28	5.50	0.06	0.00	0.00	0.21	0.33	1.36	1.39	40.60
74	2.08	0.65	3.00	3.78	0.00	0.48	0.00	0.00	0.01	0.00	0.00	0.05	10.05
75	1.21	9.43	3.15	2.10	0.00	0.00	0.00	0.31	0.00	1.13	0.00	0.00	17.33
76	5.96	9.79	3.70	1.88	0.00	0.00	0.00	0.00	0.00	0.36	3.33	1.08	26.10
77	1.08	1.10	0.26	0.05	0.05	0.00	0.00	0.00	0.01	0.00	2.48	4.25	9.27
78	0.00	9.88	2.73	2.42	0.05	0.00	0.00	0.00	0.09	0.10	0.63	2.57	18.47

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
2	594	98	339	240	107	18	18	12	338	321	258	394	2,739
3	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
4	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
5	0	596	405	240	143	166	228	411	154	220	904	578	4,044
6	483	461	274	215	77	0	0	0	12	179	221	301	2,224
7	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
8	117	117	65	31	12	0	0	0	0	0	258	516	1,116
9	222	209	506	117	77	68	0	0	0	0	12	25	1,236
10	50	111	60	25	6	0	0	0	102	94	34	18	499
11	212	276	230	46	46	5	0	0	0	27	36	147	1,025
12	162	775	879	736	145	142	14	0	45	69	62	263	3,291
13	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
14	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
15	388	493	497	319	163	80	20	7	37	102	193	941	3,239
16	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
17	666	896	730	315	151	46	7	0	54	154	307	510	3,836
18	517	346	140	85	33	5	4	50	66	240	566	809	2,859
19	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
20	92	85	204	224	197	107	80	46	52	54	31	80	1,252
21	117	117	65	31	12	0	0	0	0	0	258	516	1,116
22	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
23	50	111	60	25	6	0	0	0	102	94	34	18	499
24	666	896	730	315	151	46	7	0	54	154	307	510	3,836
25	83	198	184	126	105	83	51	54	56	53	43	42	1,078
26	49	40	66	91	98	84	79	72	57	71	47	53	807
27	9,629	636	7,091	2,114	895	326	153	138	86	97	178	313	21,656
28	300	282	271	237	165	134	102	86	85	83	74	68	1,888
29	145	278	404	356	181	108	110	99	91	90	80	75	2,017
30	103	156	157	128	153	99	78	76	74	68	66	62	1,220
31	69	85	130	137	139	98	86	80	77	76	67	69	1,113
32	67	55	78	90	93	80	78	78	76	79	66	71	910
33	66	329	743	4,550	825	283	130	108	95	145	146	116	7,536
34	246	351	189	127	111	92	84	86	83	69	68	68	1,575
35	68	67	70	69	70	68	65	65	60	58	316	164	1,140
36	124	91	38	38	36	32	28	33	22	19	19	119	597
37	139	1,904	791	449	329	169	97	82	80	84	82	82	4,287
38	85	142	145	131	104	86	79	74	66	65	62	58	1,096
39	69	50	51	62	66	54	53	53	54	45	43	41	640
40	30	23	25	46	43	36	31	34	37	35	1,305	3,300	4,944
41	1,765	1,014	778	450	308	115	68	54	45	63	91	523	5,274

TABLE 3-9

Simulated Monthly Streamflows in the Santa Clara River at the Lang Gage for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	757	489	1,028	2,295	1,880	729	212	104	89	73	255	487	8,397
43	300	247	276	180	72	32	32	30	25	133	208	851	2,384
44	13,797	2,856	1,005	489	320	147	98	98	46	318	392	399	19,966
45	461	550	1,168	465	290	169	74	60	58	27	501	1,338	5,161
46	614	524	556	397	262	167	70	25	5	30	200	420	3,270
47	332	250	131	90	50	22	32	6	0	0	11	58	983
48	153	1,717	950	471	226	71	18	12	8	3	8	44	3,679
49	608	229	392	190	129	49	17	6	0	3	19	87	1,728
50	53	90	228	181	104	31	15	3	0	0	0	0	704
51	0	110	63	39	33	12	0	0	1	0	0	0	258
52	28	7	28	19	60	5	0	0	0	0	0	0	147
53	744	9,486	11,412	1,696	2,736	1,154	418	209	101	264	422	86	28,730
54	1,254	433	1,113	506	246	190	178	111	125	90	120	558	4,925
55	1,310	7,449	1,213	568	218	78	6	0	37	274	467	553	12,175
56	594	98	339	240	107	18	18	12	338	321	258	394	2,739
57	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
58	1,922	16,971	2,755	2,576	958	523	639	512	0	0	0	0	26,855
59	0	596	405	240	143	166	228	411	154	220	904	578	4,044
60	483	461	274	215	77	0	0	0	12	179	221	301	2,224
61	483	1,138	488	283	107	6	0	12	6	12	80	129	2,744
62	117	117	65	31	12	0	0	0	0	0	258	516	1,116
63	222	209	506	117	77	68	0	0	0	0	12	25	1,236
64	50	111	60	25	6	0	0	0	102	94	34	18	499
65	212	276	230	46	46	5	0	0	0	27	36	147	1,025
66	162	775	879	736	145	142	14	0	45	69	62	263	3,291
67	336	534	429	398	117	84	16	5	108	144	498	1,446	4,115
68	14,709	5,336	1,194	530	239	110	54	10	64	145	264	281	22,937
69	388	493	497	319	163	80	20	7	37	102	193	941	3,239
70	1,211	1,421	954	802	268	156	62	8	6	1	27	189	5,104
71	666	896	730	315	151	46	7	0	54	154	307	510	3,836
72	517	346	140	85	33	5	4	50	66	240	566	809	2,859
73	18,997	8,508	3,837	961	667	347	81	91	70	139	190	186	34,074
74	92	85	204	224	197	107	80	46	52	54	31	80	1,252
75	117	117	65	31	12	0	0	0	0	0	258	516	1,116
76	333	1,420	785	283	238	0	0	0	0	95	178	855	4,188
77	50	111	60	25	6	0	0	0	102	94	34	18	499
78	666	896	730	315	151	46	7	0	54	154	307	510	3,836

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
1	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
2	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
3	0	0	0	0	0	667	842	735	0	0	0	0	2,244
4	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
5	0	0	0	0	0	0	0	0	0	0	0	0	0
6	0	0	0	0	0	0	0	0	0	0	0	0	0
7	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
8	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
9	0	0	809	341	900	0	0	0	0	0	0	0	2,050
10	0	0	0	0	0	0	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	66	66
13	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
14	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
15	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
16	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
17	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
18	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
19	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
20	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
21	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
22	0	0	0	0	0	667	842	735	0	0	0	0	2,244
23	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
25	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
28	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
30	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
31	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
32	0	0	0	0	0	667	842	735	0	0	0	0	2,244
33	0	0	0	0	0	667	842	735	0	0	0	0	2,244
34	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
35	0	0	0	0	0	0	0	0	0	0	0	0	0
36	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
37	0	0	0	0	0	667	842	735	0	0	0	0	2,244
38	0	0	0	0	0	0	0	0	0	0	0	0	0
39	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
40	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
41	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853

TABLE 3-10

Simulated Monthly Water Releases from Castaic Lagoon to Castaic Creek for the 78-year Simulation

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
42	0	0	0	0	0	667	842	735	0	0	0	0	2,244
43	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
45	0	0	0	0	0	667	842	735	0	0	0	0	2,244
46	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
47	0	0	0	0	0	0	0	0	0	0	0	0	0
48	0	0	0	0	0	667	842	735	0	0	0	0	2,244
49	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
50	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
51	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
52	0	0	0	0	0	667	842	735	0	0	0	0	2,244
53	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
54	0	0	0	0	0	667	842	735	0	0	0	0	2,244
55	0	0	0	0	0	834	1,052	919	0	0	0	0	2,805
56	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
57	0	0	0	0	0	667	842	735	0	0	0	0	2,244
58	0	0	0	0	0	1,168	1,473	1,287	0	0	0	0	3,928
59	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0
61	105	0	0	1,490	46	0	0	0	0	0	0	0	1,641
62	105	0	0	1,490	46	0	0	0	0	0	212	0	1,853
63	0	0	809	341	900	0	0	0	0	0	0	0	2,050
64	0	0	0	0	0	0	0	0	0	0	0	0	0
65	0	0	0	0	0	0	0	0	0	0	0	0	0
66	0	0	0	0	0	0	0	0	0	0	0	66	66
67	0	0	580	3,052	667	127	24	0	0	0	0	0	4,450
68	0	140	186	3,031	1,901	635	341	337	813	0	0	341	7,725
69	210	0	0	2,979	93	0	0	0	0	0	0	0	3,282
70	0	0	0	0	0	1,668	2,104	1,839	0	0	0	0	5,611
71	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632
72	0	0	8,701	873	0	0	0	0	0	0	0	310	9,884
73	1,186	19,545	10,747	4,566	7,561	47	1,370	436	464	302	652	926	47,802
74	612	691	0	3,187	1,191	149	0	0	0	0	0	0	5,830
75	0	660	855	0	2,087	3,484	0	0	0	0	0	0	7,086
76	0	0	0	0	0	667	842	735	0	0	0	0	2,244
77	0	0	0	0	0	0	0	0	0	0	0	0	0
78	0	0	0	4,961	671	0	0	0	0	0	0	0	5,632

TABLE 3-11
Water Demands and Indoor Water Use under Full Build-out Conditions (Excluding Newhall Ranch)
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year 2000 Actual (AF/yr)	Full Build-out Conditions (AF/yr)	Comments
Annual Urban Water Use Outside Newhall Ranch		
60,988	123,038	Year 2000 value is retail purveyor demand plus other demands in Table II-6 of the *2004 Santa Clarita Valley Water Report* (LSCE, 2005a). Year 2045 value is from Table 2.5-4 of the *Newhall Ranch Draft Additional Analysis* (Impact Sciences, Inc., 2001). Consists of 89,805 AF/yr Development Monitoring System[a] demand, plus 55,995 AF/yr additional urban demand, minus 14,480 AF/yr conservation, minus 5,193 AF/yr agricultural uses and 3,089 AF/yr "other" uses. Does not include 4,500 AF/yr for aquifer storage and recovery or 17,680 AF/yr of demand for the Newhall Ranch Specific Plan.
Annual Indoor Water Use Outside Newhall Ranch (Equal to LACSD WRP Influent Volumes)		
18,723	40,313 (average year)	The year 2000 volume is from the Saugus and Valencia WRPs for the period January 2000 through December 2000. The long-term current generated effluent volume is based on the influent volume estimated from water balance calculations performed for the chloride mass balance analysis. The effluent volume is 32.8 percent of the total urban water production of 123,038 AF/yr, which includes other uses.

[a]Development Monitoring System water demands are demands associated with future build-out of developments identified in Los Angeles County's Development Monitoring System for the Santa Clarita Valley.

TABLE 3-12

Treated Water Discharges from the Saugus and Valencia WRPs to the Santa Clara River under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Month	Treated Water Volume (2000)[a]	Treated Water Volume (Full Build-out Conditions)[b]	Percent of Annual Outdoor Demand	Reclaimed Volume under Full Build-out Conditions (Before Maintaining Existing Streamflows)	Reclaimed Volume under Full Build-out Conditions (After Maintaining Existing Streamflows)	WRP Discharges to River under Full Build-out Conditions[c]	Month
January	1,503	3,237	3.75	637	637	2,600	January
February	1,443	3,106	5.10	867	867	2,239	February
March	1,528	3,290	6.60	1,122	1,122	2,168	March
April	1,505	3,240	9.10	1,547	1,547	1,693	April
May	1,569	3,379	10.55	1,794	1,794	1,585	May
June	1,543	3,322	11.40	1,938	1,781	1,541	June
July	1,606	3,459	14.10	2,397	1,854	1,605	July
August	1,649	3,550	12.95	2,202	1,902	1,648	August
September	1,593	3,430	10.20	1,734	1,734	1,696	September
October	1,631	3,512	7.50	1,275	1,275	2,237	October
November	1,546	3,329	5.00	850	850	2,479	November
December	1,607	3,459	3.75	637	637	2,822	December
Total Annual	**18,723**	**40,313**	**100.0**	**17,000**	**16,000**	**24,313**	**Total Annual**

[a]Values shown are the actual volumes of treated water discharged to the Santa Clara River from the Saugus and Valencia WRPs during calendar year 2000. (See also Table 3-11.)

[b]Values shown are the combined treated water volumes estimated to be produced by the Saugus and Valencia WRPs for full build-out conditions in the Santa Clarita Valley. These values do not include the future Newhall Ranch WRP, which will be operated by LACSD.

[c]Values shown do not include discharges of treated water to the river from the future Newhall Ranch WRP. These volumes are 10 acre-feet in November, 138 acre-feet in December, and 138 acre-feet in January. During the other nine months of the year, this WRP will not discharge treated water to the river (see the *Newhall Ranch Draft Additional Analysis* [Impact Sciences, Inc., 2001] for further details). The combined total discharge from the Saugus, Valencia, and Newhall Ranch WRPs is summarized in Table 3-13.

Note:
All units are in acre-feet.

TABLE 3-13

Simulated Monthly Treated Wastewater Discharges from Santa Clarita Valley WRPs under Full Build-out Conditions

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

WRP	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Saugus	493	487	500	490	503	466	457	508	586	555	514	596	6,155
Valencia	2,107	1,752	1,668	1,203	1,082	1,075	1,148	1,140	1,110	1,682	1,965	2,226	18,158
Newhall	138	0	0	0	0	0	0	0	0	0	10	138	286
Total	**2,738**	**2,239**	**2,168**	**1,693**	**1,585**	**1,541**	**1,605**	**1,648**	**1,696**	**2,237**	**2,489**	**2,960**	**24,599**

Note:

Wastewater discharge volumes are listed in acre-feet.

Figures

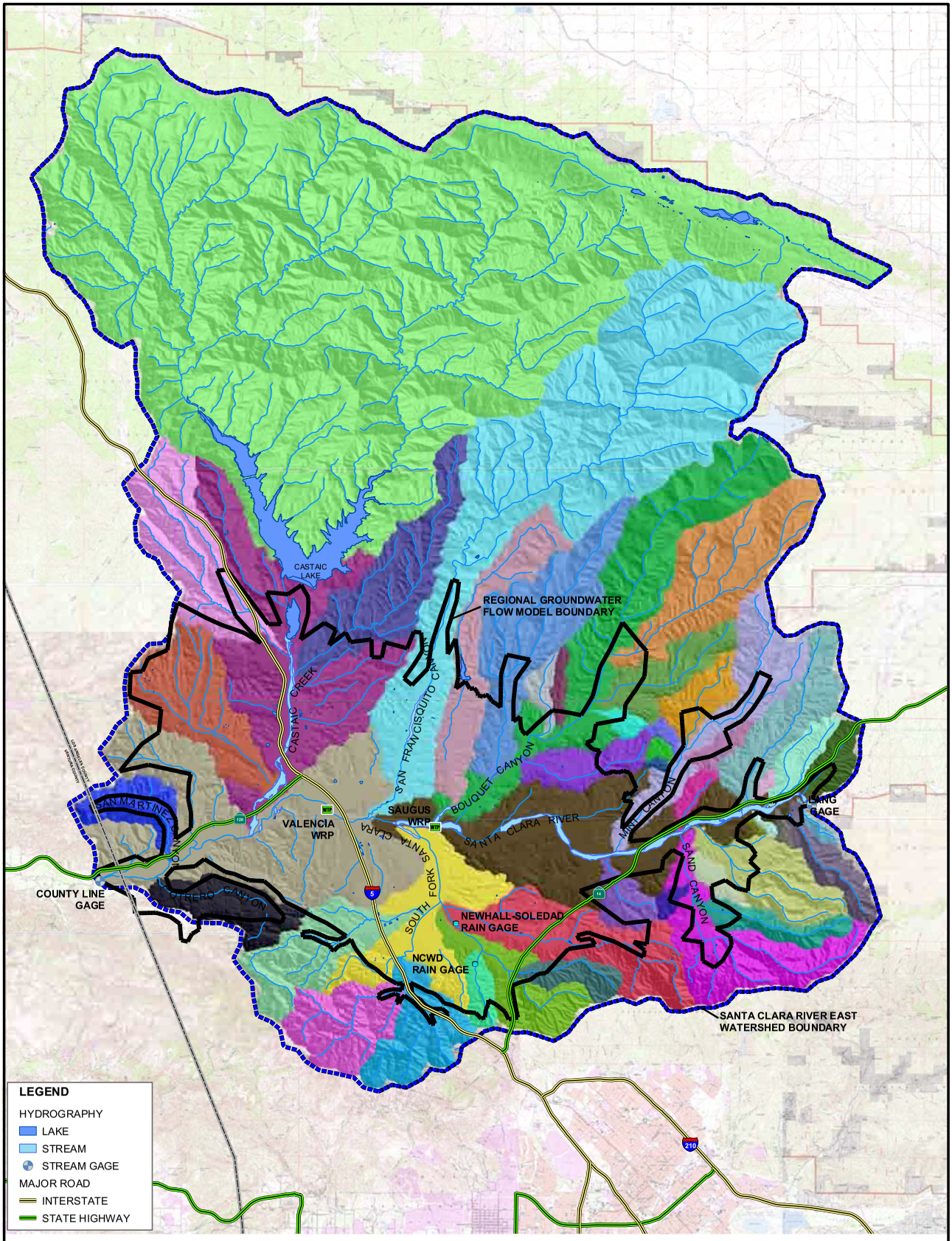

FIGURE 3-1
SUBWATERSHEDS WITHIN THE SANTA CLARA VALLEY EAST WATERSHED
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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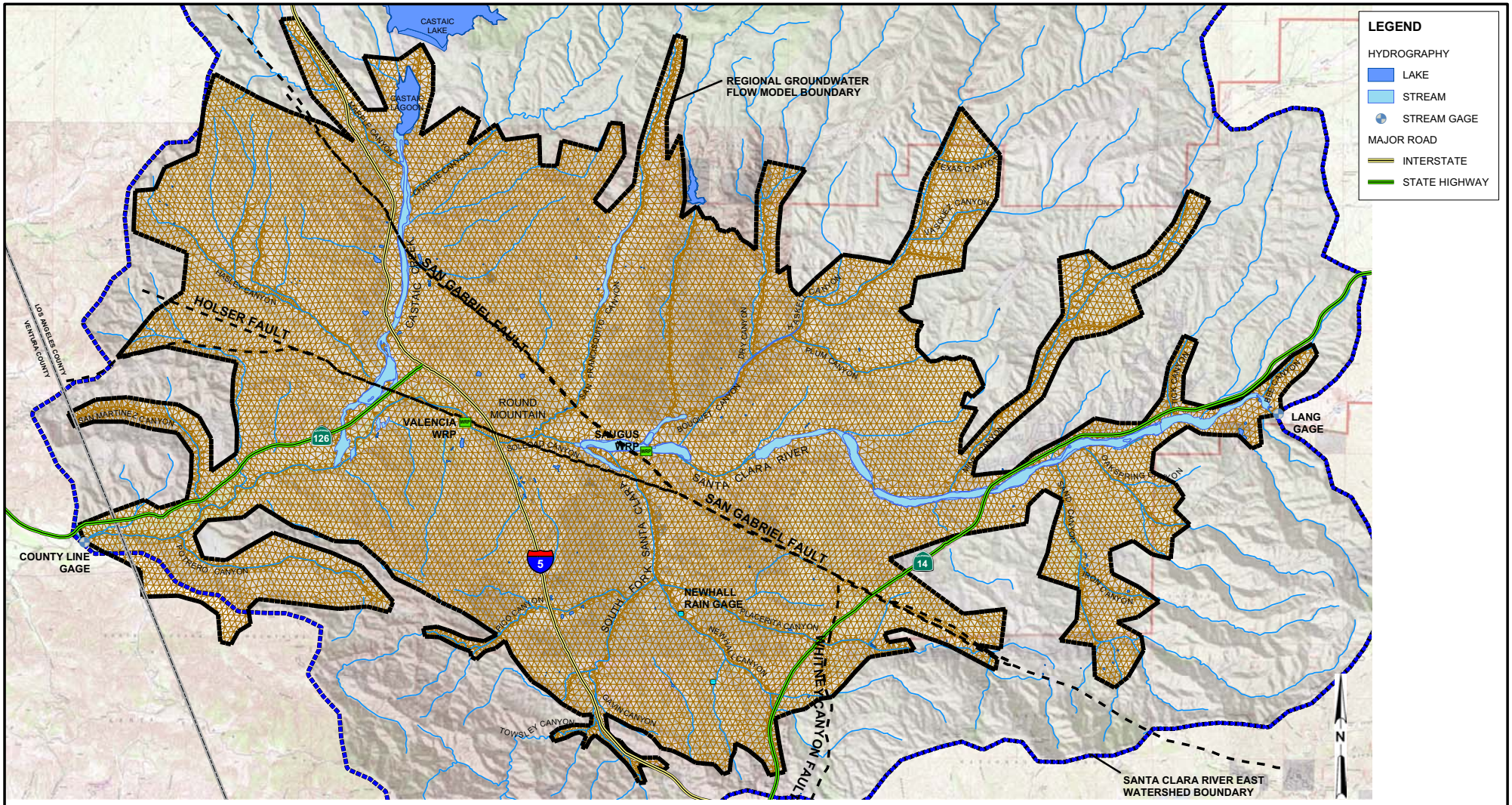

FIGURE 3-2
REGIONAL MODEL GRID
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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	Stratigraphy		Model Layer	Thickness (feet)
Saugus	Alluvium	Saugus	1	500
Saugus	Saugus	Saugus	2	
Saugus	Saugus	Saugus	3	500
Saugus	Saugus	Saugus	4	500
Saugus	Saugus	Saugus	5	500
Saugus	Saugus	Saugus	6	500
Sunshine	Sunshine	Sunshine	7	Variable

FIGURE 3-3
SCHEMATIC DIAGRAM OF THE MODEL'S REPRESENTATION OF STRATIGRAPHY IN THE MIDDLE OF THE BASIN
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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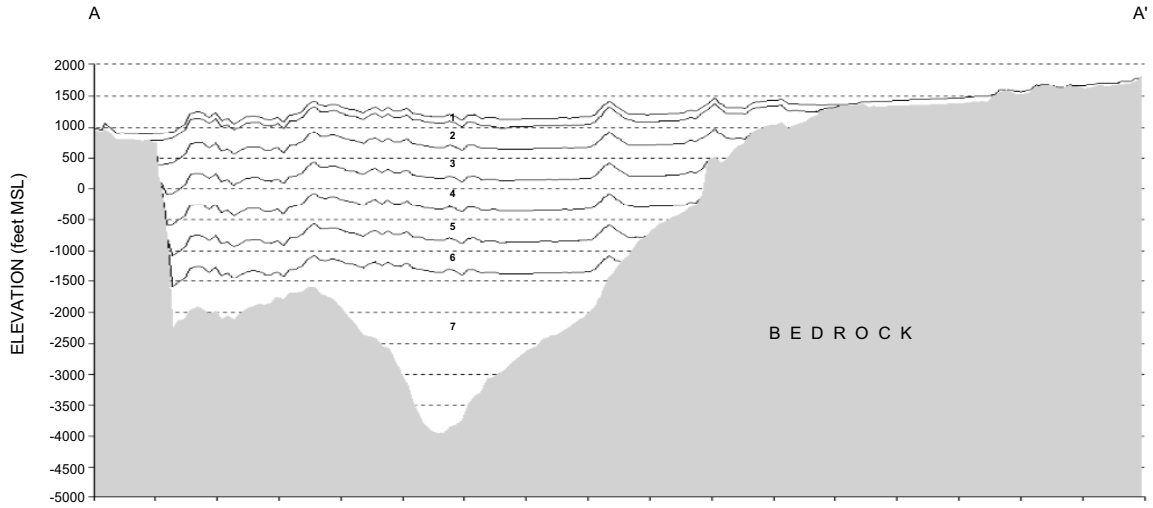
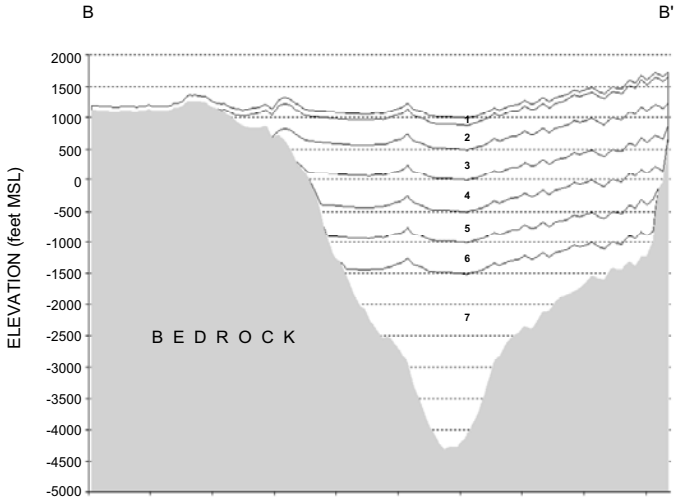
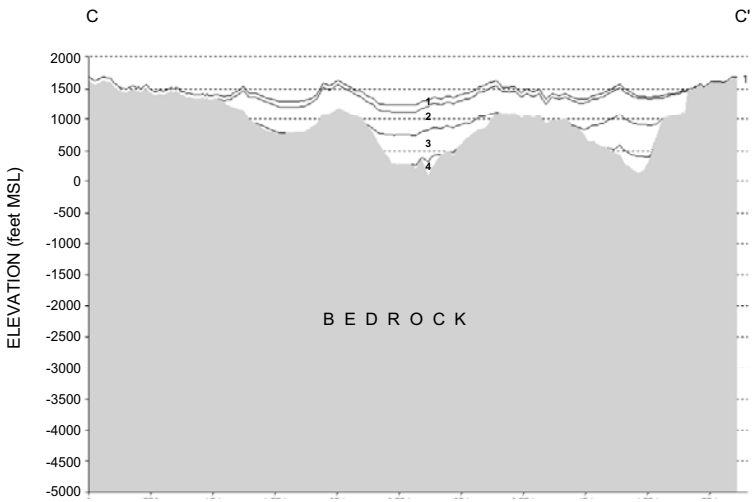
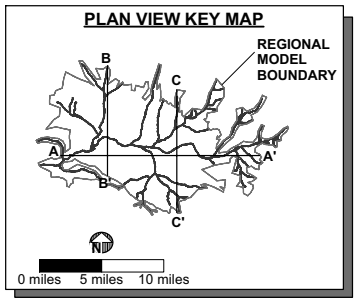
178973-414.xls\FIG3-3









LEGEND

1 = MODEL LAYER 1

2 = MODEL LAYER 2

3 = MODEL LAYER 3

4 = MODEL LAYER 4

5 = MODEL LAYER 5

6 = MODEL LAYER 6

7 = MODEL LAYER 7

HORIZONTAL CROSS SECTION SCALE

0 feet 10,000 feet 20,000 feet

5x VERTICAL EXAGGERATION

FIGURE 3-4
SCHEMATIC CROSS SECTIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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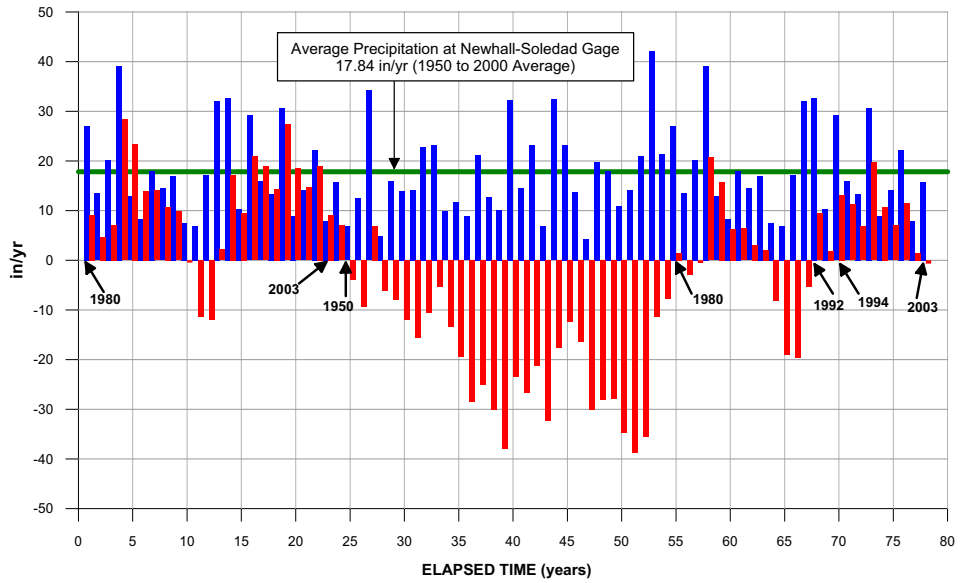

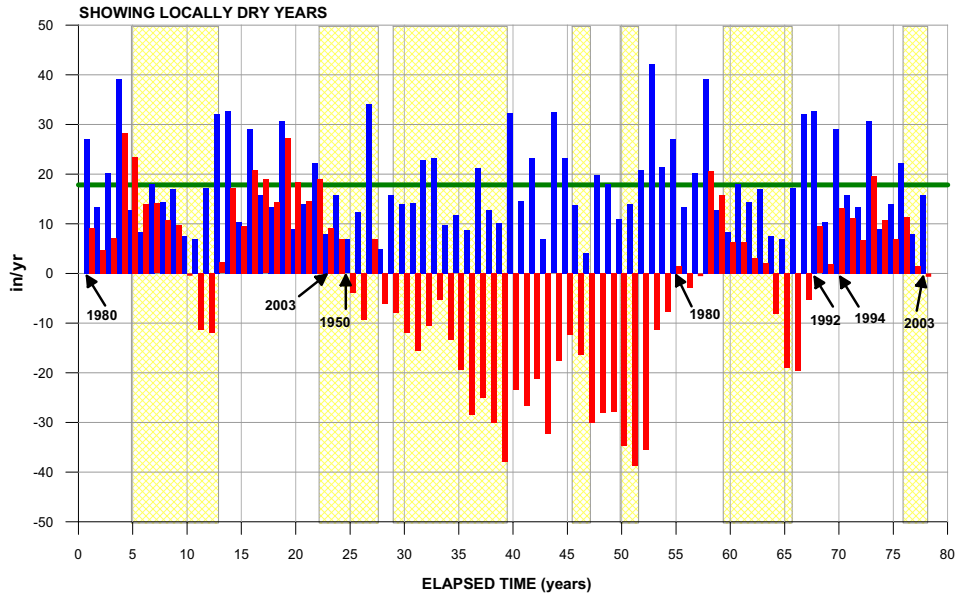

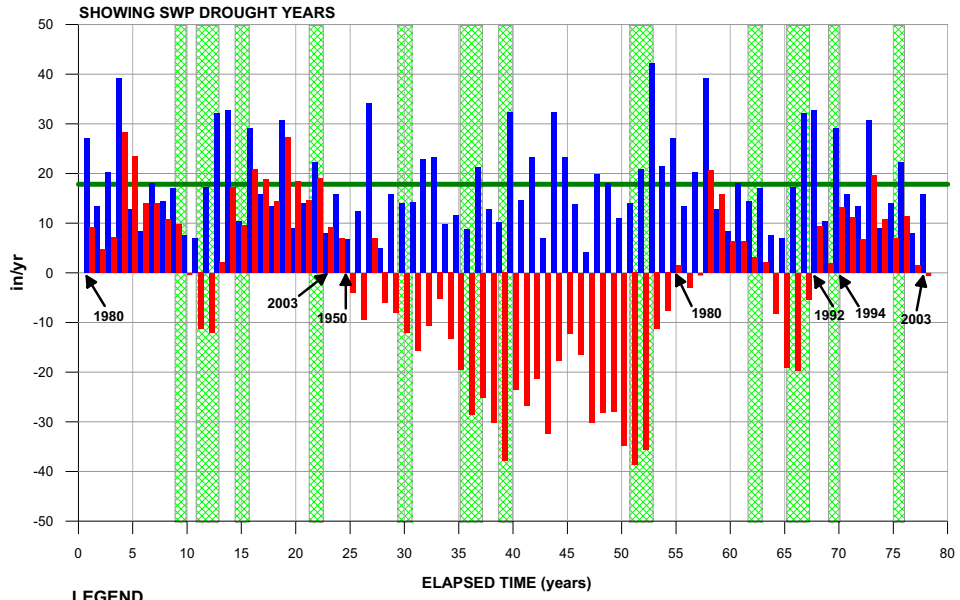

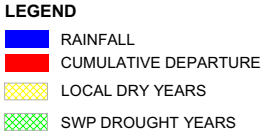

FIGURE 3-5
ANNUAL PRECIPITATION AND CUMULATIVE DEPARTURE FROM THE 1950 THROUGH 2000 AVERAGE AT THE NEWHALL-SOLEDAD RAIN GAGE FOR THE 78-YEAR SIMULATION PERIOD
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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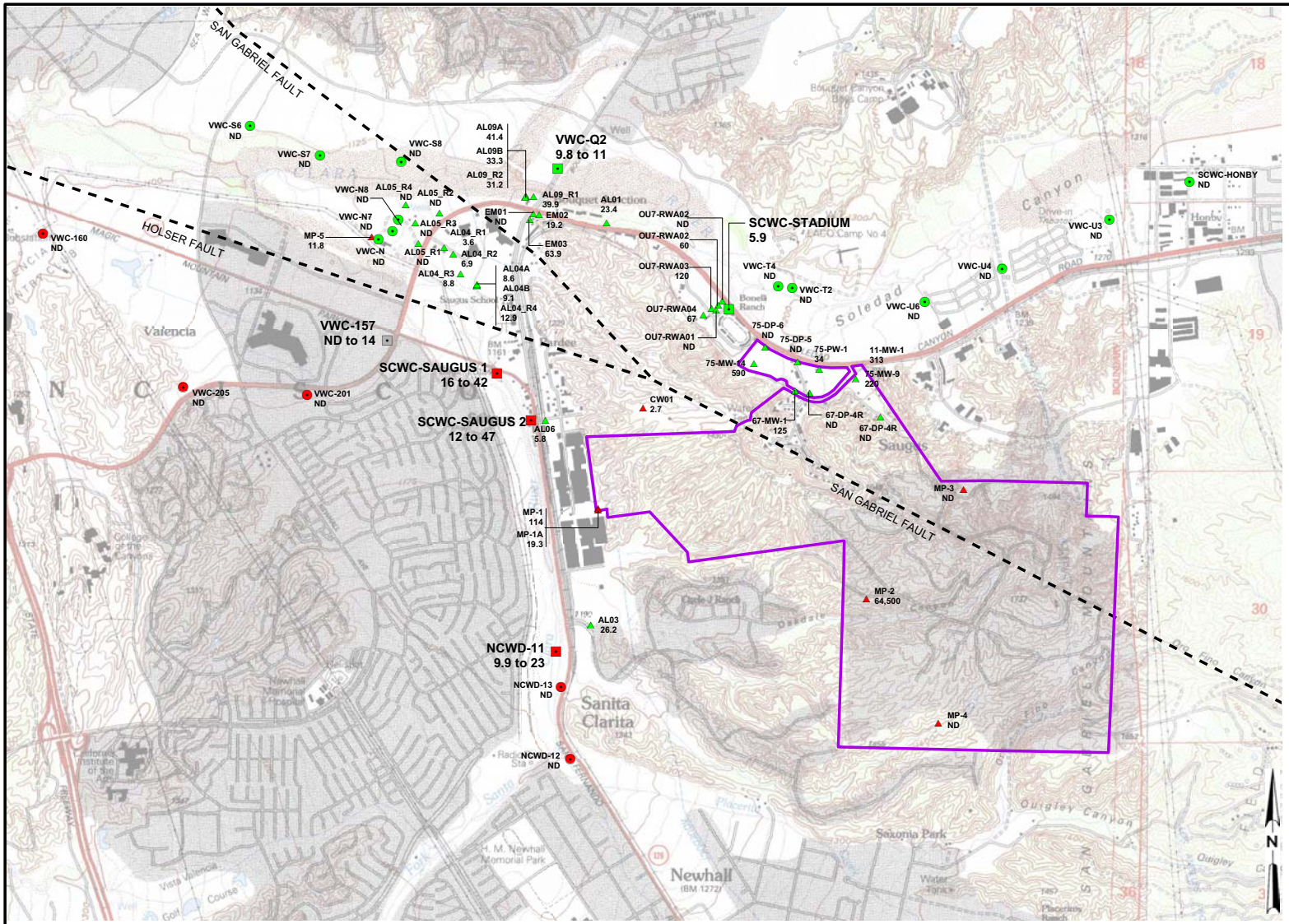

LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS
- SAUGUS (DESTROYED JANUARY 2005)

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
3. µg/L = MICROGRAMS PER LITER.

FIGURE 3-6
WELL LOCATIONS AND PERCHLORATE CONCENTRATIONS NEAR THE WHITTAKER-BERMITE PROPERTY
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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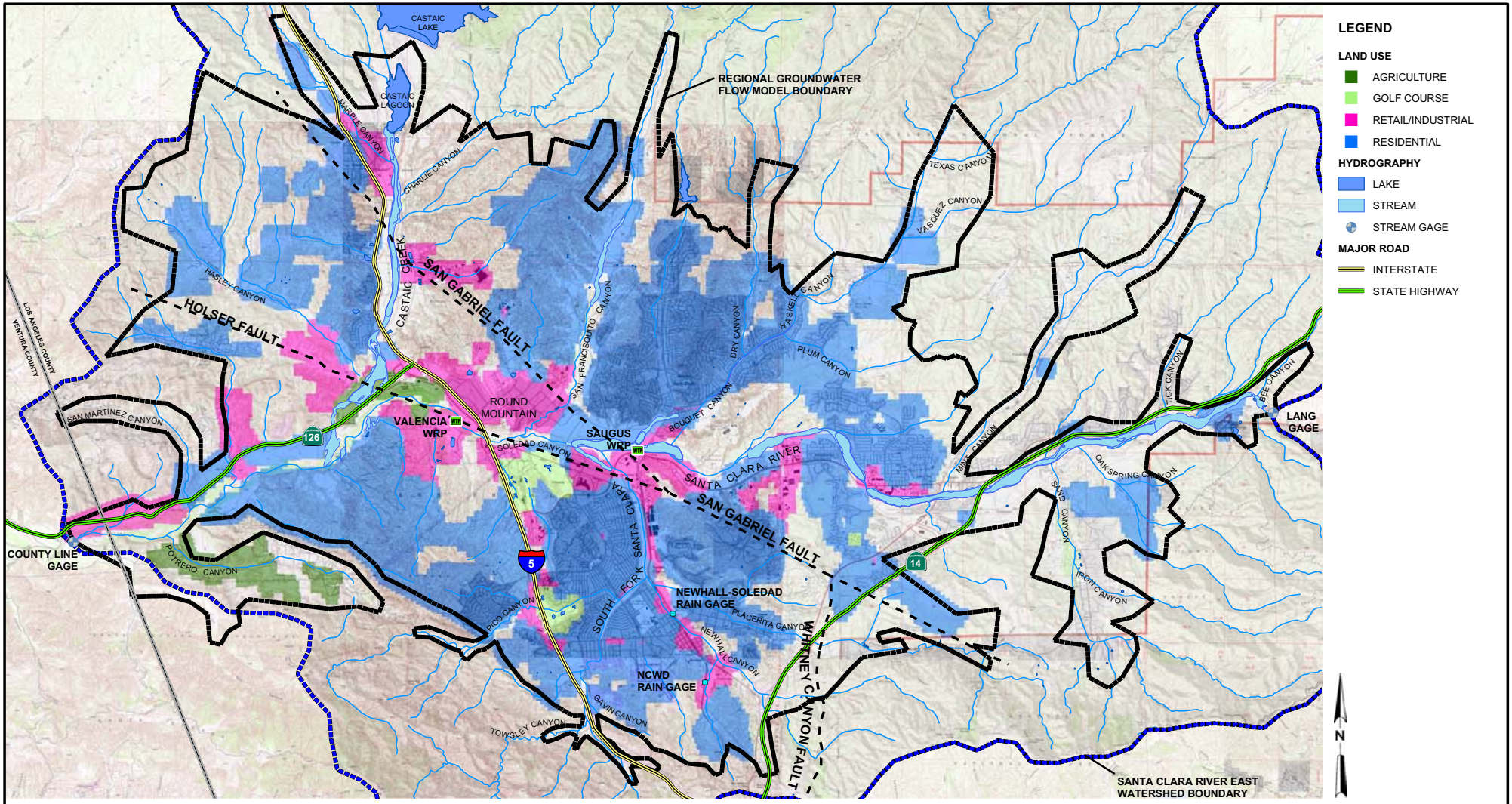


NOTE:
LAND USES UNDER FULL BUILD-OUT CONDITIONS ARE SHOWN ONLY INSIDE THE MODEL BOUNDARY, AND ARE NOT SHOWN OUTSIDE THE MODEL BOUNDARY.

FIGURE 3-7
SIMULATED LAND USE WITHIN THE REGIONAL MODEL BOUNDARY UNDER FULL BUILD-OUT CONDITIONS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

SECTION 4

Model Results

This section of the report presents and discusses hydrographs of simulated groundwater elevations, groundwater budget terms, and Santa Clara River flows for the 78-year modeling period.

4.1 Groundwater Elevations

Groundwater elevation hydrographs for different portions of the Alluvial Aquifer are presented on Figures 4-1 through 4-5. Hydrographs for different portions of the Saugus Formation are presented on Figures 4-6 and 4-7. Each figure shows the monthly groundwater elevations simulated for the 78-year modeling period.

These figures show that the spatial distribution and temporal variation of pumping are not expected to cause a long-term decline in groundwater levels in the Alluvial Aquifer or the Saugus Formation. The Regional Model simulates distinct multi-year periods of overall declining or overall increasing groundwater elevations resulting from cycles of below-normal and above-normal rainfall periods. This variation is consistent with historical observations of the relationship between rainfall and groundwater level fluctuations (CH2M HILL, 2004a). The Regional Model also simulates short-term declines in Saugus Formation groundwater elevations that arise from the increased Saugus pumping that occurs during the second and third years of reduced water imports. The model simulates water level recovery within a few years after Saugus pumping returns to normal-year pumping rates, a finding that is consistent with historical observations following a peak pumping period in the early 1990s (see Figures 2-9 and 2-10).

4.2 Groundwater Recharge, Discharge, and Storage

Figures 4-8 and 4-9 show the annual valleywide variations in groundwater recharge and discharge, respectively, throughout the 78-year simulation period. These groundwater recharge and discharge rates are also listed in Table 4-1. Figure 4-10 shows the annual and cumulative changes in groundwater storage volumes. Figures 4-8 through 4-10 and Table 4-1 together show the following:

1. Groundwater recharge rates (see Figure 4-8) vary greatly from year to year, because of variations in (a) precipitation within the groundwater basin and (b) precipitation and stormwater generation in the watersheds lying upstream of the groundwater basin. In contrast, total groundwater discharge (see Figure 4-9) is much less variable from year to year, with the more limited variations arising from increased pumping during drought years and increased ET and groundwater discharge to the Santa Clara River during wet years.
2. Year-to-year and cumulative changes in groundwater storage during the 78-year simulation period (see Figure 4-10) provide insights as to the manner in which the basin is

functioning hydrologically under the groundwater operating plan for the valley. The cumulative change in groundwater storage is a measure of the longer-term trends in the amount of groundwater in storage, and is plotted on a monthly basis. Table 4-1 tabulates the annual water budget for each year of the 78-year simulation, and shows the cumulative change on an annual basis (in contrast to the monthly basis shown on Figure 4-10). Figure 4-10 and Table 4-1 together show the following:

a. The cumulative change in total groundwater storage volume, which measures the continuous change in storage in the combined Alluvial-Saugus aquifer system since the beginning of the simulation, ranges between approximately a 150,000-acre-foot decline and a 260,000-acre-foot increase. The change in groundwater storage during a single year ranges from approximately an 80,000-AF/yr decline to a 170,000-AF/yr increase.

b. A nearly 20-year period of overall decline in the cumulative groundwater storage volume occurs between years 19 and 39, as shown on Figure 4-10. Beginning in year 40, the cumulative change in storage shows a generally upward trend, with occasional downward trends during specific drought periods.

3. Implementation of the groundwater operating plan will not cause permanent declines in groundwater storage volumes. This is shown by the forecasted recovery of groundwater storage volumes after periods of continued decline, such as after the 20-year period of groundwater declines that occurs during years 19 through 39.

4. Based on the previous observations, changes in groundwater storage volumes, particularly over a period of many years, are governed significantly by variations in local hydrologic conditions. Local precipitation and streamflows are the primary recharge mechanisms in the valley and therefore have a direct influence on year-to-year and longer-term changes in groundwater storage volumes.

4.3 River Flows

Figure 4-11 shows the total flows estimated by the model for the Santa Clara River at the County Line gage, which is located at the western end of the valley. The figure contains both a linear plot and a semi-logarithmic plot, to better illustrate the flows during low-flow periods. As shown by both plots, the total streamflows vary considerably over time at this location, due primarily to variations in rainfall.

The influences of the local hydrology and the groundwater operating plan on the Santa Clara River are also shown by Figure 4-12, which displays the model-calculated volumes of monthly groundwater discharge to the river. Groundwater discharges to the river occur along the river reach lying downstream of the mouth of San Francisquito Canyon. The figure shows that the groundwater discharge rates to the river also vary over time, both seasonally and over multi-year periods. Additionally, the figure shows that the Regional Model simulates a period of relatively low groundwater discharge to the river from years 23 through 39 (historical years 2002 through 2003, followed by 1950 through 1964), which corresponds to the prevailing below-normal rainfall conditions in those years. The figure also shows higher volumes of groundwater discharge to the river in years of above-normal

rainfall, particularly the very wet periods years 1 through 4, 13 through 19, 52 through 58, and 67 through 72.

The similarity between rainfall and groundwater discharges to the river indicates that local hydrology is the primary influence on these discharges. Additionally, the groundwater discharge hydrographs do not show any marked short-term declines in flows when Saugus Formation groundwater levels decrease during years of increased Saugus Formation pumping. The Regional Model, therefore, indicates that the operating plan for the groundwater system is not expected to adversely affect river flows.

4.4 Relationship of Simulation Results to Future Conditions

The curves presented on Figures 4-1 through 4-12 provide a general indication of the types of fluctuations in groundwater conditions that could be expected to occur in the future in the Santa Clarita Valley over a period of many years. However, these curves have been derived using an assumed sequence of local hydrologic conditions that is based on the sequence of rainfall and streamflow volumes that were measured during the past several decades. In the future, the year-to-year volumes and trends in rainfall and streamflow could vary from those observed in the past. Consequently, actual future trends in rainfall and streamflow might differ from those presented in this simulation on a short-term basis. However, over a period of several years or decades, the model-simulated recharge values and basin responses are more likely to reflect actual long-term average basin conditions under this operating plan.

The modeling simulation described in this report meets the intended objectives of quantifying possible basin responses to the operating plan, in terms of temporal variations that could occur in groundwater levels, groundwater storage, and Santa Clara River streamflows; and using the quantified responses to evaluate the sustainability of the operating plan with respect to potential trends in groundwater levels and Santa Clara River flows. The principal conclusions about the groundwater operating plan that have been drawn from the historical analyses and modeling simulations presented in this report are discussed in Section 5.

Table

TABLE 4-1

Simulated Annual Groundwater Budget

Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year			Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
0	to	1	41,053	13,970	39,953	17,871	112,847	49,119	21,649	17,524	18,464	106,756	6,091	6,091
1	to	2	11,601	13,970	3,373	18,632	47,576	49,035	10,147	10,469	18,136	87,788	-40,212	-34,120
2	to	3	51,672	13,970	28,415	18,444	112,501	49,035	10,925	12,319	18,585	90,863	21,638	-12,483
3	to	4	181,820	13,970	89,448	16,985	302,223	49,035	36,265	29,506	19,056	133,861	168,361	155,879
4	to	5	687	13,970	527	18,253	33,437	49,119	16,665	23,150	18,225	107,158	-73,721	82,158
5	to	6	2	13,970	535	18,927	33,434	44,372	9,497	13,286	18,171	85,326	-51,891	30,266
6	to	7	42,574	13,970	19,998	18,619	95,161	49,035	11,479	14,376	18,568	93,458	1,703	31,969
7	to	8	11,415	13,970	2,484	19,419	47,288	49,035	7,923	10,419	18,277	85,654	-38,366	-6,397
8	to	9	27,363	13,970	10,507	19,743	71,583	54,214	6,664	10,234	18,507	89,618	-18,036	-24,433
9	to	10	0	13,970	523	20,113	34,606	44,372	4,739	8,041	18,359	75,510	-40,904	-65,336
10	to	11	0	13,970	1,472	20,347	35,789	49,446	2,584	5,612	18,354	75,996	-40,208	-105,544
11	to	12	50,580	13,970	28,173	19,613	112,336	58,025	3,061	8,476	18,563	88,125	24,211	-81,334
12	to	13	130,074	13,970	80,760	17,850	242,654	72,600	14,234	18,462	18,728	124,024	118,630	37,296
13	to	14	112,433	13,970	51,561	17,509	195,472	49,035	24,221	29,084	18,797	121,137	74,335	111,632
14	to	15	414	13,970	1,979	18,575	34,939	49,446	7,788	16,616	18,157	92,007	-57,068	54,563
15	to	16	113,543	13,970	60,100	17,636	205,250	49,035	29,255	26,983	18,745	124,018	81,232	135,795
16	to	17	45,609	13,970	21,594	18,204	99,376	49,119	15,122	21,342	18,635	104,218	-4,842	130,954
17	to	18	16,967	13,970	5,320	18,758	55,015	49,035	11,851	16,757	18,242	95,885	-40,870	90,084
18	to	19	137,727	13,970	59,717	17,397	228,810	49,035	27,143	31,249	18,923	126,350	102,460	192,544
19	to	20	13	13,970	4,717	18,586	37,286	49,035	14,305	20,865	18,200	102,405	-65,119	127,425
20	to	21	14,095	13,970	4,962	19,294	52,321	49,119	11,194	14,485	18,342	93,139	-40,818	86,607
21	to	22	58,364	13,970	35,154	18,639	126,127	54,116	12,710	19,337	18,655	104,818	21,309	107,917
22	to	23	0	13,970	523	19,557	34,050	44,372	8,105	13,129	18,311	83,916	-49,866	58,051
23	to	24	19,602	13,970	5,065	19,867	58,504	49,035	8,138	10,710	18,375	86,258	-27,754	30,297
24	to	25	0	13,970	524	20,258	34,752	44,441	5,486	7,896	18,418	76,240	-41,489	-11,192
25	to	26	3,053	13,970	518	20,406	37,947	49,035	4,033	6,132	18,386	77,587	-39,639	-50,832
26	to	27	135,033	13,970	73,747	18,014	240,763	49,035	16,024	17,254	18,639	100,951	139,812	88,980
27	to	28	0	13,970	536	18,764	33,270	44,372	9,238	15,229	18,125	86,963	-53,693	35,287
28	to	29	20,048	13,970	4,960	19,518	58,496	49,119	7,646	10,808	18,326	85,898	-27,402	7,885
29	to	30	9,397	13,970	2,999	19,929	46,296	54,116	4,726	8,252	18,339	85,433	-39,138	-31,253
30	to	31	11,022	13,970	2,348	20,308	47,647	49,035	4,024	7,140	18,409	78,609	-30,962	-62,215
31	to	32	62,138	13,970	37,429	19,568	133,105	49,035	6,854	11,497	18,820	86,205	46,900	-15,315
32	to	33	63,939	13,970	36,375	18,890	133,174	49,119	11,471	19,025	18,678	98,293	34,881	19,566
33	to	34	244	13,970	2,395	20,199	36,808	44,372	6,943	11,585	18,375	81,275	-44,466	-24,900
34	to	35	1,555	13,970	524	20,530	36,579	49,446	3,767	7,507	18,404	79,124	-42,545	-67,445
35	to	36	32	13,970	4,852	20,690	39,543	58,025	303	5,882	18,401	82,610	-43,067	-110,512
36	to	37	52,098	13,970	24,510	19,931	110,509	44,441	4,564	10,236	18,620	77,860	32,648	-77,864
37	to	38	4,170	13,970	616	20,483	39,239	49,035	2,503	6,237	18,378	76,152	-36,913	-114,777
38	to	39	362	13,970	2,463	20,816	37,610	49,446	719	4,966	18,418	73,549	-35,938	-150,716
39	to	40	122,459	13,970	74,037	19,276	229,741	49,035	8,546	10,468	18,766	86,814	142,927	-7,789
40	to	41	12,997	13,970	4,096	19,066	50,129	49,119	8,998	13,953	18,220	90,290	-40,161	-47,950
41	to	42	64,499	13,970	40,945	18,797	138,210	49,035	10,243	16,890	18,577	94,745	43,465	-4,484
42	to	43	0	13,970	536	19,752	34,258	44,372	6,577	12,461	18,301	81,711	-47,454	-51,938
43	to	44	123,377	13,970	53,751	18,022	209,121	49,035	17,543	21,442	18,640	106,660	102,461	50,523
44	to	45	64,250	13,970	39,379	18,423	136,022	49,119	13,271	20,449	18,544	101,383	34,639	85,163
45	to	46	8,541	13,970	2,217	19,103	43,830	49,035	10,232	18,196	18,249	95,712	-51,882	33,281
46	to	47	0	13,970	533	19,897	34,399	44,372	6,746	10,372	18,334	79,823	-45,424	-12,143

TABLE 4-1

Simulated Annual Groundwater Budget

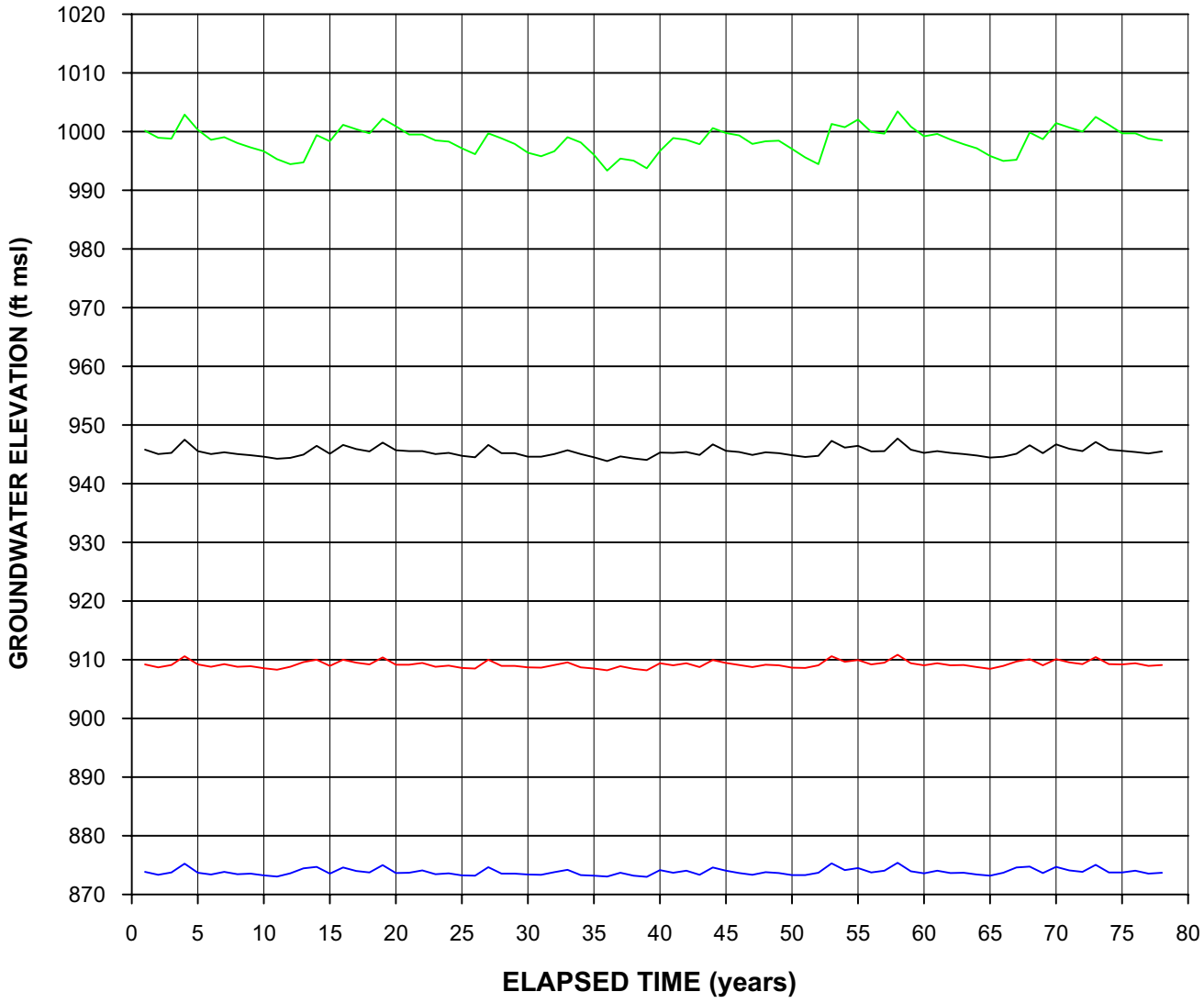
Analysis of Groundwater Basin Yield, Upper Santa Clara River Groundwater Basin, East Subbasin, Los Angeles County, California

Year	Precipitation Infiltration	Infiltration of Applied Water	Streambed Infiltration	Subsurface Inflow	Total Recharge	Pumping	Groundwater Discharge to Streams	ET	Subsurface Outflow at County Line	Total Discharge	Change in Groundwater Storage	Cumulative Change in Groundwater Storage
47 to 48	43,414	13,970	18,560	19,505	95,448	49,035	8,927	12,755	18,638	89,355	6,094	-6,050
48 to 49	32,966	13,970	13,527	19,953	80,416	49,119	8,497	12,634	18,666	88,916	-8,499	-14,549
49 to 50	839	13,970	1,856	20,451	37,117	44,372	5,528	8,992	18,434	77,326	-40,209	-54,758
50 to 51	9,990	13,970	2,645	20,684	47,289	54,116	3,517	6,845	18,455	82,933	-35,643	-90,401
51 to 52	49,961	13,970	25,027	20,153	109,112	62,702	3,319	9,913	18,755	94,689	14,423	-75,978
52 to 53	188,493	13,970	69,633	17,584	289,679	49,119	22,292	27,398	18,933	117,742	171,937	95,959
53 to 54	46,125	13,970	20,155	18,290	98,539	49,035	15,148	24,661	18,522	107,366	-8,827	87,132
54 to 55	89,718	13,970	39,953	17,979	161,620	49,035	20,589	29,655	18,624	117,903	43,716	130,848
55 to 56	11,601	13,970	3,373	19,267	48,211	49,035	11,347	18,242	18,316	96,940	-48,729	82,119
56 to 57	51,672	13,970	28,415	19,203	113,260	49,119	11,982	18,862	18,806	98,769	14,491	96,610
57 to 58	181,820	13,970	89,448	17,106	302,343	49,035	32,399	38,747	19,048	139,229	163,114	259,725
58 to 59	687	13,970	527	18,350	33,534	49,035	16,623	29,046	18,213	112,917	-79,383	180,342
59 to 60	2	13,970	535	19,266	33,773	44,372	10,576	17,223	18,266	90,437	-56,664	123,678
60 to 61	42,574	13,970	19,998	18,987	95,529	49,119	12,553	18,152	18,704	98,527	-2,998	120,680
61 to 62	11,415	13,970	2,484	19,754	47,622	49,035	9,005	13,268	18,366	89,674	-42,052	78,628
62 to 63	27,363	13,970	10,507	20,014	71,853	54,116	7,752	12,812	18,539	93,219	-21,366	57,262
63 to 64	0	13,970	523	20,416	34,909	44,372	5,755	10,119	18,437	78,683	-43,774	13,488
64 to 65	0	13,970	1,472	20,680	36,121	49,522	3,569	7,254	18,475	78,820	-42,698	-29,210
65 to 66	50,580	13,970	28,173	19,854	112,576	58,025	4,004	10,335	18,623	90,989	21,588	-7,622
66 to 67	130,074	13,970	80,760	17,898	242,702	72,452	13,502	21,223	18,686	125,863	116,839	109,216
67 to 68	112,433	13,970	51,561	17,536	195,499	49,035	23,462	32,532	18,803	123,833	71,667	180,883
68 to 69	414	13,970	1,979	18,661	35,024	49,522	8,596	18,842	18,226	95,186	-60,162	120,721
69 to 70	113,543	13,970	60,100	17,647	205,261	49,035	29,552	30,176	18,761	127,523	77,737	198,459
70 to 71	45,609	13,970	21,594	18,166	99,339	49,035	15,740	23,534	18,602	106,911	-7,572	190,886
71 to 72	16,967	13,970	5,320	18,777	55,034	49,035	12,551	18,552	18,264	98,402	-43,368	147,518
72 to 73	137,727	13,970	59,717	17,442	228,856	49,119	28,296	34,847	19,001	131,263	97,592	245,111
73 to 74	13	13,970	4,717	18,592	37,292	49,035	14,986	23,059	18,220	105,299	-68,007	177,103
74 to 75	14,095	13,970	4,962	19,254	52,281	49,035	11,783	15,930	18,311	95,059	-42,779	134,324
75 to 76	58,364	13,970	35,154	18,654	126,142	54,116	13,385	20,958	18,673	107,132	19,010	153,334
76 to 77	0	13,970	523	19,646	34,139	44,441	8,624	14,082	18,380	85,527	-51,388	101,946
77 to 78	19,602	13,970	5,065	19,899	58,536	49,035	8,607	11,515	18,393	87,550	-29,014	72,932
Minimum	0	13,970	518	16,985	33,270	44,372	303	4,966	18,125	73,549	-79,383	-150,716
Maximum	188,493	13,970	89,448	20,816	302,343	72,600	36,265	38,747	19,056	139,229	171,937	259,725
Average	42,498	13,970	21,480	19,092	97,040	49,823	11,520	16,262	18,498	96,105	935	44,866
Median	19,602	13,970	5,193	19,153	58,500	49,035	9,822	14,430	18,446	92,573	-28,384	36,292

Note:

All flow volumes are listed in AF/yr.

Figures



NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS. WELL NLF-TOPCO1 IS LOCATED 210 feet SOUTHWEST OF WELL NLF-B11.

FIGURE 4-1
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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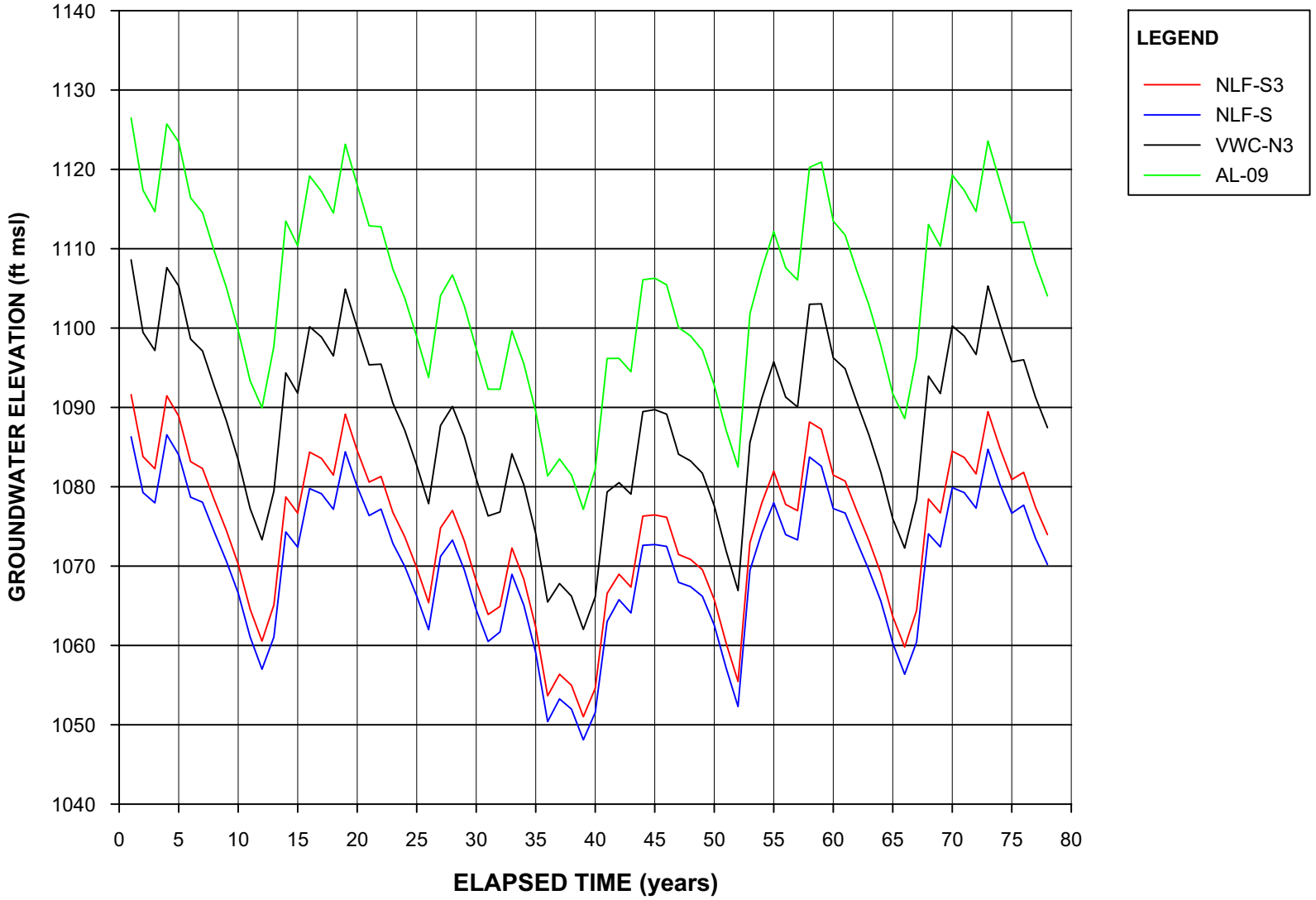

NOTES:

1. AL09 IS A CLUSTER OF OBSERVATION WELLS LOCATED 845 feet SOUTHWEST OF PRODUCTION WELL VWC-Q2.

2. THE REMAINING HYDROGRAPHS REPRESENT FORMER ALLUVIAL AQUIFER WELLS THAT HAVE BEEN ABANDONED AND THEREFORE ARE NOT PUMPED IN THE MODEL SIMULATIONS. RELATIVE TO EXISTING WELLS SHOWN ON FIGURE 2-4, THESE FORMER WELLS WERE LOCATED AS FOLLOWS:

   – WELL NLF-S3 WAS LOCATED 305 feet EAST OF WELL VWC-S6
   – WELL NLF-S WAS LOCATED 940 feet SOUTHWEST OF WELL VWC-S6
   – WELL VWC-N3 WAS LOCATED 435 feet NORTHEAST OF WELL VWC-N8

FIGURE 4-2
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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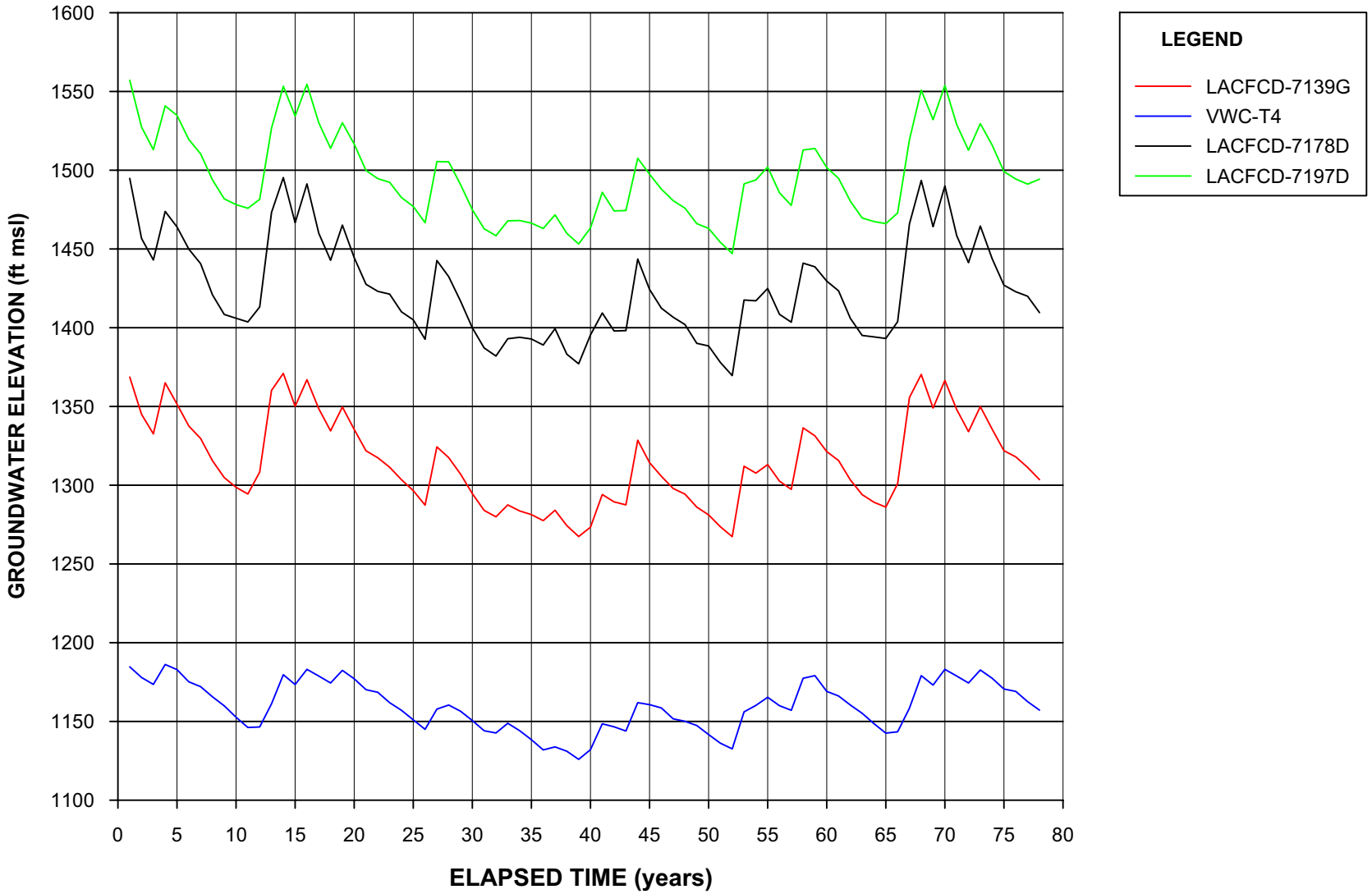

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR VWC- T4 = 1101 ft msl; ALLUVIUM BOTTOM ELEVATION ~1050 TO 1065 ft msl.
3. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7139G = 1289 ft msl; ALLUVIUM BOTTOM ELEVATION ~1256 ft msl OR LOWER.
4. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7178D = 1463 ft msl; ALLUVIUM BOTTOM ELEVATION ~1398 TO 1425 ft msl.
5. LOWEST HISTORICAL GROUNDWATER ELEVATION FOR LACFCD-7197D = 1474 ft msl; ALLUVIUM BOTTOM ELEVATION ~1423 TO 1447 ft msl.

FIGURE 4-3
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER IN SOLEDAD CANYON
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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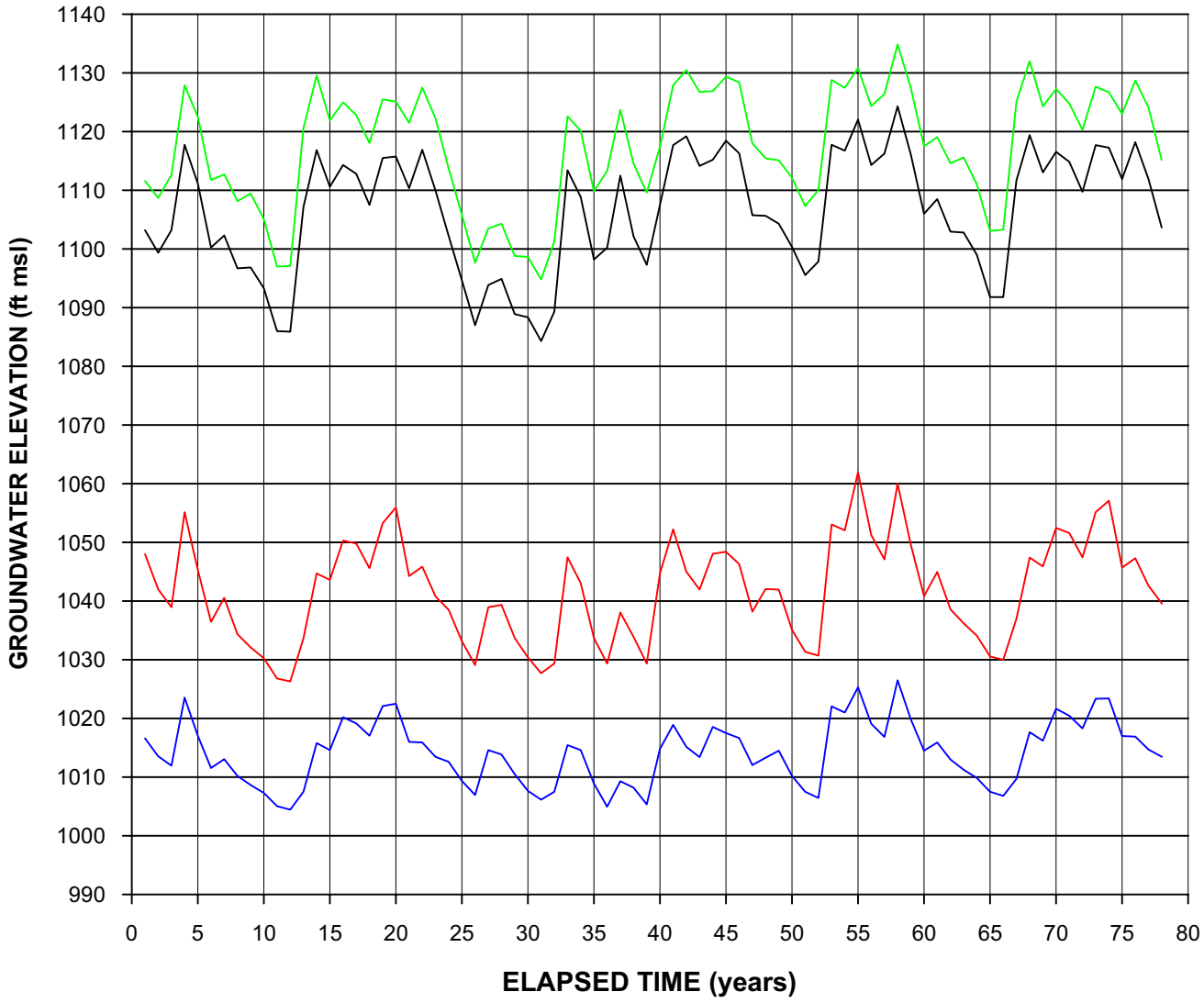

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-4
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG CASTAIC CREEK
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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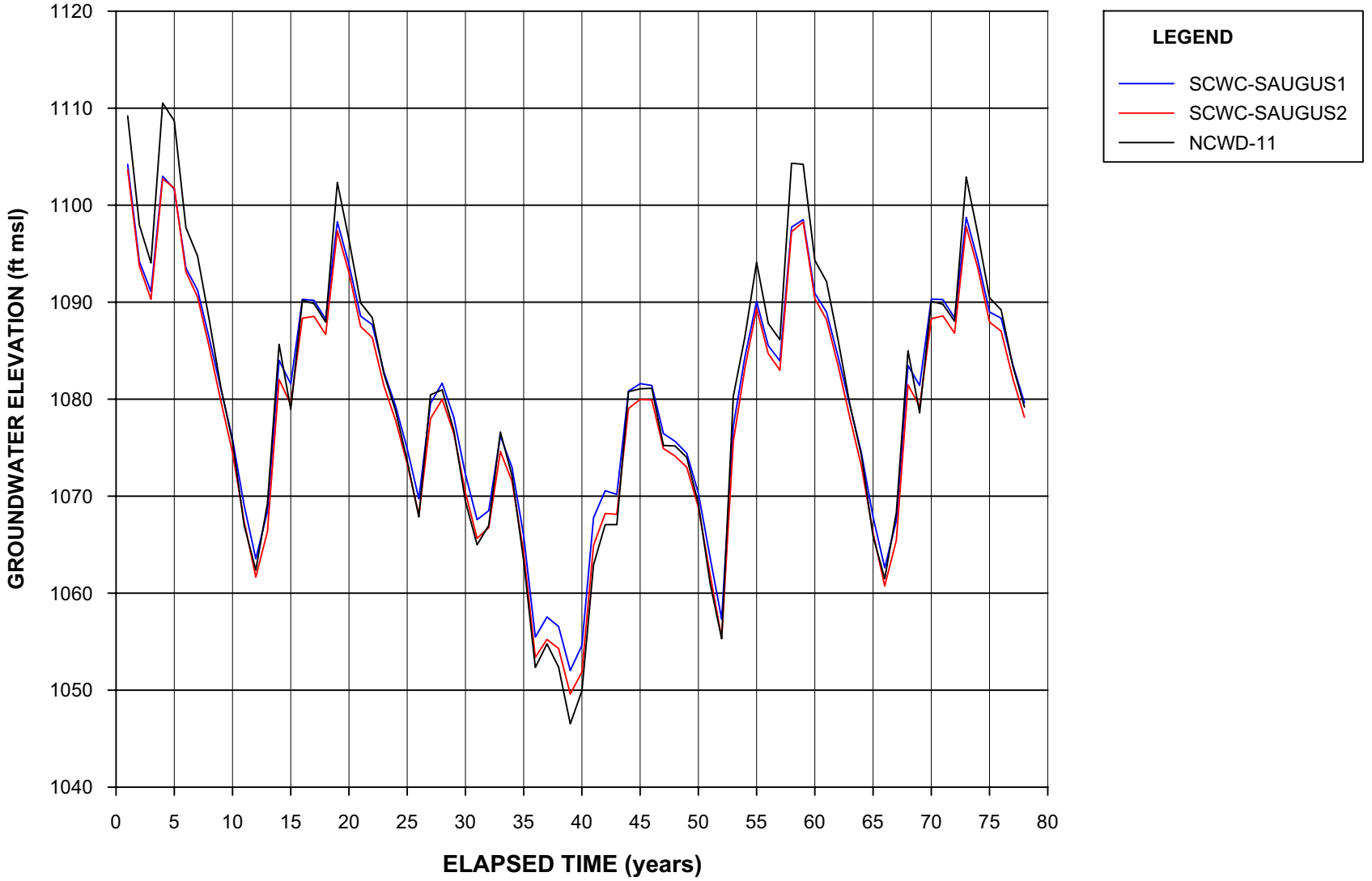

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

2. THESE WELLS ARE CONSTRUCTED IN THE SAUGUS FORMATION AND ARE NOT OPEN TO THE ALLUVIAL AQUIFER. THE SIMULATED HYDROGRAPHS AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE ALLUVIAL AQUIFER, ABOVE THE OPEN INTERVALS OF THESE WELLS.

FIGURE 4-5
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE ALLUVIAL AQUIFER ALONG THE SOUTH FORK SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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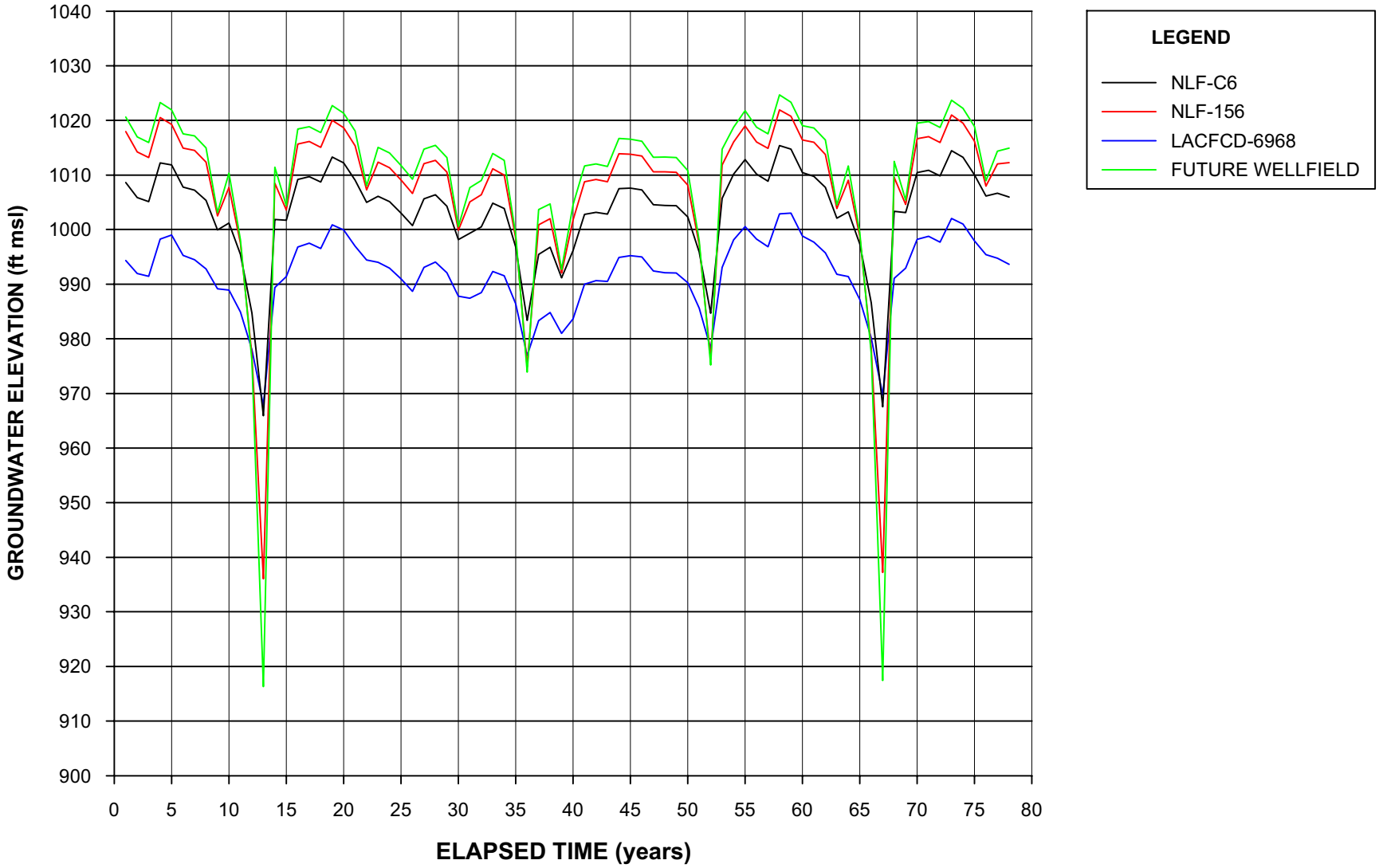

NOTES:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.
2. WELLS NLF-C6 AND LACFCD-6968 ARE CONSTRUCTED IN THE ALLUVIAL AQUIFER AND ARE NOT OPEN TO THE SAUGUS FORMATION. THE SIMULATED HYDROGRAPHS SHOWN AT THESE WELL LOCATIONS ARE FOR GROUNDWATER LEVELS IN THE SAUGUS FORMATION, BELOW THE OPEN INTERVALS OF THESE WELLS.
3. THE SIMULATED HYDROGRAPH FOR THE FUTURE WELLFIELD IS FOR A MODEL NODE WITH NO ASSIGNED PUMPING, LOCATED INSIDE THE WELLFIELD NEAR VWC-206.

FIGURE 4-6
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION WEST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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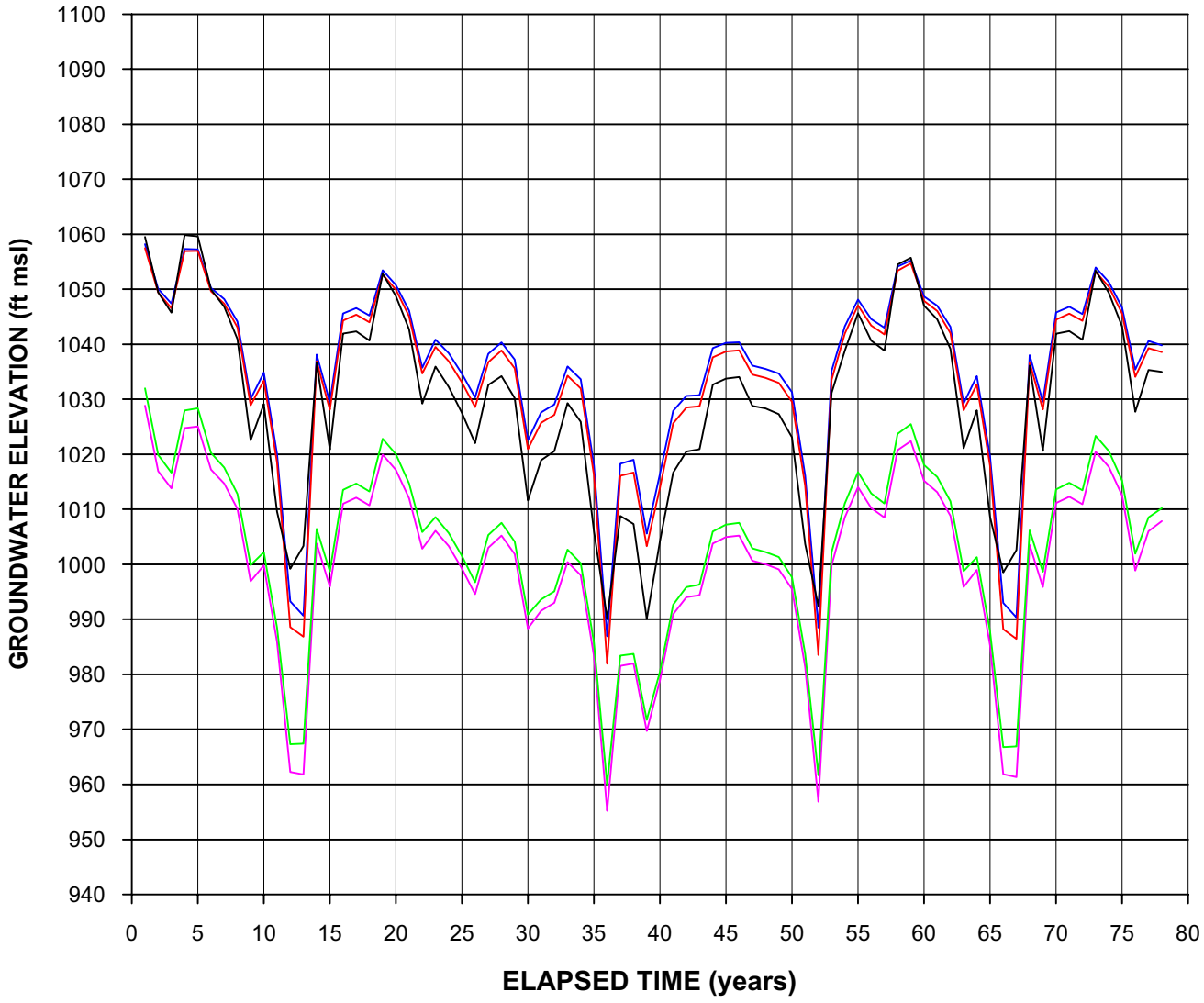

NOTE:

1. SEE FIGURE 2-4 FOR LOCATIONS OF WELLS.

FIGURE 4-7
SIMULATED AVERAGE ANNUAL GROUNDWATER ELEVATIONS IN THE SAUGUS FORMATION EAST OF INTERSTATE 5
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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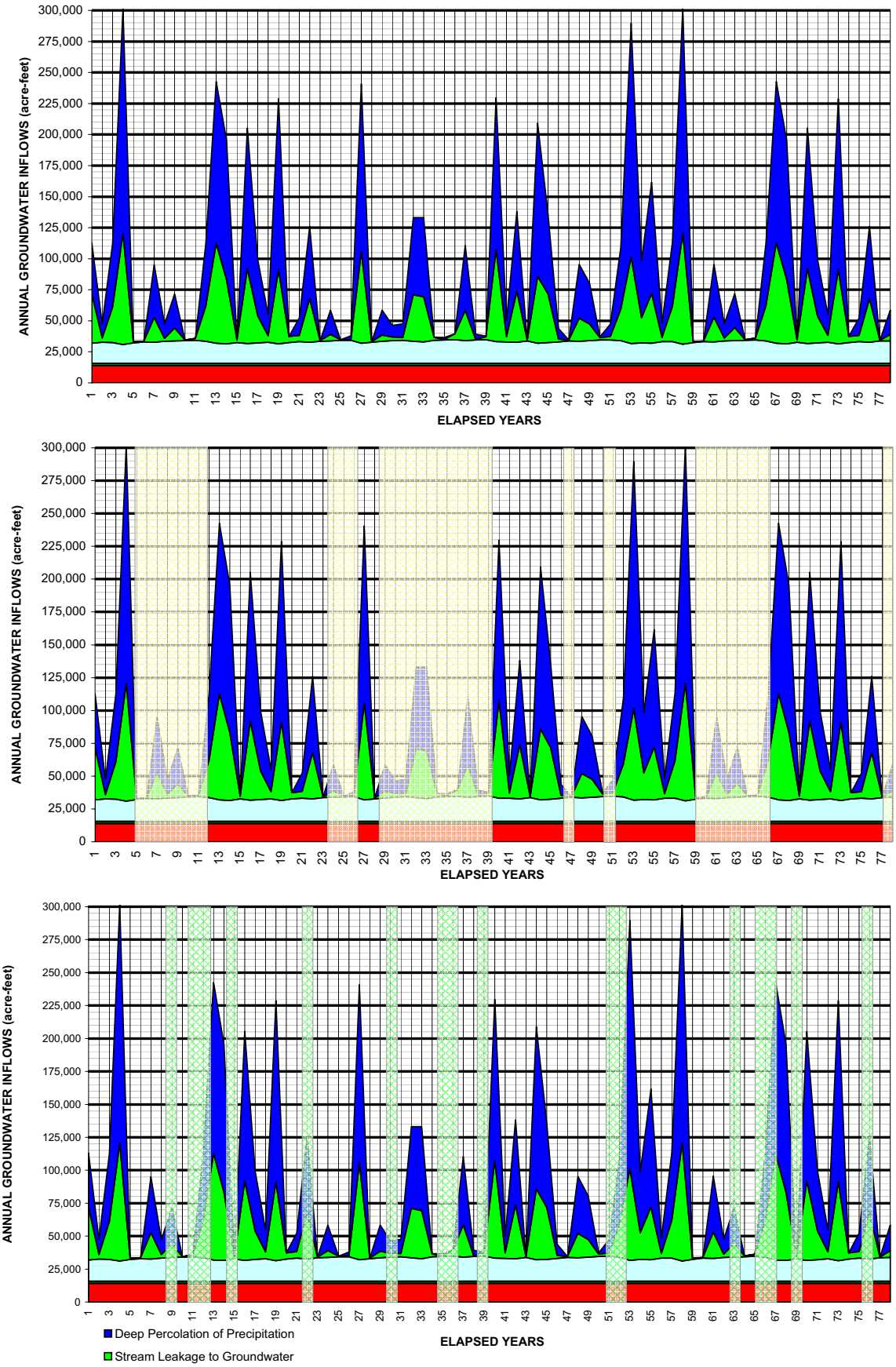

Note:

The deep percolation of applied water is calculatedfor full build-out conditions within the Regional Model boundary, as shown on Figure 3-7 and discussed in Section 3.5.

FIGURE 4-8
SIMULATED ANNUAL GROUNDWATER INFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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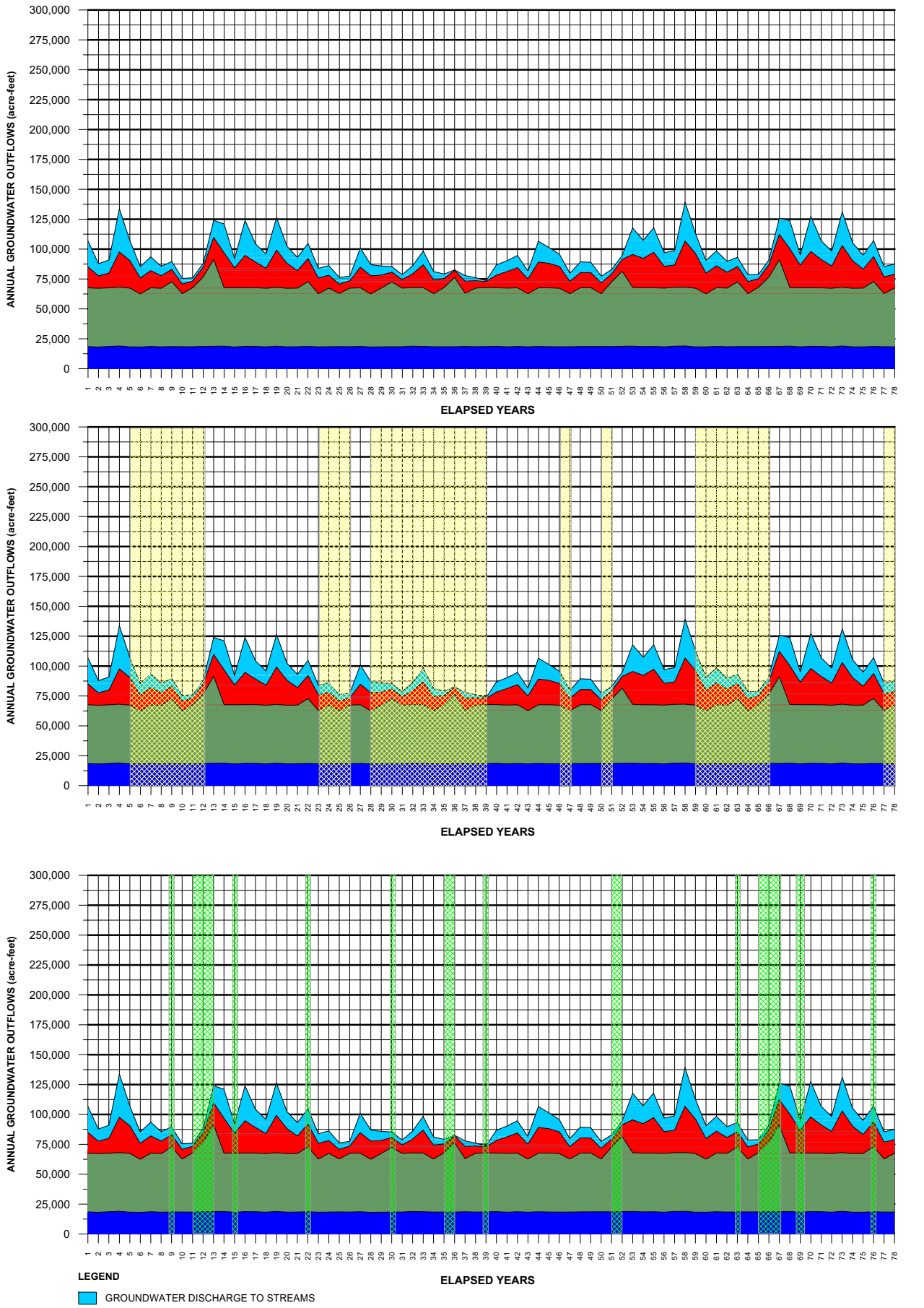

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FIGURE 4-9
SIMULATED ANNUAL GROUNDWATER OUTFLOWS
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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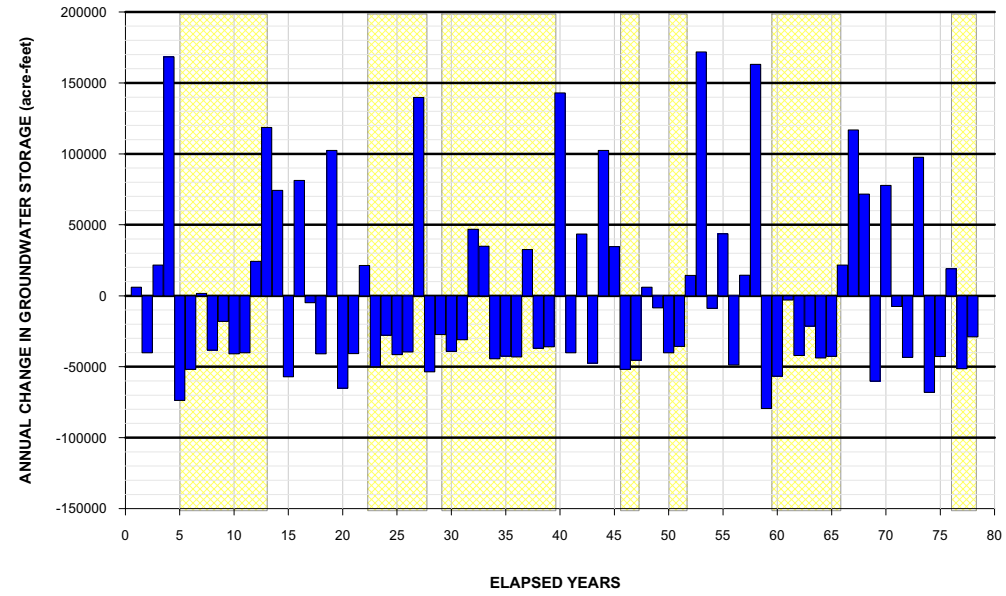

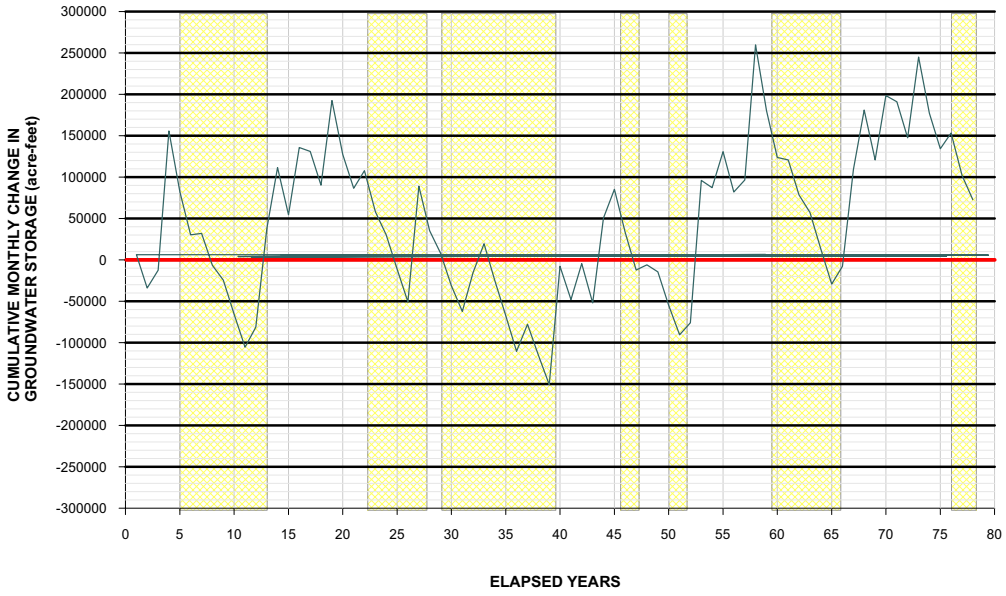

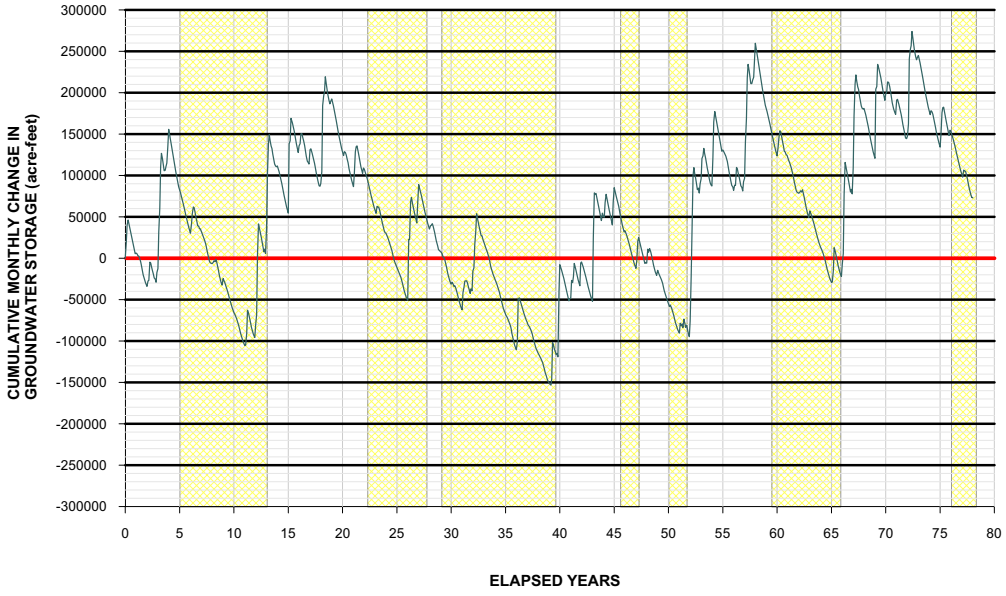

LOCAL DRY YEARS

FIGURE 4-10 (PAGE 1 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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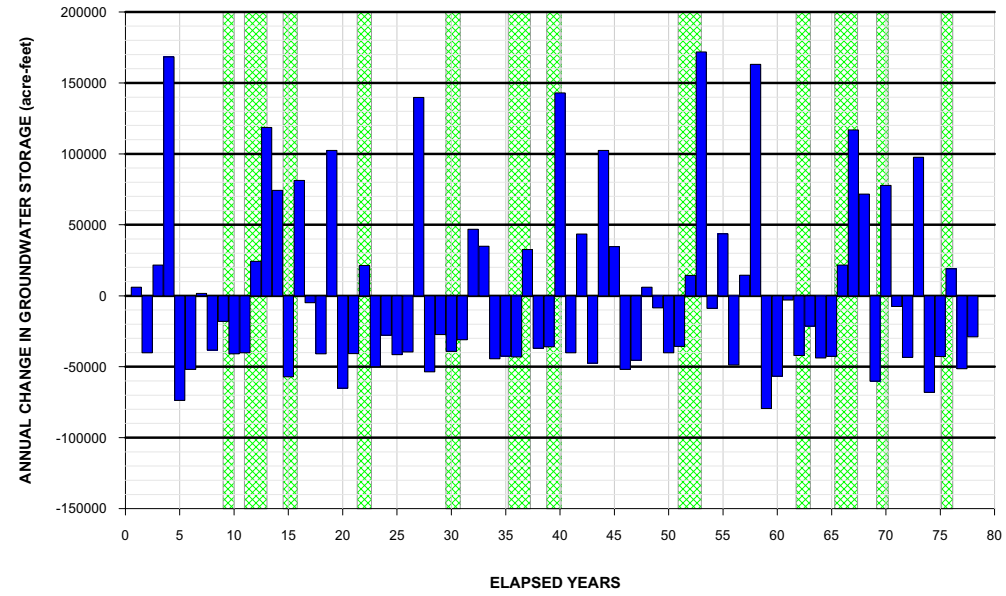

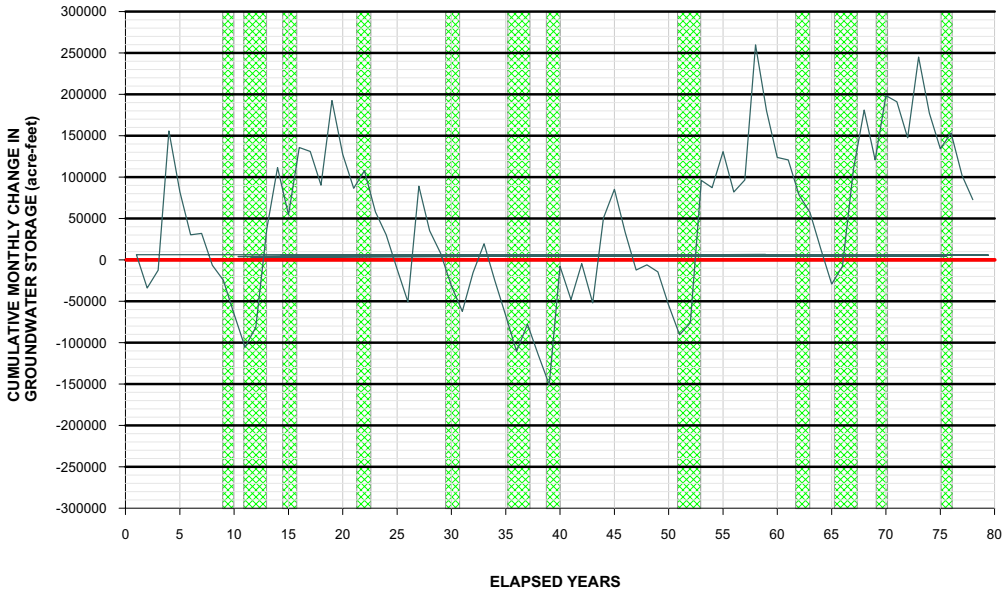

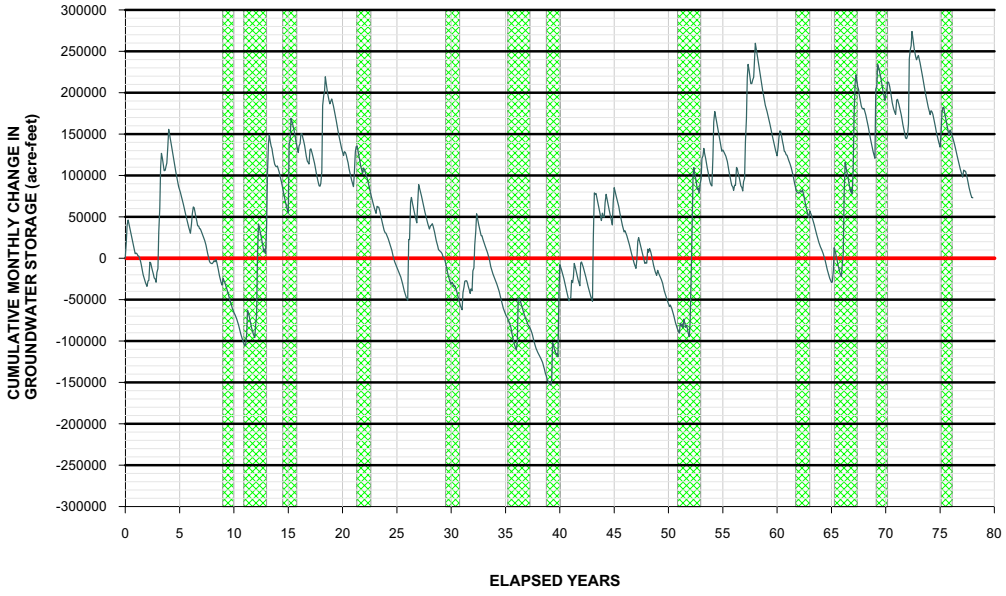

FIGURE 4-10 (PAGE 2 OF 2)
ANNUAL AND CUMULATIVE CHANGE IN SIMULATED GROUNDWATER STORAGE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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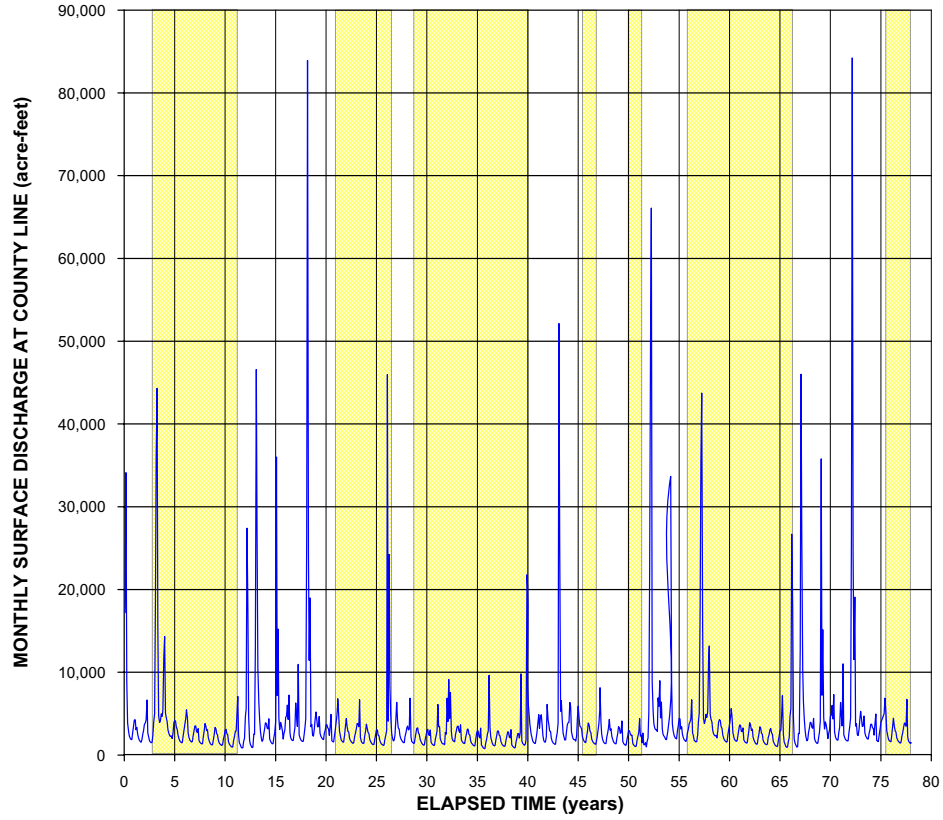

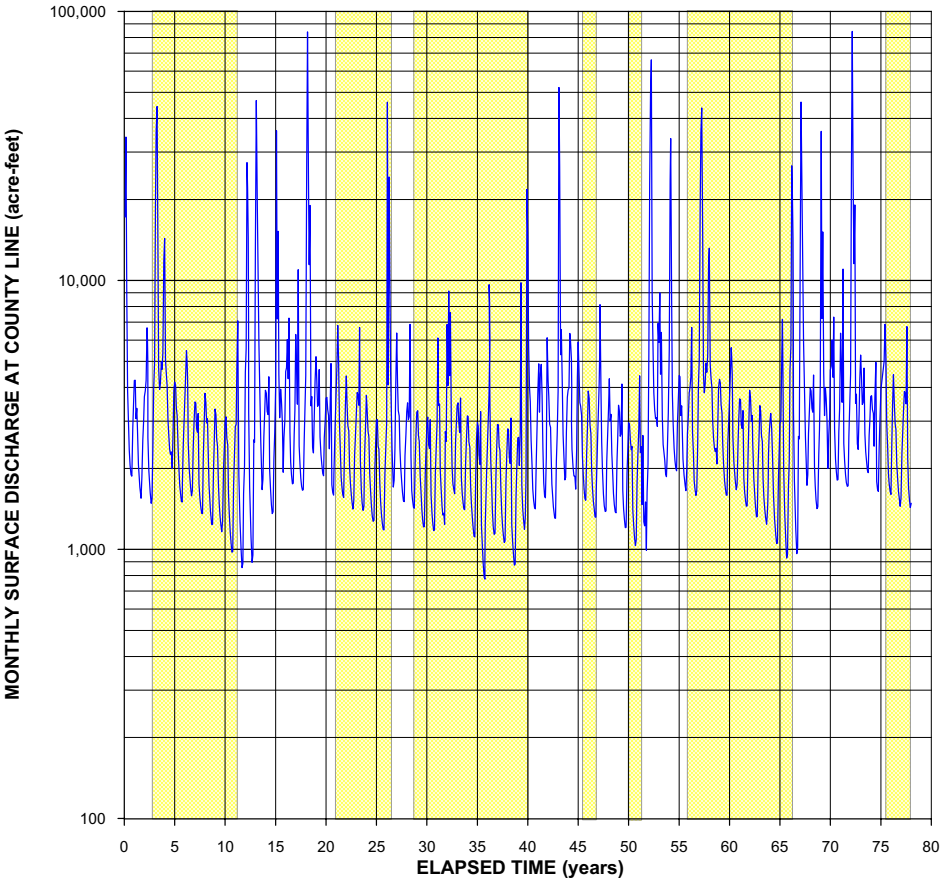

LEGEND

LOCAL DRY YEARS

FIGURE 4-11
SIMULATED SANTA CLARA RIVER FLOW AT COUNTY LINE
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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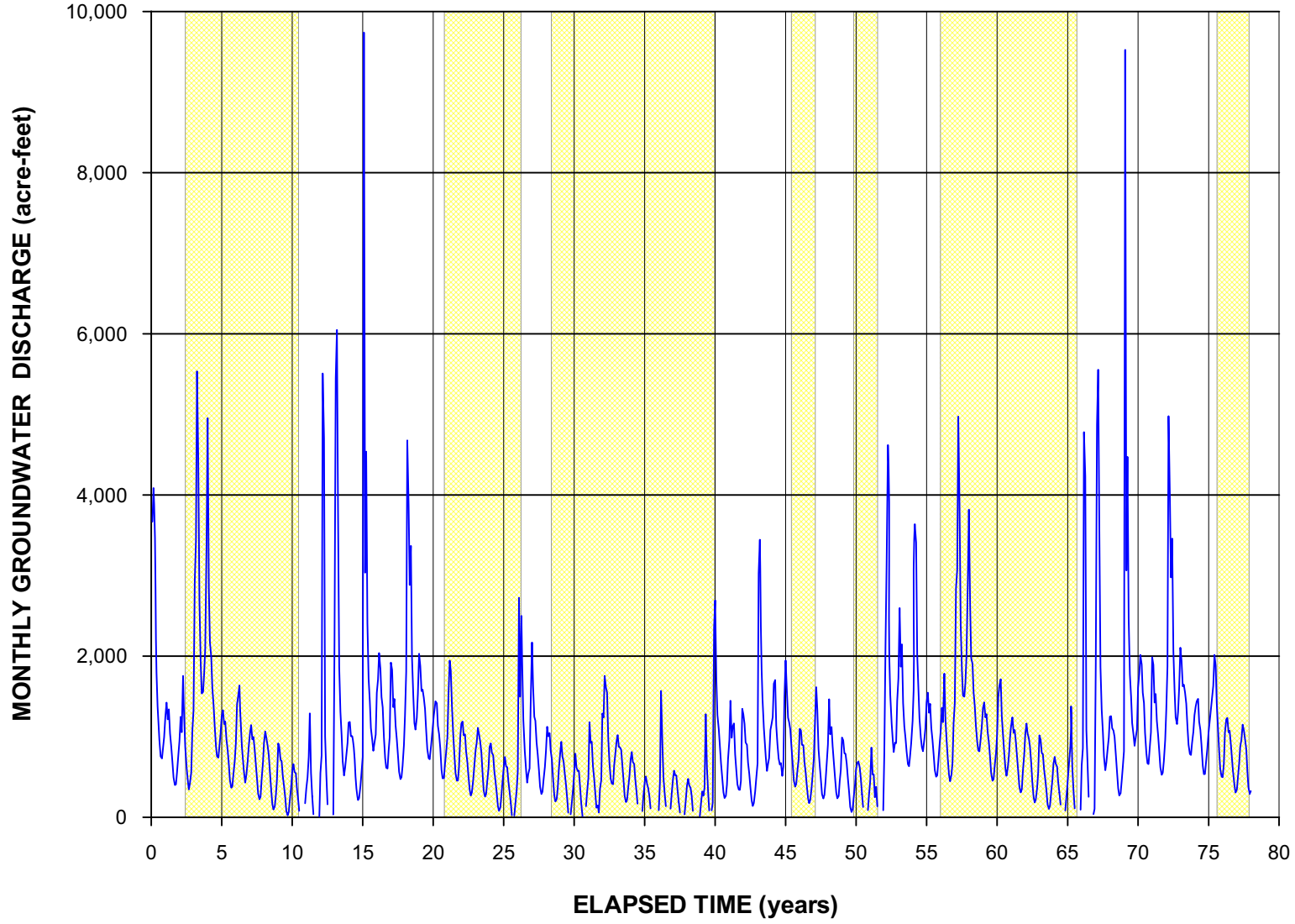

FIGURE 4-12
SIMULATED GROUNDWATER DISCHARGE TO SANTA CLARA RIVER
ANALYSIS OF GROUNDWATER BASIN YIELD
UPPER SANTA CLARA RIVER GROUNDWATER BASIN
EAST SUBBASIN, LOS ANGELES COUNTY, CALIFORNIA

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SECTION 5

Conclusions

This section discusses the principal findings from the analyses of historical data and numerical modeling results and the implications of these findings for both groundwater management and water supply in the Santa Clarita Valley.

5.1 Principal Findings

The primary objective of the groundwater basin yield evaluation was to use the Regional Model to examine the groundwater operating plan under a range of potential hydrologic conditions to determine whether the groundwater resources in the valley could be expected to respond to such operations in a sustainable fashion. For the purposes of this evaluation, as in other settings, sustainability is defined in terms of renewability (recharge) of groundwater as reflected by the following indicators:

1. Lack of chronic, or sustained, depletion of groundwater storage, as indicated by projected groundwater levels, over a reasonable range of wet, normal, and dry hydrologic conditions

2. Maintenance of surface water flows in the western portion of the basin (which are partially maintained by groundwater discharge) and surface water outflow to downstream basins over the same range of hydrologic conditions

Regarding maintenance of surface water flows, although the development and use of groundwater in a sustainable manner necessitates the inducement of recharge from surface water, sustainability, in this case, does not rely on inducing groundwater recharge by eliminating surface water flows. Rather, it retains and, as supported by increased supplemental water importation, generally increases surface water outflow. Regarding both indicators of sustainability, the range of analyzed hydrologic conditions is a long-term period that includes anticipated occurrences of the types of years and groups of year types that have historically occurred in the basin.

The primary conclusion from the modeling analysis is that the current operating plan for the groundwater basin in the Santa Clarita Valley will not cause detrimental short- or long-term effects to the groundwater and surface water resources in the valley and is, therefore, sustainable. The modeling analysis, along with the historical data described in this report, result in the following specific conclusions regarding the sustainability of the operating plan:

1. The groundwater basin has historically been, and continues to be, in good operating condition and not in overdraft conditions, as indicated by historical data.

2. The operating plan is sustainable over varying hydrologic conditions, because it is feasible to intermittently exceed a long-term average yield for 1 or more years without

creating long-term adverse impacts to the groundwater system and the Santa Clara River.

3. Yields from the Alluvial Aquifer and the Saugus Formation during wet and dry years can be used for long-term water supply planning purposes. In particular, although increased pumping from the Saugus Formation during years of reduced SWP deliveries can be expected to cause short-term declines in groundwater levels during such pumping, it is not projected to cause permanent declines in groundwater discharges or streamflow. Additionally, Saugus groundwater levels will rapidly recover to pre-drought conditions.

4. The strategy around which the plan was designed (maximizing the use of Alluvial Aquifer and imported water during years of normal or above-normal availability of these supplies, while limiting the use of the Saugus Formation during these periods, then temporarily increasing Saugus pumping during years when SWP supplies are significantly reduced because of drought conditions) is viable on a long-term basis.

5. The historical observations of basin conditions and the model simulations together support the historical and ongoing confidence that groundwater can continue to be a sustainable source of water supply under the current groundwater operating plan described in the Amended 2000 UWMP (Black & Veatch, 2000; CLWA et al., 2005), the Groundwater Management Plan (CLWA, 2003), and the annual water reports (LSCE, 2005a).

In summary, the groundwater basin can be expected to respond to the operating plan in a manner similar to what has been experienced over approximately the last 50 years: use of water from groundwater storage during drier periods, mostly reflected by small to large fluctuations in Alluvial Aquifer groundwater levels from the middle to the eastern part of the basin, followed by full to near-full recovery in wet years or periods of years. A notable difference from historically experienced conditions is in the Saugus Formation. Greater Saugus pumping during periods of significantly reduced imported water supplies is projected to cause larger fluctuations in groundwater levels during such pumping, with full to near-full recovery of Saugus water levels in subsequent years, when the availability of imported water supplies returns to normal.

5.2 Groundwater Management and Water Supply Implications

The primary focus of the MOU and a key focus of the Groundwater Management Plan is basin yield; specifically, whether a groundwater operating yield could be developed whereby some defined amount of groundwater could be pumped on a sustainable basis. The evaluation described in this report addresses that question. The MOU did not envision impacts from groundwater contamination such as have recently impacted a number of municipal water supply wells. Fortunately, the Regional Model could be used, and has been used, to also examine the effectiveness of the operating plan in containing groundwater contaminants while concurrently pumping (with appropriate treatment at contaminated wells) for municipal water supply (CH2M HILL, 2004b). Thus, in addition to the water supply and groundwater management findings derived from the original intent of the MOU, as discussed below, an additional significant finding derived from the

development and application of the model is that groundwater supply and the control of groundwater contamination migration can be concurrently accomplished without having to modify or, more importantly, compromise the operating yield of the basin.

In addition to the preceding contamination-related findings, there are other findings that directly relate to the original intent of the MOU and can be classified as findings related to the yield of the basin and/or the long-term water supply in the valley. First, the long-term yield of the basin can be considered, for the present, to be equivalent to the operating plan for the basin, based on the simulated projections of groundwater levels, storage, and stream flows. In other words, with the existing and planned distribution of wells and pumping capacities in the operating plan, the basin can be expected to sustainably yield the annual volumes of groundwater in the operating plan for ongoing municipal and agricultural water supply. Additionally, other pumpers in the basin, such as small private well owners, can expect to experience Alluvial Aquifer groundwater conditions generally similar to what they have experienced in the past. This expression of basin yield, based on the existing and planned distribution of wells and pumping capacities, should not be considered or interpreted as a limit to the yield of the basin. It is possible that some alternate configurations of well locations and pumping capacities, potentially complemented by other management actions (e.g., artificial recharge activities), could increase the yield of the basin in the future. The Regional Model, developed for analysis of the current operating plan, can be used to examine potential changes in the operating plan and associated changes in basin yield if that is ever desirable. For the present, however, the main finding of the current groundwater operating plan is that basin conditions can be expected to generally repeat what has been experienced over the last several decades, with some increase in Saugus groundwater level fluctuations if dry-year increases in pumping are actually needed as planned, all resulting in no long-term depletion of groundwater.

From a water supply perspective, the main finding of the operational yield analysis is that it supports the groundwater component of overall water supply for the Santa Clarita Valley as described in the 2000 UWMP, and as expected to be carried forward in the 2005 UWMP.

As discussed in Section 5.1, the Saugus Formation has not been historically pumped at the dry-year rates described in the operating plan. Consistent with the ongoing water resource management, data collection, data management, data evaluation, and reporting activities that have been ongoing in the basin for the past several years, the Purveyors will closely monitor the effects of the greater-than-historical Saugus Formation pumping when it occurs. Depending on the findings from monitoring activities during the first period of increased Saugus pumping, the conjunctive use program that currently relies on SWP deliveries could potentially expand to include artificial recharge activities to enhance Saugus water level recovery after periods of increased Saugus pumping.

In conclusion, through the UWMP, the MOU, the Groundwater Management Plan, and other related water resource management activities, the Purveyors have developed an ongoing process for groundwater resource management in the Santa Clarita Valley that results in a sustainable operating plan for the local groundwater basin. As discussed in the annual water reports (including LSCE, 2005a), the ongoing process of groundwater management relies not only on the historical evaluations and numerical modeling analyses, but also on other program elements identified in the MOU—data gathering, database maintenance, and annual reporting—as well as other activities, such as implementing

conservation measures, increasing the use of recycled water, planning for water reliability, updating the UWMP on a regular schedule, and administering the Groundwater Management Plan. The development and implementation of the UWMP, the MOU, and the Groundwater Management Plan have resulted in a significantly improved understanding of the local water resources, and, in particular, have demonstrated that the current groundwater operating plan results in a reliable, long-term component of water supply for the valley. Ongoing monitoring and interpretation of actual groundwater conditions, as discussed in the MOU and the Groundwater Management Plan, will allow (1) continued assessment of basin responses to future pumping; (2) verification that, as public and private development increase with time, both within and adjacent to the basin, the groundwater basin responds in the same general manner as described herein; and (3) identification of whether adjustments to the operating plan might be warranted to achieve its primary objective of a sustainable groundwater resource.

SECTION 6

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Appendix A
Memorandum of Understanding

Memorandum of Understanding
Between the
Santa Clara River Valley
Upper Basin Water Purveyors and
United Water Conservation District

August 2001

MEMORANDUM OF UNDERSTANDING

This Memorandum of Understanding ("MOU") is entered into effective August 20, 2001, by and among Castaic Lake Water Agency ("CLWA"), CLWA's Santa Clarita Water Division ("SCWC"), Newhall County Water District ("NCWD"), Valencia Water Company ("VWC") and Los Angeles County Waterworks District No. 36 ("LACWD"), which are collectively referred to as the "Upper Basin Water Purveyors" and United Water Conservation District "UWCD", hereinafter referred together as the "parties."

RECITALS

WHEREAS, UWCD is a public agency that encompasses approximately 214,000 acres of land located in central Ventura County. UWCD's service area covers the downstream portion of the Santa Clara River Valley in Ventura County, as well as the Oxnard Plain (sometimes referred to as the "Lower Santa Clara River Area"). UWCD manages surface and groundwater resources within seven groundwater basins in the Lower Santa Clara River Valley Area. UWCD's Boundary is shown on Figure 1-1; and,

WHEREAS, the Upper Basin Water Purveyors meet regularly as a technical group to coordinate conjunctive use of imported, recycled and groundwater resources of the water basins east of the Los Angeles/ Ventura County line (sometimes referred to as the "Upper Santa Clara River Area"), which is located almost entirely within northwestern Los Angeles County. The respective services areas of the Upper Basin Water Purveyors members (CLWA, SCWC, NCWD, VWC and LACWD) are shown on Figure 1-2; and,

WHEREAS, UWCD has been involved in the review of water resources in both the Lower Santa Clara River Area and also the Upper Santa Clara River Area as part of UWCD's review of the Newhall Ranch Specific Plan and EIR (NRSP); and,

WHEREAS, litigation of the Newhall Ranch Specific Plan and EIR resulted in preparation of an additional analysis to the previously certified EIR for the NRSP, including the section addressing water resource issues; and,

WHEREAS, the Additional Analysis includes a water flow model and impact analyses of the future water usage projections for the Upper Santa Clara River Area; and,

WHEREAS, UWCD, Newhall Land and Farming Company (NLF) and others have had several technical meetings to further study the Additional Analysis as it relates to the water issues, and, based on this information, and further discussions between UWCD and the Upper Basin Water Purveyors, UWCD believes that it is in the best interests of the parties and the future beneficial water resources management in the upper and lower basins to enter into a cooperative working relationship among the parties; and,

WHEREAS, the parties have determined that this MOU is the best format for establishing a program that would be implemented over time for purposes of agreeing upon overall water resources management techniques and an information database that would benefit the upper and lower basins; and,

WHEREAS, this MOU is prepared by UWCD and the Upper Basin Water Purveyors because the parties believe that a cooperative water resource monitoring program in the Upper and Lower Santa Clara River Areas is desirable to protect and enhance the conjunctive use of imported water, groundwater and surface water resources within the region; and,

WHEREAS, the parties support regional water planning efforts that rely on the provision of accurate and timely information about available water resources; and,

WHEREAS, the parties to this MOU desire to create and maintain a cooperative relationship for purposes of gathering information for UWCD and the Upper Basin Water Purveyors to be used in further assessing imported water, surface water and groundwater conditions in both the Upper and Lower Santa Clara River Areas; and,

WHEREAS, the parties to this MOU intend to form a reciprocal relationship. In order to do this, UWCD will designate an individual or individuals with technical knowledge and experience appointed by the General Manager of UWCD who will be included in discussions and efforts that take place with the Upper Basin Water Purveyors and others regarding the Upper Santa Clara River Area. Likewise, the Upper Basin Water Purveyors will designate an individual or individuals with technical knowledge and experience appointed by the General Managers of the Upper Basin Purveyors who will be included in discussions and efforts with UWCD and others regarding the Lower Santa Clara River Area, and,

WHEREAS, the goal of the MOU is to establish a joint monitoring program, which includes: (a) data collection (monitoring and testing); (b) database management; (c) groundwater flow modeling; (d) assessment of groundwater basin conditions (operational yield); and (e) report preparation and presentation.

NOW, THEREFORE, in consideration of the mutual promises and covenants herein contained, the parties to this MOU agree as follows:

1.1 **Program Monitoring.** The parties will participate in a joint monitoring program.

1.2 **Program Content.** The technical aspects of this joint monitoring program are set forth in a technical memorandum entitled, "Water Resource Monitoring Program Upper Santa Clara River Area," (Program) which is attached as Exhibit 1 and incorporated by this reference.

1.3 **Program Meetings.** The General Manager or President of each party to this MOU (or their designee) shall meet as the "Program Committee" within 30 days of the execution of this MOU. The "Program Committee" will establish appropriate subcommittees to initiate the Program and determine the meeting times and locations for the committees. The Program Committee and subcommittees will discuss and coordinate technical aspects of the Program, including the gathering, interpretation and reporting of information as outlined in the technical memorandum (Exhibit 1). Other attendees may be permitted by agreement of the parties to this MOU.

1.4 **Monitoring Costs.** The costs incurred in administrating the Monitoring Program will be determined as implementation of the Program takes place. However, it is understood that, unless the parties to this MOU agree otherwise, the Upper River monitoring costs of the program will be borne by the Upper Basin Water Purveyors because such monitoring will take place within their service areas and the Lower River monitoring costs of the program will be borne by UWCD because such monitoring will take place within its service area.

1.5 **Program Implementation**. The parties to this MOU have prepared a schedule, attached as Exhibit 2, that describes the tasks and estimated time to implement the Program. The Parties acknowledge that Program Implementation will be an on-going and evolving process and may change due to future amendments to the Program, challenging technical issues or other unforeseen circumstances.

1.6 **Water Rights**. Notwithstanding the provisions of this MOU, nothing in either this MOU or the technical memorandum (Exhibit 1) shall be construed as affecting the water rights or operations of any party, person or entity.

1.7 **Term.** This MOU shall remain in effect for an initial period of seven (7) years and shall be automatically renewed for additional one year increments unless otherwise unanimously terminated by the members of the Program Committee as that committee exists at the time action is taken to terminate this MOU.

1.8 **Counterparts.** This MOU may be executed in any number of counterparts, each of which, when so executed, will be deemed to be an original and all of which taken together will constitute one and the same agreement.

IN WITNESS WHEREOF, the parties have executed this MOU as of the date first set forth above.

United Water Conservation District

By _____
General Manager

Castaic Lake Water Agency

By _____
General Manager

Newhall County Water District

By _____
General Manager

Valencia Water Company

By _____
President

Santa Clarita Water Company

By _____
President

Los Angeles County Waterworks District No. 36

By _____
County of Los Angeles

United Water Conservation District Boundary

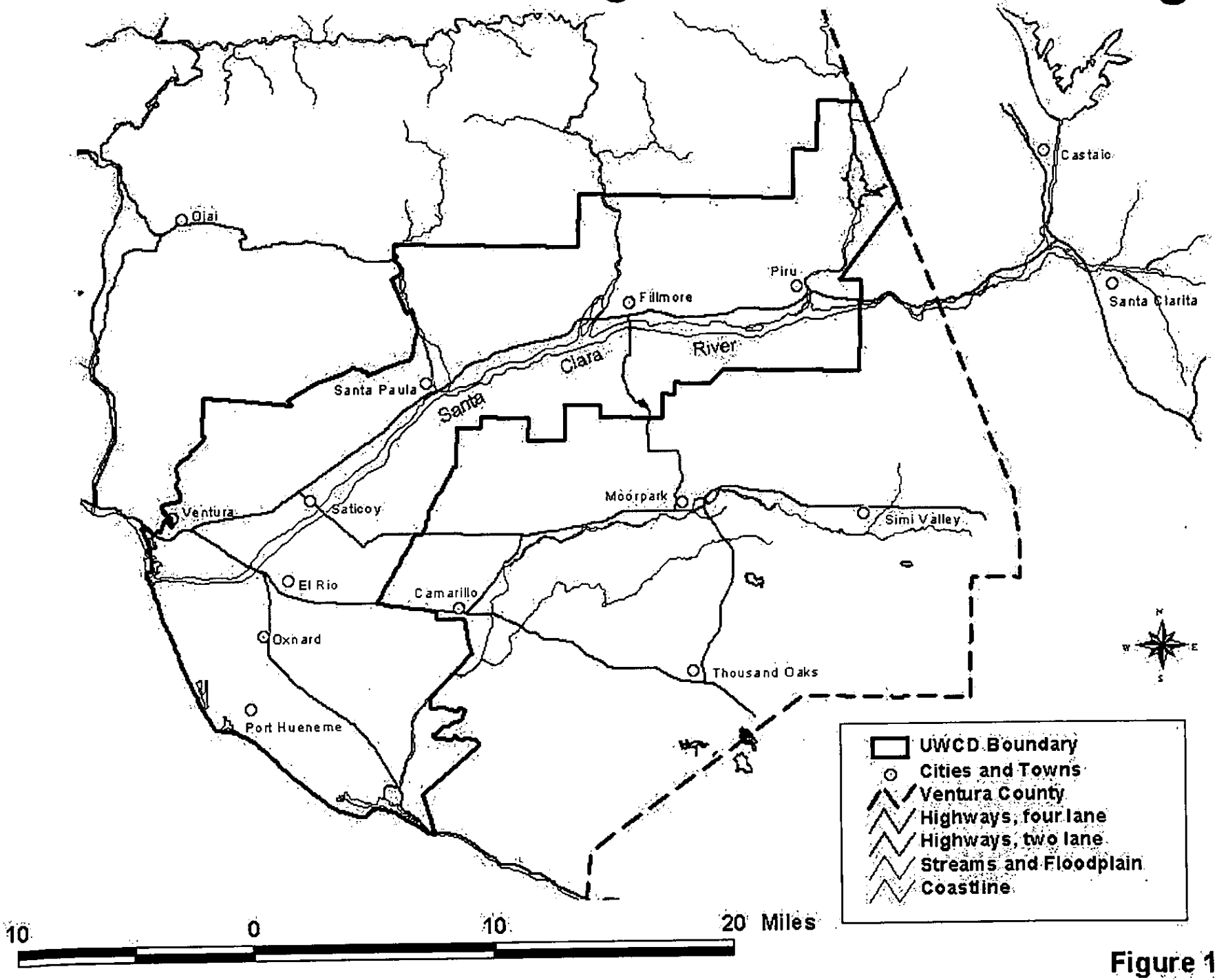


Figure 1-1

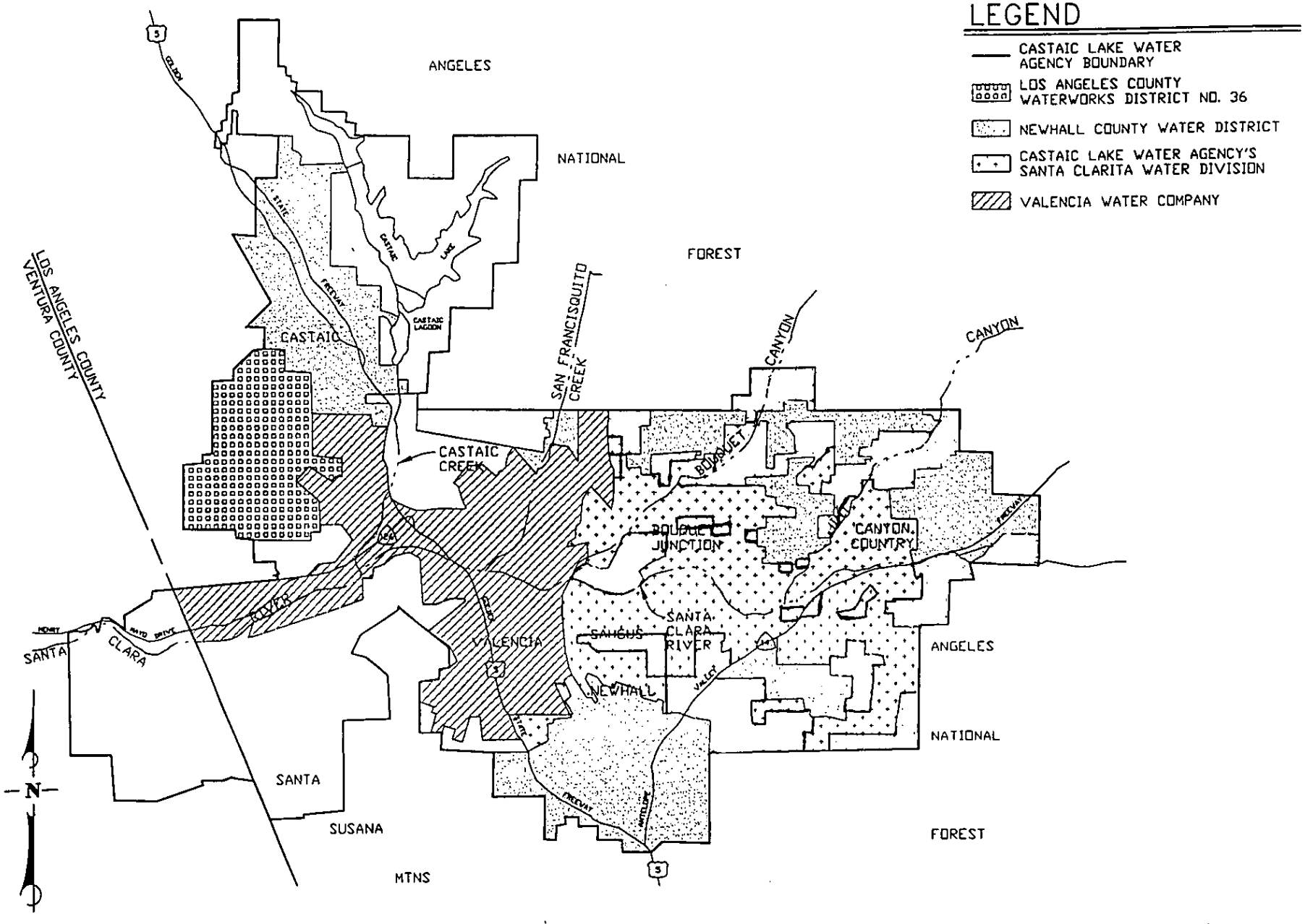


FIGURE 1-2

CLWA AND WATER PURVEYOR SERVICE AREAS

Exhibit 1
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA

INTRODUCTION

As part of its ongoing monitoring, interpretation, and reporting on imported water supplies and groundwater conditions in the aquifer systems underlying the Upper Santa Clara River Area, generally east of the Los Angeles County - Ventura County line and extending east to about the vicinity of Lang Station, the principal water purveyors in the area (primarily the municipal water purveyors - Castaic Lake Water Agency, Los Angeles County Waterworks District No. 36, Newhall County Water District, and Valencia Water Company) have committed to formalizing the data base on which water supply conditions are analyzed, and expanding the analysis of groundwater conditions such that the adequacy of water supply is well understood, and that both local and regional questions or issues about surface and groundwater can be addressed.

This water monitoring program outline has been prepared as a cooperative effort by the Upper Basin Water Purveyors operating in the Santa Clarita Valley and by the United Water Conservation District in Ventura County, the latter as the primary groundwater resource management entity in the Lower Santa Clara River Area (west of the Los Angeles - Ventura County line). The intent of the program outline is to delineate a series of elements that will be undertaken primarily by the Upper River Area entities, but in cooperation with United such that there is ultimately an integrated and coordinated data base, as well as agreed-upon technical tools such as a numerical groundwater flow model, to allow a continued regional understanding of water resources along the Santa Clara River. In that light, the following program includes elements which address data collection (monitoring and testing), database management, groundwater modeling, operational yield analyses, and report preparation and presentation.

DATA COLLECTION (MONITORING AND TESTING)

Historically, data on groundwater and related hydrologic conditions have been collected on varying frequencies and in varying formats throughout the Upper River Area. Fortunately, more than sufficient data have historically been collected on groundwater levels, quality, and production (pumpage) to permit general assessment of groundwater conditions, in some detail in the widely developed Alluvial aquifer and to a lesser extent the Saugus Formation aquifer. In order to expand on the general assessment of groundwater conditions, historical data collection efforts will be updated and formalized in the following areas.

Groundwater Levels and Quality - Wells in which historical and current water level data are available will be "qualified" (to confirm locations, depths, well completion details, annular seals, etc.) to confirm their utility for ongoing monitoring of water level and/or water quality in a particular aquifer. Based on a combination of qualified well details and available historical and current data, a network of existing and future wells will be developed for ongoing monitoring of groundwater levels (initially on a semi-annual frequency) and groundwater quality (initially on an annual to triennial frequency, depending on the use of the well) in both the Alluvium and the Saugus Formation aquifers. The water level and water quality monitoring networks may not be identical (as with most basins, the number of water level monitoring points will likely be greater than the number of water quality monitoring points). Also, in light of the relative differences in development of the two aquifer systems, there will be more monitoring points in the Alluvium than in the Saugus. However, as future development of the Saugus increases, particularly as the spatial extent of the Saugus "well field" expands, the Saugus monitoring network will evolve and expand accordingly. Water quality details are expected to begin with what historical analyses have been made; monitored details are expected to increase as the use of local Groundwater continues to change from irrigation supply to municipal supply, with the addition of organic and other hazardous chemical analyses of drinking water supplies in recent years. Finally, such as any dedicated monitoring wells are installed in the

area, for specific site investigation or other purposes, they will be added to the qualified well network as appropriate.

Groundwater Pumpage - Essentially all pumpage in the Upper Area (except small capacity individual domestic and similar wells) is metered or directly estimated from electrical power records, and the results are maintained in a decentralized data base. Metered measurement of all substantial capacity wells (all municipal and agricultural, as well as other private wells, e.g. golf course irrigation wells) will be continued on at least an annual basis, with progression to monthly data collection as appropriate for particular analyses that may be undertaken.

Surface Water Flows and Quality - Historical stream gage sites will be preserved as possible to allow ongoing surface water gaging of stream inflows to the Upper River area, stream outflows from the Upper River area into Ventura County, and return flows to the River system from in-area wastewater treatment plant discharges. Surface water quality at the same points will also be sampled on some frequency to continue historical records as appropriate or to document episodic or other (e.g. treated wastewater discharges) surface water flows into or out of the Upper River area.

Well and Aquifer Characteristics - Recently constructed wells, in both the Alluvium and Saugus Formation, have been tested, in some cases with the benefit of nearby monitoring wells, to determine well yields and aquifer hydraulic properties (e.g. transmissivity and storage coefficient). In limited cases, production logging and depth-specific water quality sampling has been undertaken to examine variations in aquifer productivity and quality with depth. Such as there is a need for additional spatial or vertical distribution of well yield or aquifer characteristic data, selected qualified wells will be tested in the Alluvium and Saugus aquifers. In general, all new production wells will be tested to determine the yields of the wells and the hydraulic characteristics of the aquifer materials in which they are completed at various locations in the Upper River area.

Precipitation - The locations of historical precipitation gaging will be verified and the quality of the

gaging stations will be assessed. Continuation of historical gaging will be a primary goal, with additions as appropriate to assess inflow of water within the Upper River area as well as distribution of precipitation throughout the area.

DATABASE MANAGEMENT

Geographic Information System - There is a good start on a regional GIS from the US Geological Survey's Regional Aquifer Study. For instance, roads, streams and other basic geographic features are in the USGS GIS that has been maintained and expanded by United Water Conservation District. United has commercial digital air photo coverage of Ventura County that includes a small portion of western Los Angeles County; additional digital imagery will be sought from agencies in Los Angeles County.

Most of the wells in the Valencia/Santa Clarita area are also in a USGS GIS coverage that includes well construction information. The wells are identified by owners designations as well as state well number. By using the state well number in identifying all monitoring data, information from the databases can be linked directly to the GIS well coverage.

Water Level Database - Monitoring data will be collected together in common databases, using an easily accessible program such as Microsoft Access. Groundwater level information is presently in a variety of forms, including paper copy, spreadsheet files, and agency databases. The digital information will be incorporated into a master database, but the data on paper copies will have to be entered into a computer. This will be accomplished by prioritizing the order in which this information is entered. Historic groundwater level data will be obtained from as many wells as possible, public and private, to ensure meaningful area coverage.

Water Quality Database - Water quality information may be a larger chore to organize in a database than water levels because each water sample collected is commonly analyzed for a large number of constituents. For water quality data collected in the future, analytical labs can provide results in digital form for ease of integration into a database. Historical water quality information is available digitally from the California Department of Health Services for public water supply wells (data is available for about the past ten years). For the rest of the historical water quality data, prioritizing the order of manual data entry would be necessary. Constituents of concern are obviously the first to be entered. Whether to enter all historical data will need to be addressed; this information is valuable in identifying long-term trends, but data entry takes time. United Water now has all historic water quality data for seven basins in Ventura County in a database, but it took several years to do this.

Water quality data from surface sources such as streams will also be included in the main water quality database. A location identifier can be used to tie the sample to the monitoring location in a GIS coverage. The approximate flow of the surface water source at the time of measurement should accompany each water quality data entry.

Pumpage Database - Pumpage data from individual wells is key to assessing both water level and water quality trends. This information is also required to construct a groundwater model. Some of this information has already been entered in computer files and can be readily imported into a database. Other information will likely have to be obtained on a cooperative basis. If pumpers do not have their own metered pumping records, pumpage will be estimated from other sources such as utility bills. For wells where no records have been kept, probable pumping quantities can be estimated through land use records and, in the case of irrigated agriculture, from irrigation methods and practices. This calculated information should not be entered directly in the pumpage database.

Streamflow Database - There should be a database of streamflow measured at various monitoring points. For USGS gauges, much of this information is already in digital form. Other agencies, such as County Flood Control, may also have digital data.

GROUNDWATER FLOW MODELING

As part of the technical analysis of water supply alternatives to meet projected water demands of the proposed Newhall Ranch project in the Upper River area, a numerical groundwater flow model was prepared for that project's proponent. That model was developed to focus on the feasibility and impacts of a potential storage and recovery project in the Saugus Formation, including the impacts of injection and recovery pumping in the Saugus on the overlying Alluvium, and the resultant impacts on Santa Clara River flows out of the Upper River area. The current model is calibrated for a steady state condition, including the addition of some focused injection and pumping. As a result, it represents a useful initial modeling effort of the overall aquifer system in the Upper River area. Depending on its availability for other uses in the Upper River area, that initial model will be subjected to transient calibration efforts and additional calibration of the Alluvial aquifer. The model will then become an evolving tool for analysis of ongoing groundwater development and recharge, in conjunction with imported surface water, and the resultant impacts on groundwater conditions in the Upper River area, as well as on surface outflows to the downstream basins on the Santa Clara River.

OPERATIONAL YIELD OF THE BASIN

A primary objective of the monitoring efforts, database management efforts, and modeling efforts described above is to assess groundwater basin conditions in the Upper River area in the context of the long term sustainability of the Alluvium aquifer and the generally underlying Saugus Formation, and to operate the basin such that the operating yield is not exceeded over a multi-year wet/dry cycle. This operational yield includes flexibility of groundwater use by allowing increased groundwater use during dry periods and increased recharge (direct or in-lieu) with supplemental water when it is

available. The operational yield protects the aquifer by assuring that groundwater supplies are adequately replenished from one wet/dry cycle to the next. Historical groundwater data demonstrates that the Alluvium has been, and continues to be developed within its long-term sustainability (i.e. no chronic lowering of water levels, no notable trend toward degradation of groundwater quality, etc.). Limited historical data in the Saugus Formation shows no lowering of water levels or degradation of water quality where it has been developed.

While current planning places future pumping of the Alluvium in the same range as has historically occurred for several decades, with anticipated similar results in terms of Alluvial water levels, storage, and quality, the model described above will be a useful tool to quantify the impacts in water budget terms and to analyze a range of scenarios as appropriate to optimize the use of the high-yielding Alluvium. The Saugus Formation is alternately being considered for short-term dry-period water supply at capacities higher than have historically been pumped from that formation, and for injection, storage and recovery of water as part of the overall water supply of the Upper Santa Clara River area. The model will also be used to determine the operational yield of the Saugus under a wide-ranging set of low to high pumping capacities (during wet to dry years, respectively), and with varying aquifer storage (recharge), to avoid undesirable impacts and assure that the operating yield is not exceeded over a multi-year wet/dry cycle.

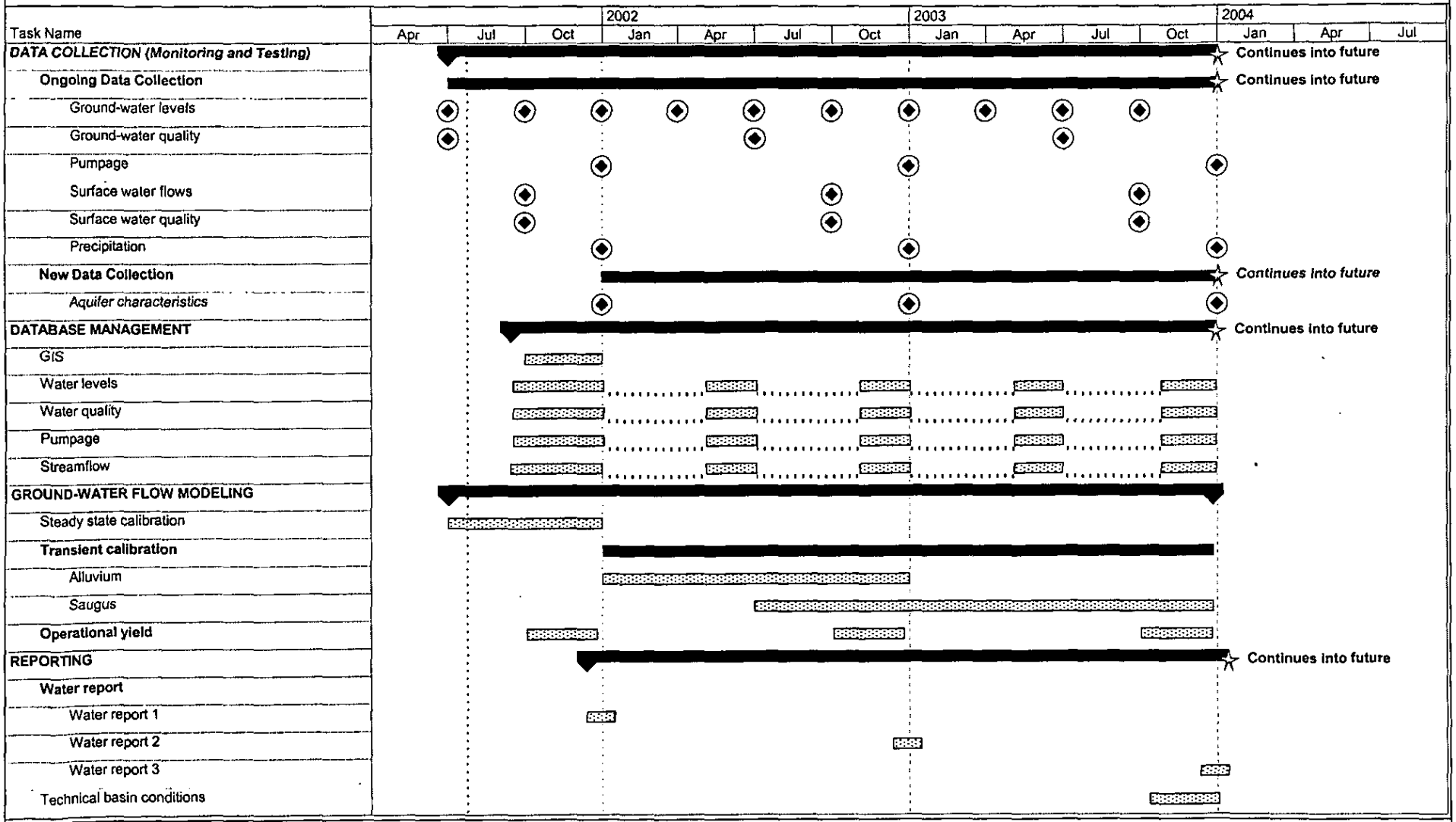
REPORTING

Beginning in 1998, an annual report on water supply conditions in the Upper Santa Clara River area has been prepared by the water purveyors in the Upper River area. Those reports have focused on a planning-level discussion of current and immediate future water demands, and the availability of local Groundwater and imported surface water to meet those demands. The overall primary objectives of the reports have been to provide some documentation, to local and County planners as

well as County Supervisors, on the water supply conditions in the Santa Clarita Valley and to present a general assessment of the status of groundwater conditions in both the Alluvial and Saugus aquifer systems, with a focus of that assessment on historical and recent groundwater development within operating yield parameters.

As the water resource monitoring program described above is implemented and evolves, it is planned that reporting on groundwater basin conditions will evolve in two generally parallel ways: 1) a continuation of the annual reporting on current water supply conditions, as a basis for current planning and consideration of development proposals; and 2) the addition of less frequent, more technically oriented reports on the geologic and hydrologic aspects of the groundwater resources of the Upper River area, including documentation of: a) groundwater basin conditions, b) development and application of modeling efforts to assess operational yield and the impacts of long-term planned utilization of local groundwater as part of the overall water supply, and c) assessment of actual versus predicted impacts on groundwater and surface water, including basin outflows, combined with ongoing updated assessments of the adequacy of local groundwater management actions and identification of any needed changes which are identified over time. As needed, the resource monitoring program and technical reports will be coordinated with interested regulatory agencies such as the Regional Water Quality Control Board, the California Department of Health Services and the California Department of Toxics and Substance Control.

Exhibit 2
WATER RESOURCE MONITORING PROGRAM
UPPER SANTA CLARA RIVER AREA



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Appendix B
Description of the Santa Clarita Valley Regional Groundwater Flow Model

APPENDIX B

Description of the Santa Clarita Valley Regional Groundwater Flow Model

B.1 Introduction

The Santa Clarita Valley Regional Groundwater Flow Model (hereafter referred to as the Regional Model) is a three-dimensional, numerical model of groundwater flow that covers the entire area underlain by the Saugus Formation, plus the portions of the Alluvial Aquifer that lie beyond the limits of the Saugus Formation. A Surface Water Routing Model (SWRM) was also developed specifically for this basin as a pre- and post-processor for the Regional Model.

The approach to developing the Regional Model included the following steps:

1. Compiling information on the geology and hydrogeology of the valley and developing a conceptual understanding of the groundwater flow system
2. Creating a variety of data sets to conduct steady-state and transient calibrations
3. Constructing the Regional Model using the MicroFEM® finite-element groundwater flow code (Hemker and de Boer, 2003), and also using the available database and geographic information system (GIS) information for the Santa Clarita Valley
4. Calibrating the Regional Model
5. Performing sensitivity tests on the Regional Model

This appendix provides an overview of the Regional Model's construction and calibration. The construction and calibration of the Regional Model and the SWRM are described in detail in the *Regional Groundwater Flow Model for the Santa Clarita Valley, Santa Clarita, California* (CH2M HILL, 2004a).

B.2 Model Construction

B.2.1 Software

The Regional Model was constructed using the three-dimensional, finite-element groundwater modeling software MicroFEM® (Hemker and de Boer, 2003). MicroFEM® operates in a Windows™ environment and can be used to solve groundwater flow problems for unconfined, semi-confined, or confined aquifer systems. This software simulates steady-state or transient flow conditions in up to a 20-layer aquifer system; the finite-element mesh may contain as many as 50,000 nodes in each model layer. The software contains several different methods for simulating groundwater/surface water interactions. MicroFEM® is based on software developed in the Netherlands during the 1980s for use in evaluating the effects of groundwater pumping in areas with complicated meandering rivers. Further

details regarding this software's design, capabilities, and functionality can be found on the Internet at www.microfem.com and in two reviews of the software by Diodato (1997, 2000).

B.2.2 Model Grid

The Regional Model is based on a finite-element mesh consisting of 7 layers, with 17,103 nodes and 32,496 elements in each layer. The nodes are spaced 500 feet apart in the majority of the modeled area. However, a finer node spacing (150 feet) was used along the Santa Clara River and its tributaries to allow a more exact simulation of surface water/ groundwater exchanges. Additionally, specific nodes were placed within this regional grid at the locations of production and monitoring wells.

B.2.3 Layering

The upper model layer simulates the Alluvial Aquifer, or the upper portion of the Saugus Formation wherever the Alluvial Aquifer is not present. The six underlying layers simulate the underlying freshwater Saugus Formation and the Sunshine Ranch Member. The northern and southern edges of the model domain are defined by the geologic contacts mapped by Richard C. Slade and Associates, LLC (2002), formerly known as Richard C. Slade, Consulting Groundwater Geologist (both hereafter referred to as RCS), for the Alluvial Aquifer and the Saugus Formation.

The saturated thickness of the Alluvial Aquifer was defined from the average base elevation of the aquifer and the water level elevations measured during the fall of 1985 and the spring of 2000, as described by RCS (1986 and 2002). Along the Santa Clara River, the typical saturated thickness of the Alluvial Aquifer is as much as 130 feet in the western (down-gradient) portion of the basin and between 80 and 90 feet in the eastern (upgradient) portion of the basin, though it can be notably less in this area during droughts. Saturated thicknesses can be less than 60 feet in some tributary canyons, particularly along the South Fork Santa Clara River, where all production wells are constructed in the Saugus Formation, rather than the alluvium (RCS, 2002).

The Saugus Formation is generally a bowl-shaped structure that thins at its margins and has its greatest thickness (about 5,500 feet) in the center of the basin. The upper, freshwater-bearing portion of the Saugus Formation was simulated using 500-foot-thick model layers to depths as great as 2,500 feet in the center of the basin (RCS, 1988 and 2002). The deepest active model layer at any given location represented the Sunshine Ranch Member of the Saugus Formation, which is of marine origin and is, therefore, more saline and thought to have lower water-bearing potential than the overlying Saugus Formation deposits that are terrestrial in origin.

B.2.4 Boundary Conditions

The following boundary conditions were used in the Regional Model:

1. **Specified flux for precipitation within the model grid.** Deep percolation of precipitation was simulated using the precipitation top-system package contained in MicroFEM®.
2. **Specified flux for irrigation.** Deep percolation of agricultural irrigation and urban irrigation in developed areas was simulated using the precipitation top-system package contained in MicroFEM®.

3. **Specified flux and head-dependent flux along ephemeral streams**. With respect to groundwater discharges to streams, the Santa Clara River was modeled as an ephemeral, predominantly losing stream at and upstream of the mouth of San Francisquito Canyon, and as a perennial, predominantly gaining stream downstream of San Francisquito Canyon. The tributaries to the Santa Clara River were modeled as ephemeral streams, using the precipitation top-system package to specify stream leakage to groundwater. For these tributaries and the ephemeral reach of the Santa Clara River, groundwater recharge rates were estimated from precipitation records, stream-flow records, watershed maps, topographic maps, and aerial photography using the SWRM, which was developed specifically to calculate time-varying recharge at each stream node from these data. Aerial photos and historical observations indicated that under high water table conditions, groundwater can locally discharge into Castaic Creek and the ephemeral reach of the Santa Clara River wherever Alluvial groundwater levels rise above the riverbed elevation. Consequently, the drain package in MicroFEM® was used in these streams to allow for drainage of any groundwater that was calculated by MicroFEM® to be above the riverbed elevation in any given river node at any given time step.

4. **Specified flux and head-dependent flux along perennial Santa Clara River**. The perennial reach of the Santa Clara River was modeled using the wadi top-system package contained in MicroFEM®. The wadi package allows groundwater to discharge to the river whenever groundwater elevations are higher than the specified river stage. When groundwater levels are below the river stage, the river recharges the Alluvial Aquifer. The rate of recharge is proportional to the difference between the river stage elevation and the model-calculated groundwater elevation. However, after the groundwater elevation drops below the streambed sediments, the rate of leakage from the stream is constant (i.e., does not vary as the groundwater elevation fluctuates). For the Regional Model, each node along the perennial reach of the Santa Clara River was assigned a river stage 1 foot higher than the mapped bed elevation of the river. The riverbed permeability, or conductance, which helps control the model-calculated groundwater/surface water exchange rates, was adjusted during model calibration by calibrating to streamflow data collected at the County Line gage.

5. **Specified flux for pumping**. Pumping rates and locations for wells completed in the Alluvial Aquifer and the Saugus Formation were directly imported into the Regional Model from the Upper Santa Clara River Groundwater Basin database. For model calibration, pumping rates were assigned from water use records maintained by the Upper Basin Water Purveyors; estimates of monthly water demand for urban water use and agricultural water use; and well construction records, which were needed to determine which model layers at each individual well should be assigned pumping

6. **Specified flux at upgradient Alluvial Aquifer boundaries.** Where there is Alluvial groundwater flow into the study area from beneath Castaic Dam, the magnitude of the specified flux was adjusted during the model calibration process using groundwater elevations and gradients published by RCS (1986 and 2002).

7. **Specified groundwater elevation in the Alluvial Aquifer at the county line.** The groundwater elevation (805 feet) was obtained from water level contour maps for the

Alluvial Aquifer prepared by RCS (1986, 2002). (See Figure 2-7 in the main text for groundwater elevation contours during Spring 2000, as mapped by RCS [2002].)

8. **Specified groundwater elevation in the Alluvial Aquifer at the Lang gage.** The groundwater elevation (1,746 feet) was derived from topographic maps of the elevation of the Santa Clara River bed. As discussed in CH2M HILL in *Final Report: Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property* (2004b), the boundary condition at this location was converted to a constant-head boundary shortly after completion of the model development report. This change was made based on results from field reconnaissance that was performed in April and May of 2004, when the Santa Clara River was dry at the Lang gage. At that time, groundwater was locally discharging from the bed of the Santa Clara River in isolated locations where the riverbed intersects the water table, then seeping back into the riverbed nearby. Significant phreatophyte growth was also present along the riverbed in this same area (just downstream of the Lang gage). Additionally, water was present and actively flowing in the river east (upstream) of the Santa Clarita Valley (in the area between the Santa Clarita Valley and the upstream Acton Basin). Based on these observations, a specified groundwater elevation of 1,746 feet was established in the Alluvial Aquifer at the eastern boundary of the Regional Model to simulate subsurface flow beneath the channel of the Santa Clara River at the Lang gage. This specified elevation was held constant throughout the simulation period.

9. **Head-dependent flux for evapotranspiration (ET).** ET from the water table by riparian vegetation was simulated using the evaporation top-system package contained in MicroFEM®. This package requires specification of the maximum rooting depth for the riparian vegetation, the maximum potential ET rate, and the ground surface elevation.

10. **No-flow boundaries**. In general, the outermost line of nodes that form the model boundary and the bottom of the model are no-flow boundaries. The exceptions are the western model boundary (specified head) and the specified-flux nodes representing underflow into the Alluvial Aquifer from beneath Castaic Dam. Also, all nodes on the model boundary are assigned specified fluxes due to precipitation and, in some cases, ephemeral streamflow.

B.2.5 Aquifer Parameters

The selection of the aquifer parameter values (horizontal and vertical hydraulic conductivity, storage coefficients, streambed conductance, and ET parameters) is described in detail in Sections 4 and 5 of the Regional Model development report (CH2M HILL, 2004a). Initial estimates of, and ranges of values for, these parameters were defined during initial model development and adjusted on an as-needed basis, and within certain limits, during model calibration. Additionally, the calibration process adjusted the coefficients for an empirical power-function equation (Turner, 1986) that was used in the SWRM to define the relationship between precipitation, stormwater flow, and the amount of stormwater flow available for potential infiltration to groundwater.

B.3 Model Calibration

B.3.1 Calibration Process

Calibration of the Regional Model involved matching both steady-state and transient conditions in the Alluvial Aquifer and the Saugus Formation. The steady-state calibration was performed for calendar years 1980 through 1985, and the transient calibration was performed for calendar years 1980 through 1999. The goals of the initial calibration process were generally to match groundwater flow directions, groundwater gradients, and groundwater elevations that were measured throughout the 20-year simulation period at wells across the valley. An additional calibration goal was to match the patterns of total flow in the Santa Clara River and estimated groundwater discharge rates to the river. The Alluvial Aquifer and the Saugus Formation were each subdivided into zones to facilitate parameter selection and model calibration. Model variables were adjusted in a manner that sought to honor independent estimates of parameter values while resulting in the best possible calibration.

B.3.2 Calibration Quality

The Regional Model meets most of the qualitative and quantitative goals that were established for the calibration process. For the steady-state model, statistical goals for the head residuals, which are equal to the modeled minus measured groundwater elevations, were easily met for the Alluvial Aquifer and adequately met for the Saugus Formation. For the transient model, trends in groundwater elevations were generally well matched, and groundwater discharges to the river were simulated well for both the steady-state and transient models. However, during the middle and late 1990s, the model tended to simulate too much decline in Alluvial Aquifer groundwater elevations in the eastern-most portion of the valley. This is the area where local droughts have the greatest effect on the Upper Basin Water Purveyors' ability to pump groundwater, so this deviation is acceptable because predictive simulations of various groundwater pumping strategies will not overestimate the degree to which groundwater can be pumped from the Alluvial Aquifer in this area during periods of below-normal rainfall.

The groundwater budget for the 20-year transient calibration period showed that recharge from precipitation and streamflows varied considerably from year to year, ranging from less than 15,000 acre-feet per year (AF/yr) in the driest years to as much as 270,000 AF/yr in the wettest years. In contrast, total groundwater discharges were less variable, ranging from approximately 61,000 AF/yr at the end of the late 1980s/early 1990s drought to 116,000 AF/yr during 1998. This variability in groundwater discharge did not follow the year-to-year pumping patterns, but instead was caused by year-to-year fluctuations in ET and groundwater discharges to the river. These fluctuations, in turn, correlated well with groundwater recharge patterns. During the 20-year transient calibration period, changes in the volume of groundwater stored in the combined Alluvial-Saugus aquifer system varied primarily according to year-to-year variations in regional rainfall. No long-term decline in groundwater storage was observed in the field or simulated by the Regional Model during the calibration period.

B.3.3 Calibration Update

In a recent technical memorandum (CH2M HILL, 2005), the calibration of the Regional Model was extended an additional 62 months (from January 2000 through February 2005) to update and test the model's calibration against an independent data set consisting of recently observed hydrologic and pumping conditions in the basin. Examination of groundwater elevation hydrographs for the Alluvial Aquifer and the Saugus Formation indicated that the model showed a similar overall ability to simulate conditions during the recent 5-year period, as was the case for the preceding 20-year period to which the model was originally calibrated.

B.4 Model Sensitivity

Sensitivity analyses were performed to evaluate whether further changes in the values of key model parameters would improve the calibration quality of the Regional Model. Variables that were tested were the hydraulic properties (horizontal and vertical hydraulic conductivities and storage coefficients) for the Alluvial Aquifer and the Saugus Formation, the riverbed leakage terms for the Santa Clara River and Castaic Creek, and the ET parameters. The sensitivity analysis indicated that the Regional Model is calibrated well and that it is sensitive to the choices of horizontal hydraulic conductivity in both aquifers and the vertical hydraulic conductivity values in the Saugus Formation. The model is also sensitive to the surface water parameters, specifically the choice of empirical coefficients used by the Turner (1986) equation to estimate stormwater flows from rainfall data and the riverbed leakage terms in both the eastern (groundwater recharge) and western (groundwater discharge) portions of the basin. The model is relatively insensitive to the choice of ET parameters.

B.5 Model Applicability

The process of developing the conceptual model of the local groundwater basin, developing a detailed numerical model, calibrating the model to a 20-year period of groundwater elevation and streamflow data, and independently testing the calibration against a recent set of basin conditions has resulted in a groundwater flow model that is suitable for its intended applications, which are evaluating groundwater management strategies, groundwater sustainability, artificial recharge options, and restoration of contaminated water supplies. The primary design and calibration attributes that make the Regional Model appropriate for its intended uses are as follows:

1. Its ability to simulate historical trends in groundwater elevations and river flows during a 2-decade period that reflects increased urbanization, increased State Water Project water imports (from outside the valley), and associated changes in land use and water use
2. Its ability to simulate trends in smaller geographic areas of interest within the valley (for example, near the Whittaker-Bermite property)
3. Its use of an integrated model of the watershed to define the amount of rainfall and stormwater that is potentially available to recharge the groundwater system

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Impact and Response to Perchlorate Contamination

Valencia Water Company Well Q2

prepared for

Valencia Water Company

prepared by

Luhdorff & Scalmanini,
Consulting Engineers

April 2005

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CONSULTING ENGINEERS

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I. Introduction and Background

Perchlorate has been a water quality concern in the Santa Clarita Valley since 1997 when it was originally detected in four Saugus wells operated by the municipal water purveyors in the eastern part of the Saugus Formation, near the former Whittaker-Bermite facility. In late 2002, perchlorate was detected in a fifth municipal well, in this case an Alluvial well also located near the former Whittaker-Bermite site. The five perchlorate-impacted wells have been removed from active water supply service.

At present, perchlorate is not a regulated chemical in drinking water. However, the state Department of Health Services (DHS) requires that water utilities test their water sources for certain unregulated chemicals, and perchlorate is one of those chemicals. The DHS "notification level" for perchlorate is 6 micrograms per liter (ug/l).[1] DHS currently anticipates proposing a Maximum Contaminant Level (MCL) for perchlorate in 2005.

Since the detection of perchlorate and resultant inactivation of impacted wells, the Purveyors have been conducting regular monitoring of active wells near the Whittaker-Bermite site. In late March 2005, that monitoring detected the presence of perchlorate in Valencia Water Company's Well Q2, an alluvial well located immediately northwest of the confluence of Bouquet Creek and the Santa Clara River (Figure I-1). The initial detection of perchlorate was at a concentration of 11 ug/l; two confirmation samples in the first two weeks of April detected perchlorate at concentrations of 9.8 and 10 ug/l, respectively. As a result of the detection and confirmation of perchlorate in its Well Q2, Valencia has removed the well from active service and is pursuing rapid permitting and installation of wellhead treatment, as described herein, in order to return the well to water supply service.

For several years prior to the recent detection of perchlorate in Valencia's Well Q2, the water Purveyors have recognized that, among other aspects of an overall remediation program, such a program would most likely include an element of pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. The overall program would also include the installation of treatment to allow the restored pumping capacity to be used for municipal supply. In cooperation with state regulatory agencies and

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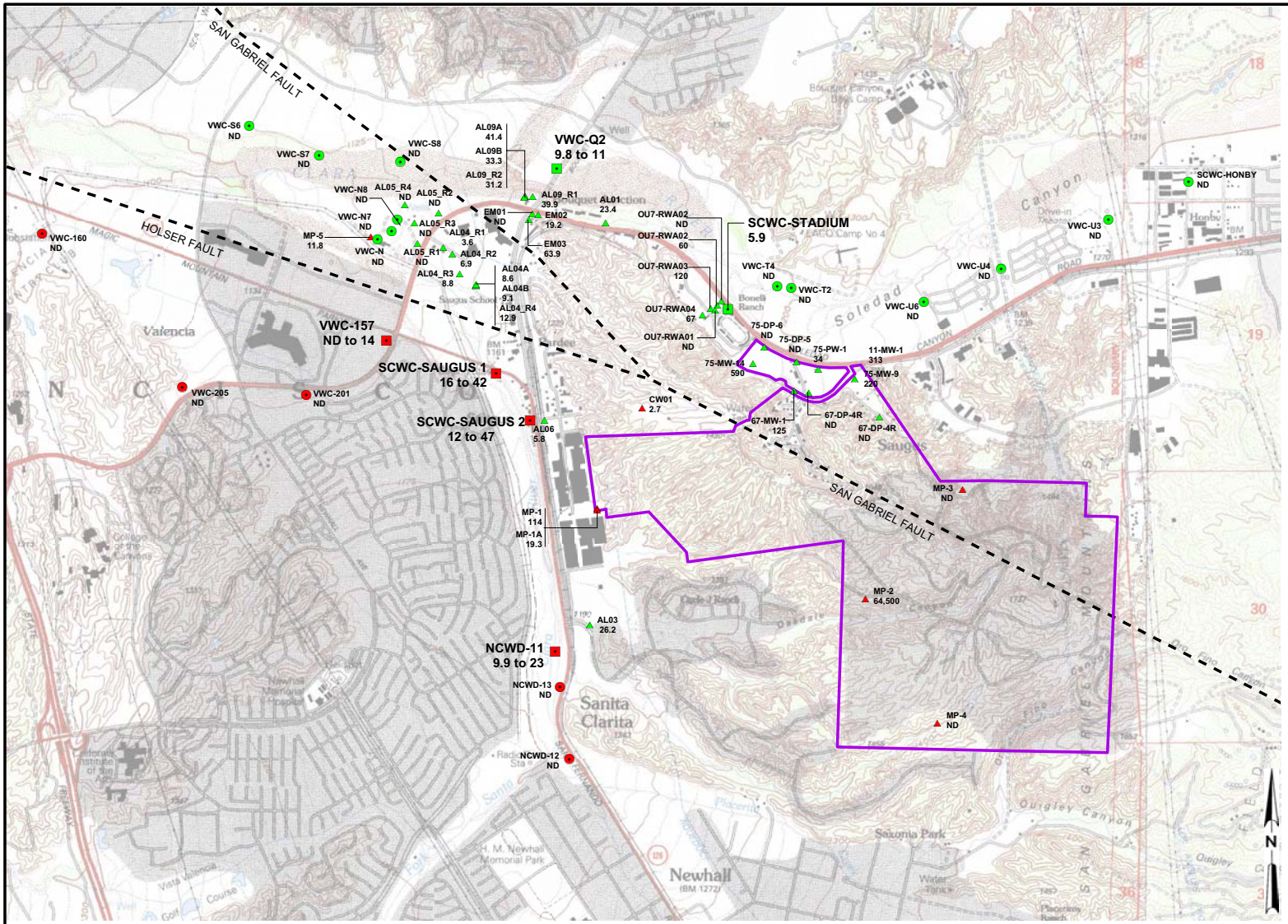
[1] "Notification level" means the concentration level of a contaminant in drinking water delivered for human consumption that DHS has determined, based on available specific information, does not pose a significant health risk but warrants notification pursuant to applicable law. Notification levels are nonregulatory, health-based advisory levels established by DHS for contaminants in drinking water for which maximum contaminant levels have not been established. Notification levels are established as precautionary measures for contaminants that may be considered candidates for establishment of maximum contaminant levels, but have not yet undergone or completed the regulatory standard setting process prescribed for the development of maximum contaminant levels. Notification levels are not drinking water standards.



LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
3. µg/L = MICROGRAMS PER LITER.

FIGURE 1-1
WELL LOCATION MAP
SANTA CLARITA, CALIFORNIA

CH2MHILL

RDD \\ODIN\PROJ2\55\SANTACLARITA_MOU\FIGURES\MXD\042205\FIG01.MXD FIG01.PDF 04/22/2005

investigators working for Whittaker-Bermite, Castaic Lake Water Agency (CLWA) and the Purveyors, including Valencia Water Company, have developed an off-site plan that will include installation of water treatment facilities to remove perchlorate and restore operation of two of the initially impacted Saugus wells through that treatment process. The operation of those two wells with treatment, scheduled to be in service in 2006, will hydraulically contain the perchlorate contamination moving from the former Whittaker-Bermite site and protect downgradient non-impacted wells. It will also restore the annual volumes of water that were pumped from the impacted wells before they were inactivated. In concert with the installation of treatment and the return of certain impacted wells to active water supply service, the balance of total pumping capacity from the impacted wells will be restored by constructing replacement wells in a non-impacted portion of the basin west of Interstate 5.

The development of the control and restoration plan for the initially impacted wells included consideration that it should fit within the larger scale of on-site and possibly other off-site remediation activities. While such activities did not specifically anticipate the treatment of VWC's Well Q2 as described herein, utilization of the same treatment methodology and operation of the well to contain perchlorate from contamination of downgradient wells, are consistent with currently planned and other potential on-site and off-site remediation activities.

II. Impact of Water Supply

As a result of the recent detection of perchlorate, Valencia Water Company has removed Well Q2 from active water supply service until it can install wellhead treatment for perchlorate removal, as described herein, such that the well can be returned to service. Although it is expected that the permitting and installation of wellhead treatment can be accomplished by mid-summer, in advance of the peak water demand season, it is appropriate to assess the impact of the removal of Well Q2 on the overall adequacy of Valencia's water supply until such treatment is in place and the well is returned as part of Valencia's total water supply.

The overall adequacy of water supply derives from three considerations: 1) sufficient source capacity (wells and pumps, plus other sources such as, in this case, connections to CLWA's treated surface water distribution system); 2) sustainability of the groundwater resource to meet the demand of Valencia and other pumpers in the basin on a renewable basis; and 3) protection of groundwater sources (wells) from known contamination, or provisions for treatment in the event of contamination. All three considerations are discussed in the following sections.

Adequacy of Source Capacity

The temporary removal of Well Q2 from active service represents a reduction of 1,200 gpm of source capacity. After that removal, Valencia still has a total of 19 active operational wells, 14 wells completed in the Alluvial aquifer and 5 wells completed in the Saugus Formation. The combined pumping capacities of the 14 Alluvial wells is slightly more than 20,000 gpm, and the combined pumping capacities of the 5 Saugus wells is slightly more than 10,000 gpm. The individual pumping capacity of each Valencia well is listed in Table II-1.

In addition to its water supply wells, Valencia has six connections to CLWA's system that distributes treated surface water from the State Water Project to the various municipal purveyors in the Valley. The combined capacity of those four connections (Turnouts V2, V4, V5, V6, V7 and V8) is 26,500 gpm. The individual capacity of each CLWA turnout connection to the Valencia distribution system is listed in Table II-2.

The combined source capacity of Valencia's active wells, after temporary inactivation of Well Q2, and its CLWA turnouts is thus a total of about 57,000 gpm.

As part of recent review of its overall water supply, Valencia examined its maximum day demand in the last year, 2004. The maximum day demand occurred in July, when the largest historical single day demand of 143.3 acre-feet was experienced. That volumetric demand equates to an average flow on that day of nearly 32,500 gpm.

Table II-1
Active Groundwater Source Capacity
Valencia Water Company

Well	Pump Capacity (gpm)	Maximum Annual Capacity (af)	Normal Year Production[1] (af)	Dry Year Production[1] (af)
Alluvium				
Well D	1,050	1,690	690	690
Well N	1,250	2,010	620	620
Well N7	2,500	4,030	1,160	1,160
Well N8	2,500	4,030	1,160	1,160
Well S6	2,000	3,220	865	865
Well S7	2,000	3,220	865	865
Well S8	2,000	3,220	865	865
Well T2	800	1,290	460	460
Well T4	700	1,120	460	460
Well U4	1,000	1,610	935	935
Well U6	1,250	2,010	825	825
Well W9	800	1,290	600	600
Well W10	1,600	2,410	865	865
Well W11	1,000	1,610	350	350
Alluvial Subtotal	**20,350**	**32,760**	**10,720**	**10,720**
Saugus Formation				
159	500	800	50	50
160	2,000	3,220	1,000	1,330
201	2,400	3,670	100	3,577
205	2,700	4,350	1,000	3,827
206	2,500	4,030	1,175	3,500
Saugus Subtotal	**10,100**	**16,270**	**3,325**	**12,284**
Total Active Capacity	**30,450**	**49,030**	**14,045**	**23,004**

1. based on recent actual annual pumping; also as simulated in perchlorate containment analysis (CH2M Hill, 2004).

Table II-2
Turnout Connections to CLWA Treated Water Distribution
Valencia Water Company

Station Number	Number of Pumps and Total Horsepower	Capacity (gpm)
V2	Pressure Regulating Station	3,000
V4	3 – 195	4,500
V5	3 – 155	4,500
V6	2 – 25	1,500
V7	Pressure Regulating Station	5,000
V8	3 – 300	8,000
	Total	**26,500**

In accordance with the provisions of the Waterworks Standards in the California Health and Safety Code, and also in accordance with the provisions of the State Public Water Commission, the source capacity of a municipal water purveyor should be adequate to meet maximum day demand. Generally accepted engineering practice adds a factor of safety to those minimum requirements to account for possible outages of one or more supply sources during a period of maximum day demand. With total source capacity of about 57,000 gpm, after temporary deactivation of Well Q2, Valencia has sufficient source capacity to meet its maximum day demand of 32,500 gpm with allowance for potential outage of one or more individual sources (wells) or treated surface water connections. As a result, the temporary deactivation of Well Q2 does not adversely impact Valencia's ability to meet existing demands; in fact, Valencia has sufficient surplus source capacity to meet future increases in maximum day demand with existing sources, to be increased by returning Q2 to service after installation of treatment as described herein.

Sustainability of Groundwater

In contrast to assessing the adequacy of Valencia's source capacity by examining the total capacity of its water sources and comparing it to Valencia's maximum day demand, the sustainability of groundwater resources in the Valley is more appropriately assessed by

examining the response of the groundwater basin to the collective pumping demands placed on it for municipal and ongoing agricultural water supply. Until recently, the long-term renewability of Alluvial groundwater was empirically determined from approximately 60 years of recorded experience: long-term stability in groundwater levels and storage, with some dry period fluctuations in the eastern part of the basin, over a historical range of Alluvial pumpage from as low as about 20,000 afy to as high as about 43,000 afy. The long-term sustainability of Saugus groundwater was empirically determined from a more historical record that shows fairly low annual pumping in most years, with one four-year period of increased pumping up to about 15,000 afy, that produced no long-term depletion of the substantial groundwater storage in the Saugus. Those empirical observations in both the Alluvium and the Saugus Formation have now been complemented by the development and application of a numerical groundwater flow model, which has been used to predict aquifer response to the planned operating ranges of pumping from both aquifers for both municipal and agricultural water supply. The numerical groundwater flow model has also been used to analyze the control of contaminant migration under selected pumping conditions that would restore, with treatment, pumping capacity that has been inactivated due to perchlorate contamination detected in some wells in the basin as described herein.

To examine the yield of the Alluvium or, in other words, the sustainability of Alluvium on a renewable basis, the groundwater flow model was used to examine long-term projected response of the aquifer to pumping for municipal and agricultural uses in the 30,000 to 40,000 afy range under average/normal and wet conditions, and in the 30,000 to 35,000 afy range under locally dry conditions. To examine the response of the entire aquifer system, the model also incorporated pumping from the Saugus Formation in accordance with the normal (7,500-15,000 afy) and dry year (15,000-35,000 afy) operating plan for that aquifer. The preceding ranges of pumping from the two aquifer systems, commonly known locally as the operating plan for groundwater supply, are described in detail in the Amended 2000 Urban Water Management Plan prepared by CLWA and the municipal Purveyors in the Valley. The model was run over a 78 year hydrologic period which was selected from actual historical hydrology (i.e., precipitation) to examine a number of hydrologic conditions that would be expected to affect both groundwater pumping and groundwater recharge. The selected 78 year simulation period was assembled from an assumed recurrence of 1980 to 2003 hydrologic conditions, followed by an assumed recurrence of 1950 to 2003 hydrologic conditions. The 78 year period was analyzed to define both local hydrologic conditions (normal vs. dry), which affect the rate of pumping from the Alluvium, and hydrologic conditions that affect State Water Project operations, which in turn affect the rate of pumping from the Saugus.

The resultant pumping cycles are summarized as follows:

- Twenty-four years of dry year Alluvial pumping at 30,000 to 35,000 afy,

- One drought of four consecutive dry years of Alluvial pumping at 30,000 to 35,000 afy,

- Two droughts of three consecutive dry years each, with Alluvial pumping at 30,000 to 35,000 afy,

- Three selected years with assigned dry-year Alluvial pumping despite near-normal or above-normal rainfall because each selected year was preceded by a multi-year drought,

- Eighteen years of dry-year pumping from the Saugus, or an average of one dry year approximately every four years,

- Two droughts lasting three years, plus (in both cases) a dry year that occurs two years before the beginning of each three-year drought and another dry year that begins one year after each three-year drought has ended; Saugus pumping increased into the 15,000 to 35,000 afy range in all those years,

- Two droughts lasting two years; Saugus pumping increased into the 15,000 to 25,000 afy range in those years,

- Sixty years of normal-year Saugus pumping, 7,500 to 15,000 afy.

The preceding ranges of Saugus pumping included the planned restoration of recent historic pumping from the perchlorate-impacted wells. That pumping was analyzed to assess, in addition to the overall recharge of the Saugus, the effectiveness of controlling the migration of perchlorate by extracting and treating contaminated water close to the source of contamination.

Simulated Alluvial aquifer response to the preceding range of hydrologic conditions and pumping stresses was essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades. The resultant response consisted of: 1) generally constant groundwater levels in the middle to western portion of the Alluvium, and fluctuating groundwater levels in the eastern portion of the Alluvium as a function of wet and dry hydrologic conditions, 2) variations in recharge that directly correlate with wet and dry hydrologic conditions, and 3) no long-term decline in groundwater levels or storage. Based on the combination of actual experience with Alluvial aquifer pumping at capacities similar to those planned for the future and the resultant sustainability (recharge) of groundwater levels and storage, complemented by modeled projections of aquifer response to planned pumping rates that also show no depletion of groundwater, the Alluvial aquifer can be considered a sustainable water supply source to meet the Alluvial portion of the operating plan for the groundwater basin.

Simulated Saugus Formation response to the ranges of pumping under assumed recurrent historical hydrologic conditions was consistent with actual experience under smaller pumping rates. The response consisted of: 1) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping, 2) rapid recovery of groundwater levels and storage after cessation of dry-period pumping, and 3) no long-term decreases or depletion of groundwater levels or storage. The combination of actual experience with Saugus pumping and recharge up to about 15,000 afy, now complemented by modeled projections of aquifer response that show long-term utility of the Saugus at 7,500 to 15,000 afy in normal years and rapid recovery from higher pumping rates during intermittent dry periods, shows that the Saugus Formation can be considered a sustainable water supply source to meet the Saugus portion of the operating plan for the groundwater basin.

Protection of Other Sources (Wells)

Some detail of the overall perchlorate contamination issue, which has had a larger impact on the Saugus Formation than on the Alluvium, is included in **Status of Saugus Restoration and Containment** below. As detailed in that section, there has been extensive investigation of the extent of perchlorate contamination which, in combination with the groundwater modeling described above, has led to the current plan for integrated control of contamination migration and restoration of impacted pumping (well) capacity by 2006. While most of the perchlorate control and restoration plan is focused on the Saugus Formation, part of that plan includes induced capture of potentially contaminated groundwater in the Alluvium by pumping of selected Saugus wells. Specific long-term resolution of perchlorate contamination in the Alluvium, which had previously impacted just one water supply well, is currently expected to focus on source control through on-site treatment in the northern Alluvium (at the north of the former Whittaker-Bermite site) and subsequent restoration of the contaminated Stadium Well. In the interim, the questions are how the recently impacted Well Q2 will be resolved, and whether other active Alluvial wells could be contaminated and, if so, what effect that might have on the adequacy of Alluvial groundwater supplies.

Until the recent detection of perchlorate in Valencia's Well Q2, ongoing monitoring of all active municipal wells near the Whittaker-Bermite site had shown no detections of perchlorate in any active Alluvial wells. However, based on a combination of proximity to the Whittaker-Bermite site and prevailing groundwater flow directions, there was logical concern that perchlorate could contaminate nearby, downgradient Alluvial wells, and, as a result, there have been provisions in place to respond to perchlorate contamination if it should occur. The groundwater model was used to examine capture zones around Alluvial wells under planned operating conditions (pumping capacities and volumes) for the time period through currently scheduled restoration of impacted contaminated wells by 2006. That capture zone analysis of Alluvial wells generally near the Whittaker-Bermite site suggested that inflow to those wells would either be upgradient

of the contamination site, or would be from the Alluvium beyond where perchlorate is most likely to be transported.

At the time of the preceding analysis, a noted possible exception to its conclusions involved Valencia Water Company's Pardee wellfield, which includes its Wells N, N7, and N8. Although the capture zone analysis did not show the Pardee wells to be impacted, they were considered to be at some potential risk due to the proximity of their capture zone to the Whittaker-Bermite site. Other nearby Alluvial wells, including Valencia's Well Q2, were considered to be at lesser risk due to their distances from the site, orientation to groundwater flow near the site, and other factors such as the presence of the Santa Clara River between the wells and the Whittaker-Bermite site.

With recognition that potentially at-risk wells such as Valencia's Pardee wellfield could be readily replaced on an interim basis by utilizing some of the surplus capacity among all the other Alluvial wells, Valencia has planned for some time that, if the Pardee wells were impacted by perchlorate contamination, it has made site provisions at those wells for installation of wellhead treatment. Such treatment would be the same methodology as planned for long-term treatment of the contaminated Saugus wells. With treatment installed, Valencia would retain the wells in service for the same objectives as planned for restoring impacted Saugus pumping capacity by extracting contaminated water, treating it for beneficial (drinking water) use, and controlling local groundwater flow to protect further downgradient wells. The response to perchlorate detection in Well Q2 is identical to what was envisioned in the event of contamination at the Pardee wells.

III. Response Plan for Well Q2

As described in the status discussion below, one of the completed tasks in the overall response to perchlorate contamination of four Saugus wells has been the evaluation of alternative treatment methodologies and the selection of ion exchange for removal of perchlorate from water to be pumped from the two impacted wells that will be used for a combination of containment and capture of perchlorate contamination. As a result of that completed work, Valencia was in a position to immediately respond to the confirmed detection of perchlorate in Well Q2 by opening contract discussions with a selected contractor who can furnish, install and operate the same ion exchange treatment methodology which has been selected for the impacted Saugus wells.

In light of the preceding, after detection of perchlorate in its Well Q2, Valencia contacted USFilter to prepare a complete turnkey service contract to install and maintain treatment facilities capable of removing perchlorate pumped from the well to a non-detectable level. USFilter would cover all major components and estimate of installation materials and labor for start-up. The specific Q2 treatment system will incorporate USFilter HP1220HF ion exchange pressure vessels operating in a lead/lag configuration. The vessels are 12 feet in diameter and each will contain a selective resin designed to remove perchlorate. There is no waste brine generated from this treatment system. If resign replacement is necessary, USFilter will remove the resin from the treatment system and destroy it by incineration at an approved waste site.

Well Q2 is located along Bouquet Canyon Road adjacent to the Rio Vista Pump Station owned by CLWA. The treatment system will be located on the existing well site property which is owned by Valencia or, if necessary, use a small portion of land owned by CLWA. Valencia is preparing a site plan that will require constructing a concrete foundation for the ion exchange pressure vessels and other ancillary equipment and controls required to integrate the treatment system into its water supply operations.

Installing wellhead treatment at Well Q2 will require review and approval by the California Department of Health Services (DHS). Valencia will prepare and submit an application to amend Valencia's water supply permit allowing wellhead treatment at Well Q2. DHS approval is expected since ion exchange technology is recognized by DHS as "best available technology" for perchlorate removal, and multiple ion exchange treatment systems have been approved and permitted by DHS for drinking water systems. Also, the Department of Toxic Substances Control (DTSC) will include this project as part of the interim actions required to address perchlorate contamination in the Northern Alluvium. Their review was contemplated under the existing Environmental Oversight Agreement between the water purveyors and DTSC.

Since Valencia is able to rapidly respond to the contamination of its Well Q2 by installation of site modifications and turnkey contracting for treatment equipment, it intends to cooperatively pursue the amended water supply permit so it can return the well to service as soon as possible.

IV. Protection Plan for Non-Impacted Wells

As noted above, based on a combination of proximity to the Whittaker-Bermite site and prevailing groundwater flow directions, there is a logical concern that perchlorate could impact nearby downgradient Alluvial wells, the closest of which are owned and operated by Valencia. As part of assessing their overall groundwater supply during the period before the impacted Saugus wells are restored in 2006, the Purveyors commissioned the use of the groundwater flow model to examine capture zones around nearby Alluvial wells under planned pumping operations through that time period. The results of that work, as reported in the CH2M Hill Technical Memorandum "*Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property*" (Santa Clarita, California), suggested that inflow to the nearby Alluvial wells would either be upgradient of the contamination site, or would be from the Alluvium beyond where perchlorate is most likely to be transported. However, again due primarily to proximity, in this case between the capture zones and the Whittaker-Bermite site, the nearest Valencia Pardee wellfield (Wells N, N7 and N8) was considered to be at some potential risk because perchlorate had been detected in nearby Alluvial monitoring wells that were installed as part of a federally funded investigation of the extent and nature of contamination by the Army Corps of Engineers. As previously described, the other nearby Alluvial wells, including Valencia's Well Q2, were considered to be at lesser risk. Ultimately, irrespective of model simulations or other considerations, Valencia has responsibilities to supply both adequate and safe municipal water and, as a result, is prepared to respond to impacts at any of its nearby Alluvial wells in a similar manner as described for Well Q2 herein.

Thus, the response by Valencia to any future well impacted by perchlorate contamination will be to install wellhead treatment as soon as practicable, thereby ensuring adequate supplies of high quality water to its customers. Toward that end, Valencia has already dedicated space at each of the nearest well sites for addition of wellhead treatment facilities, as will be installed at Well Q2, if necessary. This short-term response plan complements the longer term actions being taken by the property owner under supervision of DTSC. For example, studies conducted by consultants under contract with the property owner have completed successful testing of in-situ groundwater remediation of perchlorate. It is anticipated this program along with several other measures approved by DTSC will be implemented over time to contain and remove perchlorate from the Northern Alluvium. Once this is accomplished, the detection of perchlorate in the Northern Alluvium is expected to decline below detectable levels over time. Successful groundwater remediation will ultimately result in the removal of wellhead treatment at wells no longer impacted by perchlorate contamination.

V. Status of Saugus Restoration and Containment

From the outset of dealing with the detection of perchlorate in the four Saugus wells in 1997, the Purveyors have recognized that, among other aspects of an overall remediation programs, such a program would most likely include an element of pumping from impacted wells, or from other wells in the immediate area, to establish hydraulic conditions that would control the migration of contamination from further impacting the aquifer in a downgradient (westerly) direction. Thus, the Purveyors expected that, as the regulatory process moved forward, the overall perchlorate remediation program could include dedicated pumping from some or all of their impacted wells, with appropriate treatment, such that two desirable objectives could both be achieved: control of subsurface flow and protection of downgradient wells, and restoration of some or all impacted water supply. Not all impacted capacity is required, however, for control of groundwater flow. As a result, the remaining capacity would be replaced by construction of replacement wells at other non-impacted locations.

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, CLWA and the water Purveyors in the Santa Clarita Valley have developed an off-site plan that focuses on the above concepts of groundwater flow control and restored pumping capacity, and also fits within the larger scale of on-site and possibly other off-site remediation activities. As specifically relates to water supply, the plan includes the following:

- constructing and operating a water treatment process that removes perchlorate from two contaminated wells such that the produced water can be used for municipal supply,

- hydraulically containing the perchlorate contamination moving from the Whittaker-Bermite site toward the impacted wells by pumping the wells at rates that will capture water from all directions around them,

- protecting the downgradient non-impacted wells via the same hydraulic containment that results from pumping two of the contaminated wells,

- restoring the annual volumes of water that were pumped from the impacted wells before they were inactivated, and also restoring the wells' total capacity to produce water in a manner consistent with the Purveyor's operational plan for groundwater supply.

The schedule for implementation of the plan to restore the initially impacted wells is that permitting, design and construction is to be complete by 2006.

Returning any of the contaminated wells to municipal water supply service by installing treatment requires issuance of a permit from DHS before the water can be considered potable and safe for delivery to consumers. The permit requirements, contained in DHS Policy Memo 97-005 for direct domestic use of impaired water sources, include formal studies and engineering work to demonstrate that pumping these wells and treating the water will be protective of public health for users of the water. The policy memo requires that DHS review the water purveyor's plan, establish appropriate permit conditions for the wells and treatment system, and provide overall approval of returning the contaminated wells to service for potable use. Ultimately, the Purveyor's plan and the DHS requirements are intended to ensure that the water introduced to the potable water distribution system has no detectable concentration of perchlorate.

As part of the formal permitting for use of impacted wells with treatment, DHS Policy 97-005 requires an analysis to demonstrate contaminant capture and protection of other nearby water supply wells. The development and calibration of a numerical groundwater flow model of the entire basin was initiated as a result of a 2001 Memorandum of Understanding among the Upper Basin Water Purveyors (CLWA, CLWA Santa Clarita Water Division, Los Angeles County Waterworks District 36, and Valencia Water Company) and the United Water Conservation District in Ventura County. Although the groundwater model was initially intended for use in analyzing the yield and sustainability of groundwater in the basin, it was adaptable to analyze both the sustainability of groundwater under an operational scenario that included the full restoration of perchlorate-impacted supply, and the containment of perchlorate near the Whittaker-Bermite property (i.e. by pumping some of the impacted wells), including preventing the movement of perchlorate contamination to other portions of the aquifer system. DTSC reviewed and approved the construction and calibration of the regional model as described in the final model report "*Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration*" (CH2M Hill, April, 2004).

After DTSC approval of the model, it was used to simulate the capture and control of perchlorate via restoration of contaminated wells, with treatment, as described above. The results of that work are summarized in a second report "*Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California*" (CH2M Hill, September 2004). The modeling analysis indicated that the pumping of contaminated wells SCWC-Saugus1 and SCWC-Saugus2 at rates of 1,200 gpm each on a nearly continual basis will effectively contain perchlorate migrating westward in the Saugus Formation from the Whittaker-Bermite property. The analysis also indicated that 1) no new production wells are needed in the Saugus Formation to meet the perchlorate containment objective, 2) impacted well NCWD-11 is not a required component of the containment program, and 3) the use of other water supplies in lieu of pumping at SCWC-Saugus1 and SCWC-Saugus2 would likely be detrimental to the long-term quality of groundwater in the Saugus Formation because pumping at SCWC-Saugus1 and SCWC-Saugus2 is necessary to prevent migration of perchlorate to other portions of the Saugus Formation.

The perchlorate containment report also includes the general design of a sentinel groundwater monitoring network and program required by DHS as part of its 97-005 permitting. The perchlorate containment report was approved by DTSC in November 2004. With that approval, the model is now being used to support the source water assessment and the balance of the permitting process required by DHS under is 97-005 policy.

A detailed history of the perchlorate issue and its impact on municipal water supply in the Valley is included in the Amended 2000 Urban Water Management Plan for the Valley. Included in that history are discussions of the detection of perchlorate in municipal supply wells, investigation and oversight by regulatory agencies, federally funded investigation of the extent and nature of contamination, litigation by the affected Purveyors, and cooperative settlement work toward selection and implementation of solutions that will restore impacted municipal groundwater supply and control the migration of perchlorate, the latter to protect downgradient wells. As noted above, the overall schedule for installation of treatment and return of impacted wells to service has been that those facilities be operational by 2006. The most current status of overall work toward that schedule was prepared in early April 2005. As of that date, the treatment and well reoperation project description has been finalized, and final settlement discussions were proceeding between the Purveyors and the Whittaker-Bermite parties. A draft Remedial Action Plan (RAP) has been completed; finalization of the RAP is pending determination of requirements by DTSC. A final report on the federally funded conceptual hydrogeology investigation prepared by the Army Corps of Engineers was completed in January 2005; funding is in place for limited monitoring of existing test wells in the next fiscal year. Draft reports on Source Water Assessment, Water Quality Investigation, and Source Protection Plan, all part of the DHS 97-005 approval process, are complete and in review. Draft reports on Effective Monitoring and Treatment, Human Health Risk, and Alternatives Evaluation are scheduled for completion in early May and June, respectively. CEQA review is scheduled for completion by the first of July. In the general area of design and construction, pipeline alignment studies have been completed, and work is continuing on final treatment process selection. The start of construction is scheduled for October 2005, with startup of the restored wells and new treatment facilities scheduled for February 2006. Thus, the descriptions of planned perchlorate containment, restoration of impacted wells, and adequacy of water supply in the interim remain as detailed in the Amended 2000 Urban Water Management Plan. The response plan for Valencia's Well Q2, as detailed herein, is consistent with maintaining the planned volumes and distribution of Alluvial pumping that are part of the overall restoration of perchlorate-impacted groundwater supply in the Valley.

VI. References

California Department of Water Resources, **Final State Water Project Delivery Reliability Report, 2002**, May 2003.

Castaic Lake Water Agency (CLWA), CLWA Santa Clarita Water Division, Newhall County Water District, and Valencia Water Company, **Groundwater Perchlorate Contamination Amendment and Other Amendments, 2000 Urban Water Management Plan,** January 2005, including Black and Veatch, Reiter/Lowry/Consultants, and SA Associates **Urban Water Management Plan Update, 2000**, Castaic Lake Water Agency, Newhall County Water District, Santa Clarita Water Company, and Valencia Water Company.

CH2M Hill, **Regional Groundwater Flow Model for the Santa Clarita Valley, Model Development and Calibration**, April, 2004.

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Richard C. Slade & Associates, LLC, **2001 Update Report, Hydrogeologic Conditions in the Alluvial and Saugus Formation Aquifer Systems**, prepared for Santa Clarita Valley Water Purveyors, July 2002.

CH2MHill, "Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property (Santa Clarita, California)" (December 21, 2004)

Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property (Santa Clarita, California)

PREPARED FOR: The Santa Clarita Valley Water Purveyors

PREPARED BY: John Porcello/CH2M HILL
Nate Brown, R.G., C.Hg./CH2M HILL

DATE: December 21, 2004

Introduction

In cooperation with state regulatory agencies and investigators working for Whittaker-Bermite, the Castaic Lake Water Agency (CLWA) and the retail water purveyors in the Santa Clarita Valley (hereafter referred to collectively as the Purveyors) have developed a plan to restore municipal groundwater supply that has been impacted by perchlorate. The plan will include the resumption of groundwater pumping at two of the contaminated production wells (SCWC-Saugus1 and SCWC-Saugus2) that were shut down in 1997 because perchlorate was detected in both wells. In addition to resuming the production of water for municipal water supply, the pumping plan is also a groundwater containment plan that is designed to hydraulically control local groundwater flow patterns in a manner that protects other Saugus production wells located downgradient, to the west and northwest, where perchlorate has not been detected in groundwater. The SCWC-Saugus1 and SCWC-Saugus2 production wells are completed in the Saugus Formation aquifer system that underlies the Santa Clarita Valley in Los Angeles County, California. Figure 1 is a map of the study area, showing the locations of these and other nearby wells (tables and figures are located at the end of this technical memorandum).

The Saugus wells contaminated by perchlorate had produced a combined average of 4,186 acre-feet per year over the five years preceding the detection of perchlorate. Restoration of that amount of water supply is currently planned to be achieved by reactivating the SCWC-Saugus1 and SCWC-Saugus2 wells, with treatment for removal of perchlorate, and by constructing replacement wells in other parts of the Saugus Formation not impacted by perchlorate. Full restoration of impacted water supply, including the containment plan, is currently scheduled for implementation by 2006. The containment plan will consist of (1) pumping groundwater on a nearly continual basis from the SCWC-Saugus1 and SCWC-Saugus2 production wells; (2) treating the pumped water using ion exchange resins followed by chlorine and ammonia disinfection; and (3) pumping the treated water to CLWA's Rio Vista Intake Pump Station for subsequent distribution for municipal water supply.

The Purveyors have requested that CH2M HILL conduct an analysis to evaluate the possibility that uncontaminated Saugus production wells will be impacted by perchlorate migration while they are used for regular water supply during this interim period (prior to

the 2006 implementation of the containment plan). This issue has been evaluated using the regional groundwater flow model for the Santa Clarita Valley (hereafter referred to as the Regional Model), and is described in this technical memorandum. The Regional Model was used to forecast the locations and extents of the hydraulic capture zones that would result from the interim operation of production wells that lie north and west of the Whittaker-Bermite property and withdraw water from the Saugus Formation and Alluvial Aquifer. The Regional Model's construction and calibration are described in *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration* (CH2M HILL, 2004a). An analysis of the long-term containment plan for the contaminated Saugus Formation production wells is described in the final report, *Analysis of Perchlorate Containment in Groundwater Near the Whittaker-Bermite Property, Santa Clarita, California* (CH2M HILL, 2004b).

The remainder of this technical memorandum describes the methods used to forecast groundwater capture by production wells during the interim period, followed by the findings from the analysis.

Methodology

Figure 1 shows the location of each production well that lies in the vicinity of the Whittaker-Bermite property. The figure identifies the production wells that are completed in the surficial Alluvial Aquifer and production wells that are completed in the deeper Saugus Formation. The figure also identifies which wells have been contaminated by perchlorate. As shown on the figure, the contaminated Saugus production wells are SCWC-Saugus1, SCWC-Saugus2, NCWD-11, and VWC-157, and Alluvial Aquifer production well SCWC-Stadium. Figure 1 also shows measured perchlorate concentrations at each production well and the highest perchlorate concentrations that have been measured at monitoring wells and other exploratory borings that have been drilled on and near the Whittaker-Bermite property in recent years.

Table 1 shows the pumping rates for normal years at each active Saugus Formation production well not contaminated by perchlorate. Table 2 shows the same information for each active production well in the Alluvial Aquifer. Important notes regarding the pumping distribution during this interim period are as follows:

1. All pumping rates were derived from records of instantaneous and annual pumping in recent years.
2. In a few of the Alluvial wells, the pumping rates were increased for the purposes of this analysis to include Alluvial pumping that has ceased at the one contaminated Alluvial well (SCWC-Stadium).
3. There is no pumping at the four contaminated Saugus production wells, or at the one contaminated Alluvial well.
4. The combined pumping rate is 1,100 acre-feet per year (AF/yr) from wells VWC-201 and VWC-205, which are the closest wells to contaminated wells SCWC-Saugus1 and SCWC-Saugus2.

5. The combined pumping rate is 2,630 AF/yr from wells NCWD-12 and NCWD-13, which are the closest wells to contaminated well NWCD-11.

6. The Alluvial Aquifer production wells that are closest to the contaminated Saugus production wells are six wells owned by the Valencia Water Company (VWC). These six wells (VWC-N, -N7, -N8, -S6, -S7, and -S8) are located along the Santa Clara River at the mouth of the South Fork Santa Clara River. These wells pump 5,880 AF/yr under the operational plan that will be in effect during the interim period. Well VWC-Q2, which lies just to the east, pumps 1,046 AF/yr.

7. Two VWC-owned Alluvial Aquifer wells that are due north of the Whittaker-Bermite property (VWC-T2 and VWC-T4) pump a combined 978 AF/yr. These wells lie along the north side of Soledad Canyon, on the opposite side of the Santa Clara River from the Whittaker-Bermite facility.

8. Two VWC-owned Alluvial Aquifer wells (VWC-U4 and VWC-U6) that lie south of the river and east (upgradient) of the Whittaker-Bermite site pump a combined 1,869 AF/yr.

9. The normal-year pumping rates listed in Tables 1 and 2 were simulated with the model. Dry-year pumping was not simulated because (a) the remainder of 2004 has an average water supply, and (b) if 2005 were to be a dry year, water demands during such a year can be met from a combination of non-impacted local groundwater, water imported from the State Water Project, and alternate firming supplies available to CLWA, most notably some of the nearly 51,000 AF that CLWA can recover from its banked water in the Semitropic Groundwater Banking Program.

The pumping rates listed in Tables 1 and 2 were used to generate new groundwater elevations and groundwater flow fields in each of the seven model layers, using the steady-state version of the Regional Model. Groundwater capture zones[1] were then delineated for a 2-year period, which is conservative in light of the approximately 1.5-year period that is currently scheduled for returning the SCWC-Saugus1 and SCWC-Saugus2 production wells to service. For the groundwater capture zone delineation process, an effective porosity of 0.05 was assumed, which is at or slightly below the low end of the range of effective porosity values that are typical for the deposits that comprise the aquifer matrix in the Saugus Formation. The longer time and the lower effective porosity were used together for modeling purposes to minimize the possibility of underestimating the extents of the 2-year groundwater capture zone for each well.

Results for Saugus Production Wells

Figure 2 shows the forecasted 2-year groundwater capture zones for the four actively pumping Saugus Formation production wells that lie closest to the Whittaker-Bermite property. The figure shows the following:

1. Wells VWC-201 and VWC-205 would draw water from very localized areas around these wells, and would not draw water from locations where perchlorate has been detected in the Saugus Formation. Specifically:

[1] A groundwater capture zone is defined in this technical memorandum as the geographic area within which a well obtains a specified volume of groundwater during a specific time period.

a. During the next two years, well VWC-201 will potentially draw Saugus groundwater from areas located as far as 450 feet east of this well, but is unlikely to draw water from areas any farther to the east during this period.

b. During the next two years, well VWC-205 will potentially draw Saugus groundwater from areas lying as far as 650 feet to the east and northeast of this well.

2. Wells NCWD-12 and NCWD-13, which are owned by the Newhall County Water District (NCWD), would also draw water from relatively localized areas during the modeled 2-year period, although the areal extent of these groundwater capture zones is larger than for the two Valencia Water Company wells because the simulated pumping is higher at the two NCWD wells (2,630 AF/yr) than at the two Valencia Water Company wells (1,100 AF/yr). The areal extent of these 2-year groundwater capture zones is approximately 1,500 feet for Well 12 and 1,300 feet for Well 13. Additionally, the outer portion of the 2-year groundwater capture zone for NCWD-13 includes the location of contaminated well NCWD-11. A reduction in the pumping rate at NCWD-13 would decrease the areal extent of its groundwater capture zone so that it does not include the location of NCWD-11. A decrease in the NCWD-13 pumping rate could be accomplished by shifting some or all of its pumping to another NCWD well and/or by increasing NCWD's importation of State Water Project water.

The groundwater capture zones shown on Figure 2 for each uncontaminated well might be larger than the areas that actually contribute water to these wells during the interim period that precedes implementation of the long-term containment plan. This is because (1) the analysis period (two years) is longer than is likely to be required to implement the long-term containment plan, and (2) the assumed effective porosity (0.05) is relatively low for the types of sediment that comprise the Saugus Formation, which therefore makes the areal extent of each simulated groundwater capture zone larger for each Saugus production well than might arise in the field.

Results for Alluvial Production Wells

Figure 3 shows the forecasted 2-year groundwater capture zones for the Alluvial Aquifer production wells in the vicinity of the Whittaker-Bermite property. The figure uses separate colors to distinguish the groundwater capture zones for each well. The analysis suggests the following:

1. VWC's Pardee wellfield (wells VWC-N, -N7, and -N8) could be impacted by perchlorate during the interim period, because the groundwater capture zones for these wells lie close to the contaminated well SCWC-Stadium and are closer to the Whittaker-Bermite property than the groundwater capture zones of the other Alluvial Aquifer production wells.

2. The other Alluvial Aquifer production wells will likely obtain water from areas upgradient of the Whittaker-Bermite property or from areas that lie north of the groundwater capture zones for the Pardee wells. Consequently, these wells are less likely to be impacted by perchlorate during the interim period.

3. The VWC-owned Alluvial Aquifer production wells shown in Figure 3 obtain their water from the portion of the Alluvial Aquifer that lies along the Santa Clara River in and near Soledad Canyon. These wells do not obtain water from areas to the south that include the alluvial valley occupied by the South Fork Santa Clara River. The groundwater capture zones for these wells also do not include the area at, and immediately south of, Bouquet Junction where observation wells with historical perchlorate detections are located (observation wells EM01, EM02, EM03, AL04A, AL04B, AL04_R1, AL04_R2, AL04_R3, and AL04_R4).

References

CH2M HILL. 2004a. *Regional Groundwater Flow Model for the Santa Clarita Valley: Model Development and Calibration.* Prepared for the Upper Basin Water Purveyors (Castaic Lake Water Agency, Santa Clarita Water Division of CLWA, Newhall County Water District, and Valencia Water Company). April.

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TABLE 1
Active Municipal Groundwater Source Capacity for Saugus Formation Wells
Technical Memorandum: Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property, Santa Clarita, California

Wells	Pump Capacity (gpm)	Maximum Annual Capacity (AF)	Normal-year Production[a] (AF)
Newhall County Water District			
7	300	480	N/A[b]
10	600	960	N/A[b]
12	2,300	3,700	1,315
13	2,500	4,030	1,315
NCWD Subtotal	5,700	9,170	2,630
Valencia Water Company			
159	500	800	50
160	2,000	3,220	1,000
201	2,400	3,870	100
205	2,700	4,350	1,000
206	2,500	4,030	1,175
VWC Subtotal	10,100	16,270	3,325
Total Active Capacity	**15,800**	**25,440[c]**	**5,955[c]**

[a]Based on recent actual annual pumping, as simulated in the perchlorate containment analysis report (CH2M HILL, 2004b), except contaminated production wells SCWC-Saugus1, SCWC-Saugus2, and NCWD-11 do not currently operate

[b]Emergency supply only

[c]Currently active wells only; additional capacity to meet dry-year operating plan would be met by restoration of contaminated wells and new well construction

Notes:

gpm = gallons per minute
AF = acre-feet

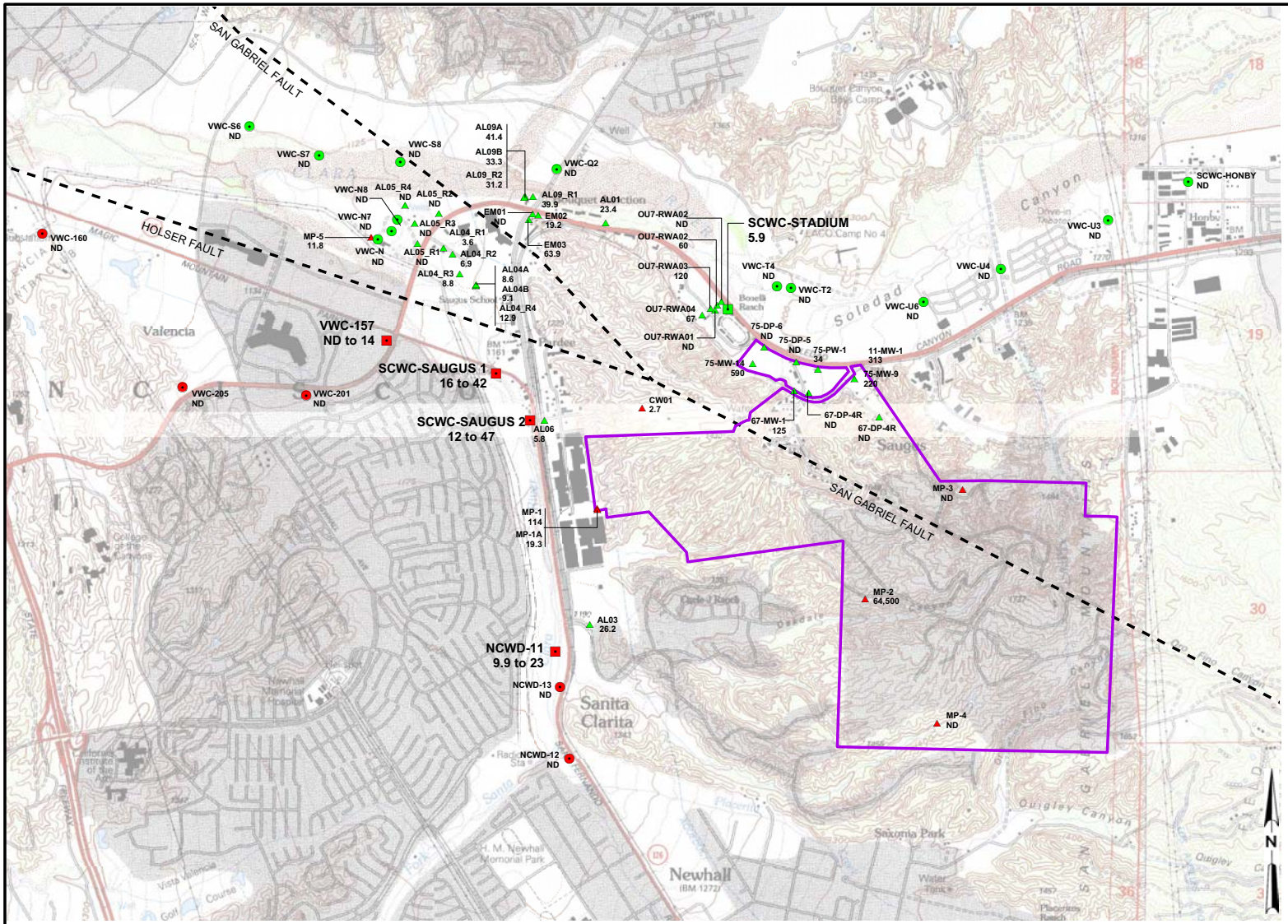
TABLE 2
Active Municipal Groundwater Source Capacity for Alluvial Aquifer Wells
Technical Memorandum: Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property, Santa Clarita, California

Wells	Pump Capacity (gpm)	Maximum Annual Capacity (AF)	Normal-year Production[a] (AF)
Newhall County Water District			
Castaic1	600	960	385
Castaic2	425	680	166
Castaic4	270	430	100
Pinetree1	300	480	164
Pinetree3	550	880	545
Pinetree4	500	800	300
NCWD Subtotal	2,645	4,230	1,660
Santa Clarita Water Division of CLWA			
Clark	600	960	782
Guida	1,000	1,610	1,320
Honby	950	1,530	740
Lost Canyon 2	850	1,370	741
Lost Canyon 2A	825	1,330	1,034
Mitchell 5B	700	1,120	557
N. Oaks Central	1,000	1,610	873
N. Oaks East	950	1,530	1,311
N. Oaks West	1,400	2,250	954
Sand Canyon	750	1,200	930
Sierra	1,500	2,410	846
SCWD Subtotal	10,525	16,920	10,088
Valencia Water Company			
Well D	1,050	1,690	690
Well N	1,250	2,010	659
Well N7	2,500	4,030	1,232
Well N8	2,500	4,030	1,232
Well Q2	1,200	1,930	1,046
Well S6	2,000	3,220	919
Well S7	2,000	3,220	919
Well S8	2,000	3,220	919
Well T2	800	1,290	489
Well T4	700	1,120	489
Well U4	1,000	1,610	876

TABLE 2
Active Municipal Groundwater Source Capacity for Alluvial Aquifer Wells
Technical Memorandum: Analysis of Near-Term Groundwater Capture Areas for Production Wells Located Near the Whittaker-Bermite Property, Santa Clarita, California

Wells	Pump Capacity (gpm)	Maximum Annual Capacity (AF)	Normal-year Production[a] (AF)
Well U6	1,250	2,010	993
Well W9	800	1,290	600
Well W10	1,500	2,410	865
Well W11	1,000	1,610	350
VWC Subtotal	21,550	34,690	12,278
Wayside Honor Rancho			
Well 10	500	800	300
Well 15	1,600	2,580	950
Well 17	600	960	350
WHR Subtotal	2,700	4,340	1,600
Total Purveyors	**34,720**	**55,840**	**24,026**
Total Purveyors and Wayside Honor Rancho	**37,420**	**60,180**	**25,626**

[a]Based on recent actual annual pumping, as simulated in the perchlorate containment analysis report (CH2M HILL, 2004b), but with SCWC-Stadium well pumping (800 AF/yr) assigned to selected wells owned by the Valencia Water Company and the Santa Clarita Water Division of CLWA.



LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
3. µg/L = MICROGRAMS PER LITER.

FIGURE 1
WELL LOCATION MAP
SANTA CLARITA, CALIFORNIA

CH2MHILL

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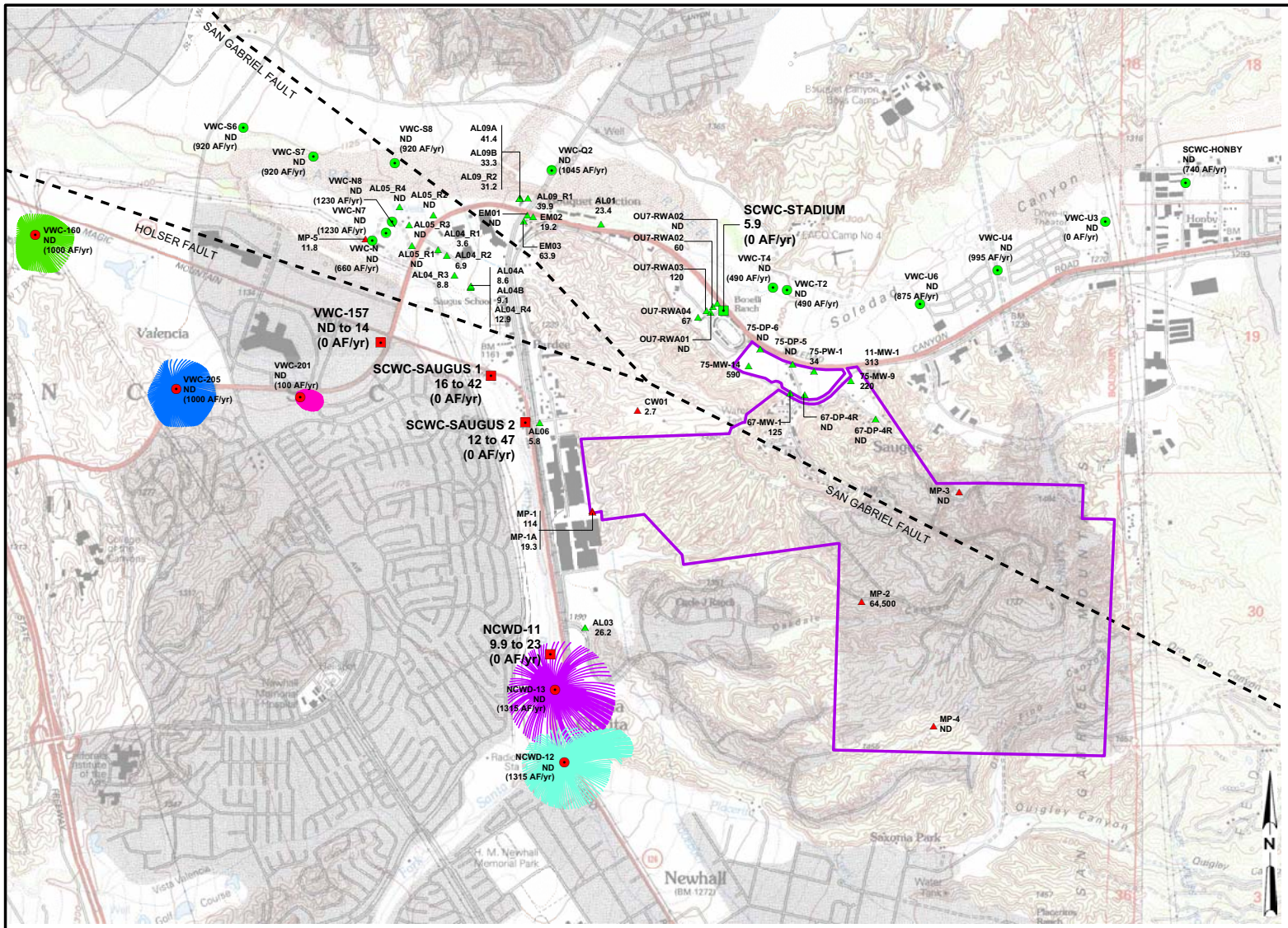

LEGEND

CONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL

- ALLUVIUM
- SAUGUS

MONITORING WELL

- ALLUVIUM
- SAUGUS

TWO-YEAR GROUNDWATER CAPTURE ZONE

- NC-12
- NC-13
- VWC-160
- VWC-201
- VWC-205
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:

1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. PUMPING VALUES IN PARENTHESES ARE ANNUAL PUMPING VOLUMES.
3. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
4. µg/L = MICROGRAMS PER LITER; AF/yr = acre feet per year
5. FLOWPATHS ARE DELINEATED USING AN EFFECTIVE POROSITY OF 0.10 IN THE ALLUVIAL AQUIFER AND 0.05 IN THE SAUGUS FORMATION.

FIGURE 2
FORECASTED TWO-YEAR GROUNDWATER CAPTURE ZONES FOR ACTIVE SAUGUS PRODUCTION WELLS LOCATED CLOSEST TO THE WHITTAKER-BERMITE PROPERTY
SANTA CLARITA, CALIFORNIA

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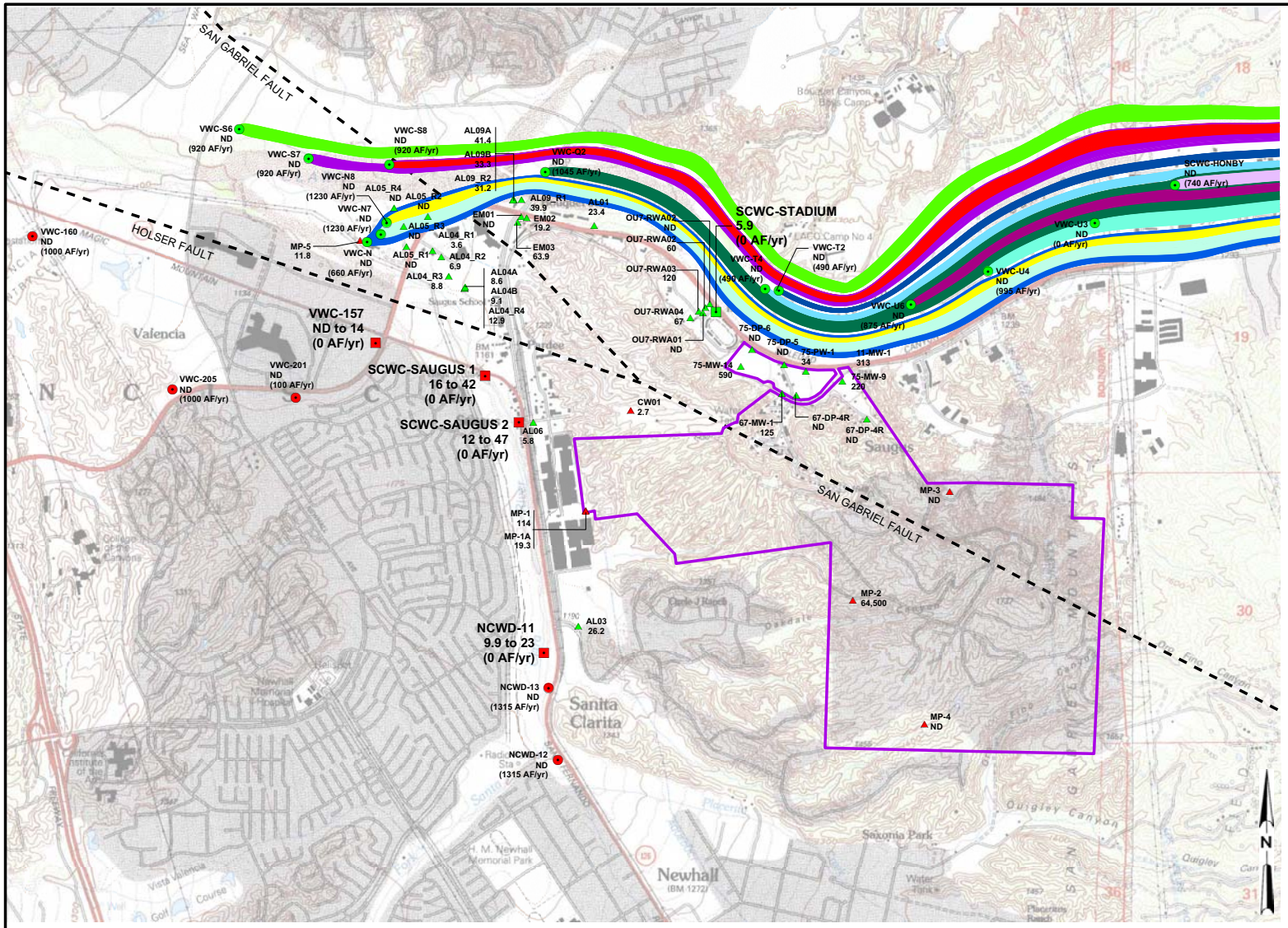

LEGEND

CONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

UNCONTAMINATED PRODUCTION WELL
- ALLUVIUM
- SAUGUS

MONITORING WELL
- ALLUVIUM
- SAUGUS

TWO-YEAR GROUNDWATER CAPTURE ZONE
- SCWC-HONBY
- VWC-N
- VWC-N7
- VWC-N8
- VWC-Q2
- VWC-S6
- VWC-S7
- VWC-S8
- VWC-T2
- VWC-T4
- VWC-U4
- VWC-U6
- WHITTAKER-BERMITE PROPERTY BOUNDARY

NOTES:
1. VALUES PRESENTED UNDER WELL SYMBOLS REPRESENT PERCHLORATE CONCENTRATION IN GROUNDWATER (µg/L).
2. PUMPING VALUES IN PARENTHESES ARE ANNUAL PUMPING VOLUMES
3. ND = PERCHLORATE NOT DETECTED IN GROUNDWATER SAMPLE.
4. µg/L = MICROGRAMS PER LITER; AF/yr = acre feet per year
5. FLOWPATHS ARE DELINEATED USING AN EFFECTIVE POROSITY OF 0.10 IN THE ALLUVIAL AQUIFER AND 0.05 IN THE SAUGUS FORMATION.

FIGURE 3
FORECASTED TWO-YEAR GROUNDWATER CAPTURE ZONES FOR ACTIVE ALLUVIAL PRODUCTION WELLS LOCATED CLOSEST TO THE WHITTAKER-BERMITE PROPERTY
SANTA CLARITA, CALIFORNIA

CH2MHILL

Geomatrix, "Letter to the Department of Toxic Substances Control Regarding the Former Whittaker-Bermite Facility, Santa Clarita, CA -- Summary Report for Month of November 2007" (January 15, 2008)

Geomatrix

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Sayareh Amir
Department of Toxic Substances Control
Site Mitigation Branch
1011 N. Grandview Avenue
Glendale, CA 91201

Subject: Former Whittaker-Bermite Facility, Santa Clarita, CA
Summary Report for Month of November 2007

Dear Ms. Amir:

This letter constitutes a progress report for the month of November 2007, prepared pursuant to Task 4 and Section 6.3 of the "Imminent and Substantial Endangerment Determination and Order and Remedial Action Order" (the Order) that the Department of Toxic Substances Control (DTSC) issued on November 22, 2002 for the former Whittaker-Bermite facility (site) in Santa Clarita, California.

SECTION I – SITE WIDE ISSUES

Specific actions taken on behalf of the respondent, actions expected to be undertaken, and planned activities for site-wide issues are summarized in the following:

PUBLIC PARTICIPATION

Activities for This Report Period

Cerrell Associates Inc. team provided the following services in support of the project and on behalf of the Whittaker Corporation during the month of December 2007.

Researched DTSC EnviroStor web site Community Outreach section for Bermite updates.

Regularly monitored the Community Information Line for messages and/or inquiries from area residents.

Regularly monitored and updated client and DTSC on Bermite site-related media coverage by the *Los Angeles Daily News, Santa Clarita Signal,* and other area media outlets.

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Anticipated Activities for This Month

Continue supporting DTSC's public outreach activities and assist with updating the DTSC's Web site (www.envirostor.dtsc.ca.gov) as necessary.

UXO/OE Clearance Activities

Activities for This Report Period

EOD Technology, Inc. (EODT) has developed a scope of work for ordnance survey and clearance of the areas referenced in the Historical Site Assessment (HSA) Report. The EODT work plan addresses the specific areas that require survey and clearance for potential scattered UXO. The scope of work of the geophysical sweeps includes the detection procedure and equipment to be utilized, and the quality control program to be followed. A draft of the document was submitted to the insurance company (AIG) for review to ensure coverage and budget allocation. AIG provided comments and requested clarifications of scope items which EODT provided responses. EODT has revised the work plan for the surface area sweeps that has incorporated AIG's comments. The revised document has been sent to AIG's technical team for final review.

Anticipated Activities for This Month

Following AIG's concurrence with the scope of work and fund allocation, the work plan for geophysical clearing of the specific target areas will be submitted to DTSC for review and approval prior to implementation.

Long-Term Actions

Following DTSC's review and approval of the scope of geophysical sweep activities, the specific areas addressed in the HSA Report will be swept and surveyed for UXO/ordnance and explosives.

SECTION II – SOIL ISSUES

Specific actions taken on behalf of the respondent, actions expected to be undertaken, and planned activities for soil issues are summarized in the following sections:

RI AND RCRA MONITORING

Activities for This Report Period (1)

All Remedial Investigation (RI) activities for characterization of soils have been completed. No additional soil RI work is anticipated.

Activities for This Report Period (2)

Geomatrix submitted a letter to DTSC on July 24th 2006 requesting DTSC's agreement to incorporate the current Resource Conservation and Recovery Act (RCRA) groundwater monitoring of the Area 317 to the OU-7 groundwater study and monitoring. DTSC provided a response letter on October 31, 2006 and requested that a closure report be prepared and submitted to provide the status of the closure activities identified in the closure plan for the Area 317 RCRA unit. Geomatrix participated in a conference call with the DTSC Site Mitigation and the Permitting Units to clarify specific items of the October 31, 2006, letter. Based on DTSC request and the discussions during the conference call, the closure report and a letter of response to DTSC comments were prepared and submitted to DTSC on April 30, 2007.

Environ has prepared the scope and the frequency of the monitoring activities to focus the RCRA groundwater monitoring to those areas that will provide meaningful results. The document has been provided to AIG for their review to ensure adequate funding.

Meanwhile, monitoring of the groundwater under the Area 317 continues on schedule.

Anticipated Activities for This Month

The current RCRA groundwater monitoring program will continue per the current plan until further agreements and arrangements are made.

Long-Term Actions

Provide recommendation for modification of the current RCRA monitoring program, and continue the closure activities.

REMEDIAL ACTION PLAN

Activities for This Report Period

The final site-wide feasibility study (FS) for soil was submitted to DTSC on October 15. DTSC requested that the draft site-wide Remedial Action Plan (RAP) for OU2 through OU6 be prepared and submitted. The submittal date for the draft site-wide RAP was set for January 15, 2008. During the December 14, 2007 joint meeting of representatives of the Department of Toxic Substances Control (DTSC), City of Santa Clarita (City), SunCal Santa Clarita LLC (SSC), American International Specialty Lines Insurance Company (AISLIC), and Whittaker; SSC representatives presented an outline of the approach to integrate the shallow soil treatment and treated soil disposition programs with the site grading and land use plans to avoid potential "piecemealing" issues under the California Environmental Quality Act (CEQA). In addition, representatives of the parties discussed strategies to accelerate planning for groundwater containment and remediation and other remedies (e.g., soil vapor extraction, depleted uranium removal, and sweeps for potential munitions and explosives of concern [MEC]) through series of accelerated pilot studies. It was realized that the deadline for submittal of the RAP needed to be extended to enable further discussions and work as necessary regarding integration of soil and groundwater and integration of site soils with grading activities for future development and compliance with all applicable CEQA requirements.

Anticipated Activities for This Month

As discussed during the December 14, 2007 meeting with DTSC and City of Santa Clarita, a request for deadline extension for sit-wide RAP will be submitted.

Long-Term Actions

Work with DTSC to set a new deadline for submittal of the site-wide RAP. Prepare and submit work plans for pilot studies.

REMOVAL ACTIONS AND INTERIM REMEDIAL MEASURES

Activities for this Report Period

A Work Plan for Supplemental Characterization and Bench Top Testing of Proposed Method for depleted uranium (DU) removal at Areas 57 and 14 of the Whittaker-Bermite site was prepared

by EnergySolutions and submitted to DTSC and the Radiological Health Branch of the California Department of Public Health (DPH) on December 10, 2007.

Submittal was made to the CA Department of Public Health (CDPH), Radiologic Health Branch requesting reciprocal recognition of the EnergySolutions mobile radioactive materials license issued by the U.S. Nuclear Regulatory Commission (NRC) to perform work in California for the 2008 calendar year. A request for additional information was received in December 2007.

Anticipated Activities for this Month

Address and incorporate any comments on the Draft Work Plan provided by DTSC and CDPH and submit the final version of or an addendum to the Work Plan, if necessary. All comments received from these agencies will be reviewed and addressed.

Long Term Actions

After the Work Plan has been accepted, field work will be scheduled. Results of the field work will support the dose modeling effort.

OU1 REMEDIATION

Activities for This Report Period (1)

Operated soil vapor extraction (SVE) systems at Area 43. The hi-vacuum system is currently at the Building 329 area, but is not being operated until a site-specific permit is obtained from the South Coast Air Quality Management District (SCAQMD). The hi-vacuum system was previously operated under a various locations permit that expired.

Anticipated Activities for This Month

Continue operation and optimization of SVE system in Area 43 and restart the Building 329 operations upon receipt of the site-specific permit.

Long-Term Actions

Two SVE systems will be operated at Area 43 and Building 329 concurrently until halogenated volatile organic compound levels are eliminated or reduced to appropriate levels or asymptotic levels are reached.

Activities for This Report Period (2)

Approximately 3,588 cubic yards of soil were excavated from Area 55 during this reporting period. Excavation operations were limited due to weather conditions, shutdown of the operation during the holidays, and limited space on the treatment pad resulting from the slowdown in the bioremediation process during the winter.

Full-scale enhanced biological treatment of impacted soils continued during this reporting period using a combination of glycerin, di-ammonium phosphate, and bioaugmentation culture (0.01% when available). During this reporting period, approximately 2,280 tons of soil was processed and placed into treatment cells (4). Sampling results have generally shown consistent and successful reduction of perchlorate to non-detectable levels, although the incubation time has increased from approximately 2 weeks or less to 4 to 6 weeks, due to colder ambient air temperatures and higher baseline perchlorate concentrations. A total of one Ag Bag and 9 treatment cells were approved as "clean" by DTSC during this reporting period and the treated soil was transported to clean soil stockpile areas for later use as backfill material.

Dust monitoring indicated that, in general, the net dust readings at the downwind monitoring stations were below 50 micrograms per cubic meter ($\mu g/m^3$) during the soil excavation and processing operations. In the few cases when the dust readings exceeded 50 $\mu g/m^3$, the dust was suppressed with water; therefore, the exceedances were insignificant.

Anticipated Activities for This Month

Continue full-scale operations.

Long-Term Actions

Continue soil remediation operations in accordance with the OU1 RAP/Remedial Design.

SECTION III – GROUNDWATER AND SURFACE WATER ISSUES

Specific actions taken on behalf of the respondent, action expected to be undertaken and planned activities for groundwater and surface water issues are summarized in the following sections:

REMEDIAL INVESTIGATIONS AND GROUNDWATER/SURFACE WATER MONITORING AND INTERIM ACTIONS

Activities for This Report Period (1)

The updated groundwater (OU-7) RI was submitted in February 2007 for DTSC review and comment. Section 7, Risk Evaluation of Groundwater and Surface Water, was revised to address comments received from DTSC, and the Response to Comments was completed. The responses and revised Section 7 were sent to the DTSC on November 16, 2007 for final review and approval. DTSC issued a letter dated December 10, 2007 approving the OU-7 RI Report, including Section 7.

Anticipated Activities for This Month

Complete the distribution of the final Section 7 and Response to Comments.

Long-Term Actions

Groundwater monitoring and sampling data will be used in developing the OU-7 FS.

Activities for This Report Period (2)

A Pilot Remediation Pumping Program was started in Northern Alluvium Areas 11, 67, and 75, in 2006. As a part of expanded pumping program, an alternate extraction well 75-MW-35 for higher groundwater extraction and observation well clusters were completed in January 2007. Well 75-MW-35 and the six hot spot wells were connected to the new higher capacity groundwater treatment system. The low flow wells were brought online during the week of June 11, 2007. System shake-down and performance startup testing began on June 18, 2007, and continued through early October. Sustained pumping of the extraction well 75-MW-35 began in mid-October and continued during December. In late December, the wells were shut down for treatment system maintenance.

Monitoring of the aquifer response to pumping from the alternate extraction well 75-MW-35 was conducted during December following the start up of sustained pumping of the extraction well and completion of the system shake-down and startup testing of the new treatment system.

Anticipated Activities for This Month

Monitoring of the aquifer response to pumping from the alternate extraction well 75-MW-35 and the downgradient site boundary low flow extraction wells will continue during January after the wells are restarted.

Long-Term Actions

Continue operating the extraction and treatment system and conduct additional performance monitoring.

Activities for This Report Period (3)

Potential remedial technologies to address Northern Alluvium groundwater hot spots, including evaluation of the Area 75 boundary containment established by sustained operation of the low flow pumping wells that started in early October, are being evaluated as part of the OU-7 FS.

Anticipated Activities for This Month

Work on the draft OU-7 FS will continue during this month.

Long-Term Actions

Additional source control measures in Northern Alluvium will be considered and recommended where determined to be necessary.

Activities for This Report Period (4)

The Quarterly Groundwater Monitoring Report, Second Quarter 2007 was submitted to DTSC on December 11, 2007.

Anticipated Activities for This Month

The Quarterly Groundwater Monitoring Report, Third Quarter 2007 was submitted to DTSC on January 10, 2008. Data review and reporting for the Fourth Quarter 2007 quarterly monitoring

conducted in November is in progress. In addition, a proposed plan to refine and focus the groundwater monitoring program is being developed based on the extensive body of groundwater monitoring data that has been collected at the Site since 2003. The draft plan is currently being reviewed by AIG and their consultants.

Long-Term Actions

Continue monitoring and reporting of the proposed network of monitoring wells on quarterly schedule.

NORTHERN ALLUVIUM GROUNDWATER TREATMENT SYSTEM CONSTRUCTION (OU5)

Activities for This Report Period

The December compliance samples were collected on December 3, 2007 and results indicated an exceedance of copper over the monthly average compliance limit and the daily maximum limit for nitrogen. The system was placed in recycle mode after the samples analyses were received. The media in the lag nitrate vessel was replaced on December 13, 2007 and the filter media of the lead vessel was replaced on December 18, 2007. Weekly samples for nitrate compliance were collected on December 17, 24, and 31, results of which indicated that the water treatment plant was operating within the permit limits. Additionally, a process sample collected on December 31, 2007 brought the monthly average for copper below the permit limit.

In addition to the downtime while waiting for the nitrate media to be replaced, the overnight freezing temperatures kept the system from operating in normal mode for most of December, with a few exceptions when weekly samples were collected and rainwater was processed. As of December 3, 2007 we have treated and discharged 2,509,803 gallons of impacted water from Northern Alluvium. During December we treated and discharged 20,027 gallons of storm water collected from various areas of the site.

CDM sent a written request to RWQCB on 12/11/07 for using the clean discharge water for dust control purposes.

Anticipated Activities for This Month

Bag filters are expected to be removed from the site in January.

Monthly sampling is anticipated to occur on January 8, 2008. The GAC vessel that was sent for processing in November is expected to be put into service in January; also, the media in the metals resin vessels is expected to be replaced.

CDM will follow up with RWQCB on the status of the 12/11/07 request for using the clean discharge water for dust control purposes.

FEASIBILITY STUDIES, INTERIM REMEDIAL MEASURES, STORM WATER POLLUTION PREVENTION (SWPP)

Activities for This Report Period (1)

Work on the draft OU-7 FS is in progress.

Anticipated Activities for This Month

The refined site conceptual model will be incorporated into the OU-7 FS. Work on the draft OU-7 FS will continue during this month.

Long-Term Actions

Submit the OU-7 FS to DTSC.

Activities for This Report Period (2)

Pursuant to the Site Storm Water Pollution Prevention Plan, Environ continued coordinating the implementation of short-term surface water run-off mitigation measures. Implementation of the short-term mitigation measures is being coordinated with CDM, particularly in the areas of the site where soil remediation activities are in progress.

Anticipated Activities for This Month

Upgrades to the short-term mitigation measures will continue as necessary.

Long-Term Actions

Long-term mitigation of the drainages and excavations will be conducted in conjunction with the soil remediation.

REMEDIAL ACTION PLAN

Activities for This Report Period

No activity at this time, other than those outlined above for OU1 remediation.

SECTION IV – REQUIREMENTS UNDER THE ORDER THAT WERE NOT COMPLETED

All requirements of the Order were completed. Whittaker has met or exceeded all the substantive requirements of the Order.

SECTION V – PROBLEMS OR ANTICIPATED PROBLEMS IN COMPLYING WITH THE ORDER

Following DTSC's agreement with Whittaker's proposed modifications to implementation plans in compliance with the Order reflected in the letter dated September 28, 2004, DTSC's letter dated July 11, 2005, included a schedule for submitting a number of documents. All deadlines have been met and documents have been submitted per requested schedule.

SECTION VI – RESULTS OF SAMPLE ANALYSIS, TESTS, AND OTHER DATA

Whittaker has instructed its contractors to continue to provide DTSC staff with raw data sets for ongoing quarterly groundwater monitoring events and RI/FS work upon receipt from the lab.

Sincerely yours,
GEOMATRIX CONSULTANTS, INC.

Hassan Amini, PhD, CHG
Project Coordinator

cc: Eric Lardiere, Whittaker Corp; William Weaver, CDM; Jessica Donovan, ENVIRON; Paul Bergstrom, Knight Piésold; Jeremy Duncan, EODT; Tim Bricker, Santa Clarita L.L.C.; Myla Bobrow, RFI Corporate Offices; Megan Trend, Chubb Financial Solutions; Cindy Hunter and Stacy Parker, AIG Insurance; Vitthal Hosangadi, MACTEC; Jim Strandberg, Malcom Pirnie; John Carty, Zurich North America; Hal Dash, Cerrell Associates; Lisa Hardy and Jeff Hogan, City of Santa Clarita; Yueh Chuang, CH2M Hill; Kathy Stryker Anderson, US Army Corps of Engineers; Robert DiPrimio, Valencia Water Company; Lynn Takaichi, and Meredith Durant, Kennedy Jenks; David Bacharowski, RWQCB; James Leserman, Castaic Lake Water Agency; Steve Cole, Newhall County Water District; Neil Elsey, Avion Holdings LLC; Mauricio Guardado, Santa Clarita Water; Scott Andrews and Doug Mosteller, Cherokee Investment Services, Inc.; Jeff O'Keefe, Department of Public Health.

United States Environmental Protection Agency, "Perchlorate Update" (March 2002)

Perchlorate Update

United States Environmental Protection Agency

march 2002

The United States Environmental Protection Agency (EPA) has released its revised draft toxicity assessment, "Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization." When finalized, this assessment will be an important update of EPA's health assessment that reflects the state of the science regarding the health effects of the chemical perchlorate. The preliminary revised human health risk estimates found in the document are still undergoing review and deliberations both by the external scientific community and within EPA, and do not represent EPA policy at this stage.

How To Review and Comment on EPA's Draft Perchlorate Toxicity Assessment

The draft perchlorate toxicity assessment is available at EPA's National Center for Environmental Assessment (NCEA) Web site www.epa.gov/ncea under "what's new." Written public comments on the scientific literature and on EPA's characterization of the science in the draft perchlorate assessment will be accepted by EPA's contractor, Eastern Research Group, for consideration during the Agency's document revision process. These comments will be made available to the peer reviewers. Public comments must be received by April 5, 2002. Send your comments to: Eastern Research Group ERG, Attn: Meetings, 100 Hartwell Avenue, Lexington, MA 02421. If your comments are under 50 pages in length, you can send them via email attachment (in Word, WordPerfect or PDF) to *meetings@erg.com*.

What is Perchlorate?

Perchlorate is both a naturally occurring and man-made chemical. Most of the perchlorate manufactured in the United States is used as the primary ingredient of solid rocket propellant. Wastes from the manufacture and improper disposal of perchlorate-containing chemicals are increasingly being discovered in soil and water.

How Can Perchlorate Affect Human Health?

Perchlorate interferes with iodide uptake into the thyroid gland. Because iodide is an essential component of thyroid hormones, perchlorate disrupts how the thyroid functions. In adults, the thyroid helps to regulate metabolism. In children, the thyroid plays a major role in proper development in addition to metabolism. Impairment of thyroid function in expectant mothers may impact the fetus and newborn and result in effects including changes in behavior, delayed development and decreased learning capability. Changes in thyroid hormone levels may also result in thyroid gland tumors. EPA's draft analysis of perchlorate toxicity is that perchlorate's disruption of iodide uptake is the key event leading to changes in development or tumor formation.

What are the Preliminary Conclusions of the Draft Toxicity Assessment?

The EPA draft assessment concludes that the potential human health risks of perchlorate exposures include effects on the developing nervous system and thyroid tumors. The draft assessment includes a draft reference dose (RfD) that is intended to be protective for both types of effects. It is based on early events that could potentially result in these effects, and factors to account for sensitive populations, the nature of the effects, and data gaps were used. The draft RfD is 0.00003 milligrams per kilogram per day (mg/kg/day). The RfD is defined as an estimate, with uncertainty spanning perhaps an order of magnitude, of a daily exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of adverse effects over a lifetime. As with any EPA draft assessment document containing a quantitative risk value, that risk value is also draft and should not at that stage be construed to represent EPA policy. Thus, the draft RfD for perchlorate is still undergoing science review and deliberations both by the external scientific community and within the Agency.

The assessment provides a hypothetical conversion of the draft RfD to a drinking water equivalent level, assuming factors of 70 kilograms (kg) body weight and 2 liters (L) of water consumption per day. The converted draft estimate would be 1 microgram per liter (ug/L) or 1 part per billion (ppb). If the Agency were to make a determination to regulate perchlorate, the RfD, along with other considerations would factor into the final value.

Does Perchlorate Cause Cancer?

Perchlorate is associated with disruption of thyroid function which can potentially lead to thyroid tumor formation. This draft toxicity assessment accounts for both developmental and tumor formation effects.

Does My Water Contain Perchlorate?

Confirmed perchlorate releases have occurred in at least 20 states throughout the United States (see Figure 2). In EPA Region 9, perchlorate releases have occurred in California, Arizona, and Nevada. Perchlorate has also been released into the Colorado River, which is a drinking water source for some areas of the region. Additional information and maps detailing those sites are available in Chapter 1 of the draft of the "Perchlorate Environmental Contamination: Toxicological Review and Risk Characterization." EPA, other federal agencies, states, water suppliers and industry are already actively addressing perchlorate contamination through monitoring for perchlorate in drinking water and surface water. The full extent of perchlorate contamination is not known at this time.

What is Being Done about Perchlorate?

A peer review of the draft perchlorate toxicity assessment will be held March 5 and 6, 2002 in Sacramento, CA. The purpose of the peer review is to provide an independent review of the scientific information and interpretation used in the document. Once the assessment is finalized, the reference dose will be used in EPA's ongoing efforts to address perchlorate problems. EPA's draft reference dose represents a preliminary estimate of a protective health level and is not a drinking water standard. In the future, EPA may issue a Health Advisory that will provide information on protective levels for drinking water. This is one step in the process of developing a broader response to perchlorate including, for example, technical guidance, possible regulations and additional health information. A federal drinking water regulation for perchlorate, if ultimately developed, could take several years.

In 1998, perchlorate was placed on EPA's Contaminant Candidate List for consideration for possible regulation. In 1999, EPA required drinking water monitoring for perchlorate under the Unregulated Contaminant Monitoring Rule (UCMR). Under the UCMR, all large public water systems and a representative sample of small public water systems are required to monitor for perchlorate over the next two years to determine whether the public is exposed to perchlorate in drinking water nationwide.

How is Perchlorate Removed from Water?

Several types of treatment systems designed to reduce perchlorate concentrations are operating around the United States, reducing perchlorate to below the 4 ppb reporting level. Biological treatment and ion (anion) exchange systems are among the technologies that are being used, with additional treatment technologies under development.

Many other perchlorate studies have been completed during the last several years. A May 2001 summary of 65 perchlorate treatment studies is available online at www.gwrtac.org/ (click on "Technical Documents" then look for "Technology Status Reports"). The summary report was prepared by the Ground-Water Remediation Technologies Analysis Center. Most of the projects described in the report are bench-scale and pilot-scale demonstrations of water treatment technologies, although several entries describe full-scale systems and soil treatment methods. Most of the projects employ biological treatment methods or ion (anion) exchange technology, although reverse osmosis, nanofiltration, granular activated carbon, and chemical reduction are also discussed. Results of federally-funded perchlorate treatment research, managed by the American Water Works Association Research Foundation (AWWARF), are also becoming available (see www. awwarf. com/ research/spperch.asp).

Is Perchlorate-contaminated Water Safe to Drink?

EPA's draft toxicity assessment is preliminary and thus, it is difficult to make definitive recommendations at this stage. Other factors that influence the answer to this question include how much water is consumed, the degree of perchlorate contamination and the health status of the consumer.

Sensitive populations, like pregnant women, children and people who have health problems or compromised thyroid conditions, should follow the advice of their health care provider regarding the amount and type of liquids, including water that should be consumed.

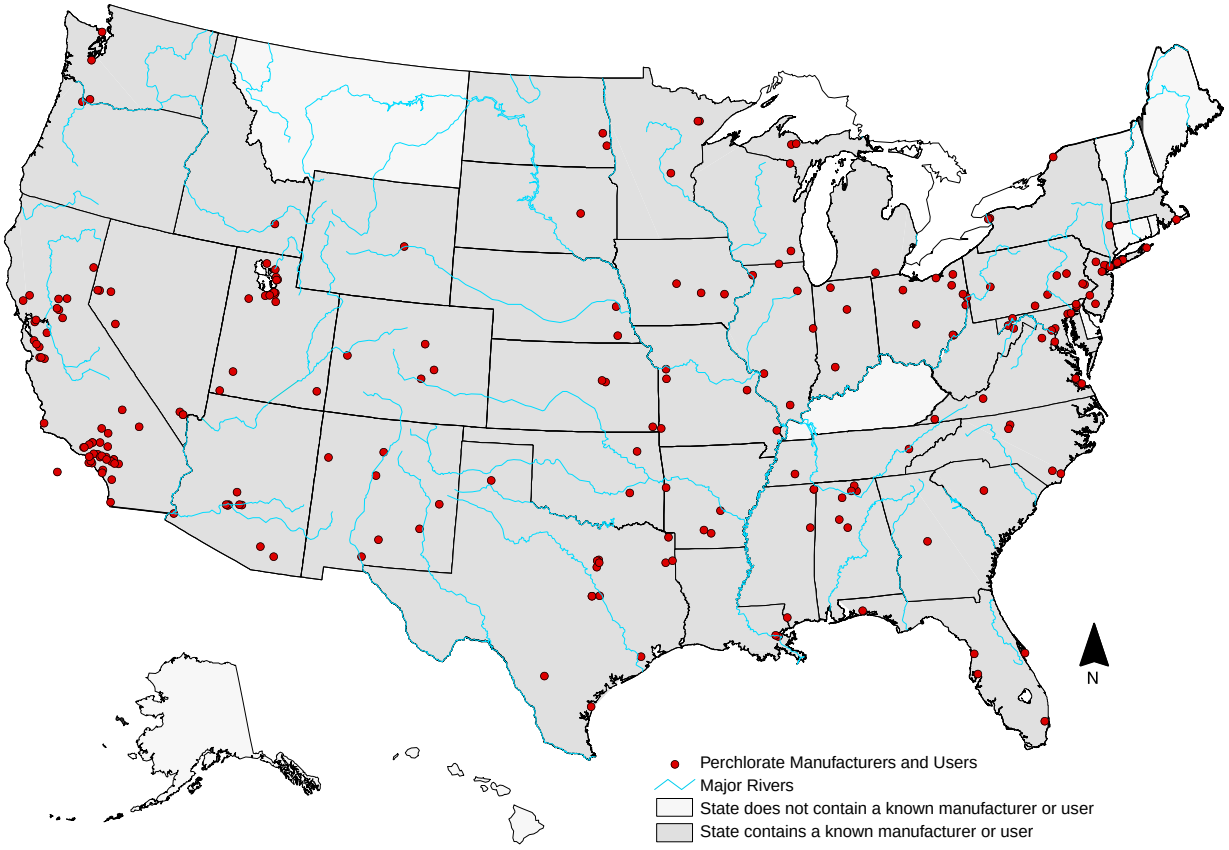

Figure 1: U.S. Perchlorate Manufacturers and Users, as of October 2001

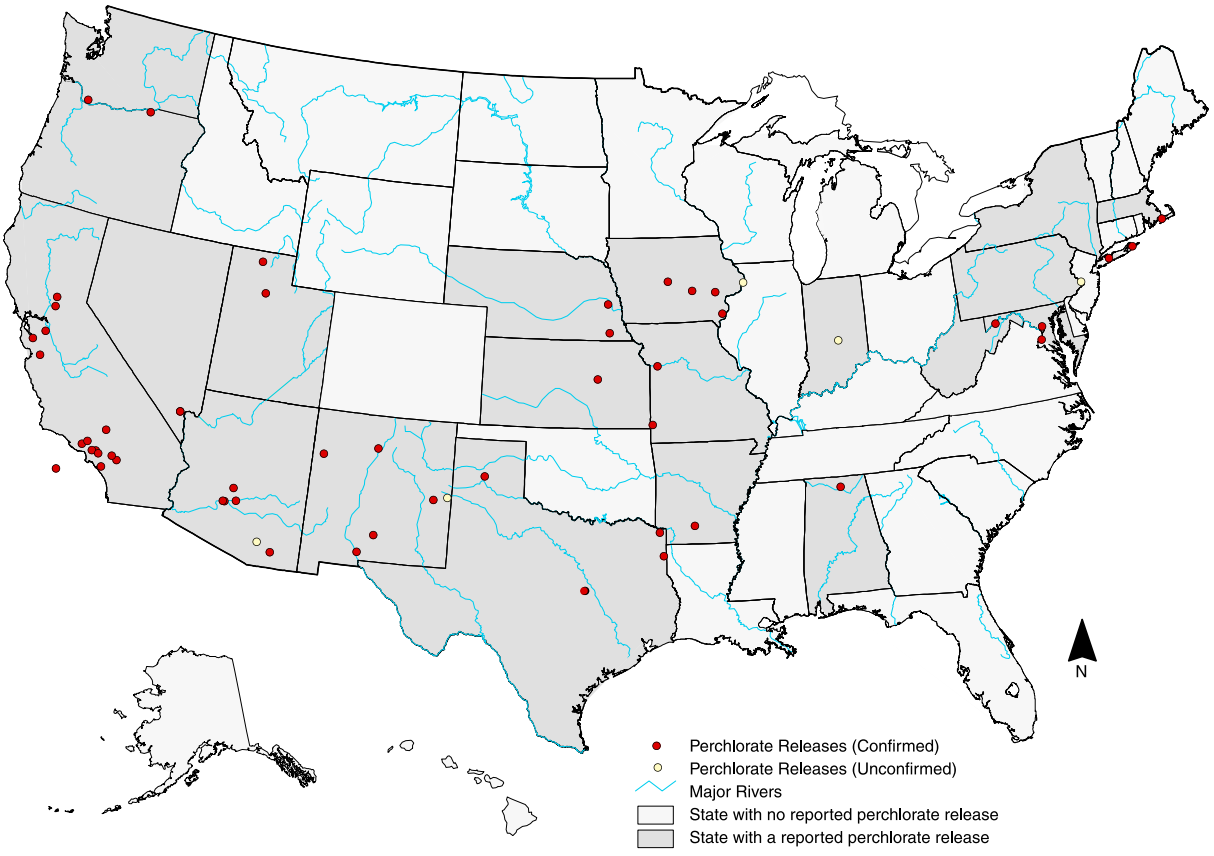

Figure 2: Reported Releases of Perchlorate into the Environment, as of November 2001

For more information

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Carollo Engineers, "Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer, Technical Memorandum No. 3 Bench and Pilot Test Results" (February 2004)

Castaic Lake Water Agency

Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer

TECHNICAL MEMORANDUM NO. 3 BENCH AND PILOT TEST RESULTS

February 2004

CASTAIC LAKE WATER AGENCY

TREATMENT OF PERCHLORATE CONTAMINATED GROUNDWATER FROM THE SAUGUS AQUIFER

TECHNICAL MEMORANDUM NO. 3

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1.0 EXECUTIVE SUMMARY

1.1 Background

A 6-month study was performed to evaluate the effectiveness of ion exchange (IX) and biological processes for treating perchlorate-contaminated water from the Saugus aquifer. Three single-pass perchlorate-selective IX resins were evaluated at the bench-scale while fixed-bed biological reactors (FXBs) and fluidized-bed biological reactors (FBRs) were tested at the pilot-scale. These processes were chosen due to their ability to remove perchlorate from groundwater without generating a perchlorate-laden waste stream or brine that needs to be discharged.

1.2 Ion Exchange

Breakthrough of most anions from the IX resins occurred in the first 24 hours of run time. No chromatographic peaking was observed for any of the critical anions. Chloride breakthrough decreased from 325 mg/L to background concentrations (~35 mg/L) after 280 bed volumes. Perchlorate breakthrough (i.e., greater than 1 μg/L) occurred at 25,000 to 76,000 bed volumes (26 to 79 days). This translates to treated water volumes of 187,000 to 569,000 gal/cu-ft resin.

Contacting IX effluent with free and combined chlorine for 2- and 24-hour incubation periods produced no detectable (i.e., < 2 ng/L) N-nitrosdimethylamine (NDMA) concentrations for all three resins tested, indicating that NDMA precursors did not leach from the resins. When 2 mg/L of free chlorine was dosed to the IX feed water, effluent NDMA concentrations were below or just over the detection limit. To evaluate the NDMA precursor leaching potential of the resins, 100 mL batches of fresh resin were incubated for four hours in deionized water and groundwater. NDMA was detected in only one sample, which measured at less than half the 10 ng/L Action Level.

A California Total Threshold Limit Concentration (TTLC) analysis showed that metals were mostly non-detect in all three spent resins. Chromium, vanadium, and zinc were detected in two of the spent resins at levels significantly below the regulatory TTLC threshold concentrations. Uranium levels in the spent resin leachate were significantly below the Title 22 MCL of 20 pCi/L. To investigate whether the spent resins would be classified as hazardous for transportation to an incineration facility, a mass balance of the uranium adsorbed and desorbed from the resin up to 50 percent perchlorate breakthrough was performed. The amount of uranium accumulated on the spent resins is far below the lowest permissible reporting quantity and A-value of the California Department of Transportation.

1.3 Biological Filtration

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shut-downs, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 23 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter.

Demonstration testing showed that a submerged membrane bioreactor (SMBR) can meet several post-FXB treatment objectives in a single step: 1) aeration, 2) biomass separation, 3) residual organic carbon removal, and 4) hydrogen sulfide removal.

The FBR did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

Disinfection by-product formation potential (DBPFP) tests were performed using effluent from the FXB, FBR, and SMBR reactors. After 7 days of incubation with an excess chlorine residual, DBPs were formed in all three streams, though only the FBR stream produced DBPs exceeding the current MCLs of 80 μg/L total trihalomethanes (TTHMs) and 60 μg/L HAA5s. It should be noted that the FBR was not optimized prior to the DBPFP tests. Because the FBR feed acetic acid concentrations were higher than ultimately required, the FBR DBPFP tests are considered conservative. DBPs formed in all three streams consisted primarily of haloacetic acids (HAAs). Seven-day incubation of process effluents with combined chlorine produced only low levels of THMs and HAAs. A follow-up 72-hour simulated distribution system (SDS) DBP formation test was conducted on the FBR effluent. The SDS-THM4 and SDS-HAA5 concentrations were 40 μg/L and 23 μg/L, respectively.

To simulate DBP formation potential of FXB effluent that is post-treated at the Rio Vista Water Treatment Plant (WTP), a blend of 90 percent State Project Water (SPW) and 10 percent FXB effluent was ozonated and contacted with free or combined chlorine. Bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L due to high bromide concentrations (200 μg/L) in the blended water. Aldehydes were formed at moderate levels, even in one sample that was spiked with 7.5 mg/L of acetic acid carbon prior to ozonation. High levels of THMs and HAAs were measured in the ozonated samples following a 7-day incubation with free chlorine. However, residual chlorine concentrations were excessive

during incubation and, more importantly, a large fraction of DBP precursors would likely be removed downstream of ozonation, prior to chlorination at the Rio Vista WTP. Seven-day incubation of ozonated water with combined chlorine generated only 23 μg/L TTHM4 and 12 μg/L HAA5.

2.0 INTRODUCTION

2.1 Overview

Castaic Lake Water Agency (CLWA) retained Carollo Engineers (Carollo) to screen available perchlorate treatment alternatives applicable to Saugus Aquifer water, test the most promising alternatives, and select a process train for predesign to treat perchlorate-impacted wells.

Carollo identified the following processes as potential treatment approaches for perchlorate:

- Conventional regenerable IX.
- "Throw-away" perchlorate selective IX.
- FBR biological filtration.
- FXB biological filtration.
- High-pressure membrane separation.

A desktop study was conducted to narrow the treatment alternatives. The benefits and issues related to each one of these approaches were presented at a workshop held at CLWA on February 3, 2003. During the workshop, participants from CLWA, member agencies (Newhall County Water District (NCWD), Valencia Water Company, and Santa Clarita Water Company), Carollo, and Kennedy/Jenks performed a process selection based on the following criteria:

- Effectiveness in treating other potential contaminants such as NDMA, HMX, RDX, TNT, etc.
- DHS approval (fast track implementation).
- O&M costs.
- Capital costs.
- Architectural, siting, and permitting issues.
- Robustness of the process.
- TDS and hardness removal ability.

Workshop participants performed a pair-wise comparison analysis to weight the relative importance of each criterion, and assigned criteria scores to each process. The following alternatives were recommended by the participants for bench and/or pilot testing.

- "Throw-away" perchlorate selective IX.
- FBR biological filtration.
- FXB biological filtration.

These alternatives were selected because they can treat perchlorate with minimal production of perchlorate-laden liquid waste or brine that needs to be discharged.

2.2 Project Objectives

The overall goal of bench and pilot testing at the CLWA was to develop design parameters for a treatment facility that is capable of removing perchlorate to below the action level (AL) at affected Santa Clarita Valley wells. The AL in the State of California is currently 4 µg/L. The method detection limit (MDL) used by the CLWA lab was 1 to 4 µg/L and the minimum reporting limit (MRL) for the standard analytical method (EPA 314.0) is currently 4 µg/L.

The specific objectives of this work were to:

1. Compare the perchlorate removal performance of three commercially available and NSF certified perchlorate-selective IX resins using water from the Saugus Aquifer under identical operational conditions by running a parallel bench-scale flow-through column test.
2. Determine the NDMA formation potential of the three IX resins when subject to pre- or post-chlorination at the bench-scale.
3. Determine characteristics of the spent IX resins.
4. Demonstrate the efficacy of FBR and FXB treatment for perchlorate removal from Saugus aquifer water (i.e., show consistent removal of perchlorate to below the MRL of 4 µg/L).
5. Verify that sufficient perchlorate-reducing biological activity can be developed in the pilot-scale reactors using microorganisms indigenous to the Saugus Aquifer.
6. Using pilot-scale FBRs and FXBs, develop full-scale design criteria for empty-bed contact time (EBCT), backwashing procedures, electron donor (acetic acid) addition, and nutrient addition.
7. Evaluate the robustness of the fluidized- and FXB biological process with respect to system upsets, such as electron donor feed failure, process shutdowns, and changes in the feedwater oxidant concentrations.

8. Compare overall process performance between a FXB and FBR configuration.

9. Demonstrate the efficacy and robustness of the FBR's on-line perchlorate analyzer in comparison to other laboratories.

10. Prepare planning-level capital and O&M cost analyses for biological- and IX-based treatment facilities to be incorporated in the pre-design report.

11. Determine post-treatment requirements for the IX, FBR, and FXB perchlorate removal processes (i.e., characterize process effluent quality and disinfection by-product formation potential).

3.0 BACKGROUND AND TEST SITING

3.1 Test Approach and Siting

The preliminary test program included two main testing protocols:

- Bench-scale IX testing using three perchlorate selective resins.
- Pilot-scale biological testing using two system configurations.

The perchlorate selective resins have a high capacity for perchlorate adsorption and depending on the influent perchlorate and sulfate concentrations, may experience extensive run-times to reach perchlorate breakthrough (i.e., perchlorate > 4 µg/L). To simplify testing logistics, IX testing was conducted at the bench-scale. The test was carried out in the chemical building at the Rio Vista WTP. This site also served as the pilot-scale testing site. Bench-sale IX data are readily scaleable. Factors considered in scaling-up the bench test are water quality, bed volumes until perchlorate breakthrough, EBCT, and separation factors specific to the selected resin. The controlling factor of the contaminants' diffusion into the resin matrix is the selectivity of the resin's positively charged quaternary amine functional group for a specific anion relative to the chloride anion. The order of elution of ions from the resin is determined solely by the selectivity sequence. The species exit the column in reverse preferential order, with the less preferred ions (smallest separation factors) emerging first. Other factors include charge of ion, valence of ion (mono- or divalent), and other resin-specific physical factors.

While the effectiveness of treating perchlorate using biological processes has been demonstrated extensively at the bench-scale, the scalability of these processes is not well established. This project evaluated the removal of perchlorate from Saugus Aquifer water using two pilot-scale biological system configurations (FXB and FBR).

3.2 Feed Water

Perchlorate-contaminated wells were not used for testing due to the complications and costs associated with the discharge requirements and the need for an extensive analysis of influent and effluent waters. Instead, a perchlorate-free operational well (NC-12) located near one of the perchlorate contaminated wells (NC-11) was used as feed water for both bench- and pilot-scale systems. Perchlorate was spiked to achieve a final target concentration of 50 µg/L for most of the study. NC-11 and NC-12 draw water from the Saugus Aquifer and have comparable raw water quality (chemistry). Sulfate was spiked to the feed of the ion-exchange unit to achieve a final target concentration of 300 mg/L. This mimics the highest average sulfate concentration measured in Saugus wells. Sulfate is a critical parameter in the ion-exchange process since it competes with the perchlorate ion. NC-11 and NC-12 were sampled and characterized in February and March 2003, respectively (Table 3.1). NC-12 well water was transferred to four 6,500-gallon storage tanks located outside the chemical building at the Rio Vista WTP via a 6,000-gallon stainless steel tanker truck which was filled at the well site and transferred to the pilot site. The tanker used for transferring the raw feed water was washed with hot water or a caustic solution and then rinsed prior to use, to ensure no impact on the raw water quality. The water stored in the baker tanks at the site was delivered to the test equipment via Schedule 80 PVC. To maintain a consistent water temperature, feed flows were routed through an ITT Standard heat exchanger, Model SX200. The water was used at a rate varying from 2,900 to 5,800 gallons per day (2 to 4 gpm).

Table 3.1 Water Quality Parameters in the Groundwater at Newhall 11 and 12 Wells Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

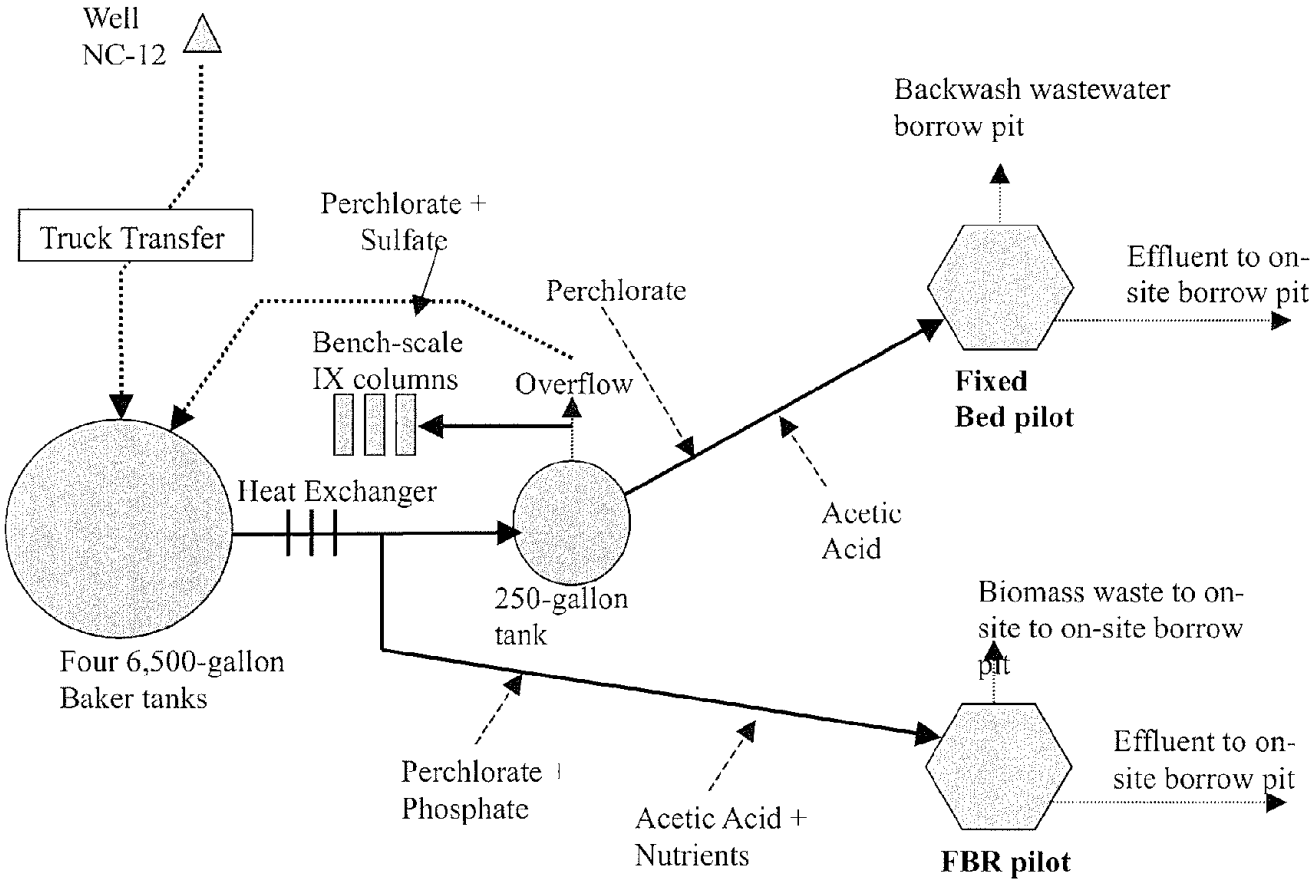
Parameter	Units	NC-12 (March 2003)	NC-11 (Feb 2003)	NC-11 (Historic)
Perchlorate	µg/L	ND(1)	17-20	13-23
Nitrate-NO_3^-	mg/L	14.6	18-20	14-30
Sulfate	mg/L	131	309-330	255-443
Bicarbonate	mg/L	199	220	232-235
Chloride	mg/L	38	28	29-38
Alkalinity	mg/L as $CaCO_3$	163	180	182-280
pH	–	7.5	7.4	7.5-7.7
Conductivity	µhom/cm	846	1,120-1,138	980-1,116
Temperature	degrees C	19	16	
Uranium	pCi/L	0.679	2.887-4.368	NA

Table 3.1	Water Quality Parameters in the Groundwater at Newhall 11 and 12 Wells Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Units**	**NC-12 (March 2003)**	**NC-11 (Feb 2003)**	**NC-11 (Historic)**
Arsenic	µg/L	1.3	<1.0-1.0	<2.0-2.0
TOC[2]	mg/L	<0.7	2.0[3]	N/A[4]

Notes:
(1) Not detected.
(2) Total Organic Carbon.
(3) After approximately three hours of flushing.
(4) Not available.

A process flow schematic for bench- and pilot-testing is provided in Figure 3.1. The water was pumped from the four 6,500-gal tanks to a 250-gallon tank inside the building. The flow was then split two ways into the FXB and the FBR pilots. Schedule 80 PVC was used to hard pipe the baker tank to the feed pump of each biological pilot skid. Perchlorate stock solution was prepared as necessary by spiking reagent grade sodium perchlorate (Fischer Scientific, Hanover Park, Illinois) to 1 liter of deionized, distilled water from the CLWA laboratory. Peristaltic pumps (Ismatec, Northbrook, Illinois) dosed the perchlorate stock solution near the front end of each pilot feed line for adequate mixing. Perchlorate was dosed independently to each pilot skid to maintain flexibility in the pilot testing protocol. For example, using this configuration, perchlorate spiking tests were applied to one pilot without having to be applied to the other. Technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) was used as the stock electron donor solution and dosed to the pilot feed lines just before entry to the biological reactors using a peristaltic pump. This acetic acid is undergoing ANSI/NSF 60 certification, which should be completed by the mid-2004. ANSI/NSF 60 - certified, food-grade phosphoric acid (Prayon, Inc., Augusta, Georgia) was also dosed to the pilot feed lines using peristaltic pumps. For the FBR system, a micronutrient mixture was added to the phosphoric acid solution for selected tests. The micronutrient mixture contained trace amounts of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt. The main PVC feed pipes were fitted with a static mixer downstream of the chemical injection points.

For the bench-scale IX tests, water was collected from the pilot feed tank in two 55-gallon tanks (approximately 1 week's supply). The tanks were filled from the overflow line of the 250-gallon tank. A 1,000-mg/L perchlorate stock solution was prepared by adding reagent-grade sodium perchlorate salt to distilled deionized water obtained from the CLWA laboratory. This solution was spiked directly into the containers to result in a final concentration of 50 µg/L. Additional sulfate was also added to the containers by dissolving reagent sodium sulfate (Na_2SO_4) in distilled-deionized water to reach a final sulfate concentration of 300 mg/L.



PROCESS FLOW SCHEMATIC FOR BENCH- AND PILOT-SCALE TESTING

FIGURE 3.1

3.3 Discharge Streams

All process effluents (i.e., bench-scale effluent, pilot-scale effluents, and backwash wastewater) were pumped to a borrow pit on the Rio Vista plant site. The discharge waters were first directed to off-site GAC drums to remove any residual perchlorate prior to ultimate disposal in the borrow pit. The backwash water from the pilot-scale systems was first directed to a 100-gallon drum to allow for settling, and the decant wastewater was then directed to the feed of the GAC drums. The effluent stream from the GAC drums was analyzed for perchlorate once per week. Additional tanks with approximately 300 pounds of Virgin GAC were installed before the discharge point to treat any perchlorate that may be present in the effluents. If perchlorate was detected in the GAC effluent, the spent GAC was removed and replaced with virgin GAC. The borrow pit has no surface discharge and allows negligible percolation due to the presence of a heavy clay soil lining. There was no discharge to the sewer system or Santa Clara River. Spent resins were sent to a certified laboratory for further characterization and disposal.

4.0 EQUIPMENT DESCRIPTION AND CAPABILITIES

4.1 Ion Exchange

4.1.1 Bench-Scale Flow-Through Column Testing Unit

A bench-scale flow-through column apparatus was used to evaluate the removal of perchlorate and other anions by IX (Figures 3.2 and 3.2(a)). This equipment was used to determine performance and cost data for three commercially-available perchlorate-selective, IX resins.

Three glass columns were set up to run in parallel, each with a different resin. The columns are 15 mm in diameter, 30 cm in length, and were filled to a depth of 12.7 cm with resin media (22.5 mL of resin). The media was supported with stainless steel screens. Each column was first half-filled with distilled water. Resin was then added from the top and allowed to settle to the bottom of the column. Resin was added until the settled resin level reached the 12.7-cm mark. Resin was added with excess water in the column to prevent the formation of air-gaps in the packed resin. Once the full amount of resin was added, the column was filled with distilled water. An in-line pre-filter (9.824-inch Osmonics Flotrex-GF pleated 3.0 μm absolute Model FGF031AAS) was installed after the feed pump to remove suspended material from the feed water. To monitor headloss, pressure gauges were installed upstream and downstream of the filter housing unit, and pressure relief valves were used to prevent pressure build-up. A three-way valve was also installed in the effluent line to provide a location for manual sampling.

BENCH-SCALE FLOW-THROUGH ION EXCHANGE EQUIPMENT

FIGURE 3.2

carollo engineers

CASTAIC LAKE WATER AGENCY

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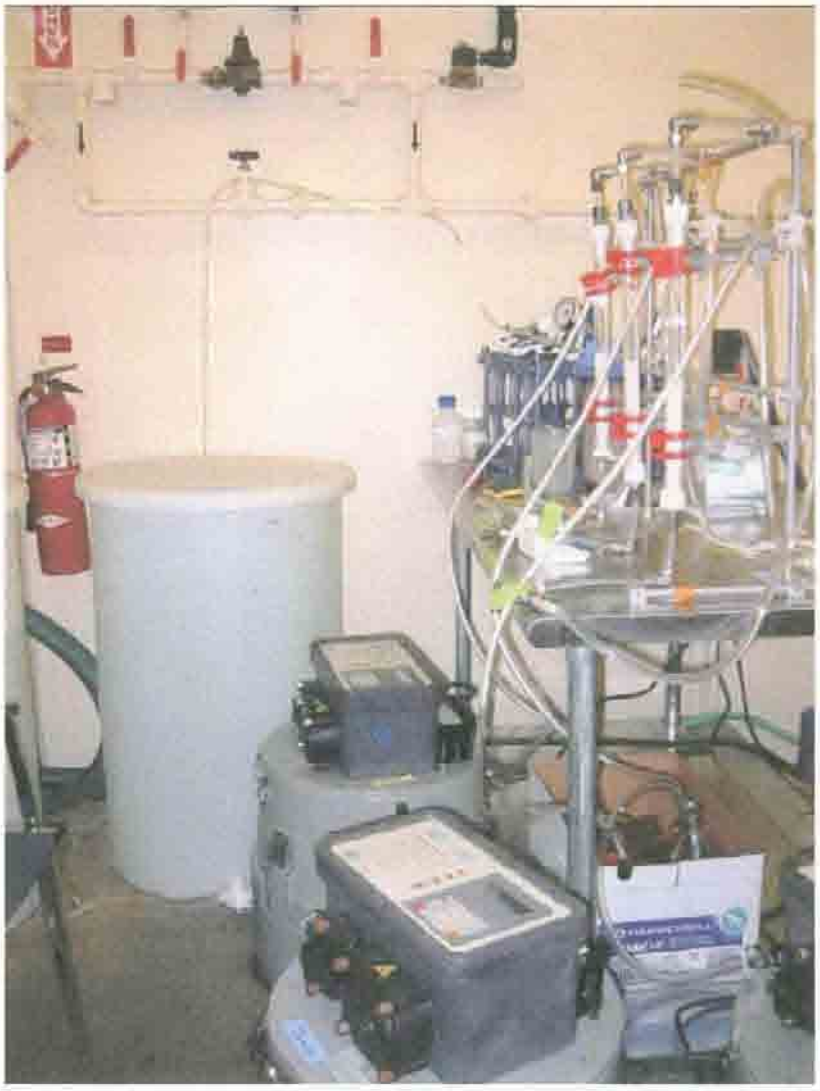


BENCH-SCALE COLUMN SETUP AND AUTOSAMPLERS

FIGURE 3.2(a)

The columns were set up to run in parallel such that perchlorate spiked water was delivered from the two 55-gallon storage tanks to the head of the columns using an LMI model QG 400 piston lab pump. Flow-rates from each column were measured using a stopwatch and a 5-mL graduated cylinder. Volumetric measurements were taken on a daily basis. The flow was adjusted as necessary using a needle valve located at the effluent of each column. Timed effluent water samples were collected by autosamplers (leased from ISCO, Lincoln, Nebraska) during the first week of testing. The autosamplers were used to collect a one-hour composite batch from each column over a period of 24 hours. This process was repeated over the entire first week. The sampling intervals were determined from modeling results provided by the resin suppliers and/or generated by IX Pro Software using the Saugus water quality and separation factors associated with a perchlorate-selective resin as inputs.

4.1.2 Resins

There are several commercial resin manufacturers/suppliers. Based on the raw water quality in the Saugus Aquifer (i.e., perchlorate, sulfate, nitrate, TDS) and the lack of a dedicated line for disposing spent brine produced from conventional ion-exchange systems, perchlorate-selective, throw-away ion-exchange resins were selected for further evaluation using bench-scale testing. The following three resins were tested in parallel based on the availability for use in packaged systems, vendor recommendations and applicability to treating Saugus groundwater based on modeling results:

- US Filter K-9710 (US Filter Corporation, Rockford, Illinois): USF K-9710 is a strong base quarternary amine macroporous anion resin consisting of a styrene divinylbenzene matrix. The resin was tested at the Edwards Air Force Base. This resin, which received on NSF-61 certification in July 2003, can be supplied directly through a system manufacturer (e.g., US Filter, Calgon Carbon). A full-scale system using this resin is operational in the City of Rialto, California. The resin has a unique dual functionality exhibiting very high selectivity for oxy anions, such as perchlorate and pertechnate, that allows for efficient removal in a relatively high TDS background. US Filter recommends the use of this resin for single pass applications.

- Calgon Carbon Cal Resin 2 Resin 2100 Series (Calgon Carbon Corporation, Pittsburgh, Pennsylvania): This resin consists of a trimethylamine functionalized, chloromethylated copolymer of styrene and divinylbenzene in the chloride form. DHS approved packaged treatment systems are located at the City of Riverside and at California Domestic Water Company. Cal 2100 Series resins are NSF certified (NSF/ANSI Standard 61) through WQA.

- US Filter K-9708 resin (US Filter Corporation, Rockford, Illinois): USF K-9708 is a strong base quarternary amine macroporous anion resin consisting of a styrene divinylbenzene matrix. The resin has a special functionality which exhibits high

selectivity for perchlorates and nitrates over sulfates. This selectivity allows the resin to remove perchlorates and nitrates preferentially over sulfates with no potential for perchlorate or nitrate dumping. The resin is initially in the chloride form. USF K-9708 is an NSF-certified resin.

4.1.3 Autosamplers

During the first week of testing, sample collection from each column was automated using 3700 Portable Isco autosamplers (Isco, Inc., Lincoln, NE). Effluent samples were drawn every hour from 2-L glass Erlenmeyer flasks into the custom-fit polypropylene bottles located within the autosampler. Selected samples were stored at 4 degrees C in amber glass bottles until they were analyzed by CLWA or MWH laboratories. Samples were preserved by laboratory personnel with the exception of TOC/DOC samples for which 8 drops of 50 percent HCl were added on site to reduce the pH to less than 2.

During the remainder of the weeks, samples were manually collected by allowing the effluent to flow directly into the sampling bottles using three-way valves.

4.1.4 NDMA Formation Potential Testing

Bench-scale NDMA formation potential tests were conducted during the later phases of the ion-exchange testing. Post-chlorination testing with free and combined chlorine was conducted on each column effluent, as well as pre-chlorination testing with free chlorine. In addition, resin leaching testing in groundwater and DI water without the addition of chlorine was conducted for baseline comparison.

4.1.4.1 Post-Chlorination Testing with Free Chlorine

A 2,000 mg/L free chlorine stock solution was prepared from a 17,000 mg/L hypochlorite solution provided by CLWA. Two 1-L samples were collected from each column effluent. A 1-mL volume of chlorine stock solution was added to each of the bottles, resulting in a 2 mg/L free chlorine dose. The bottles were incubated for 24 hours in the dark under ambient room temperature. Free chlorine residuals were measured after 2 hours of incubation and after 24 hours of incubation. Samples were sent to MWH Laboratories for NDMA analysis. All chlorine stock solutions, doses, and residuals were measured on-site using a Hach DPD field test kit.

4.1.4.2 Post-Chlorination Testing with Chloramines

An ammonium chloride stock solution was prepared by dissolving 1.9 g of reagent-grade anhydrous NH_4Cl (also provided by CLWA laboratory) in 500 mL water. A chlorine:ammonia-N ratio of 4.0 on a weight basis was used (i.e., 2 mg/L chlorine and 0.5 mg/L ammonia-nitrogen) and 2-hour and 24-hour incubation periods were used as described above. Free and total chlorine residuals were measured in the bottles at the end of the incubation period. Bottles were sent to MWH Laboratories for NDMA analysis.

4.1.4.3 Pre-Chlorination Testing with Free Chlorine

Toward the end of the study, a 2 mg/L free chlorine dose was added to the 55-gallon drum, which fed the IX columns. Two samples were collected over a 4-day time period from each column effluent for NDMA analysis. Free chlorine residuals were measured in the bottles.

4.1.4.4 Fresh Resin Batch Testing

To evaluate the leaching potential of fresh resin, approximately 100 mL of fresh resin was added to 1 L of DI water and 1 L of feed groundwater. Bottles were allowed to incubate for a period of 4 hours. Samples were shipped to MWH Laboratories for NDMA analysis.

4.1.5 Spent Resin Characterization

TTLC and Soluble Threshold Limit Concentration (STLC) are used when determining the hazardous waste characterization of a substance under California State regulations as outlined in Title 26 of the California Code of Regulations (CCR). The three spent resins were shipped to MWH Laboratories (TTLC analyses were subcontracted to Columbia Labs in Canoga Park, California) for the following characterizations:

- TTLC Analysis for CAM 17 Metals (in California): This analysis determines the total concentration of each target analyte in a sample. Resin samples were homogenized and 5 grams of each sample were digested and analyzed for the TTLC metals according to standardized EPA methods (EPA Methods 6020 for most metals, 6010B for cooper, lead, and zinc, and 7471A for mercury). When any target analyte exceeds the TTLC limits (Table 3.19 in the Results Section), the waste is classified as hazardous and its waste code is determined by the compound(s) that failed TTLC. The results of this analysis can be used to determine if analysis for STLC level is necessary by comparing 10 times the STLC limit to the TTLC results. A factor of ten is necessary to compensate for a 1:10 dilution factor that is present in one analysis but not the other. If the TTLC results do not exceed 10 times the STLC limit, then normally no further STLC analysis is required.

- STLC Analysis for Perchlorate, Nitrate, and Uranium: This analysis determines the amount of each analyte that is soluble in the "Waste Extraction Test" (WET) leachate. This WET leachate procedure is used for solid samples or for samples containing more than 0.5 percent solids. The sample is tumbled in 10 times its weight of a 0.2 M sodium citrate buffer for 48 hours.

- Approximately 100 mL of STLC extract was obtained from each resin sample. These extracts were returned to MWH Labs for analysis of perchlorate, nitrate, and radioactive uranium.

4.2 Biological Fixed-Bed Filter

4.2.1 Pilot Skid

A photo of the FXB granular media filtration skid is provided in Figure 3.3. Important process components are identified.

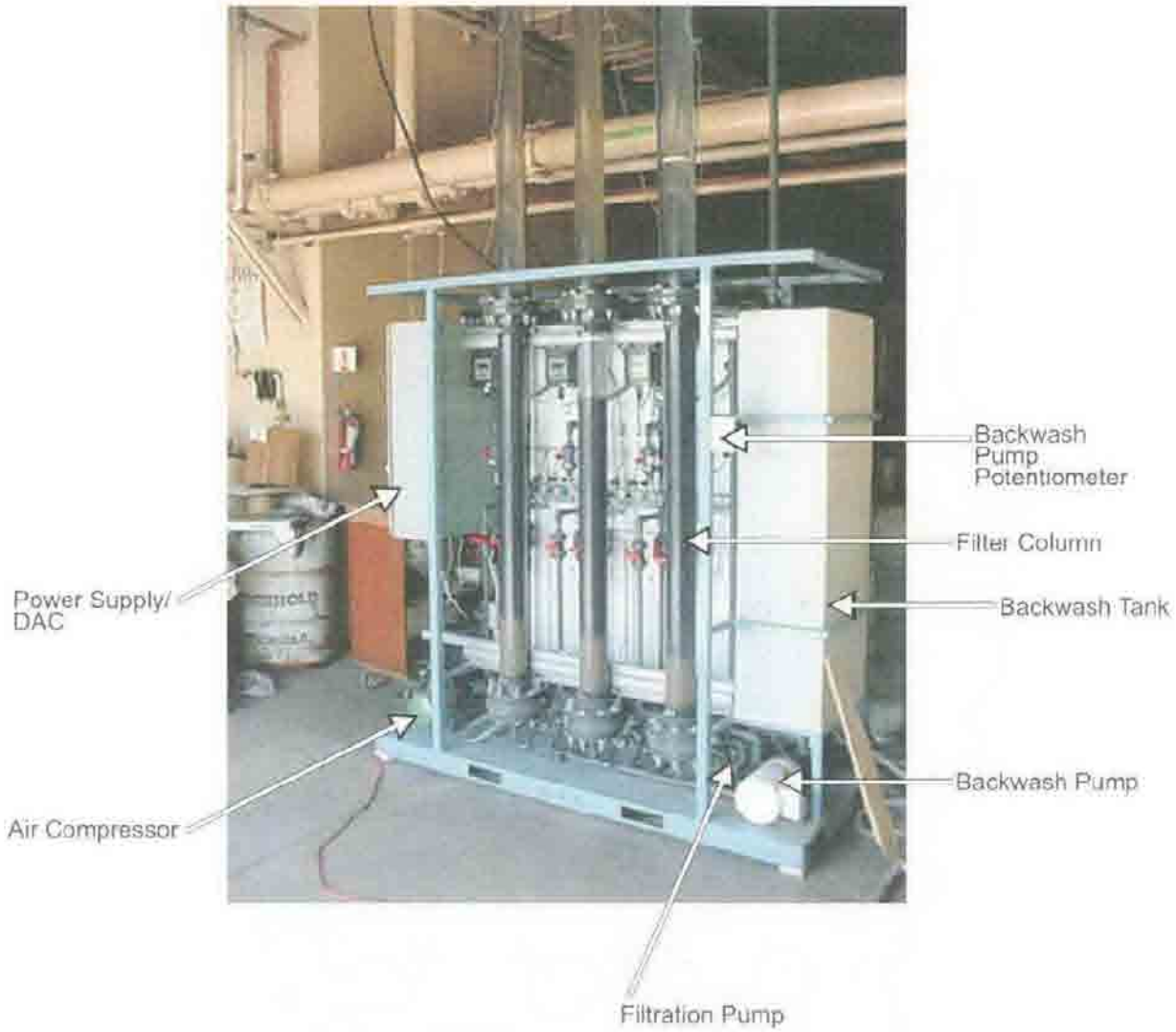
Design criteria and technical specifications for the FXB biological filtration skid are provided in Tables 3.2 and 3.3, respectively.

Table 3.2 Fixed-Bed Filter Design Criteria
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Value/Description
Filter dimensions	4" diameter, 14' tall
Number of filters per skid	3
Number of independent feed pumps	3
Maximum flow per filter	1.5 gpm
Hydraulic loading rate	2-17 gpm/ft^2
Media support mechanism	Retention plate
Backwash type	Air and/or water
Air supply	On-board compressor (with 5 μm filter)
Backwash water tank volume	20 gallons
Parameters measured by in-line meters	Flow Effluent turbidity Effluent particle counts Headloss across the filters

Table 3.3 Fixed-Bed Filter Technical Specifications
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Value/Description
Skid weight	750 lbs
Skid dimensions (LxWxH)	6'6"x2'6"x14'
Electrical requirements	3-phase, 30A, 208-Volt, AC power (Y connection)
Influent, effluent, overflow connections	1" Cam Lock



FIXED-BED BIOLOGICAL FILTRATION PILOT PLANT

FIGURE 3.3

30-CLWA204F3-3-6926A10.CDR

A schematic of the FXB pilot is shown in Figure 3.4. The FXB skid is configured for down-flow operation. Initially, all three columns on the skid were utilized for pilot testing.

However, because sampling and other daily pilot tasks required for three columns were too onerous for a single operator, two of the columns were shut down one month into the piloting period. Stock perchlorate and (temporarily) phosphate solutions were added upstream of an in-line static mixer using an Ismatec ISM 832B two-channel eight-roller peristaltic pump together with Pharmed 0.020-inch ID peristaltic pump tubing. A second head was added to the peristaltic pump to add acetic acid to the system. Initially, acetic acid was also added at the same location as the perchlorate stock solution. However, excessive growth in the feed lines prompted a relocation of the acetic acid feed to the top of the column one month into the piloting period. Filter effluent turbidity and particle counts were monitored continuously by dedicated turbidimeters and particle counters. A pressure transducer mounted on the pilot skid monitored head loss development across the filter; backwashes, which could include air scour, were initiated manually. The pilot skid is equipped with a data acquisition and control (DAC) system, which stores and manages data. For each filter column, the DAC continuously logs date/time, flow, headloss, effluent turbidity, and effluent particle counts. The skid includes a touch screen interface to monitor and control pilot operations.

4.2.2 Media

The columns were filled to a depth of 7 feet (approximately 0.6 ft^3) with virgin Calgon F-400 granular activated carbon (GAC). This allowed for bed expansion up to 50 percent. F-400 is a bituminous-based carbon commonly used in the United States. The GAC was stored overnight in 5-gallon buckets to wet the surface and internal pores. The filter columns were filled with NC-12 well water and the GAC was dosed slowly into the columns until the 7-foot depth was reached. Once the columns were packed with GAC, they were backwashed for a period of 24 hours at a 45 percent bed expansion to remove carbon fines from the GAC bed.

4.2.3 Stock Solutions

For the biological pilot systems, an intermediate stock perchlorate solution of 136.17 g/L ClO_4^- was made using reagent grade sodium perchlorate salt and distilled deionized water. Individual stock solutions were made as necessary in 2-L glass bottles using the intermediate stock solution. During periods where phosphorus was added to the feed stream, 75 percent pure food-grade phosphoric acid was added directly to the perchlorate stock solution. For the acetic acid stock solutions, technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) was used. Stock solutions were stored in 2-L glass bottles that were flame sterilized using ethanol.

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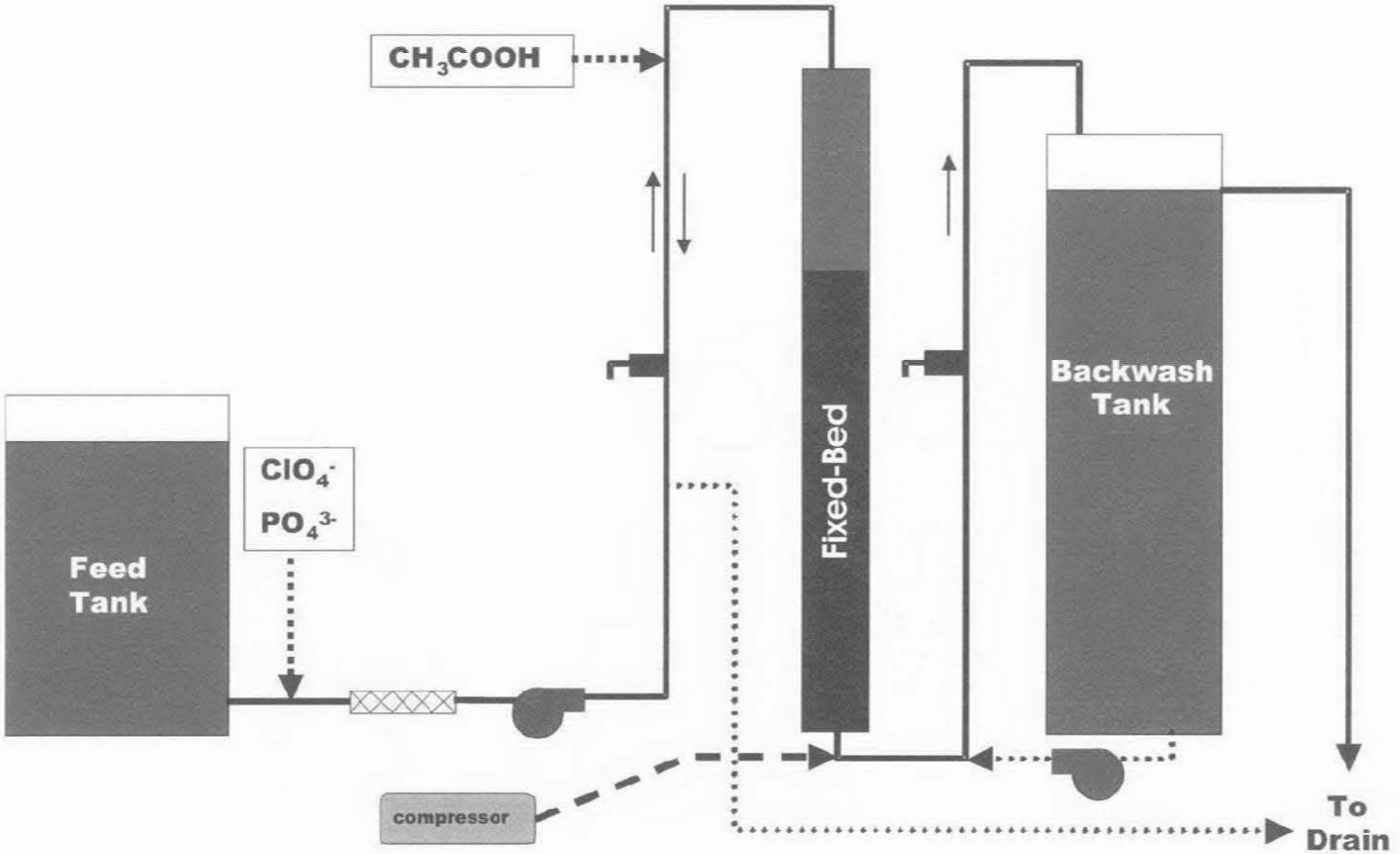

FIXED-BED BIOLOGICAL FILTRATION PILOT SCHEMATIC (NOT TO SCALE)

FIGURE 3.4

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CASTAIC LAKE WATER AGENCY

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4.3 Biological Fluidized-Bed Reactor

4.3.1 Pilot Skid

The basic components of the pilot FBR system included the bioreactor, bed height control component (when required), biomass separator, a fluid distribution system at the bottom of the reactor, a feed pump, and chemical feed systems (Figure 3.5). The bed of GAC media is hydraulically fluidized to reduce its resistance to flow and to improve substrate/biomass contact by directing liquid flow upward into the bed. The fluidization rate is controlled to maintain a 25 to 30 percent bed expansion over the resting bed height. Feed flow is supplemented with recycle flow to provide the appropriate up-flow velocity for fluidization. When biofilm growth occurs on the GAC media, the particle diameter increases and the effective density of the particle decreases, which causes further expansion of the bed. It is necessary to manage film thickness to control or prevent bed carryover. In full-scale FBR systems, bed height is managed in the top portion of the bed by mechanically shearing the biomass from the GAC through a valve. The "cleaned" GAC particles settle back into the bed, ready to support more biofilm growth, and the sloughed biomass is discharged. In the pilot test unit, mechanical mixing or pump shear was used to perform this task.

Perchlorate and phosphorous stock solutions were added directly to the feed line upstream of the recycle line connection using a diaphragm metering pump. A second diaphragm metering pump was used to add acetic acid stock solution to the feed line. Initially, the acetic acid was injected just prior to the feed pump, but was later moved closer to the bioreactor to minimize biofouling in the feed lines.

4.3.2 Media

The FBR bioreactor uses a proprietary coconut shell based carbon that meets Shaw Environmental-Envirogen specifications for hardness, apparent density, effective size, iodine number, and uniformity coefficient.

4.3.3 Stock Solutions

For the biological pilot systems, an intermediate stock perchlorate solution of 136.17 g/L ClO_4^- was made using reagent grade sodium perchlorate salt and distilled deionized water. Individual stock solutions were made as necessary in 2-L glass bottles using the intermediate stock solution. Food-grade phosphoric acid (Prayon, Inc., Augusta, Georgia) was added directly to the perchlorate stock solution. Acetic acid stock solutions were prepared using technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) and were stored in a 10-L polypropylene carboy. Before stock solutions were prepared, these carboys were rinsed with rubbing alcohol for sterilization. For selected tests, a micronutrient mixture (GrowMore, Gardena, California) was added directly to the acetic acid stock solution. The micronutrient mixture contained trace amounts of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt.

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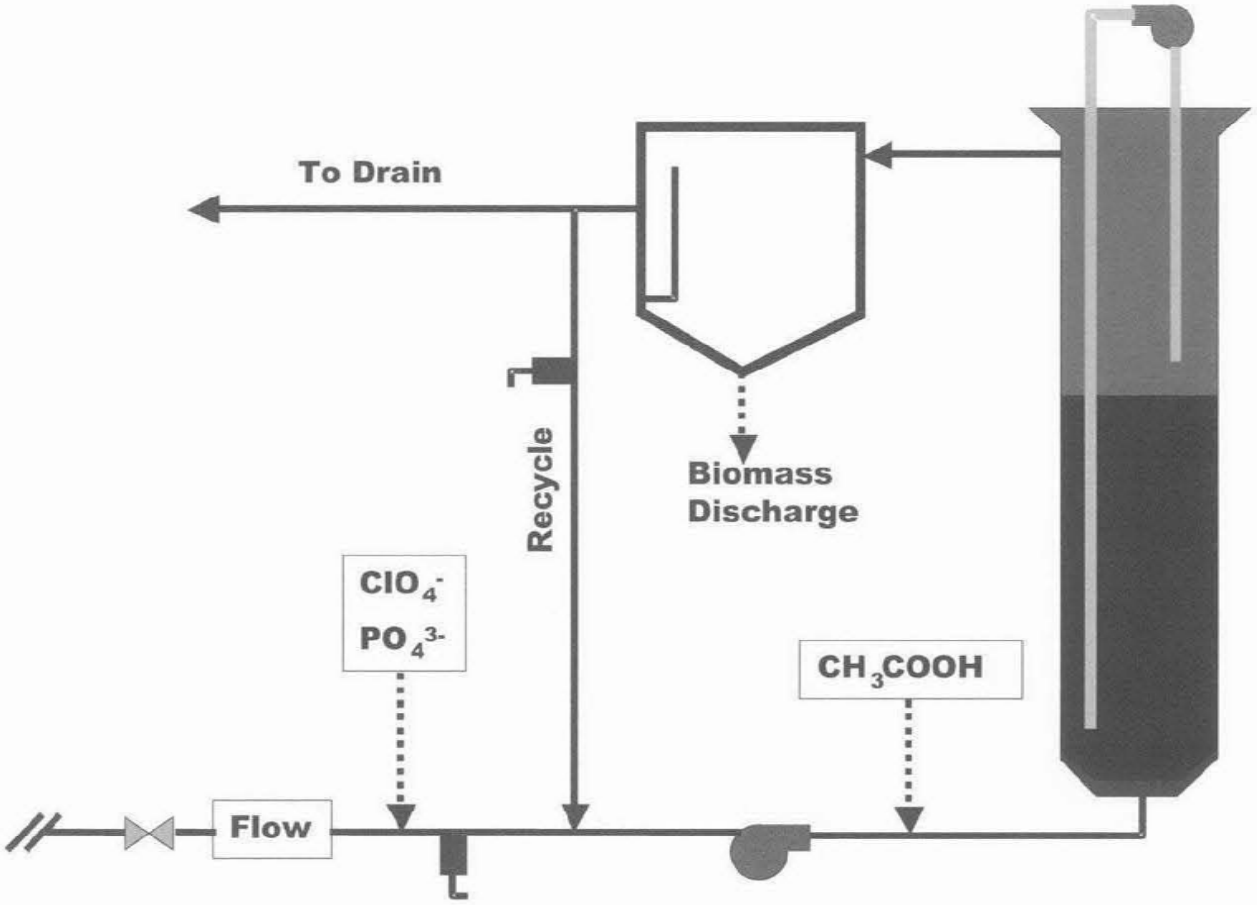

FLUIDIZED-BED BIOLOGICAL FILTRATION PROCESS SCHEMATIC (NOT TO SCALE)

FIGURE 3.5

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4.4 Submerged Membrane Bioreactor

4.4.1 Objectives

Zenon Zeeweed® membranes, operating in an SMBR configuration, were evaluated as an alternative combined treatment step for post-treatment of effluent from the biological filtration process. The post-treatment process must achieve four treatment goals:

1. Aeration: Since biological perchlorate reduction requires anaerobic conditions, DO must be supplied during the post-treatment process.

2. Residual Organic Carbon Removal: Organic substrate is added to the FXB to achieve perchlorate reduction. Therefore, to prevent regrowth problems and to minimize the formation of DBPs, the effluent water must be stabilized biologically.

3. Sulfide Removal: Under anaerobic conditions, sulfate can be reduced to sulfide, which generates a rotten-egg odor. Therefore, the post-treatment process must be able to remove sulfide, which can be accomplished via biological oxidation or air stripping.

4. Biomass Separation: The post-treatment process must provide a barrier for removal of biological matter (HPC bacteria) that sloughs from the biological filters.

4.4.2 System Description

The ZeeWeed® water treatment process is a proprietary ZENON process technology that involves the production of treated water by drawing water through ZeeWeed® "outside-in" hollow fiber membranes that are immersed in the feed water. The ZeeWeed® ultrafiltration membranes have nominal and absolute pore sizes of 0.04 and 0.10 mm, respectively. The membranes act as a physical barrier that prohibits particulate matter exceeding 0.1 μm in size, including *Giardia* cysts and *Cryptosporidium* oocysts, from entering the treated water supply. The small pore size ensures the removal of a high percentage of impurities, including some viruses (typically 2 to 4.5 log reduction), which are removed by a combination of adsorption onto the solids in the process tank and membrane filtration.

The ZeeWeed® membrane filtration system operates under a low-pressure vacuum that is induced within the hollow membrane fibers by a connection to the inlet (suction) side of a centrifugal permeate pump. The treated water is drawn through the membrane by vacuum, enters the hollow fibers and is pumped out to distribution by the permeate pumps. Airflow is introduced at the bottom of the membrane module to create turbulence that scrubs and cleans the outside of the membrane fibers. This reduces the solids accumulation on the membrane surface, thereby allowing the membrane to operate for extended periods at high permeate fluxes. The air also has the beneficial side effect of oxidizing iron and other organic compounds that may be present. It also provides mixing within the process tank to maintain solids in suspension. The membranes are periodically backwashed which consists

of passing permeate through the membranes in the reverse direction to dislodge solids from the membrane surface.

The ZeeWeed® Ultrafiltration system provides a single step process, effectively replacing both the clarification and granular media type (sand) filtration processes found in conventional water treatment plants. The membrane pore size is extremely small and effectively provides a physical barrier to solids present in the water. Therefore, there is no need to create flocculated particles that are large enough to settle in clarifiers or large enough to be captured by granular media filters. Also, as the membranes are immersed directly in the process tank and under only low vacuum, high levels of suspended solids do not foul the membrane.

The ZeeWeed® membranes, operating in an MBR configuration, were considered in this case as an alternative combined treatment step for post-treatment of the effluent from the biological filtration processes. Post-treatment has three main purposes:

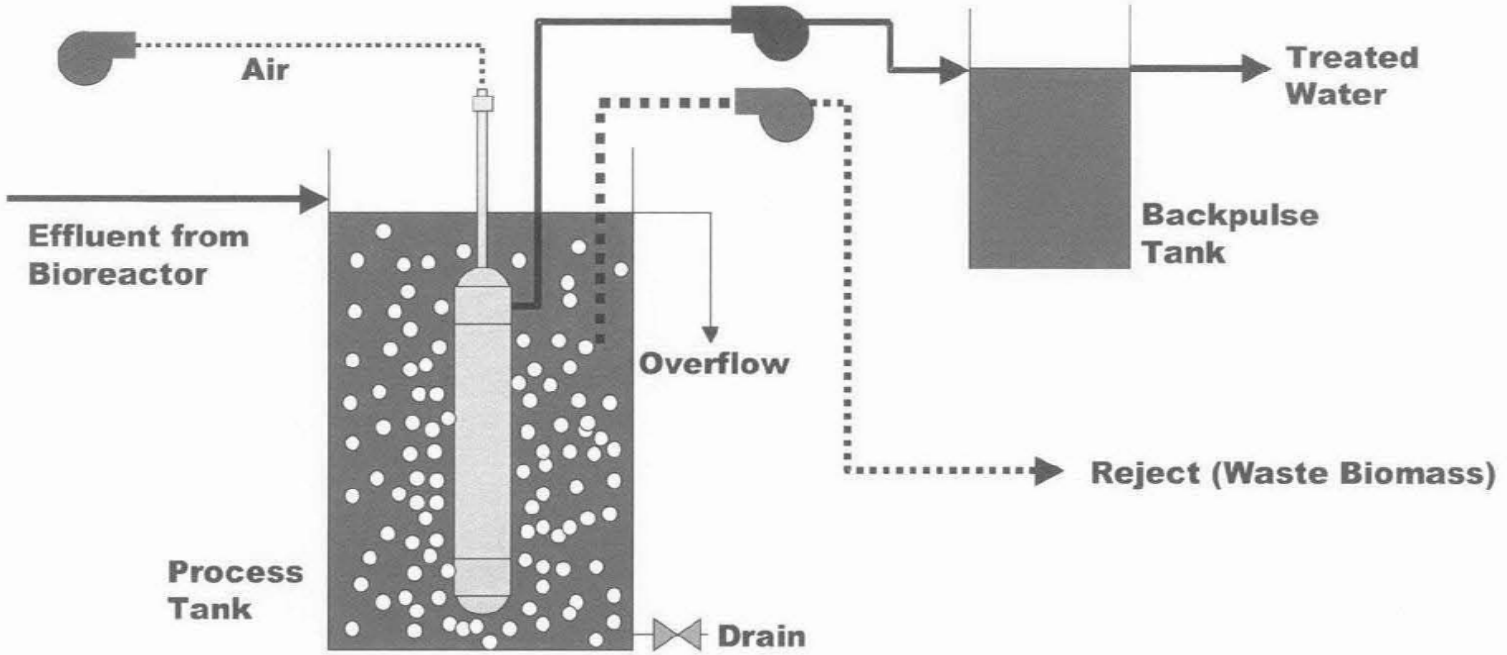
- To provide biological oxidation of excess substrate (acetic acid) fed to the filters;
- To re-oxygenate the water; and
- To provide a barrier for removal of biological matter (HPC bacteria) present in effluent from the biological filters.

A flow schematic for the ZeeWeed®-based post biological FXB filtration process is presented in Figure 3.6.

4.4.3 System Components and Specifications

The unit is equipped with:

- Coagulant Feed Pump and Chemical Tank.
- Cleaning Chemicals.
- Process Tank (hydraulic retention time is 3 to 5 hours).
- Membrane Air Scour Blower.
- Dual head, variable speed, reversible, metering pump for permeate and reject.
- One ZeeWeed®-10 Ultrafiltration Membrane.
- Backpulse Tank.
- Instrumentation and Control Panel.



POST-FXB TREATMENT MBR SCHEMATIC (NOT TO SCALE)

FIGURE 3.6

ZW-10 module and system specifications are listed in Tables 3.4 and 3.5, respectively. Table 3.6 lists system operating limits.

Table 3.4	**SMBR ZW-10 Module Specifications Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency**
Model	ZW-10, Submersible Module
Configuration	Outside/In Hollow Fiber
Dimensions (length x width x height)	6'x4'x5'
Nominal Membrane Surface Area	0.93 m^2 (10 ft^2)
Absolute Pore Size	0.1 micron
Weight of Module (Drained)	1.9 kg (4.2 lb)
Weight of Module (Wet)	2.1 kg (4.6 lb)
Permeate (Fiber Side) Hold-up Volume	0.13 liters (0.033 gal)

Table 3.5	**SMBR ZW-10 System Specifications Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency**
Designation	ZW-10 Bench Test Unit
Electrical service required	115 V, 60 Hz, 2A
Process tank total volume	220 L (58 usg)
Process tank working volume, nominal	190 L (50 usg)
Backpulse tank total volume	20 L (5 usg)
Backpulse tank working volume	15 L (4 usg)
Shipping weight	75 kg (160 lb)
Operating weight	300 kg (660 lb)
Process tank size (with backpulse tank)	75 cm Ø x 160 cm H (30"Ø x 60" H)
Process pump size	40 cm x 15 cm x 15 cm (16" x 6" x 6")
Blower size	40 cm x 25 cm x 25 cm (16" x 10" x 10")
Control panel size	38 cm x 38 cm x 20 cm (15" x 15" x 8")

Table 3.6	SMBR ZW-10 System Operating Limits Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Maximum pump capacity	2 liters/minute (0.53 gpm)
Maximum Transmembrane Pressure	62 kPa (9.0 psig) @ 40°C (104°F)
Typical Operating TMP	10-50 kPa (1.0-7.0 psi) @ 40°C (104°F)
Maximum Operating Temperature	40°C (104°F)
Operating pH range	5-9
Maximum Cleaning Temperature	40°C (104°F)
Cleaning pH Range	2-10.5
Maximum OCl^- Exposure(1)	1,000 mg/L
Maximum TMP Back Wash Pressure	55 kPa (8.0 psi)
Maximum Aeration Flow per Module	3.6 m^3/h (2 scfm)

Notes:
(1) Higher OCl^- concentrations can occasionally be used.

4.5 DBP Formation Potential Testing

4.5.1 Source Waters

DBPFP is defined as the difference between the TTHM or HAA concentration after 7 days of incubation with excess free or combined chlorine residual and the initial TTHM or HAA concentration. Free chlorine and combined chlorine DBPFP tests were conducted using the following source waters:

- FXB and FBR Effluent: This test served as a worst-case scenario test (i.e., no post-treatment downstream to remove excess electron donor).
- SMBR Effluent: This test simulated on-site post-treatment with an aerated SMBR.
- Ozonated FXB and FBR Effluent: This test simulated post-treatment at the Rio Vista WTP.

4.5.2 Formation Potential Method

Test waters were subjected to formation potential evaluation of trihalomethanes and haloacetic acids. The trihalomethane formation potential method (THMFP) is described in the 20th Edition of Standard Methods (Method 5710B). All samples for DBP formation potentials were subjected to the standard methodology for THM formation potential:

"Under standard conditions, samples are buffered at pH 7.0 ±0.2, chlorinated with an excess of free chlorine, and stored at 25 ± 2 degrees C for 7 days to allow the reaction to approach completion. As a minimum, pH is buffered at a defined value and a free chlorine residual of 3 to 5 mg/L exists at the end of the reaction time and THMFP = TTHM at day 7-TTHM at day 0."

In the same manner, HAAFP = THAA at day 7 – THAA at day 0. The same conditions were be used for THMFP and HAAFP with combined chlorine (w:w, chlorine:ammonia = 4).

4.5.3 DBPFP Yield

The THMFP and HAAFP TOXFP yields are a measure of DBP formation potential per mg dissolved organic carbon and are defined as the following:

THMFP yield = THMFP/DOC, where DOC = dissolved organic carbon;

HAAFP yield = HAAFP/DOC and TOXFP yield = TOXFP/DOC.

The yield is a way to estimate the fraction of natural organic matter that is a precursor to formation of halogenated disinfection by-products. It was determined as part of this test.

4.5.4 Chlorine Demand

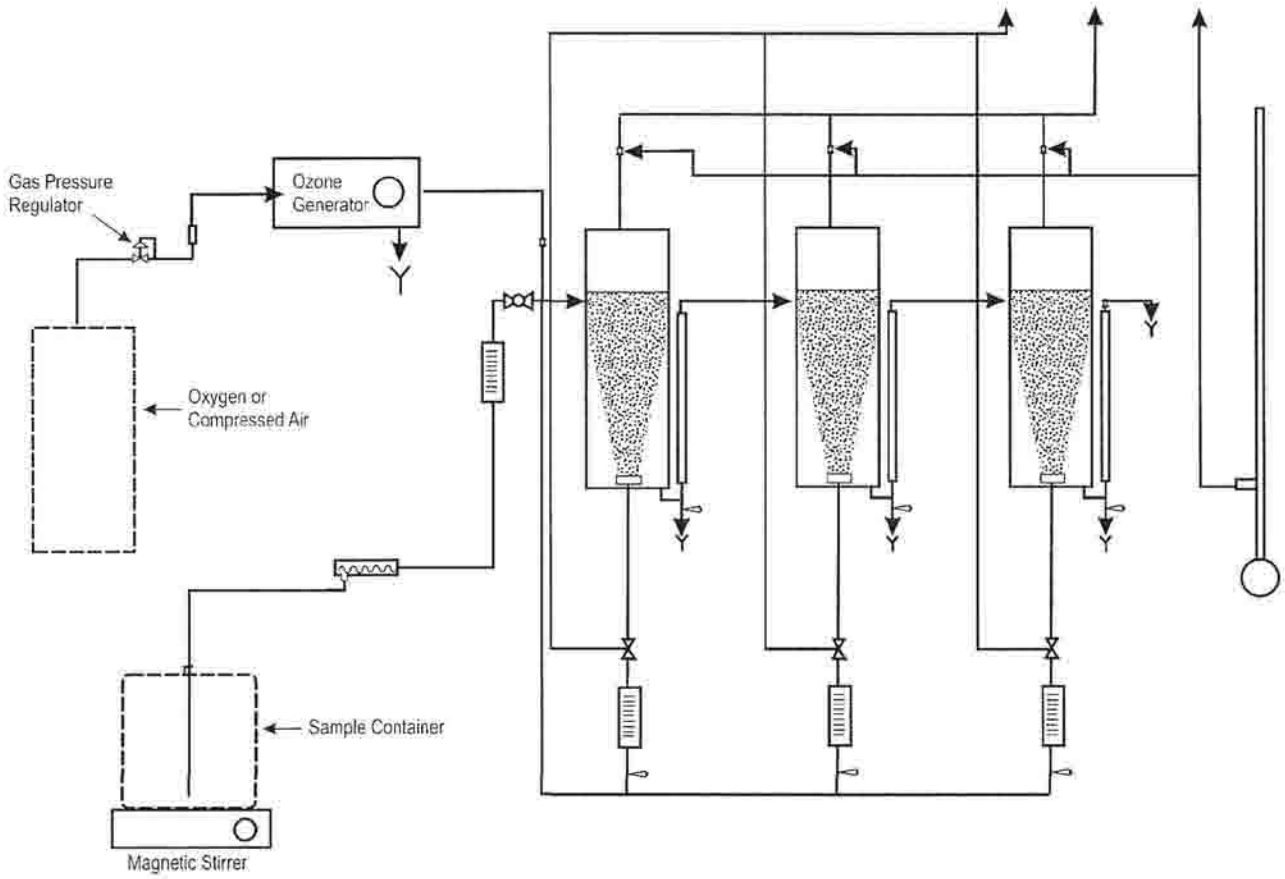
The 7-day chlorine demand was determined by the following procedure:

- Upon receipt of the samples, each sample was analyzed for ammonia, total and free chlorine, and TOC/DOC. The one-hour chlorine demand was measured at day 0. A chlorine:DOC ratio ranging from 2.5 to 5 was used. The results of this preliminary evaluation were used to estimate the required chlorine dose to achieve a 3 to 5 mg/L free chlorine residual at the end of the 7-day incubation period. It was assumed that once the instantaneous free chlorine demand is satisfied, the free chlorine decay would be much slower over the 7-day incubation period.

  A total chlorine residual of 3 to 5 mg/L after the 7-day incubation period was targeted. A chlorine:ammonia ratio of 4 was used.

4.5.5 Ozone Testing

An ozone demand test was conducted on two blended water samples that simulated the feed of the biological effluent to the Rio Vista Surface Water Treatment Plant: 90 percent SPW with 10 percent fixed bed reactor effluent and 90 percent SPW with 10 percent fixed bed effluent spiked with acetic acid. Carollo's bench-scale, continuous-flow, three-chamber ozone contactor was used (Figure 3.7). The hydraulic retention time in the bench-scale contactor was set at 6 minutes, and the test was conducted at ambient water temperature and ambient pH. The applied ozone dose (1.5 mg/L) was equally split between the three chambers. Ozone residuals were measured at the effluent of the third chamber. The



CAROLLO'S CONTINUOUS BENCH-SCALE OZONE REACTOR (NOT TO SCALE)

FIGURE 3.7

20-CLWA204F3.7-6625A10.CDR

effluent of the third ozone chamber was sampled for parameters listed in Table 3.7. Effluent samples were taken after a minimum of three nominal hydraulic retention times (HRTs) were achieved. The ozonated waters were then subjected to chlorine and chloramines for formation potential testing.

Table 3.7 DBPFP Analytical Matrix
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	FXB and FBR BIO Effluent	MBR Effluent	Ozonated Effluent	Lab
TOC/DOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
BDOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	MWH
AOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	MWH
TTHM	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
HAA5	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	7-day Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
Free/Total Chlorine				On-site
	After Cl_2/NH_2Cl (time 0 and time 7 day)	After Cl_2/NH_2Cl (time 0 and time 7 day)	After Cl_2/NH_2Cl (time 0 and time 7 day)	
Ammonia	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	On-site
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
pH	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	On-site
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
UV_{254} Absorbance	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
Alkalinity	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
Bromide	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
Bromate			Before Cl_2/NH_2Cl	CLWA/MWH
Aldehydes			Before Cl_2/NH_2Cl	MWH

4.5.6 Water Quality Analysis

Each sample was analyzed according to the matrix presented in Table 3.7 for full characterization before the addition of disinfectant and 7 days after addition. Ozonated waters were analyzed for bromate and aldehydes. On day 7 of the test following application of chlorine or chloramines, samples were analyzed for free and total chlorine residual, THM4, HAA5, pH, and bromide.

4.6 Simulated Distribution System Test

A follow-up SDS test was conducted on the FBR effluent with free chlorine to confirm the high THM4 and HAA5 levels measured in the FBR effluent during the DBPFP test. Free chlorine was added to the FBR effluent to satisfy the initial demand (approximately 8 mg/L) and to result in a free chlorine residual of 0.3 to 0.5 mg/L after an incubation period of 72 hours. This free chlorine residual and incubation period mimic the free chlorine residuals and maximum hydraulic residence time in the distribution system served by Newhall County Water District wells. The SDS test was conducted at ambient room temperature.

5.0 ANALYTICAL METHODS

Water quality data were measured on-site using bench-top equipment, on-line instruments, and laboratory analyses. The CLWA lab performed the majority of the laboratory analyses. Initial samples for nitrate, sulfate, chloride and bicarbonate were sent to MWH Laboratories in Monrovia, California, in addition to routine analysis for BDOC, sulfide, AOC, VSS, COD, NDMA, uranium, HAAs, TTHMs, and split perchlorate samples. For laboratory analyses, samples were collected in amber glass or polypropylene bottles. Samples sent to MHW labs were placed in bottles supplied by the laboratory and stored at 4 degrees C until analyzed.

5.1 pH

pH was measured on-site using Standard Method 4500-H + B. The pH meter was an Oakton 300 series with a single junction pH electrode. A 2-point calibration of the pH meter was performed daily.

5.2 Temperature

Temperature was measured in accordance with Standard Method 2550 B. This was done daily to check in-line temperature transmitters on the pilot plants. Temperature measurements were made daily using an Oakton 300 series pH/Conductivity meter with a built-in automatic temperature compensation ATC element.

5.3 Turbidity

Feed and permeate water in-line turbidity measurements were logged continuously on the pilot plant using Hach 1720 D low range process turbidimeters. The feed and permeate turbidimeters were calibrated after each run using primary calibration standards purchased from the manufacturer. Turbidimeter sensor lenses were cleaned every two weeks according to the manufacturer's instructions. Turbidimeter flow rates were checked daily to insure that they were within the range required by the manufacturer. Daily bench-top turbidity analyses were performed using a Hach 2100 P field turbidimeter. The instrument was calibrated before measurements using primary turbidity standards (0, 20, 100, 800 NTU).

5.4 Perchlorate

Perchlorate was measured by the CLWA laboratory using EPA method 3.14.0 with a minimum reporting limit of 4 µg/L.

5.5 Common Anions

Analysis for nitrate, nitrite, sulfate, bicarbonate, chloride, and phosphate were provided by CLWA using EPA method 300.0A.

5.6 Dissolved Oxygen

On-site DO measurements were taken using a YSI 5500 portable dissolved oxygen (DO) meter that was calibrated daily.

5.7 Metals

Calcium, magnesium, iron, chromium, and manganese measurements were analyzed using EPA method 200.7 by the CLWA laboratory.

5.8 Sulfide

Total sulfide measurements were made by MWH laboratories using EPA method 376.2.

5.9 NDMA

Analysis for NDMA was made using EPA method 1625 at MWH laboratory.

5.10 Uranium

Uranium analysis was performed by MWH using EPA method 908.1.

5.11 Total Suspended Solids

Total suspended solids (TSS) were measured at CLWA laboratory according to Standard Method 2540 D.

5.12 Total Alkalinity

Total alkalinity was measured at CLWA laboratory according to Standard Method 2320 B.

5.13 Total Hardness

Total hardness was measured at CLWA laboratory according to EPA Method 200.7 and Standard Method 2340 B.

5.14 Organic Carbon

Total organic carbon (TOC) and dissolved organic carbon (DOC) were measured at CLWA laboratory according to EPA Method 415.1. CLWA uses a Shimadzu TOC-5050 Total Organic Carbon Analyzer. The minimum reporting level was 0.7 mg/L. Biodegradable DOC was measured by MWH using the Servais method.

5.15 UV_{254} Absorbance

UV_{254} absorbance was measured at CLWA laboratory according to Standard Method 5910 B. The instrument used for measurements was a Shumadzu UV-1201 UV-VIS Spectrophotometer.

5.16 Total and Free Chlorine

Total and free chlorine concentrations were measured using an on-site, HACH DR 890 field spectrophotometer. High range measurements (0 to 5 mg/L) for total and free chlorine were made in accordance with HACH methods 10070 and 10069, respectively (adapted from Standard Methods). Measurements for total and free chlorine concentrations from 0 to 2.00 mg/L were made using HACH methods 8167 and 8021, respectively (equivalent to Standard Method 4500-Cl G).

5.17 Microbial Parameters

Heterotrophic plates counts (HPCs) and total and fecal coliform counts were measured according to Standard Methods 9215B and 9221 D, respectively by CLWA and MWH laboratories.

5.18 Particle Counts

FXB in-line particle count measurements of the effluent water were logged continuously using a Hach 2200 PCX particle counter. Continuous maintenance of the particle counter (cleaning and flow adjustment) ensured accurate readings.

5.19 Disinfection By-Products

TTHMs and HAAs were measured by MWH laboratories according to EPA Methods 502.2 and 552.2, respectively.

5.20 Ozone Residual

Ozone residual was measured according to the Indigo Blue Method (Standard Method 4500-O3 B). Hach accuvacs were used that withdraw 10 mL of samples directly reacting with the Indigo Powder in the ampule.

5.21 COD

Chemical oxygen demand (COD) analysis was performed at MWH laboratories using EPA method 410.4.

6.0 OPERATING PROTOCOL

6.1 Ion-Exchange Columns

6.1.1 Experimental Design

The bench-scale IX study was conducted by Carollo. There were four objectives for this work:

1. Evaluate the efficiency of three ion-exchange resins for perchlorate removal under the identical feed water, flow rate, and EBCT.
2. Establish the perchlorate breakthrough curves for Saugus Aquifer water using three perchlorate-selective, throw-away resins.
3. Determine the NDMA formation potential of treating Saugus Aquifer water with these resins.
4. Determine characteristics of the spent resin.

- Phase 1 (Perchlorate Breakthrough: Approximately 2 to 4 Months): The columns were fed at a constant flow rate with perchlorate- and sulfate-spiked groundwater and sufficient influent and effluent samples were taken to establish a complete breakthrough curve for each anion. The columns were shut off once perchlorate breakthrough in all columns reached approximately 20 percent of the feed concentration. This translates into an effluent perchlorate concentration of 10 µg/L.

  The operating conditions for each ion-exchange column are listed in Table 3.8. The columns were operated at a service loading rate of 5 gpm/ft^3. With a resin volume of 22.5 mL in each column, the flow rate to each column was approximately 15 mL/min, which equates to an EBCT of 1.5 minutes.

Table 3.8	Breakthrough of Anions Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Parameter	**Value**
EBCT	1.5 min
Service Flow Rate	15 mL/min
Service Loading Rate	5 gpm/ft^3
Surface Loading Rate	2.1gpm/ft^2
Run Length- from Preliminary Modeling	> 20,000 BVs
Batch Feedwater Volume per Column	40 gal/week
Total Batch Feedwater Volume	119 gal/week

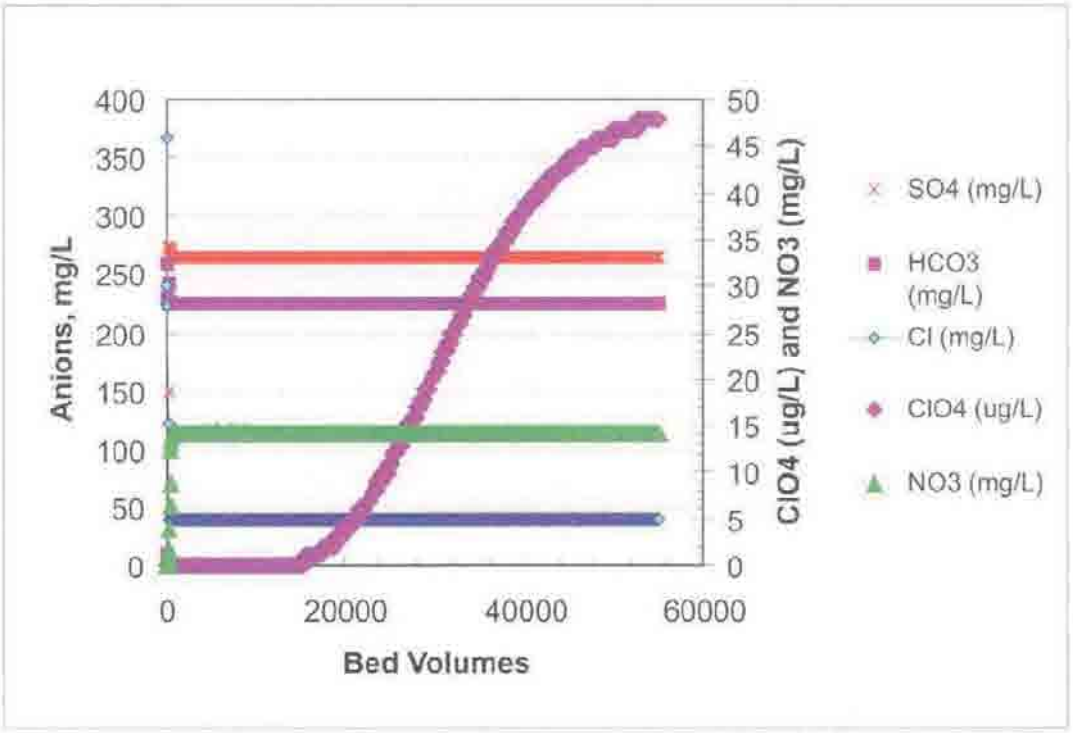
The breakthrough profiles of the various anions depend on the resins selected. Breakthrough modeling data (IX Pro Software) for a generic perchlorate selective resin are tabulated and plotted in Table 3.9 and Figure 3.8, respectively. The anticipated anionic breakthrough order was as follows: bicarbonate, sulfate, nitrate, perchlorate. The inputs to the modeling program were: component concentration, component separation factor (or selectivity coefficient); resin capacity; number of plates; and run length. The separation factors were based on the research conducted by Tripp et al. (2003).

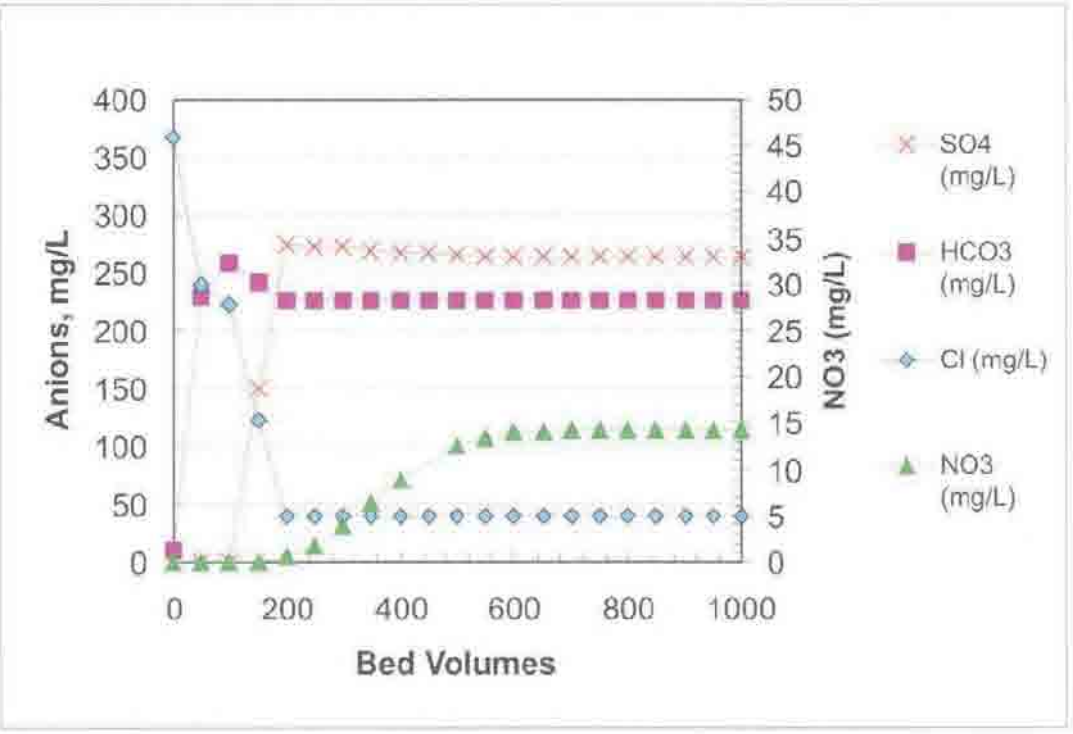
Table 3.9	Breakthrough of Anions for a Generic Perchlorate Selective Resin Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency	
Anions	**Bed Volumes (BVs)**	**Equivalent Time (EBCTxBVs)**
Bicarbonate	40 BVs for complete breakthrough	1 hr
Sulfate	200 BVs for complete breakthrough	5 hours
Nitrate	600 BVs for complete breakthrough	15 hours
Perchlorate	>20,000 BVs for breakthrough up to 4 μg/L	21 days

6.1.2 Sampling

Carollo staff was responsible for day-to-day operation and sampling of the bench-scale IX columns during regular weekdays (excluding holidays). CLWA staff checked on the columns during the weekend and holidays. To address emergencies during off-hours, CLWA staff contacted the lead Carollo operator. Operator log sheets were used daily to record flow rates and sample collection times.

Perchlorate-spiked raw water was analyzed once per week for perchlorate, nitrate, sulfate, bicarbonate, chloride, pH, and conductivity.





ANITICIPATED BREAKTHROUGH CURVES FOR KEY ANIONS

FIGURE 3.8

Sampling frequencies for column effluents were established so that breakthrough profiles for sulfate, bicarbonate, chloride, nitrate, and perchlorate were captured. Sampling frequencies were as follows:

- First 48 hours: One sample per hour. Analyzed 12 (every 3 to 4 hours) samples for nitrate, sulfate, chloride, and bicarbonate. Perchlorate was analyzed three times per week.
- After the first two days of operation, sample frequencies were decreased to six samples per day, depending on whether the parameter has broken through. Perchlorate was analyzed three per week.

Table 3.10 lists the sampling frequencies and locations from Day 3 until 20 percent perchlorate breakthrough occurred. This sampling schedule was adequate to capture breakthrough of all anions for all three types of resins. During the first week of operation (i.e., the time-sensitive breakthrough period for bicarbonate, chloride, sulfate, and nitrate), samples were collected with a timed autosampler. Subsequently, all samples were collected manually at the frequencies describe in Table 3.10.

Table 3.10 Testing Matrix for Bench-Scale Ion Exchange Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Chemical Parameter	Lab	Sampling Frequency from Each Column Effluent		
		Day 3-Day 7	Weeks 2-5	Weeks 6-10
pH[1]	-	1/day	1/day	1/day
Temperature[1]	-	1/day	1/day	1/day
Conductivity[1]	-	1/day	1/day	1/day
Perchlorate	CLWA & MWH	2/week	3/week	1/day
Nitrate	CLWA	6/day	3/week	1/week
Sulfate	CLWA	6/day	3/week	1/week
Bicarbonate	CLWA	6/day	3/week	1/week
Chloride	CLWA	6/day	3/week	1/week
Alkalinity	CLWA	2/week	1/week	1/week
Hardness	CLWA	1/week	1/week	1/week
Iron	CLWA	1/week	1/week	1/week
Manganese	CLWA	1/week	1/week	1/week
Calcium	CLWA	1/week	1/week	1/week
Magnesium	CLWA	1/week	1/week	1/week

Table 3.10 Testing Matrix for Bench-Scale Ion Exchange Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Chemical Parameter	Lab	Sampling Frequency from Each Column Effluent		
		Day 3-Day 7	Weeks 2-5	Weeks 6-10
Turbidity	CLWA	1/week	1/week	1/week
TOC	CLWA	1/week	1/week	1/week
Chromium	CLWA	As needed	As needed	As needed
NDMA	MWH	As needed	As needed	As needed
Bromide	CLWA	As needed	As needed	As needed
Arsenic	CLWA	As needed	As needed	As needed
Uranium	MWH	As needed	As needed	As needed

Note:
(1) Measured on-site.

Table 3.10 also identifies the laboratory that was responsible for analyzing each parameter. The majority of parameters were analyzed at CLWA, while perchlorate checks, NDMA, and uranium were measured at MWH laboratories. All samples not analyzed immediately were stored at 4 degrees C for no more than the recommended holding time before analysis.

6.2 Biological Fixed-Bed Filter

6.2.1 Experimental Design

A 6-month biological FXB filtration pilot study was conducted. The overall objective of this study was to demonstrate the efficacy of biological FXB filtration for perchlorate removal from Saugus aquifer water. A more specific objective was to determine whether biologically acclimating the GAC with indigenous microorganisms would be sufficient to achieve efficient perchlorate reduction in the filter. Once these objectives were achieved, a testing protocol was employed to determine requirements for EBCT, backwashing protocol, and acetic acid addition. A series of short-term experiments were also performed to evaluate the robustness of the process with respect to system upsets.

During the first 2 weeks of pilot-testing, acetic acid was fed to each filter at a concentration twice that required to stoichiometrically reduce all influent DO and nitrate ($(O_2 \Rightarrow H_2O$, $NO_3^- \Rightarrow N_2$; for calculation purposes, it was assumed that no electron donor is used for cell synthesis). This ensured that electron donor was not limiting. EBCT and acetic acid feed were optimized during Phase 2 of the FXB pilot study. Perchlorate was spiked to the influent at 50 μg/L except during the perchlorate spiking tests (see Phase 3 of this section). Phosphoric acid was added for a two-month portion of the pilot study. No other chemicals were added to the process system during the pilot study.

- Phase 1 (Biological Acclimation): The purpose of this phase was to determine whether or not efficient perchlorate-reducing biological activity could be developed in the GAC filters using microorganisms indigenous to the Saugus Aquifer. Once the filtration skid was mobilized, the filters began treating Saugus Aquifer water from Well NC-12 spiked with perchlorate. Technical-grade acetic acid (electron donor) was added to the feed water. An EBCT of 15 minutes was used during the first few weeks of the acclimation phase to allow for the rapid saturation of sorption sites on the surface of the GAC and to promote rapid growth of the microbial community in the biological FXB filter.

- Phase 2 (EBCT and Acetic Acid Optimization): The purpose of this phase was to determine the minimum EBCT required to achieve perchlorate removal to below the 4 μg/L reporting limit ($EBCT_{critical}$). Acetic acid was initially added at 100 percent excess relative to the emperical stoichiometric influent DO and nitrate demand (based on an influent DO concentration of 7.0 mg/L and an influent nitrate concentration of 15 mg/L). EBCT was incrementally lowered until perchlorate breakthrough was observed. Once $EBCT_{critical}$ was found, the feed acetic acid concentration was incrementally lowered until perchlorate breakthrough was observed ($AC_{critical}$).

- Phase 3 (Robustness Characterization): The purpose of this phase was to determine how the FXB system responds to various process up-sets. The $EBCT_{critical}$ and $AC_{critical}$ were set as operating parameters throughout this phase of testing. Five process upsets were tested: 1) backwashing, 2) perchlorate spiking, 3) nitrate spiking, 4) electron donor feed failure simulation, and 5) a total system shutdown.
  - Backwashing: These tests were designed to evaluate perchlorate removal performance immediately after backwash episodes. Because backwashes remove perchlorate-reducing biomass from the filter, it is possible that perchlorate breakthrough would occur after backwashes until the biological community in the filter had sufficient time to regrow. This test was performed twice, one-month apart. Samples were taken a 0, 15, 30, 45, and 60 minutes after the filter was put into production following a backwash.
  - Perchlorate Spiking: These tests were designed to evaluate perchlorate removal performance during periods of transient perchlorate loading episodes. Perchlorate was spiked to the feed at 100 μg/L for a 48-hour period and effluent perchlorate concentrations were monitored. Influent perchlorate concentration was then readjusted to 50 μg/L and the system was allowed to stabilize (i.e., reestablish pre-spiking, perchlorate removal performance), if necessary. A 48-hour spiking test was then performed using 300 μg/L perchlorate, followed by a 5 mg/L perchlorate spiking test. The 5 μg/L perchlorate spiking test was designed to: 1) demonstrate perchlorate removal performance at a low-end feed perchlorate concentration, 2) initiate the desorption of perchlorate from the carbon surface (if any) as the bed equilibrated with a lowered feed perchlorate concentration. Along

with the regular daily samples, samples were taken at 0, 15, 30, 45, and 60 minutes after the filter was put into production following a change in feed perchlorate concentration.

- Nitrate Spiking: This test was designed to evaluate perchlorate removal performance during periods of transient nitrate loading episodes. Over a 48-hour period, nitrate was spiked to the feed to reach a final influent concentration of 30 mg/L (the historical Saugus aquifer maximum concentration) and effluent perchlorate concentrations were monitored. During the first part of the test, EBCT and acetic acid concentration were not adjusted to account for the increased nitrate in the feed. A second nitrate spiking test was performed during which the EBCT and acetic acid were both adjusted to achieve perchlorate removal to below detection. Along with the regular daily samples, samples were taken at 0, 15, 30, 45, and 60 minutes after the filter was put into production following a change in feed nitrate concentration.
- Electron Donor Feed Failure Simulation: This test was designed to evaluate perchlorate removal performance during a period of simulated electron donor feed system failure. The acetic acid feed was shut off for 48 hours and effluent perchlorate concentrations were monitored. The acetic acid feed was then restarted and the time required to reestablish efficient perchlorate reduction was evaluated. Along with the regular daily samples, samples were taken at 0, 15, 30, 45, 60, 120, 180, 240, and 630 minutes after the filter was put into production following a change in feed perchlorate concentration.
- System Shutdown: This test was designed to evaluate perchlorate removal performance after the system has been shut down for 1-day, 2-day, and 2-week periods. The time required to reestablish efficient perchlorate reduction in the filters was evaluated.

- Backwashing Protocol: Backwashes were performed using effluent water stored in the pilot backwash tank (see Figure 2.4). Backwashes were performed approximately every 48 hours. If run times did not reach 48 hours due to rapid headloss build-up, operating parameters were adjusted (i.e., EBCT and acetic acid concentration). Backwashes consisted of a 10-minute air scour period using ~0.1-0.2 scfm, followed by a 20-minute backwash at 0.8 gpm (9 gpm/ft^2), which resulted in a 45 percent bed expansion.

6.2.2 Sampling

Table 3.11 lists the various water quality parameters that were measured, sampling location and frequency, and the associated laboratory responsible for the analysis. Increased perchlorate sampling frequencies during the challenge tests are described above.

Table 3.11 Sampling Schedule for Fixed-Bed Biological Pilot Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
ClO_4^-	Feed	Once per 2 days	CLWA and occasional checks with MWH
	Effluent	Daily	
	Backwash	As Needed	
NO_3^-	Feed	2/week	CLWA
	Effluent	3/week	
DO	Feed	Daily	On-site
	Effluent	Daily	
NO_2^-	Feed	1/week	CLWA
	Effluent	1/week	
PO_4^{3-}	Feed	1/week	CLWA
	Effluent	1/week	
SO_4^{2-}	Feed	1/week	CLWA
	Effluent	1/week	
NH_3	Feed	1/week	CLWA
	Effluent	2/week	
H_2S	Feed	1/week	MWH
	Effluent	1/week	
TOC/DOC	Feed	3/week	CLWA
	Effluent	3/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPC	Feed	2/week	CLWA
	Effluent	2/week	
Total coliforms	Feed	1/week	CLWA & MWH
	Effluent	1/week	
	Backwash	1/backwash	
Fecal coliforms	Feed	1/week	CLWA & MWH
	Effluent	1/week	
	Backwash	1/backwash	
Turbidity	Feed	3/wk	Dedicated in-line HACH 1720D turbidimeters and Bench-top turbidimeter
	Effluent	Continuous	
Total particle counts	Effluent	Continuous	In-line particle counter

Table 3.11 Sampling Schedule for Fixed-Bed Biological Pilot Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Sampling Location**	**Sampling Frequency**	**Lab**
pH	Feed	Daily	On-site
	Effluent	Daily	
Headloss	Across FXB	Continuous	In-line pressure transducer
Backwash volatile suspended solids (VSS)	Backwash water	Once per backwash	CLWA
Assimilable Organic Carbon	Backwash water	Once per backwash	MWH
Chemical Oxygen Demand	Backwash water	Once per backwash	MWH
Total Suspended Solids	Backwash water	Once per backwash	MWH

Given that adjustments to process operation were made based on perchlorate removal performance in the filters, it was important to maintain a short turn-around time for perchlorate samples throughout pilot testing. Therefore, perchlorate samples was taken for analysis at the CLWA laboratory to expedite the acquisition of perchlorate data. However, since the CLWA laboratory has partial certification for perchlorate analysis, duplicate samples were set weekly to MWH for analysis. Bacterial samples, TOC/DOC, and anions were transported to the laboratory every Tuesday. Additional anion samples were transported to the lab every 3 days (i.e., Monday, Wednesday, and Friday) due to the short holding time of nitrate (48 hours).

The on-line ion chromatography perchlorate analyzer (DX-800 Process Analyzer), which was generally used to continuously monitor FBR effluent perchlorate concentrations, was configured to accept manual injections of FXB samples. Thus, near real-time perchlorate removal performance was monitored during the majority of FXB pilot testing.

6.3 Biological Fluidized-Bed Reactor

6.3.1 Experimental Design

A 6-month biological FBR pilot study was conducted using Shaw Environmental-Envirogen/US Filter/Envirex Products' low-flow FBR. The overall objective of this study was to demonstrate the efficacy of an FBR biological process for perchlorate removal from Saugus aquifer water. A more specific objective was to determine whether biologically acclimating the GAC with indigenous microorganisms is sufficient to achieve efficient perchlorate reduction in the FBR. The testing protocol was also designed to optimize HRT and acetic acid addition, and to test the robustness of the process during system upsets.

However, establishing consistent perchlorate removal to below detection required the entire length of the pilot testing period.

The FBR system was monitored using a Dionex On-Line Ion Chromatography Perchlorate analyzer (DX-800 Process Analyzer). The use of the DX-800 analyzer provided a better understanding of the instrument's capabilities in a field setting. The testing of this system also allowed for immediate operational responses based on FBR performance.

- Phase 1 (Biological Acclimation): During start-up, the FBR system was filled with NC-12 groundwater. Carbon was added to provide a desired settled bed height of approximately 5 feet. The system was then started in recycle and the carbon hydraulically fluidized 1.25 to 1.30 times the settled bed height. The feed and recycle rates required to meet this bed expansion were documented and utilized as a baseline for future bed growth measurements. Following this procedure, nutrients and electron donor were added to the reactor in batch mode to allow the microbial consortium to develop over a period of two days. The system was then put into continuous operation mode at a feed flow of 1 gpm and a recycle flow of 8 to 9 gpm. The feed flow was set between 1 and 3 gpm throughout pilot testing and the recycle flow was typically set so that total flow was approximately 10 gpm.

- Phase 2 (Continuous Operation): This phase was initially intended to determine optimal feed and recycle flow rates as well as optimal feed phosphorous and acetic acid concentrations. During the bulk of this phase, Carollo worked with Shaw Environmental (formerly Envirogen) staff to make mechanical and operational changes designed to improve the perchlorate removal performance of the FBR.

- Phase 3 (Robustness Characterization): FBR robustness characterization testing did not occur for the FBR as stable performance was not achieved during the 6-month period.

6.3.2 Sampling

Table 3.12 lists the various water quality parameters that were measured once start-up was completed, the sampling location and frequency, and the associated laboratory responsible for the analysis.

Table 3.12 Fluidized-Bed Sampling Matrix
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
Perchlorate	Feed	Once per 2 days	CLWA and occasional checks with MWH + on-line ion chromatograph
	Effluent	Daily	

Table 3.12 Fluidized-Bed Sampling Matrix
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
Nitrate	Feed	3/week	CLWA
	Effluent	3/week	
Nitrite	Feed	1/week	CLWA
	Effluent	1/week	
Phosphate	Feed	1/week	CLWA
	Effluent	1/week	
Sulfate	Feed	-	CLWA
	Effluent	-	
DO	Influent	Daily	On-site analysis
	Effluent	Daily	
H_2S	Influent	1/week	MWH
	Effluent	1/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPC	Feed	1/week	CLWA
	Effluent	1/week	
Total Coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Fecal Coliforms	Feed	1/week	CLWA
	Effluent	1/week	
TOC	Feed	-	CLWA
	Effluent	2/week	
TSS	Feed	-	CLWA
	Effluent	-	
Ammonia	Feed	1/week	CLWA
	Effluent	1/week	
Total phosphorous	Feed	1/week	CLWA
	Effluent	2/week	

6.4 Submerged Membrane Bioreactor

6.4.1 Experimental Design

Due to the short SMBR testing period, the experimental design focused only on demonstration, not optimization, of the SMBR process. Operational settings for the SMBR are listed in Table 3.13.

Table 3.13 SMBR ZW-10 System Operating Parameters Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Value
Q_{FEED} (mL/min)	300-680
$Q_{PERMEATE}$ (mL/min)	300-680
Recovery (%)	80-99
HRT (hours)	4.7-10.6
Aeration rate (scfm)	1-2

For the majority of SMBR testing, the biological FXB filter was operated using $EBCT_{critical}$ and $AC_{critical}$. SMBR backpulses were initiated every 15 minutes, for a duration of 15 seconds. The system was operated continuously and monitored regularly for two months to determine whether each of the four post-treatment objectives was being met. A three-week acetic acid spiking test was performed after it was observed that biological FXB filter effluent contained non-detect concentrations of TOC. During this test, 3.5 mg/L of acetic acid carbon was continuously spiked to the SMBR process tank using a peristaltic pump to validate residual organic removal efficiency.

6.4.2 Sampling

Table 3.14 lists the various water quality parameters that were measured, sampling location and frequency, and the associated laboratory responsible for the analysis.

Table 3.14 SMBR Sampling Matrix Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
DO	Feed	Daily	On-site
	Effluent	Daily	
H_2S	Feed	1/week	CLWA & qualitative (i.e., by nose)
	Effluent	1/week	

Table 3.14 SMBR Sampling Matrix Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Sampling Location**	**Sampling Frequency**	**Lab**
TOC/DOC	Feed	3/week	CLWA
	Effluent	3/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPCs	Feed	2/week	CLWA
	Effluent	2/week	
Total coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Fecal coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Turbidity	Feed	3/week	Bench-top turbidimeter
	Effluent	3/week	
pH	Feed	2/week	On-site probe
	Effluent	2/week	
Process tank volatile suspended solids	Process tank	2/week	CLWA

7.0 TEST RESULTS

7.1 Ion-Exchange Testing Results

7.1.1 Feed Water Quality

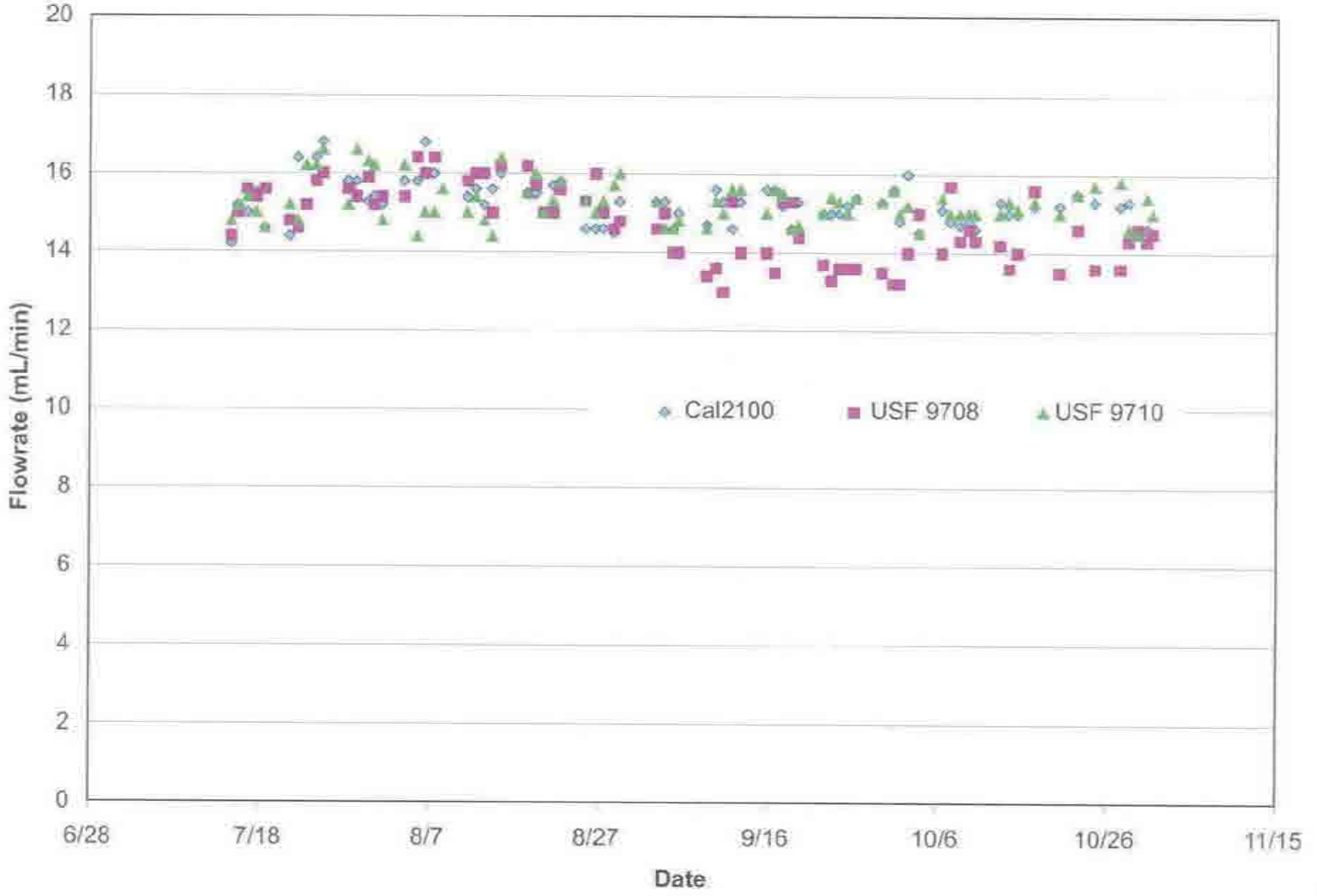
The range of constituent concentrations in the feed water to the ion-exchange columns is presented in Table 3.15. The feed water is characterized as low in organic matter, moderately hard and buffered, and moderate in iron and bromide. It should be noted that during the month of October 2003 the NC-12 groundwater quality was observed to slowly change over a 4-week period before returning to its steady-state quality at the end of the bench-scale study. The nitrate concentration decreased from 3.3 mg/L as N to 1.7 mg/L as N, sulfate increased from 290 mg/L to 373 mg/L (after sulfate spike), and the chloride concentration increased from 35 mg/L to 45 mg/L.

Table 3.15	Range of Constituent Concentration in Feedwater to the IX System Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Chemical Parameter	**Unit**	**Count**	**Average**	**Min**	**Max**
Perchlorate	µg/L	18	45.5	42.6	52.9
Nitrate-N	mg/L	18	3.0	1.7	3.4
Sulfate	mg/L	18	301	276	373
Bicarbonate	mg/L	18	199	171	221
Chloride	mg/L	18	37	32	45
pH	—	18	8.1	7.9	8.4
Alkalinity	mg/L as $CaCO_3$	18	165	152	181
TOC	mg/L			<0.7	<0.7
DOC	mg/L			<0.7	<0.7
Arsenic	µg/L			ND	ND
Iron	µg/L	9	15.3	7	27
Manganese	µg/L	9		<1	<1
Hardness	mg/L as $CaCO_3$	2		282	315
Calcium	mg/L	3	84	77	94
Magnesium	mg/L	3	17.7	17	18
Uranium	pCi/L			ND	1.03
NDMA	ng/L			ND	ND
Vanadium	µg/L	3	10.7	2.0	15.0
Bromide	mg/L	2		0.22	0.24
Turbidity	NTU	12	0.337	0.180	0.580
Conductivity	µmhos/cm	15	1043	1003	1158

7.1.2 Operational Data

Two operational parameters were recorded on a daily basis for the ion-exchange setup: flowrate through the columns (Figure 3.9) and pressure buildup. The pump setting and/or the needle valves connected downstream of the columns were adjusted when the measured flow rate deviated by more than 10 percent from the target flow rate of 15 mL/min. The flow rate ranged from 13.5 to 16.5 mL/min during the course of the study, which resulted in an EBCT range of 1.4 to 1.6 minutes. The pressure drop remained constant at 5 psi throughout most of the project duration, and increased to 7 psi during the last two weeks of testing. The level of water in the 55-gal feed tanks was monitored daily. The experimental apparatus was monitored for the presence of air bubbles and leaks.

20-CLWA204F3.9-8625A10.CDR



FLOW RATES MEASURED THROUGH THE THREE ION-EXCHANGE COLUMNS

FIGURE 3.9

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7.1.3 Temperature

The temperature, which was measured in the effluent of the three columns over the course of the study, ranged from 32 degrees C (89 degrees F) in the summer months to 16 degrees C (61 degrees F) in the fall (Figure 3.10).

7.1.4 pH Values

pH was measured in the feed and effluent of the three columns, and both ranged from 7.6 to 8.4 (Figure 3.11), indicating only minor impact on pH by the resins.

7.1.5 Breakthrough Curves

Breakthrough curves of key anions were developed for the ion-exchange resins under identical conditions of water quality, flowrate, and EBCT. The three columns were operated in parallel using one feed pump. The columns ran continuously with minimal shut-down periods. A 45-hour shut-down period was simulated at the end of the study to investigate its potential effect on breakthrough.

7.1.5.1 High-Resolution Breakthrough Curves of Key Anions

As predicted by the IXPro Model, the breakthrough of most anions (with the exception of perchlorate) was very fast and occurred in the first 24 hours of operation. This breakthrough sequence was similar for the three resins tested, as illustrated in Figures 3.12 through 3.14. The figures are plotted for the first 2,000 bed volumes of run time.Bicarbonate was the first anion to break through reaching its background value of 220 mg/L after 80 to120 bed volumes. Sulfate was next to breakthrough after 80 bed volumes and reached its steady-state concentration of 300 mg/L after 280 to 310 bed volumes. The nitrate breakthrough rate was somewhat different for the three columns. Nitrate broke through after 280 bed volumes, 440 bed volumes, and 600 bed volumes from USF 9708, USF 9710, and Cal 2100 resins, respectively. Steady-state concentrations were reached after 1,000 bed volumes for all three tested resins. No chromatographic peaking was observed for any of the critical anions within the test conditions.

Chloride concentration dropped from a high of approximately 325 mg/L to background levels of approximately 35 mg/L after 280 bed volumes. The highest measured chloride levels in the first 280 bed volumes did not exceed the Title 22 Secondary Maximum Contaminant Level of 500 mg/L. However, they did exceed the Los Angeles County Sanitation District (LACSD) maximum acceptable chloride level of 100 mg/L in the Santa Clara Valley Basin.

In a full-scale application, following a resin change-out, the new resin may need to be flushed over a few days to meet DHS requirements. This flushed water, which will contain higher concentrations of chloride during the first few hours of flushing (as illustrated in Figures 3.12 to 3.14), will need to be dealt with by discharge to a sewer, for example. The flushed water will be free of perchlorate.

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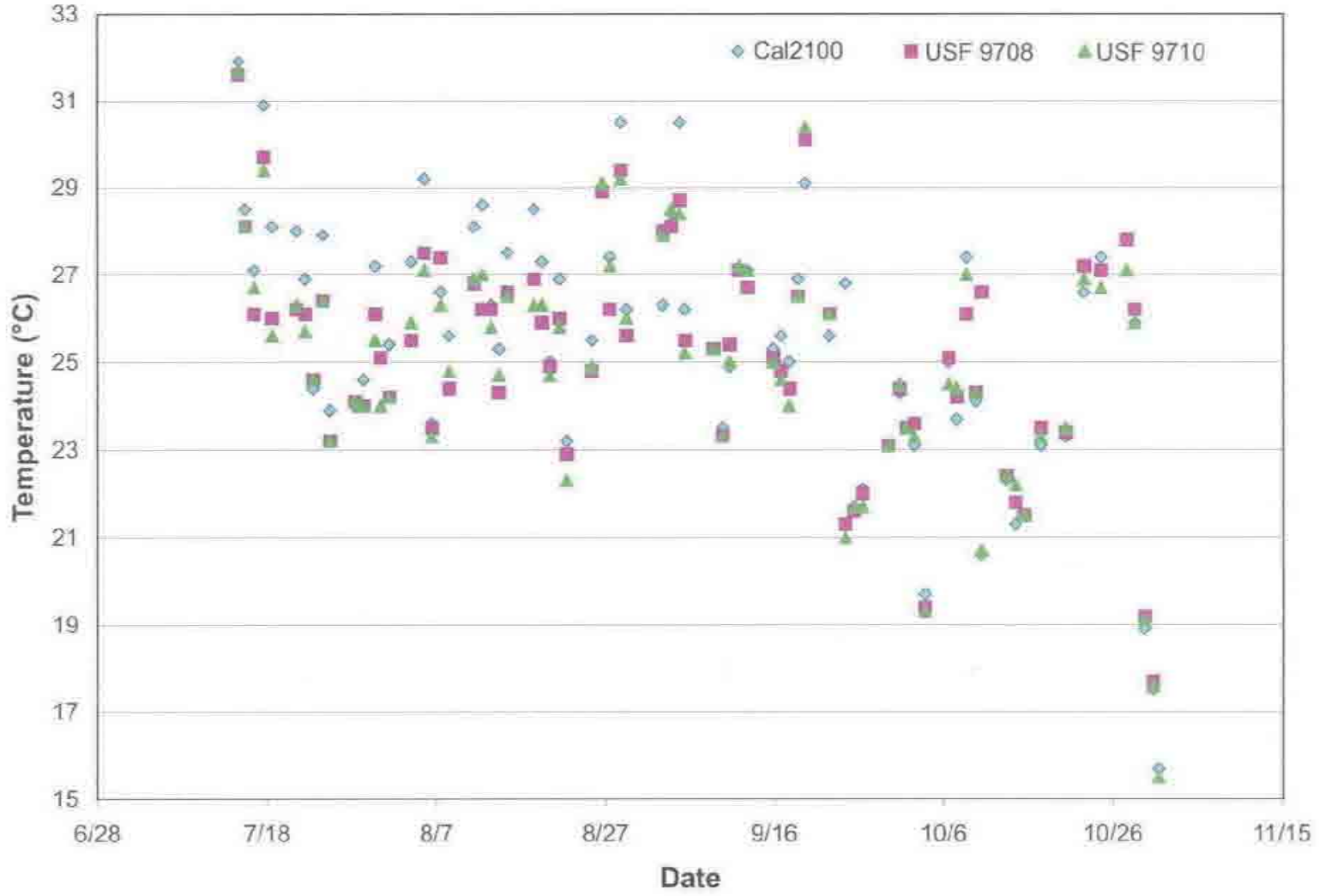

COLUMN EFFLUENT TEMPERATURE MEASURED OVER THE COURSE OF THE STUDY

FIGURE 3.10

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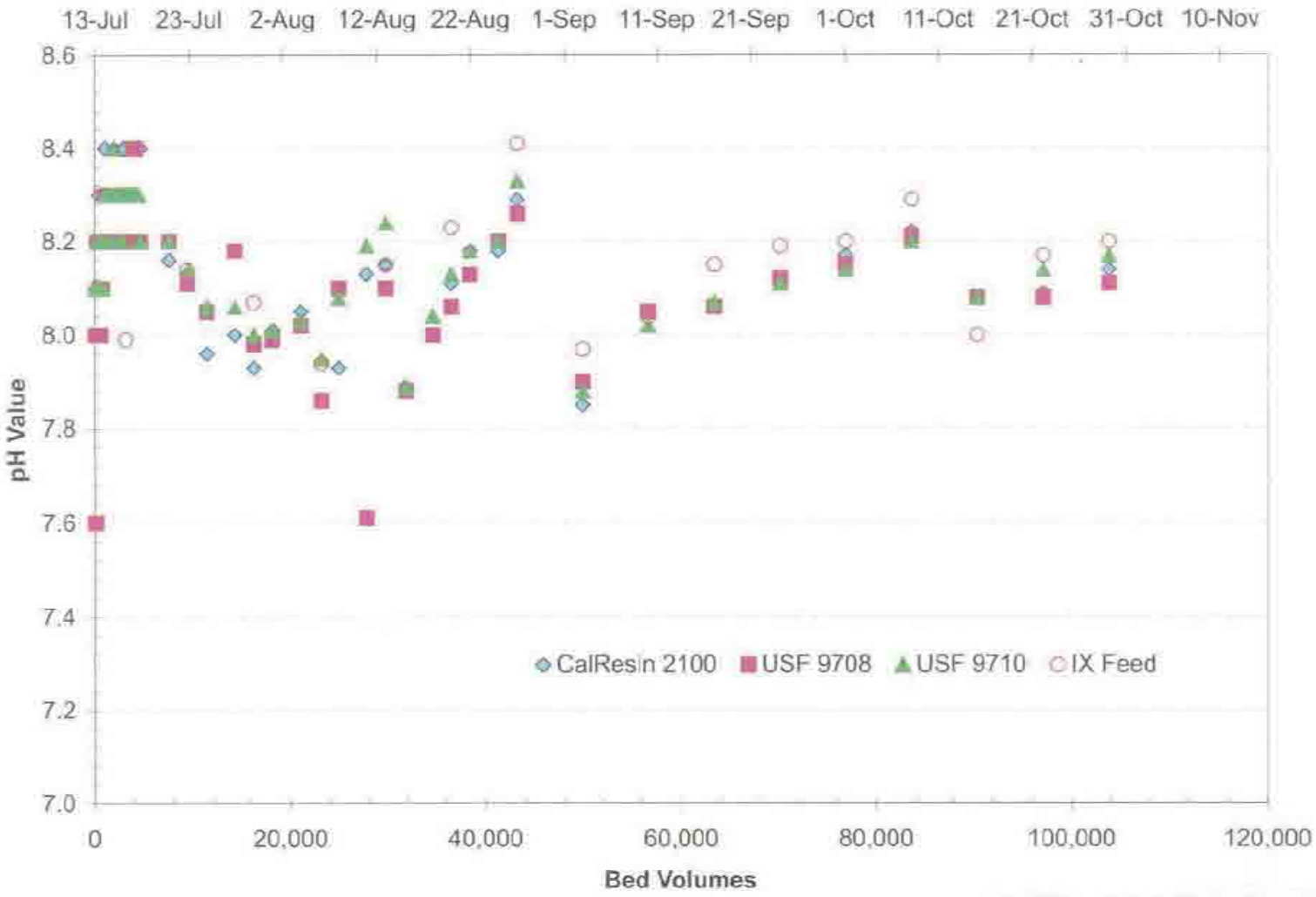
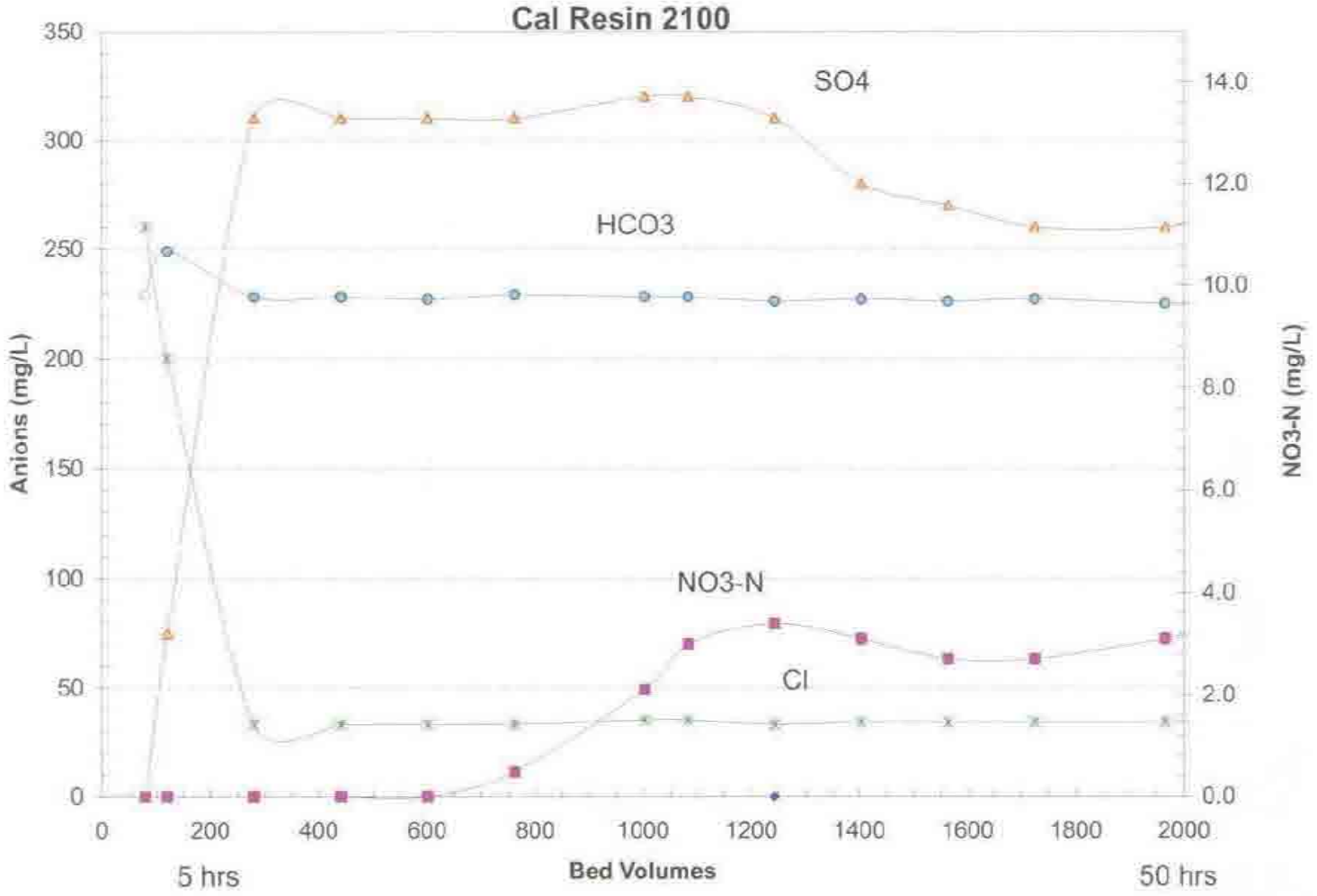


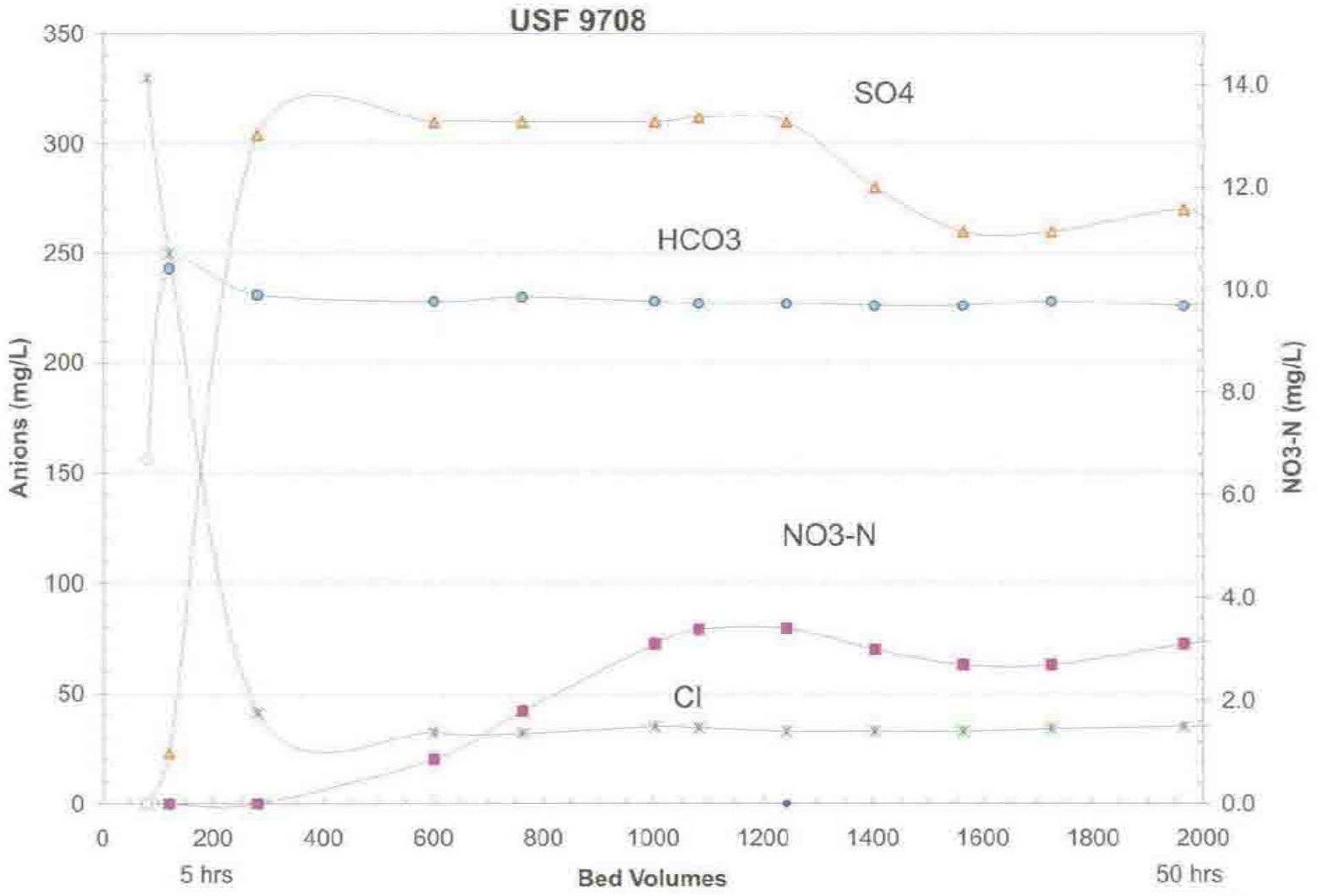
pH VALUES MEASURED IN THE FEED AND IX COLUMN EFFLUENT

FIGURE 3.11



BREAKTHROUGH OF MAJOR ANIONS FROM CAL 2100 SERIES RESIN IN THE FIRST 2000 BVs

FIGURE 3.12



BREAKTHROUGH OF MAJOR ANIONS FROM 9708 RESIN IN THE FIRST 2000 BVs

FIGURE 3.13

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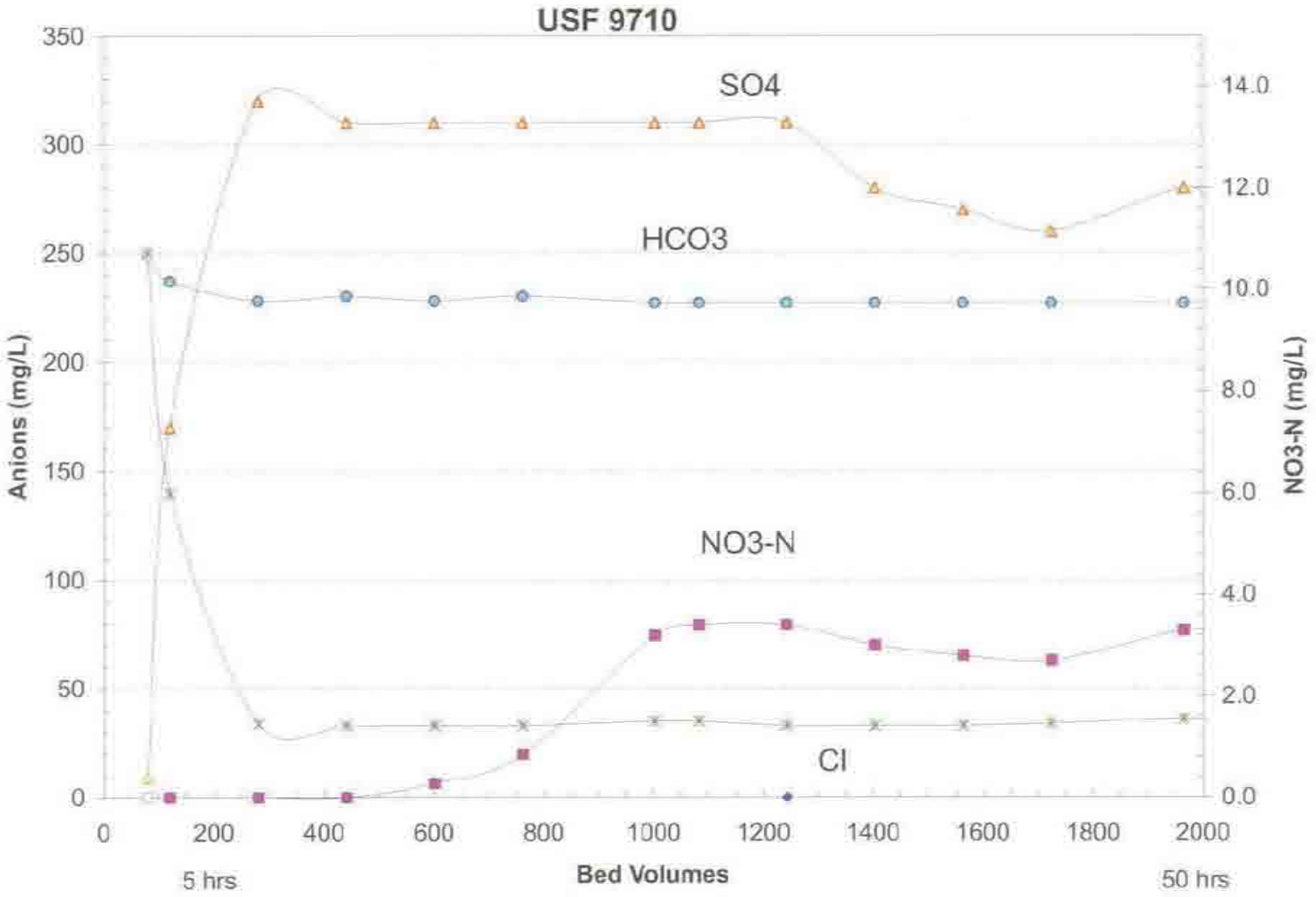

BREAKTHROUGH OF MAJOR ANIONS FROM 9710 RESIN IN THE FIRST 2000 BVs

FIGURE 3.14

7.1.5.2 Breakthrough Curves of Perchlorate and Other Anions

Perchlorate breakthrough curves for the three ion-exchange resins are illustrated in Figure 3.15. As expected, perchlorate breakthrough did not occur until several thousand bed volumes had been treated by the resin. Actual run lengths were longer than those predicted by the IX-Pro Model. Bed volumes to perchlorate breakthrough (greater than 1 μg/L) were 25,000 bed volumes (26 days), 72,000 bed volumes (75 days), and 76,000 bed volumes (79 days) for USF 9708 resin, USF 9710 resin, and CalResin 2100, respectively. The details of run lengths until perchlorate breakthrough are presented in Table 3.16.

Table 3.16 Run Lengths Until Perchlorate Breakthrough (1 μg/L) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Resin	Bed Volumes	Treated Water Volumes (gal)	Treated Volume gal/cu-ft resin
USF 9708	25,000	145.3	187,045
USF 9710	72,000	418.5	538,735
CalResin 2100	76,000	441.7	568,600

A temporal change in raw well water quality occurred between 85,000 and 100,000 bed volumes. However, this did not seem to impact the breakthrough of anions, with the possible exception of the USF 9708 perchlorate breakthrough curve, for which a noticeable drop in perchlorate concentration was measured in the effluent during that period.

At the end of the study, a 45-hour shutdown period was simulated by shutting off the feed pump. During this period, the resins were allowed to sit in the columns containing the groundwater. Critical anions were measured immediately after the shut-down period and breakthrough curves were developed for all key anions after restarting the columns. Breakthrough curves of all major anions for USF 9710 are illustrated in Figure 3.16. An increase in chloride concentration (45 to 72 mg/L) was observed upon column restart. Similar trends were observed for USF 9708 and CalResin 2100, indicating leaching from the IX resins.

7.2 NDMA Formation Potential Testing

7.2.1 Post-Chlorination Testing

The results from the post-chlorination testing with free chlorine are plotted in Figure 3.17. Free chlorine residuals ranged from 1.8 to 1.9 mg/L after 24 hours of incubation. The 2- and 24-hour NDMA concentrations in all three ion-exchange column effluents were below the 2 ng/L detection limit. Therefore, precursors did not leach from the resin to form NDMA upon post-chlorination with free chlorine.

The results from the post-chlorination testing with combined chlorine are plotted in Figure 3.18. Total chlorine residuals ranged from 1.6 to 2.2 mg/L after 24 hours of

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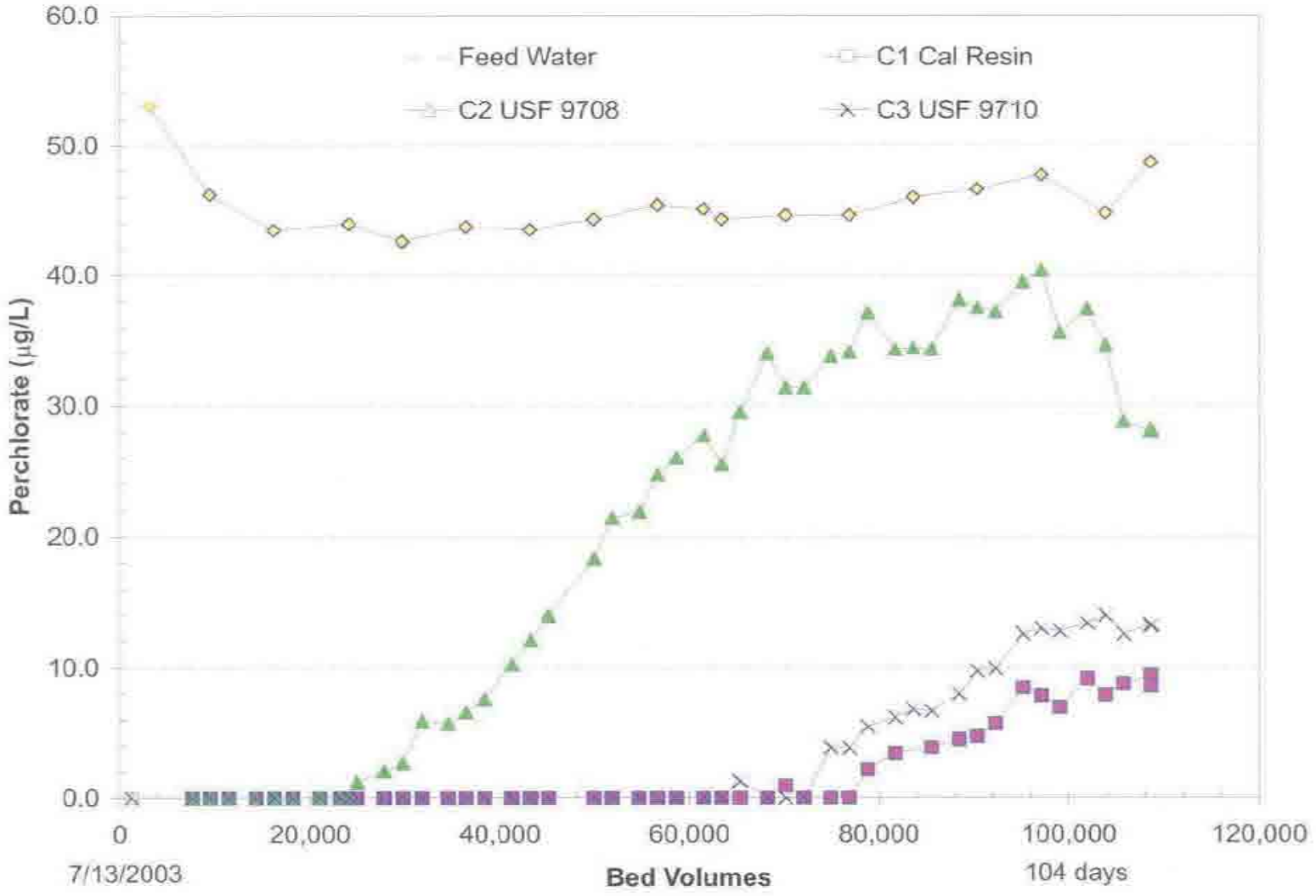

COMPARISON OF PERCHLORATE BREAKTHROUGH CURVES

FIGURE 3.15

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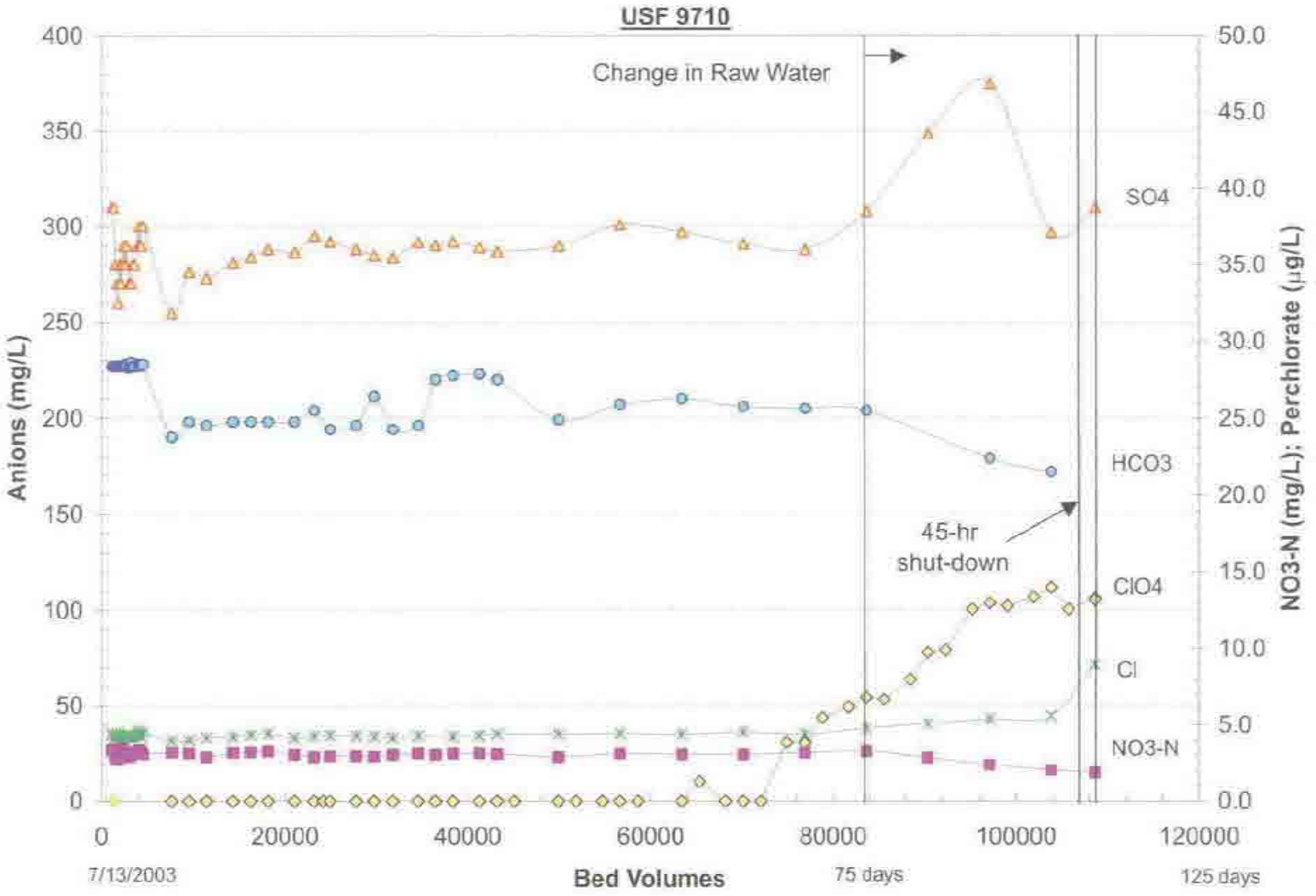

BREAKTHROUGH OF CRITICAL ANIONS FROM USF 9710

FIGURE 3.16

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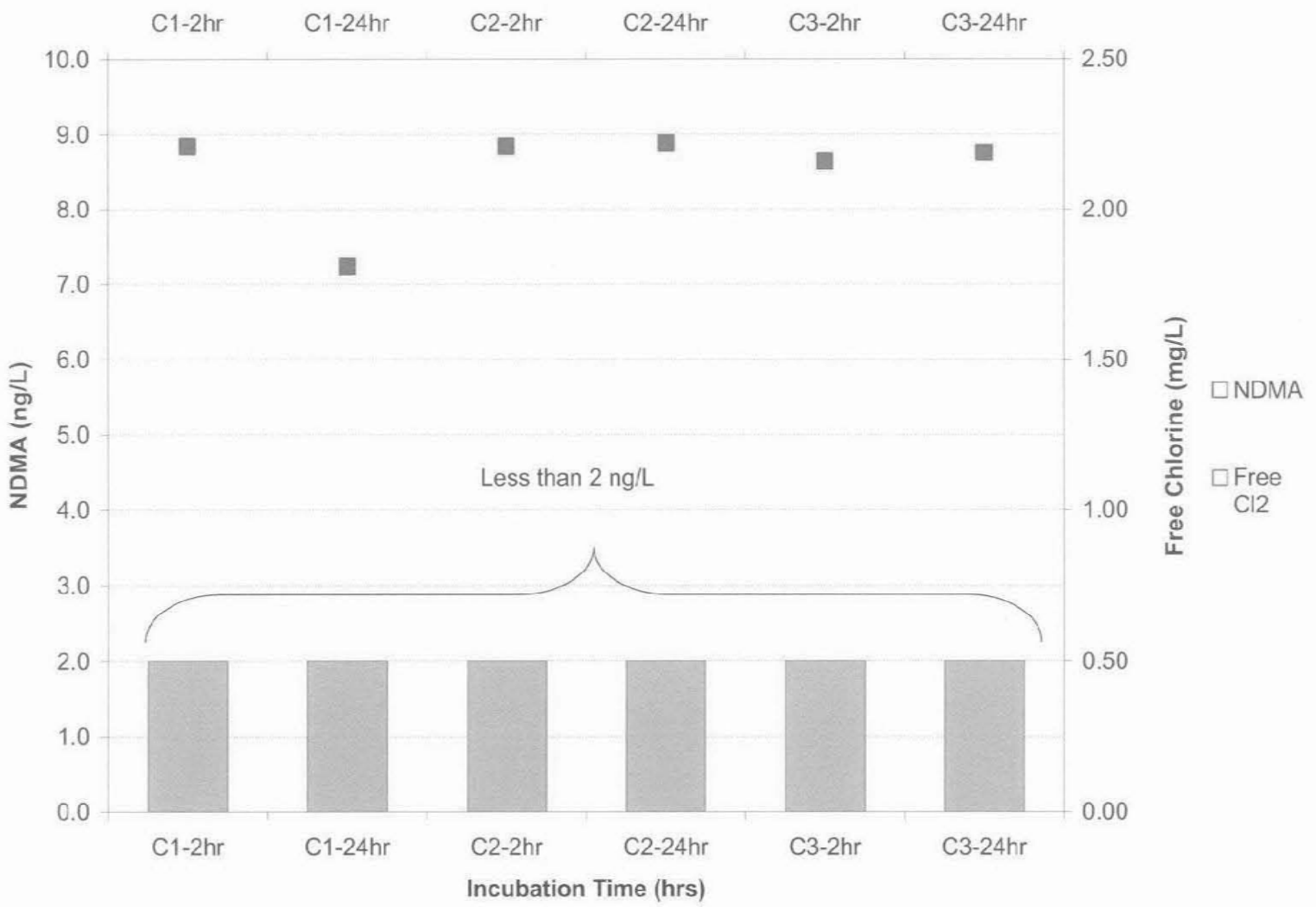

POST-CHLORINATION TESTING WITH FREE CHLORINE NDMA RESULTS

FIGURE 3.17

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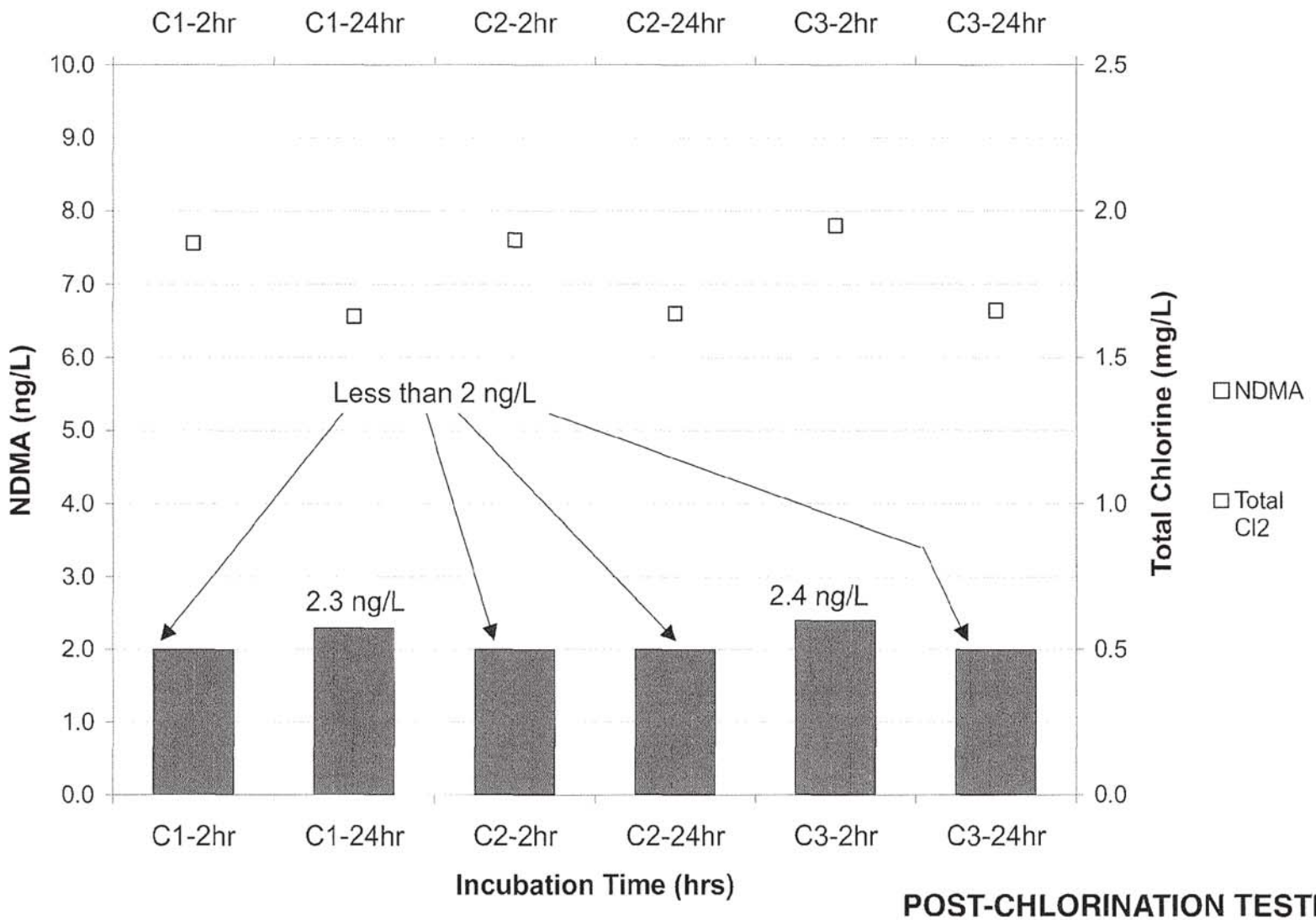

POST-CHLORINATION TESTING WITH COMBINED CHLORINE NDMA RESULTS

FIGURE 3.18

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incubation. The 2- and 24-hour NDMA concentrations in all three ion-exchange column effluents were below or just above the detection limit of 2 ng/L.

7.2.2 Pre-Chlorination Testing

To test the effect of prechlorinated water on the resins, chlorinated feedwater was allowed to run through the columns for a period of 2 hours. After that time, samples were collected and analyzed for NDMA. No detectable free chlorine residual was measured at the column effluents. This experiment was repeated four days later by adding a second 2 mg/L dose of free chlorine (duplicate samples). NDMA results are plotted in Figure 3.19. Measured levels were below or just over the detectable limit of 2 ng/L. The NDMA concentration in the feedwater (control sample) was non-detect.

7.2.3 Fresh Resin Batch Testing

Each resin was tested to determine if leaching of NDMA occurred from precursors in the resin functional sites. These results are plotted in Figure 3.20. Although NDMA was detected in one sample (CalResin), the result was less than half the current Action Level of 10 ng/L.

7.3 Spent Resin Characterization

7.3.1 Lab Results

Table 3.17 presents the Federal Toxicity Characteristic Leaching Procedure (TCLP) toxicity limits, TTLC, and STLC threshold values defined in the California Code of Regulations, Title 22, Chapter 11, Article 3, Section 66261.24, as well as the results from the actual TTLC metal concentrations measured in the three ion-exchange spent resins. TTLC results indicate the total bulk amount of each constituent per unit mass of solid waste. If the TTLC (or bulk) content is low, then the solid waste when subjected to leaching tests (STLC, TCLP) does not produce significant amounts of contaminants in the leachate. Since TTLC results are very low, there would not be any problem with the STLC or TCLP. These soluble limits, however, are listed in the table for comparison.

Most values for the TTLC analysis were non-detect. Chromium, vanadium, and zinc were detected in USF 9708 and USF 9710 spent resins at levels just above minimum reporting limits, but these values are several orders of magnitude below the regulatory TTLC threshold concentrations. Given that the TTLC metal concentrations were 10 times lower than the STLC limits, no further metals analysis for STLC was needed.

Due to the limited quantity of resin samples, TTLC for uranium, which required separate analysis, was not performed by the lab. However, projected total amount of uranium was calculated to be well below the regulatory limit (see Table 3.21). The leachate from spent resins was further analyzed for perchlorate, nitrate, and uranium (Table 3.18). Uranium

levels in the spent resin leachate were significantly below the drinking water Title 22 maximum contaminant limit of 20 pCi/L.

Table 3.17 Comparison of TTLC Metals in Spent Resins to Federal and State Toxicity Limits
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

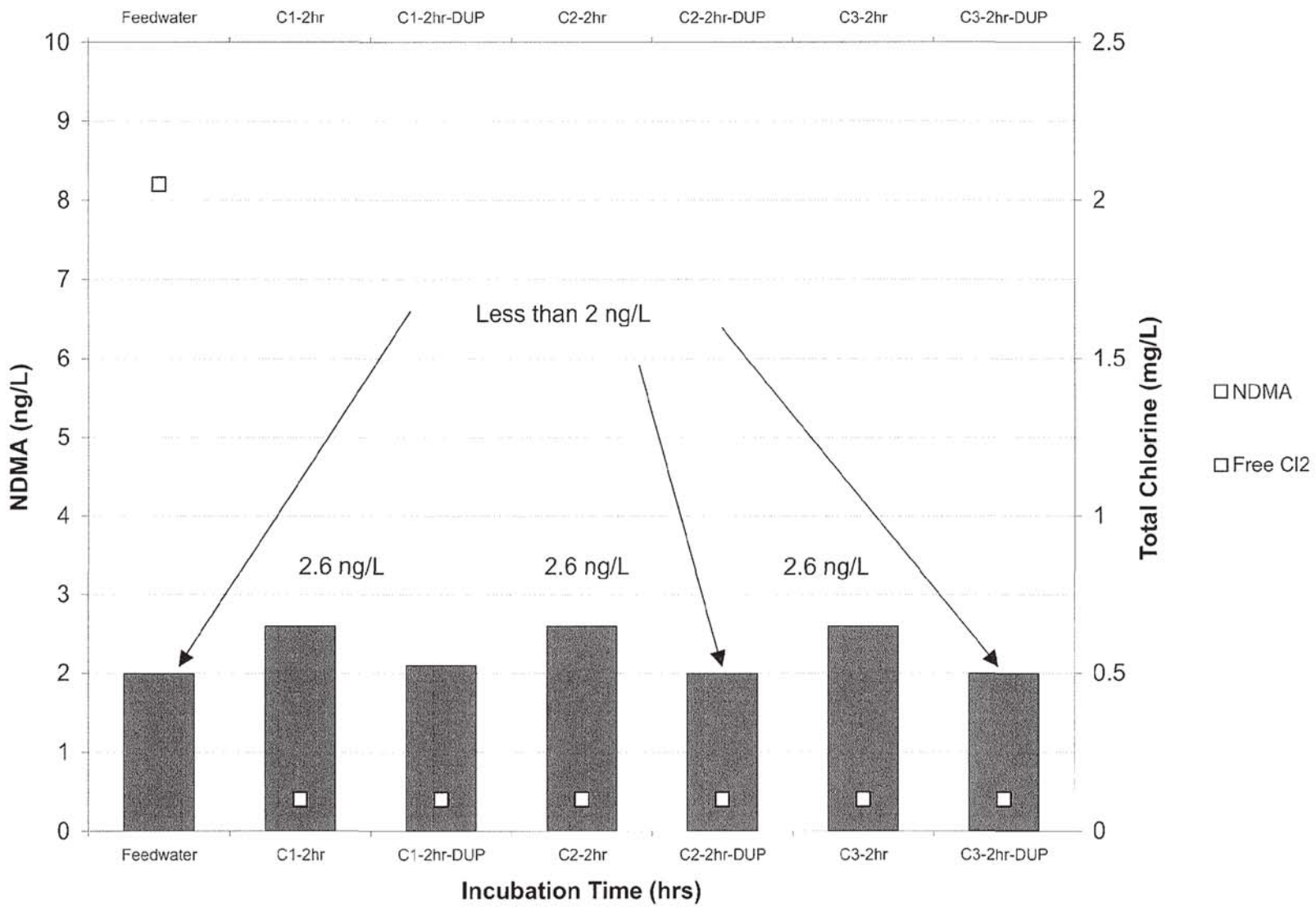
	Actual TTLC Metals Concentrations Measured in Spent Resins (mg/kg)			Federal and State Regulatory Limits		
Contaminant	Cal 2100 Series	USF 9708	USF 9710	TTLC Threshold Concentration (mg/kg)	STLC Threshold Concentration (mg/L)	TCLP Regulatory Level (mg/L)
Antimony	<4	<4	<4	500	15	
Arsenic	<0.5	<0.5	<0.5	500	5.0	5.0
Barium	<0.3	<0.3	<0.3	10,000	100	100.0
Beryllium	<0.2	<0.2	<0.2	75	0.75	
Cadmium	<0.2	<0.2	<0.2	100	1.0	1.0
Chromium	<0.3	**0.4**	<0.3	2,500	5	5.0
Chromium VI				500	5	
Cobalt	<1	<1	<1	8,000	80	
Copper	<4	<4	<4	2,500	25	
Lead	<10	<10	<10	1,000	5.0	5.0
Mercury	<0.05	<0.05	<0.05	20	0.2	0.2
Molybdenum	<2	<2	<2	3,500	350	
Nickel	<2	<2	<2	2,000	20	
Selenium	<3	<3	<3	100	1.0	1.0
Thallium	<0.2	<0.2	<0.2	700	7.0	
Vanadium	<0.5	**0.6**	<0.5	2,400	24	
Zinc	<4	<4	**7.8**	5,000	250	

Table 3.18 Comparison of Perchlorate, Nitrate and Uranium in Spent Resins Leachates Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Contaminant	**Cal 2100 Series**	**USF 9708**	**USF 9710**	**CA-T22 MCL**	**DHS Action Level**
Perchlorate (μg/L)	< 4,000	< 4,000	< 4,000	—	4
Nitrate-N (mg/L)	21	19	22	10	—
Uranium (pCi/L)	3.0 ± 0.307	7.35 ± 0.752	4.06 ± 0.419	20	—

Table 3.19 Radionuclides Reportable Quantities (Table 2 of Appendix A under CERCLA) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency		
Radionuclide	**Atomic Number**	**RQ (Ci)**
Uranium 230	92	1
Uranium 231	92	1,000
Uranium 232	92	0.01
Uranium 233	92	0.1
Uranium 234	92	0.1
Uranium 235	92	0.1
Uranium 236	92	0.1
Uranium 237	92	100
Uranium 238	92	0.1
Uranium 239	92	1000
Uranium 240	92	1000

7.3.2 Uranium Accumulation

To further assess any challenges of transporting spent resins from the treatment plant to an incineration facility, a mass balance was performed to calculate the amount of uranium accumulated on the resins for comparison to the Department of Transportation's (DOT's) reportable quantities (which define whether or not a substance is hazardous) and A-Values (values used during shipping of hazardous substances).



POST-CHLORINATION TESTING
NDMA RESULTS

FIGURE 3.19

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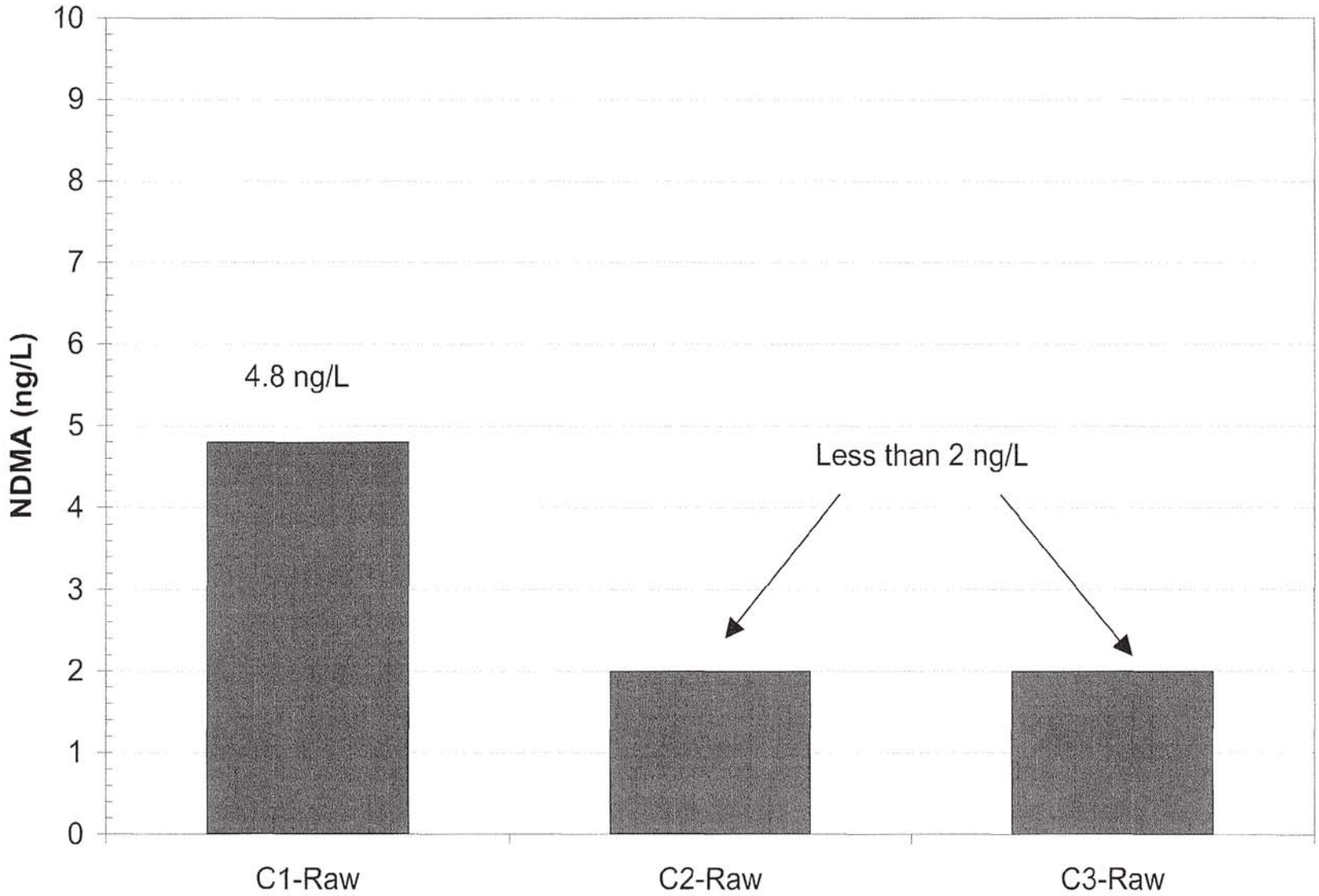

RESIN LEACH TEST RESULTS

FIGURE 3.20

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According to DOT's Hazardous Materials Regulations, 49 Code of Regulation SubChapter C (Hazardous Materials Regulations), subpart §171.8 (Definitions), a hazardous substance means a material, including its mixtures and solutions, that:

1. Is listed in the Appendix A to subpart §172.101 of the subchapter (Purpose and use of hazardous materials table).

2. Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the Appendix A to §172.101 of the subchapter.

Appendix A lists materials and their corresponding RQs that are listed or designated as "hazardous substances" under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601(14) (CERCLA; 42 U.S.C. 9601 et seq). Table 2 of Appendix A lists radionuclides that are hazardous substances and their corresponding RQs. The RQs in Table 2 for radionuclides are expressed in units of curies, and are shown in Table 3.20.

Table 3.20 A1 and A2 Values for Radionuclides- Shipments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Radionuclide	Atomic Number	A1 (Ci)	A2 (Ci)	Specific Activity (Ci/g)
Uranium 230	92	1,080	0.270	27,000
Uranium 232	92	81.1	0.00811	22
Uranium 233	92	270	0.027	9,700
Uranium 234	92	270	0.027	6,200
Uranium 235	92	Unlimited	Unlimited	0.0000022
Uranium 236	92	270	0.027	0.000065
Uranium 238	92	Unlimited	Unlimited	0.00000034
Uranium Natural	92	Unlimited	Unlimited	0.00000071

As far as transportation of hazardous substances, in Part 173 (Shippers- General Requirements for Shipments and Packaging), Subpart § 173.435, the values of A1 and A2 for radionuclides are defined. A1 means the maximum activity of special form Class 7 (radioactive) material permitted in a Type A package. A2 means the maximum activity of Class 7 (radioactive) material, other than special form, Low-Specific Activity (LSA) or Surface Contaminated Object (SCO), permitted in a Type A package, see Table 3.21.

Table 3.21 Calculated Accumulated Amount of Uranium on the Spent Resins Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Resin	Days Until 50% ClO_4^- Breakthrough	Projected Uranium Accumulation (Ci)	Lowest RQ (Ci)	Lowest A Value (Ci)
Cal Resin	146(1)	1.6E-09	0.01	0.027
USF 9708	60	3.1E-09	0.01	0.027
USF 9710	138(1)	1.2E-09	0.01	0.027

Note:
(1) Extrapolated from perchlorate breakthrough plots

A mass balance of the uranium adsorbed and desorbed from each of the three resins up to 50 percent perchlorate breakthrough was performed based on an influent concentration range of 1.0 to 3.9 pCi/L and measured effluent uranium concentrations from each of the columns. The amount of uranium accumulated on the resins through 50 percent perchlorate breakthrough was calculated and is presented in Table 3.21. Accumulated uranium is far below the lowest permissible reporting quantity and A-value. The resins are thus not classified as hazardous and their transportation and disposal to an incineration facility should not pose a challenge to CLWA.

7.4 Summary of Ion-Exchange Testing Results

7.4.1 Feed Water Quality

The feed water is low in organic matter, has moderate hardness and alkalinity, and contains moderate levels of iron and bromide. The raw water quality was stable over the testing period with the exception of the month of October 2003, during which period pumping rates at the NC-12 well were temporarily reduced, causing a decrease in nitrate concentration, and increases in sulfate and chloride concentrations.

7.4.2 Operational Data

The flow rate ranged from 13.5 to16.5 mg/L during the course of the study, which resulted in EBCTs of 1.4 to 1.6 minutes (the target was 1.5 min).The pressure drop across the column remained constant at 5 psi during most of the project. The water temperature ranged from 32 degrees C (89 degrees F) in the summer months to 16 degrees C (61 degrees F) in the fall. pH ranged from 7.6 to 8.4.

7.4.3 Focused Breakthrough Curves of Nitrate, Sulfate, Chloride, and Bicarbonate

The breakthrough of most anions (with the exception of perchlorate) occurred in the first 24 hours of run time. Bicarbonate broke through immediately, followed by sulfate at 80 bed volumes. Nitrate broke through after 280 bed volumes, 440 bed volumes, and 600 bed

volumes from USF 9708, USF 9710, and Cal 2100 resins, respectively. No chromatographic peaking was observed for any of the critical anions. Chloride level dropped from a high of approximately 325 mg/L to background concentrations (~35 mg/L) after 280 bed volumes.

7.4.4 Long-Term Breakthrough Curves of Perchlorate and Other Anions

Bed volumes to reach perchlorate breakthrough (greater than 1 μg/L) were 25,000 (26 days), 72,000 (75 days), and 76,000 (79 days) for USF 9708 resin, USF 9710 resin, and CalResin 2100, respectively. This translates in treated water volumes of 187,000 gal/ft^3, 540, 000 gal/ft^3, and 569,000 gal/ft^3, respectively. A small increase in chloride concentration was observed after a simulated 45-hour shutdown period, likely due to leaching from the resin.

7.4.5 NDMA Results

The results from the post-chlorination testing with free chlorine (residual of 1.8 to 2.2 mg/L after 24 hours) and with combined chlorine (residual of 1.6 to 1.9 mg/L after 24 hrs) showed that NDMA concentrations in all three ion-exchange column effluents after 2- and 24-hour incubation times were below the detection limit of 2 ng/L. Therefore NDMA precursors did not leach from the resin .

To investigate the formation potential of NDMA upon the reaction of chlorine with DBP precursors in the water or leaching from the resin, a 2-mg/L free chlorine dose was added directly to the feed water. Measured NDMA levels were below or just over the detectable limit of 2 ng/L.

To evaluate the NDMA precursor leaching potential of the resins, 100 mL batches of fresh resin were incubated for four hours in deionized water and groundwater. NDMA was detected in only one sample, which measured at less than half the 10 ng/L Action Level.

7.4.6 Spent Resin Characterization

The California TTLC metal concentration values were mostly non-detect in all three spent resins. Chromium, vanadium, and zinc were detected in USF 9708 and USF 9710 spent resins at levels significantly below the regulatory TTLC threshold concentrations. Uranium levels in the spent resin leachate were significantly below the Title 22 MCL of 20 pCi/L. To investigate whether the spent resins would be classified as hazardous for transportation to an incineration facility, a mass balance of the uranium adsorbed and desorbed from the resin up to 50 percent perchlorate breakthrough was performed. The amount of uranium accumulated on the spent resins is far below the lowest permissible reporting quantity and A-value of the California DOT.

7.5 Fixed-Bed Filter

7.5.1 Biological Acclimation

Figure 3.21 shows FXB perchlorate removal performance during the biological acclimation and optimization phases[1]. Perchlorate was initially removed by adsorption onto the virgin GAC, and began to break through after 12 days as the carbon's adsorption capacity diminished. These data are consistent with other perchlorate/GAC breakthrough curves reported in the literature (Na et al., 2002, Brown et.al, 2002). During the subsequent month of biological acclimation, run times were less than 24 hours due to rapid headloss development in the filter. The pilot feed lines were experiencing heavy biological growth, and the biofilm from the feedlines would occasionally detach and clog the bed. The acetic acid feed concentration was lowered during the acclimation phase (Figure 3.22) to minimize growth. However, excessive biogrowth in the feed lines continued to generate rapid headloss build-up. Phosphoric acid was added at 0.2 mg/L PO_4-P to select away from filamentous organisms suspected of causing the overgrowth and clogging problems. Simultaneously, the electron donor feed was repositioned so that acetic acid was fed directly to the top of the filter column instead of upstream of the static mixer, thus minimizing biofilm growth in the feed line. Consequently, biogrowth was isolated to the filter bed, headloss development rates decreased, and 48-hour run times were achieved. Within 10 days of adding phosphoric acid and repositioning the acetic acid feed, steady perchlorate removal to below detection was achieved in the filter. The phosphoric acid feed was removed during the optimization tests without affecting perchlorate removal performance, indicating that phosphorous in the natural water did not limit biological activity in the filter. Therefore, repositioning the acetic acid feed was likely the key to effectively acclimating the FXB filter for biological perchlorate removal. If this electron donor feed configuration had been used from time zero, it is estimated that steady-state biological perchlorate removal to below detection would have required 3 to 4 weeks of operation.

7.5.2 Optimization

During the two months of piloting after the acclimation period, EBCT and acetic acid feed concentrations were optimized (Figures 3.21 and 3.22). The minimal acetic acid concentration that still allowed removal of perchlorate to below detection was 7.8 mg/L as carbon (25% excess).[2] EBCTs as low as 15 minutes allowed for the consistent, complete removal of perchlorate to below detection, although only 24-hour run times were achieved. To lengthen run times, the EBCT was increased to 20 minutes. However, short-circuiting of the filter was observed throughout this period, resulting in perchlorate breakthroughs from 20 to 65 percent. While the 15-minute EBCT operation resulted in rapid headloss development (i.e., < 24-hour run times) but no perchlorate breakthrough, the 20-minute EBCT resulted in short-circuiting and variable perchlorate breakthrough. It appears that the

[1] All perchlorate detections (even those lower than the 4 μg/L MRL) are shown in the FXB and FBR figures.

[2] Assumes complete reduction of 7.0 mg/L of feed DO and 15 mg/L of feed nitrate.

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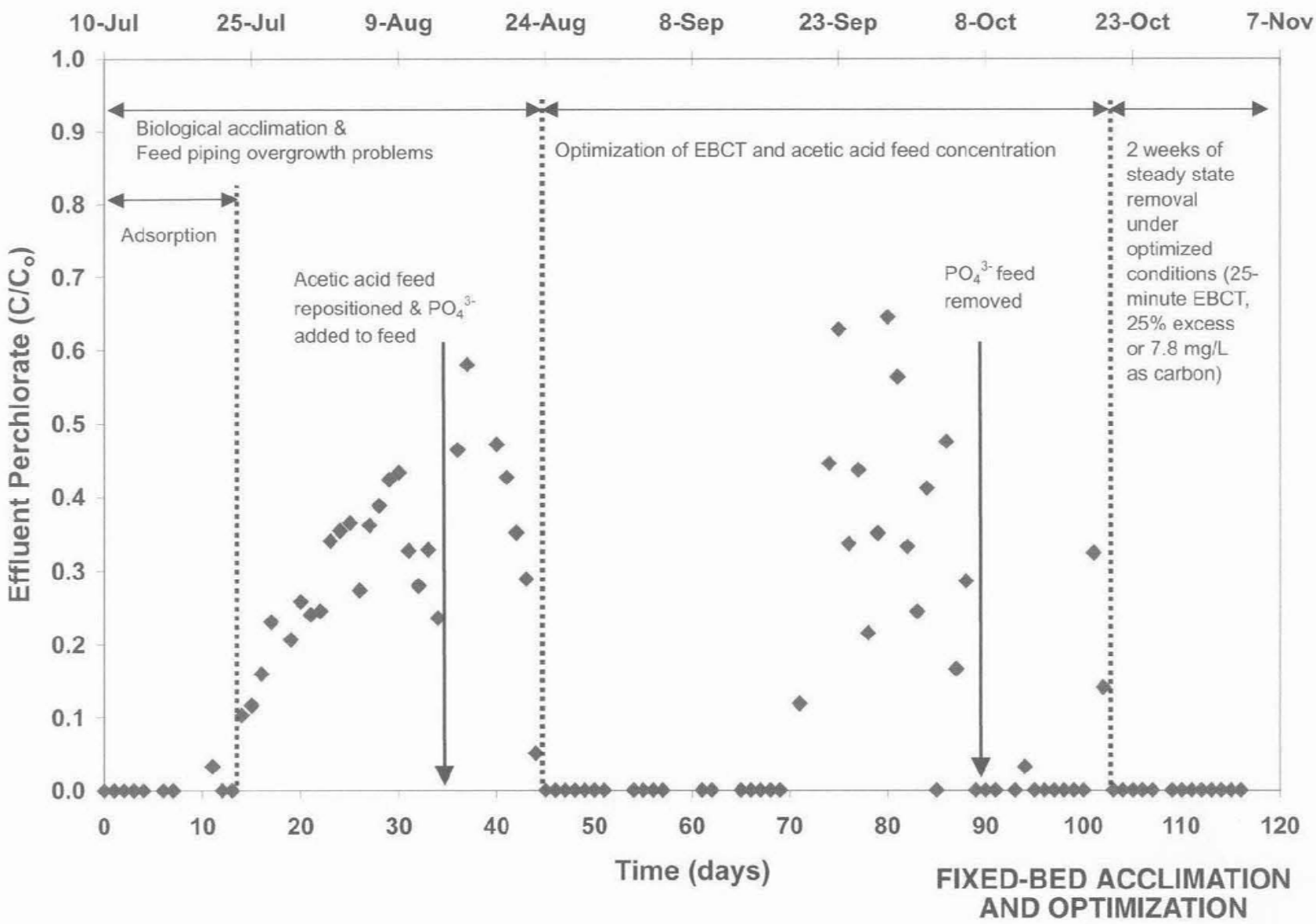

FIXED-BED ACCLIMATION AND OPTIMIZATION

FIGURE 3.21

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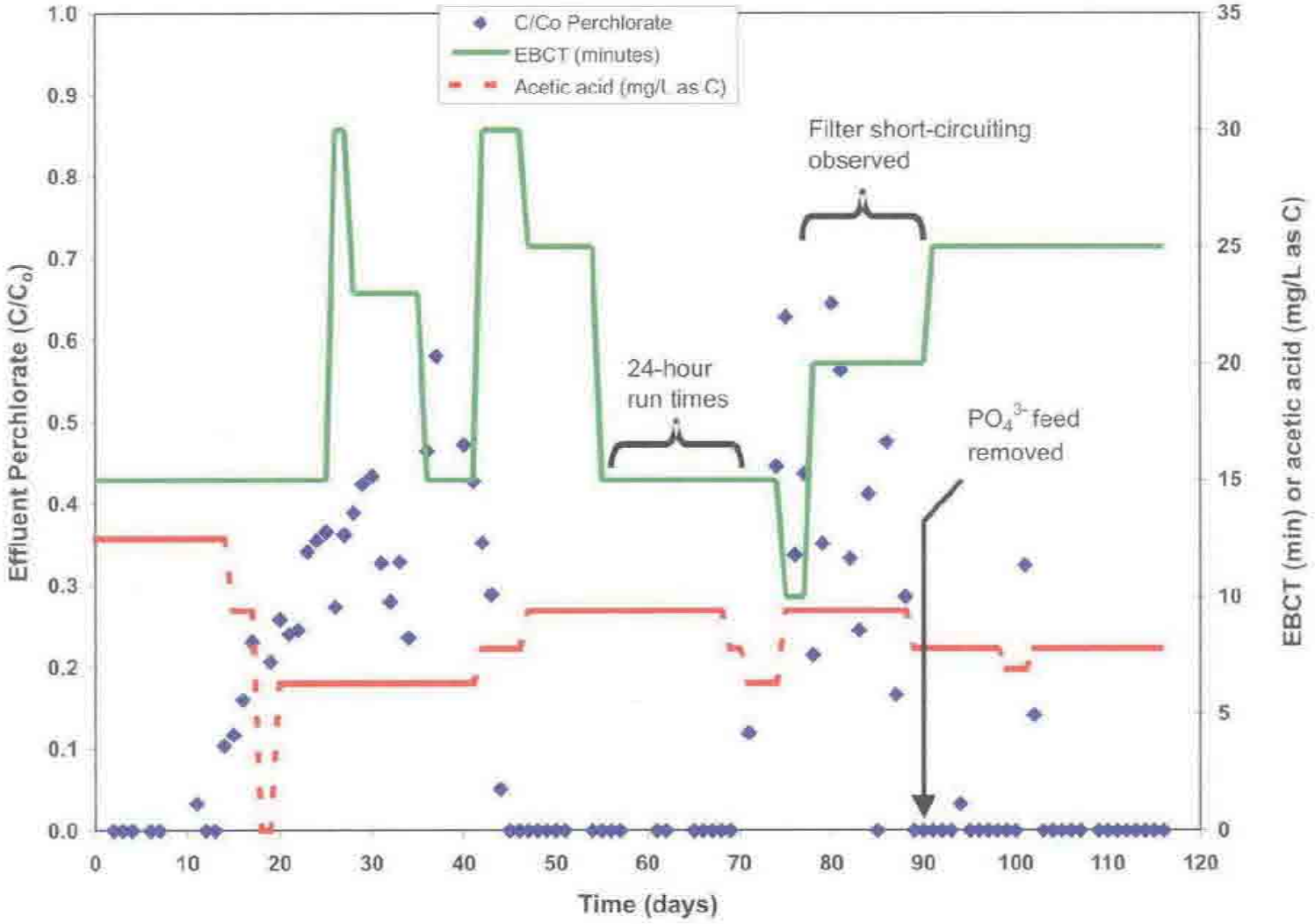

FIXED-BED EBCT AND ACETIC ACID SET-POINTS

FIGURE 3.22

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higher flow rate promoted more uniform hydraulic loading in the filter, which distributed growth evenly across the bed. Instead of passing through the filter evenly, feedwater pumped at lower flow rates followed preferential paths that produced the observed channeling. The shortest EBCT that allowed ≥ 48-hour run times while consistently removing perchlorate to below detection was 25 minutes. Though some channeling was observed under 25-minute EBCT conditions, it was less extensive than that observed during 20-minute EBCT operation. After the optimization period, the filter was run for two weeks using a 25-minute EBCT and 7.8 mg/L acetic acid carbon. Removal of perchlorate to below detection was observed throughout this period as well.

7.5.3 Dissolved Oxygen and Nitrate

All perchlorate-reducing bacteria described in the literature are facultative aerobes or microaerophiles. Thus, oxygen can inhibit biological perchlorate reduction by acting as a competing electron acceptor. Similar to oxygen, nitrate has a high redox potential that allows it to compete with perchlorate for use as an electron acceptor. Research has confirmed the occurrence of this competitive inhibition by demonstrating that DO and nitrate concentrations must be very low to achieve efficient perchlorate reduction in biological reactors (Brown et al., 2001, Herman and Frankenberger, 1999). Therefore, influent and effluent DO and nitrate concentrations were monitored closely during pilot testing.

Effluent DO concentrations were generally low during the acclimation phase (Figure 3.23). DO was likely reacting with the surface of the GAC initially, and was being reduced biologically as bacteria colonized the bed. Influent DO concentrations ranged from 4 to 8 mg/L and were reduced to 0.2 percent 0.3 mg/L throughout most of the pilot testing period. While effluent DO concentrations were steady, Figure 3.24 shows that effluent nitrate concentrations were variable. It was also observed that when effluent nitrate concentrations were detected, effluent perchlorate concentrations were also detected. These data: 1) indicate that DO was preferentially reduced over nitrate, and 2) confirm that DO and nitrate inhibit biological perchlorate reduction, as has been widely reported in the literature.

Figure 3.24 also reveals that feed nitrate concentrations gradually declined to approximately 7 mg/L as NO_3 after operating for 80 days at 15 mg/L as NO_3. The decline in feed nitrate concentrations coincided with a change in the NC-12 pumping schedule. After Day 80 of pilot operation, NC-12 was no longer pumped continuously for production, but rather was turned on periodically only to produce water for pilot plant operation. The resultant decrease in NC-12 production may have caused the variable background nitrate as well as sulfate (Figure 3.27).

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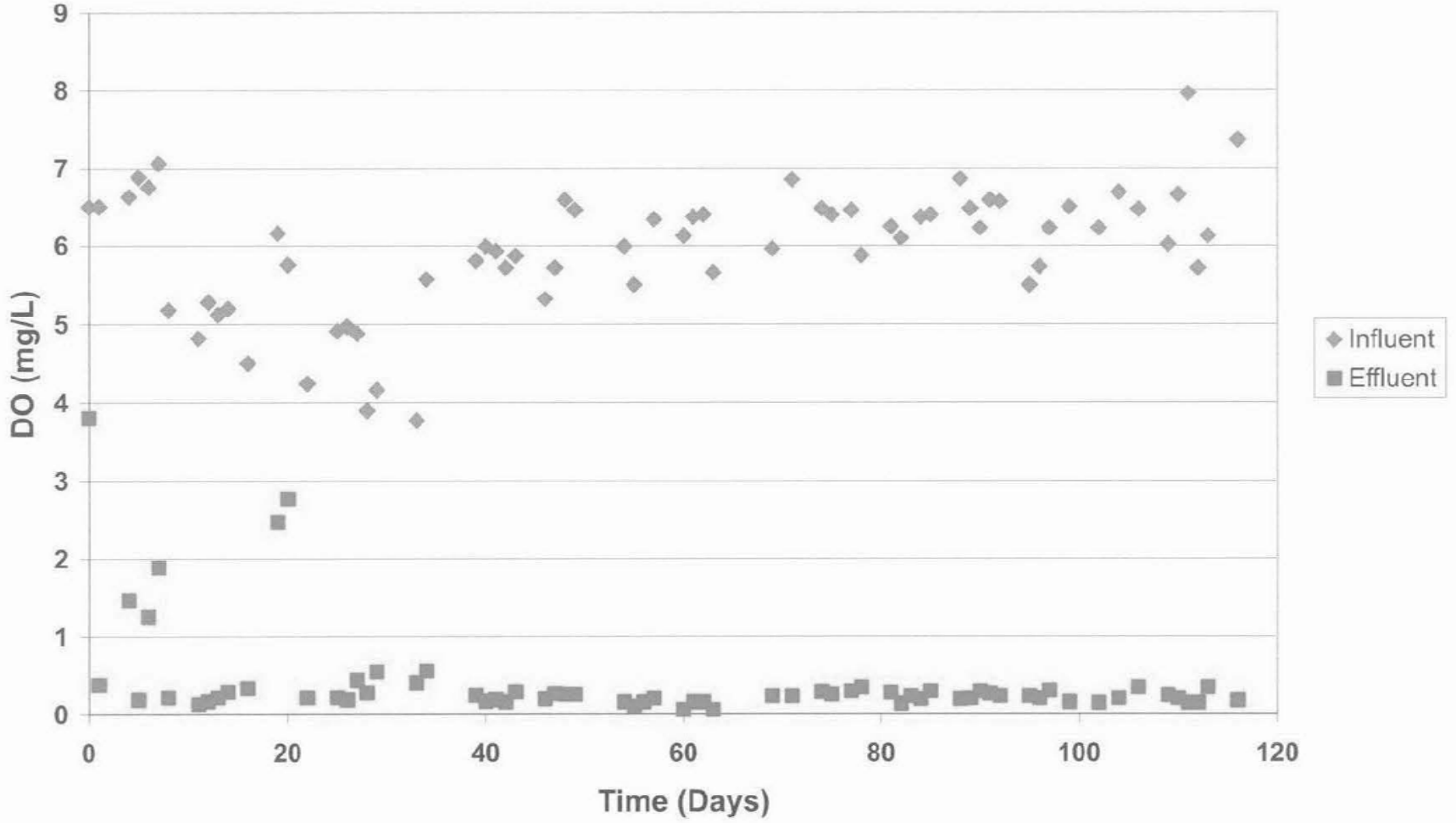

FIXED-BED DISSOLVED OXYGEN

FIGURE 3.23

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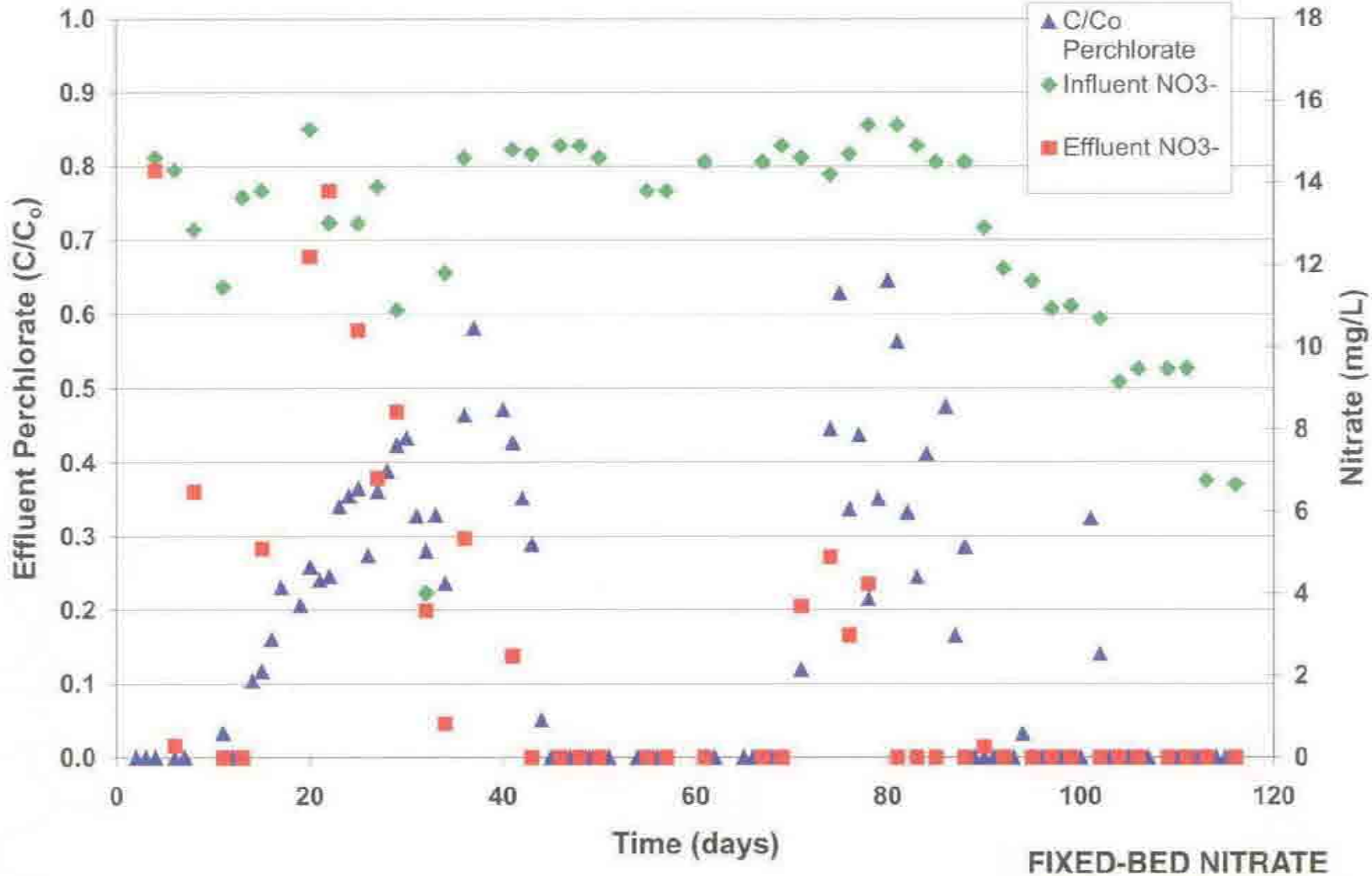

FIXED-BED NITRATE AND PERCHLORATE

FIGURE 3.24

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7.5.4 Other Parameters

The following water quality observations were made during acclimation and optimization phases of FXB piloting:

- Effluent TOC concentrations were very low (Figure 3.25); generally non-detect (i.e, ≤ 0.7 mg/L). Effluent BDOC concentrations were non-detect (Figure 3.26). These data indicate that effluent from the FXB filter is biologically stable, and suggest that the post-treatment steps may be somewhat simplified to aeration and disinfection.
- Sulfate concentrations and pH were not significantly impacted across the filter (Figures 3.27 and 3.28, respectively). However, sulfide was occasionally detectable by smell.
- HPCs increased across the filter, resulting in counts between 70,000 and 650,000/mL (Figure 3.29).
- With the exception of two data points, total coliforms were not detected in the feed or effluent of the filter (Figure 3.30). The two detections indicated that coliforms in the feed water were partially removed across the filter. No fecal coliforms were detected.
- Average feed water turbidities were approximately 0.5 NTU. Average effluent turbidities were approximately 0.6 NTU (Figure 3.31). Average effluent particle count (>2 µm) was 99 counts/mL (Figure 3.31). The particle counter malfunctioned after 80 days of operation.
- Headloss across the filter ranged from < 2 feet to 30 feet (Figure 3.32). Under optimal operating EBCT and acetic acid conditions, headloss peaked at 25 feet, but was typically between 5 and10 feet.

7.5.5 Robustness Characterization

7.5.5.1 Backwashing

The results of the backwash challenge tests are shown in Figure 3.33. After the filter was put back into production following a backwash event, samples were taken every 15 minutes for an hour. No perchlorate was detected. This experiment was repeated one month after the first backwash challenge test with the same result.

7.5.5.2 Perchlorate Spiking

Transient perchlorate loading episodes did not impact perchlorate removal performance in the FXB filter (Figure 3.34). The feed perchlorate concentration was varied from 50 µg/L to 100 µg/L to 50 µg/L to 300 µg/L to 5 µg/L while EBCT and feed acetic acid concentration were maintained at 25 minutes and 7.8 mg/L as carbon, respectively. No perchlorate was detected in the effluent, even for the high resolution samples (i.e., samples taken at 0, 15, 30, 45, and 60 minutes) taken immediately after the influent perchlorate concentration was changed.

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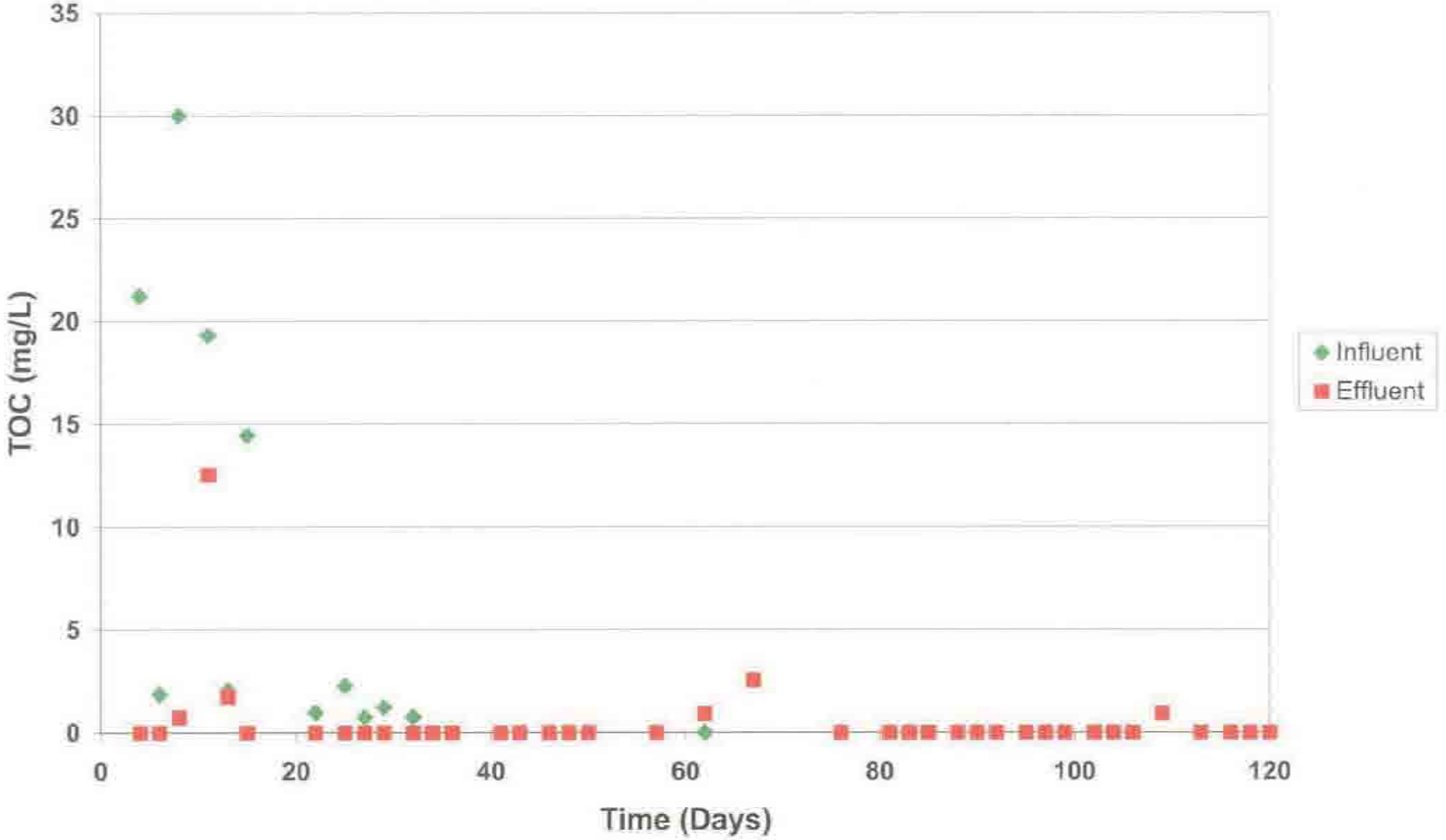

FIXED-BED TOTAL ORGANIC CARBON

FIGURE 3.25

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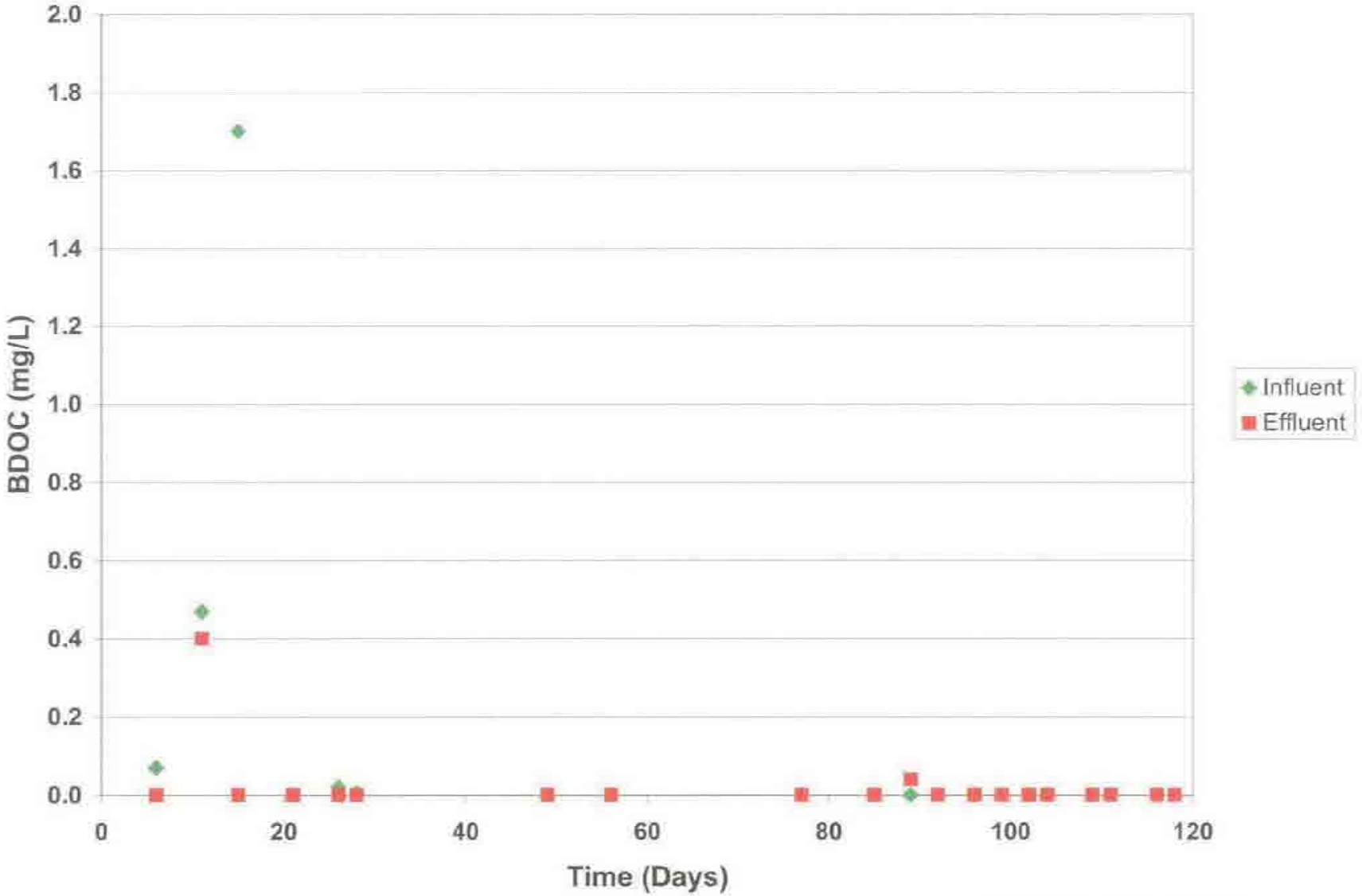

FIXED-BED BDOC

FIGURE 3.26

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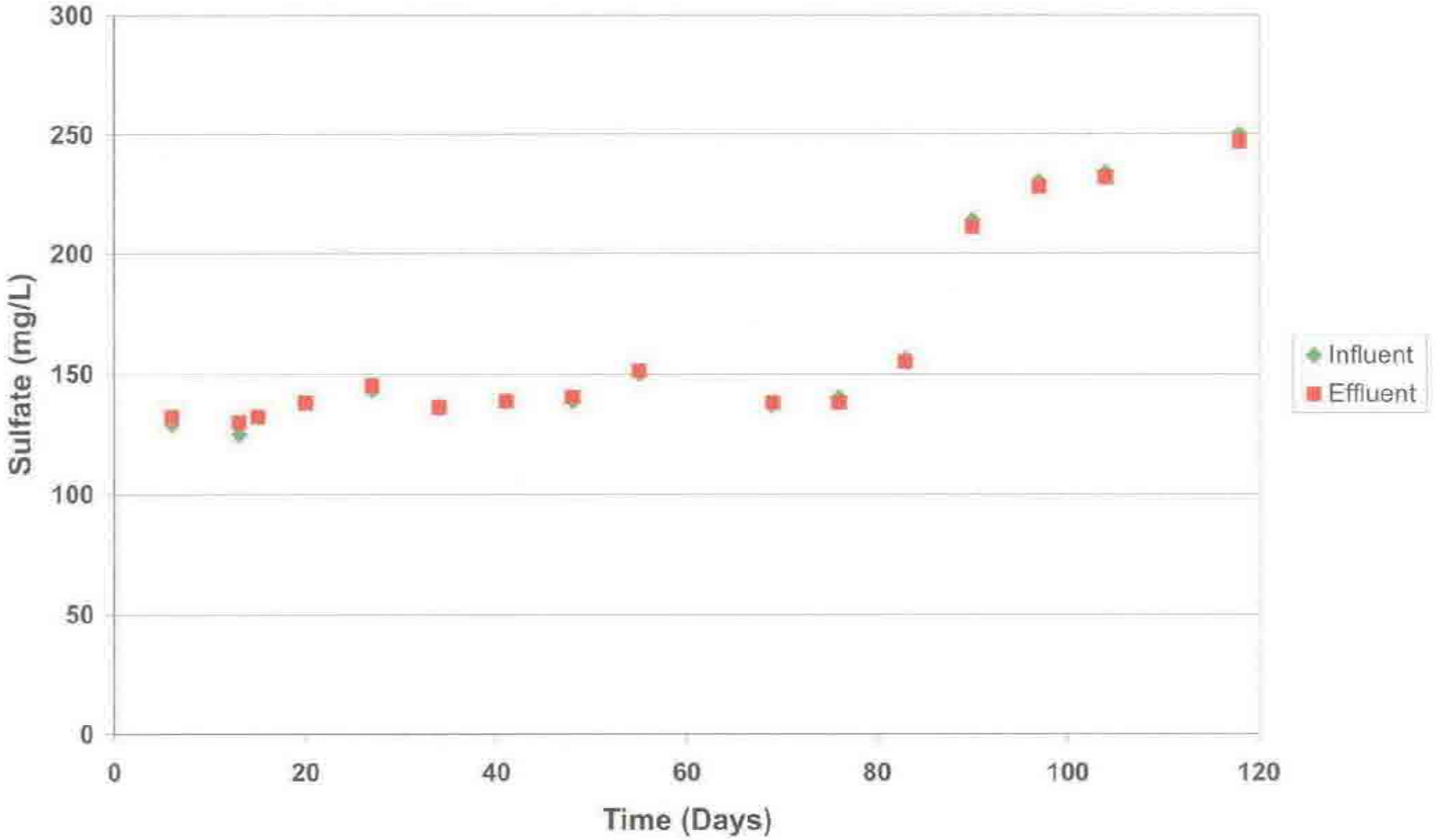

FIXED-BED SULFATE

FIGURE 3.27

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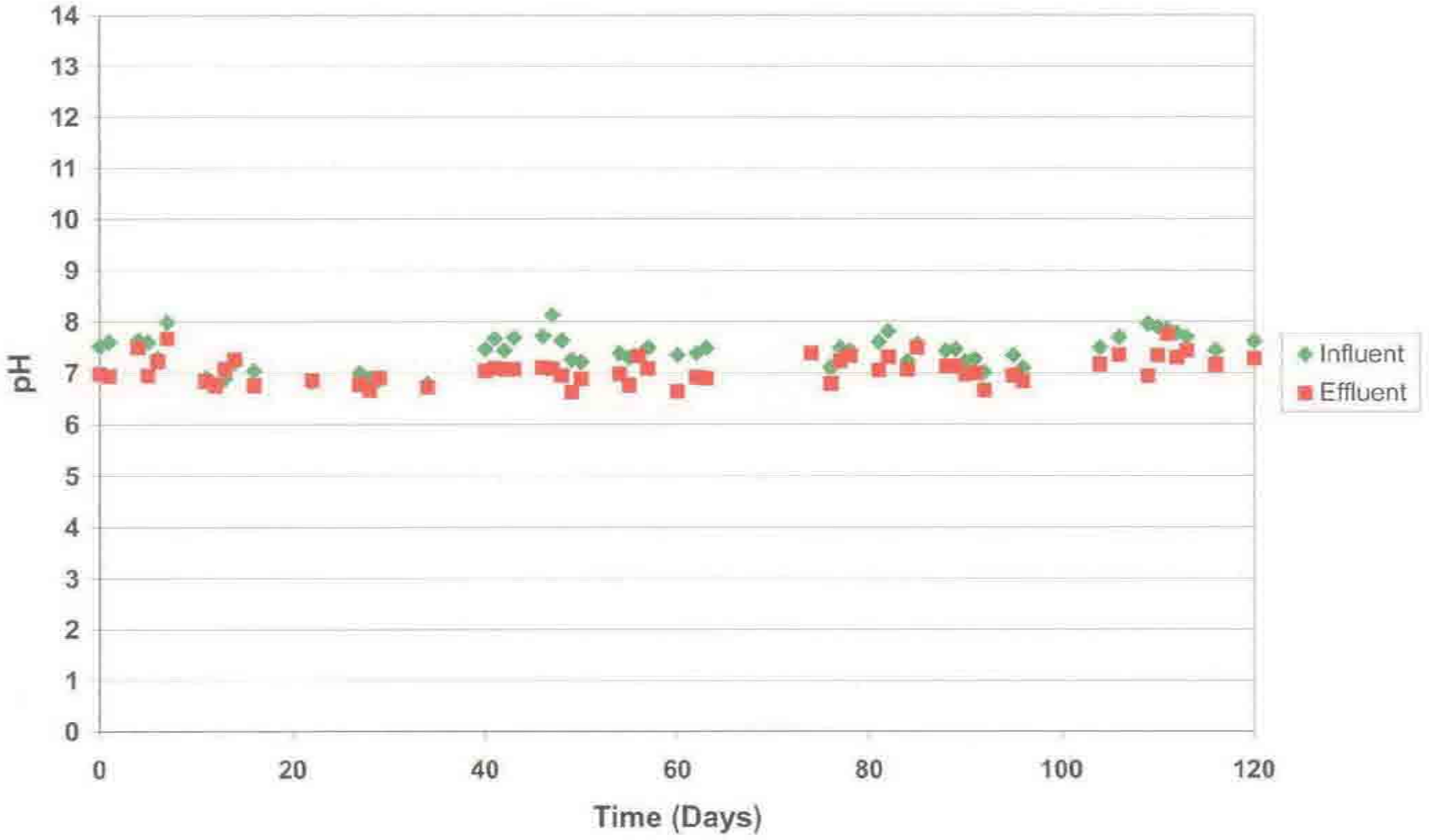

FIXED-BED pH

FIGURE 3.28

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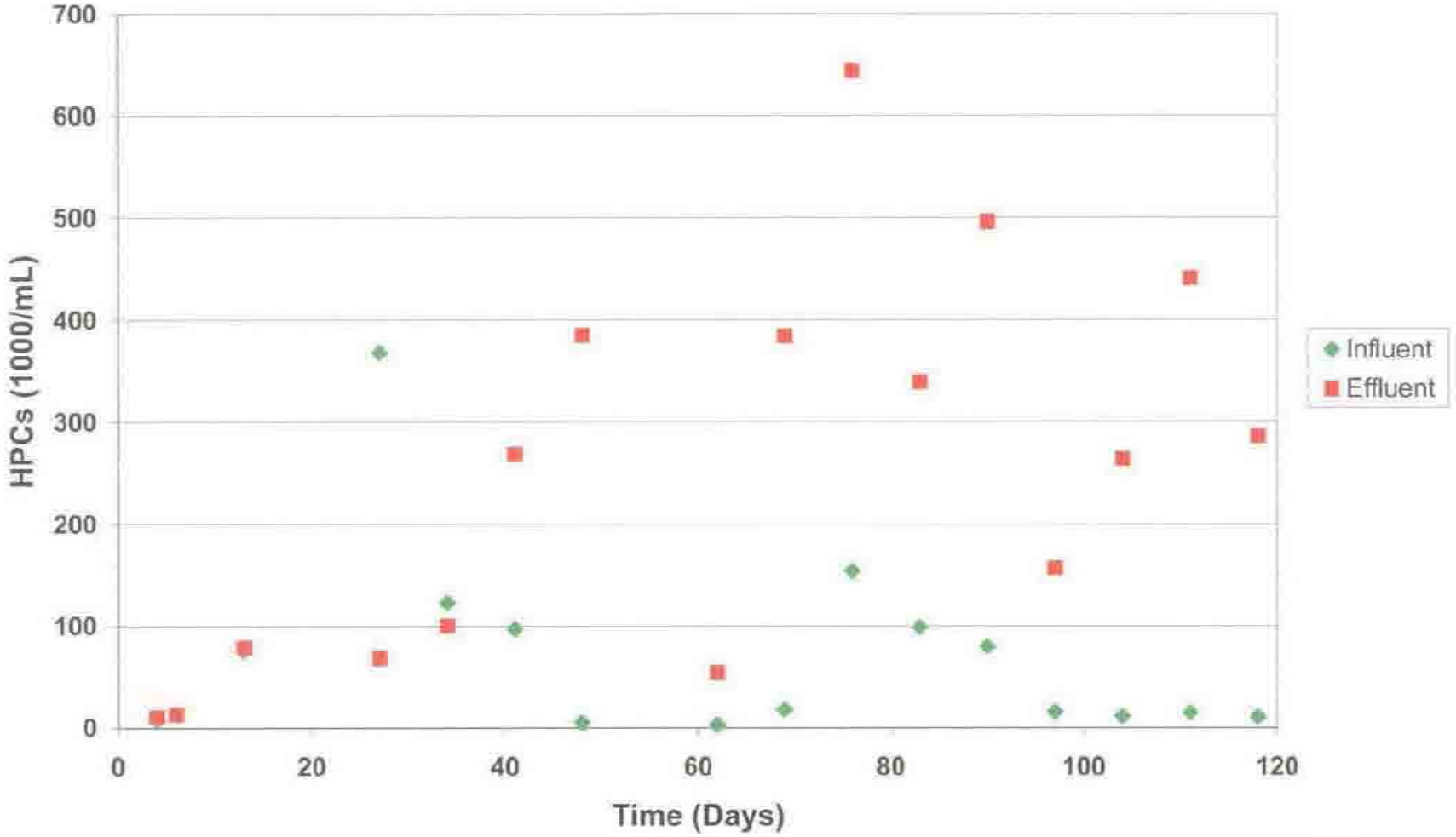

FIXED-BED HETEROTROPHIC PLATE COUNTS

FIGURE 3.29

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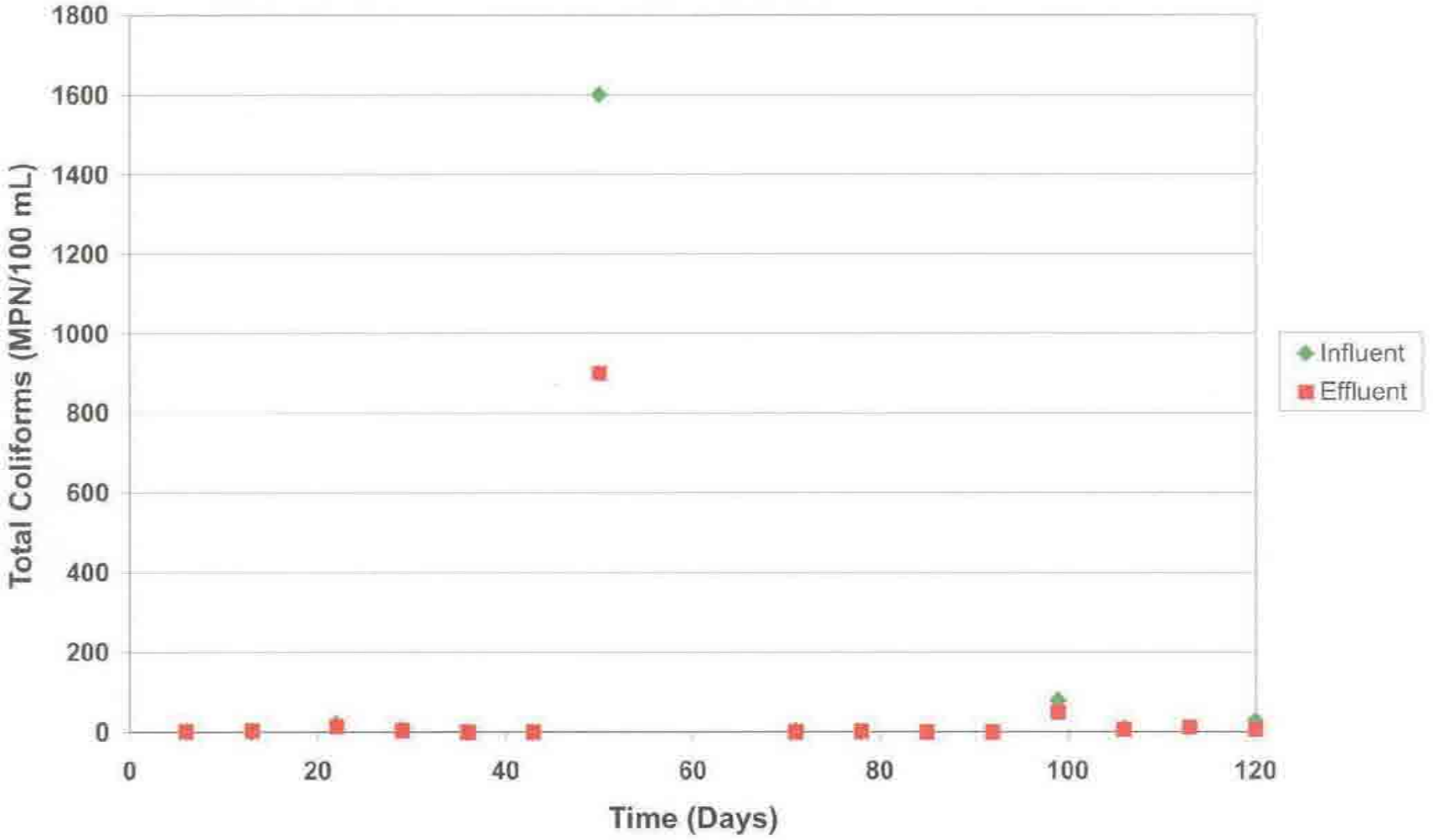
30-CLWA204F3 30-6625A16.CDR



FIXED-BED TOTAL COLIFORMS

FIGURE 3.30

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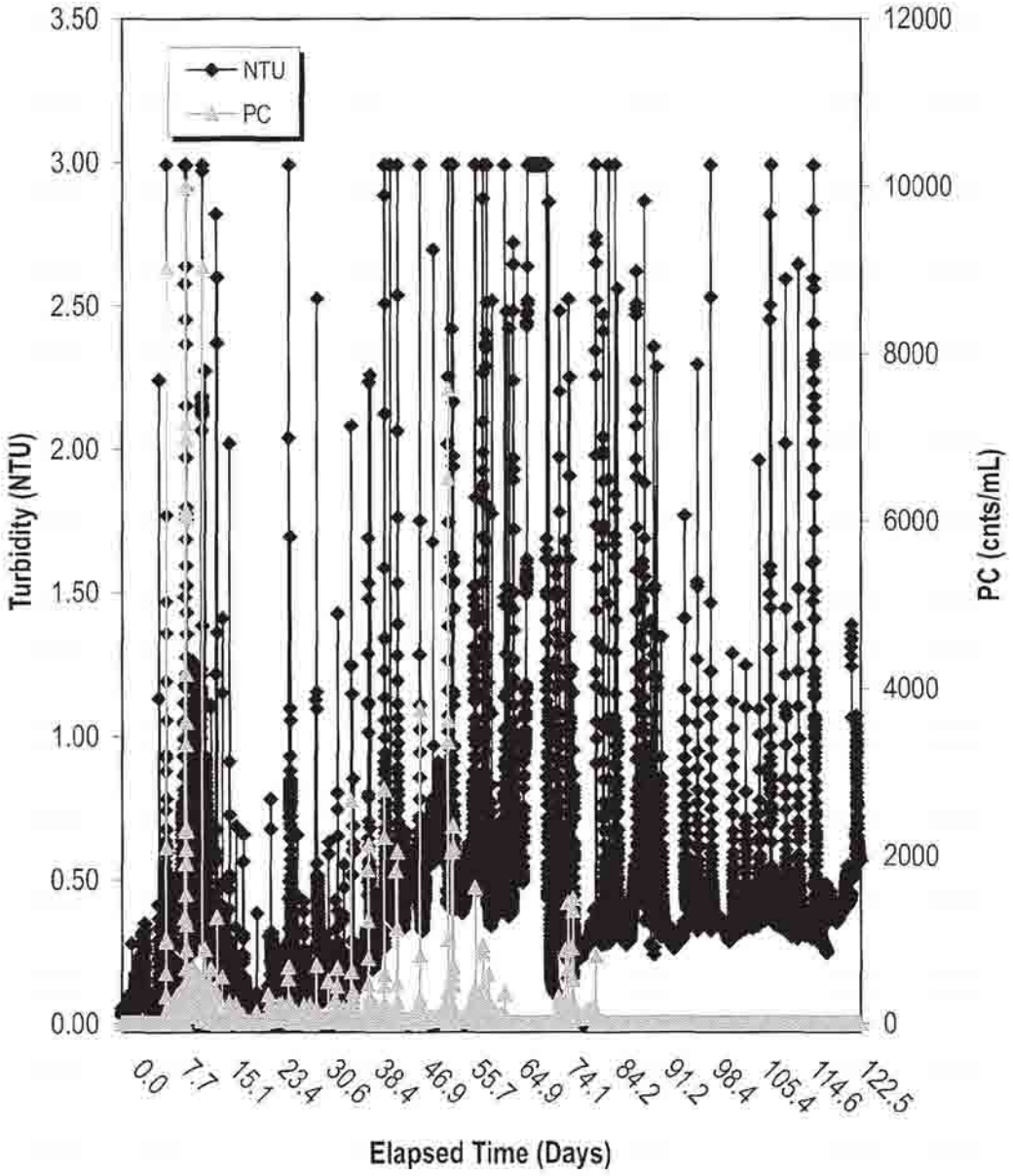

FIXED-BED EFFLUENT TURBIDITY AND PARTICLE COUNTS

FIGURE 3.31

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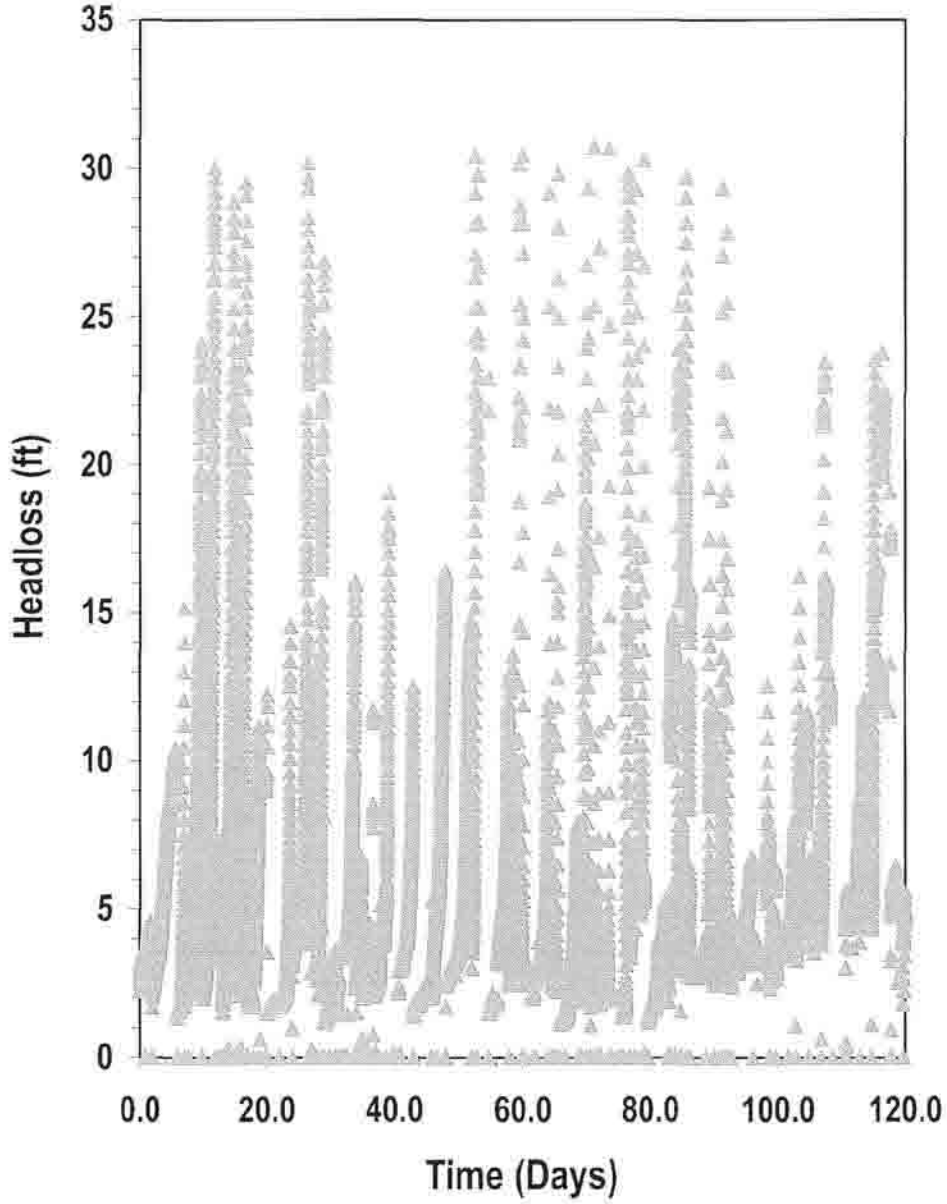

FIXED-BED HEADLOSS

FIGURE 3.32

20-CLWA204F3.32-6625A10.CDR

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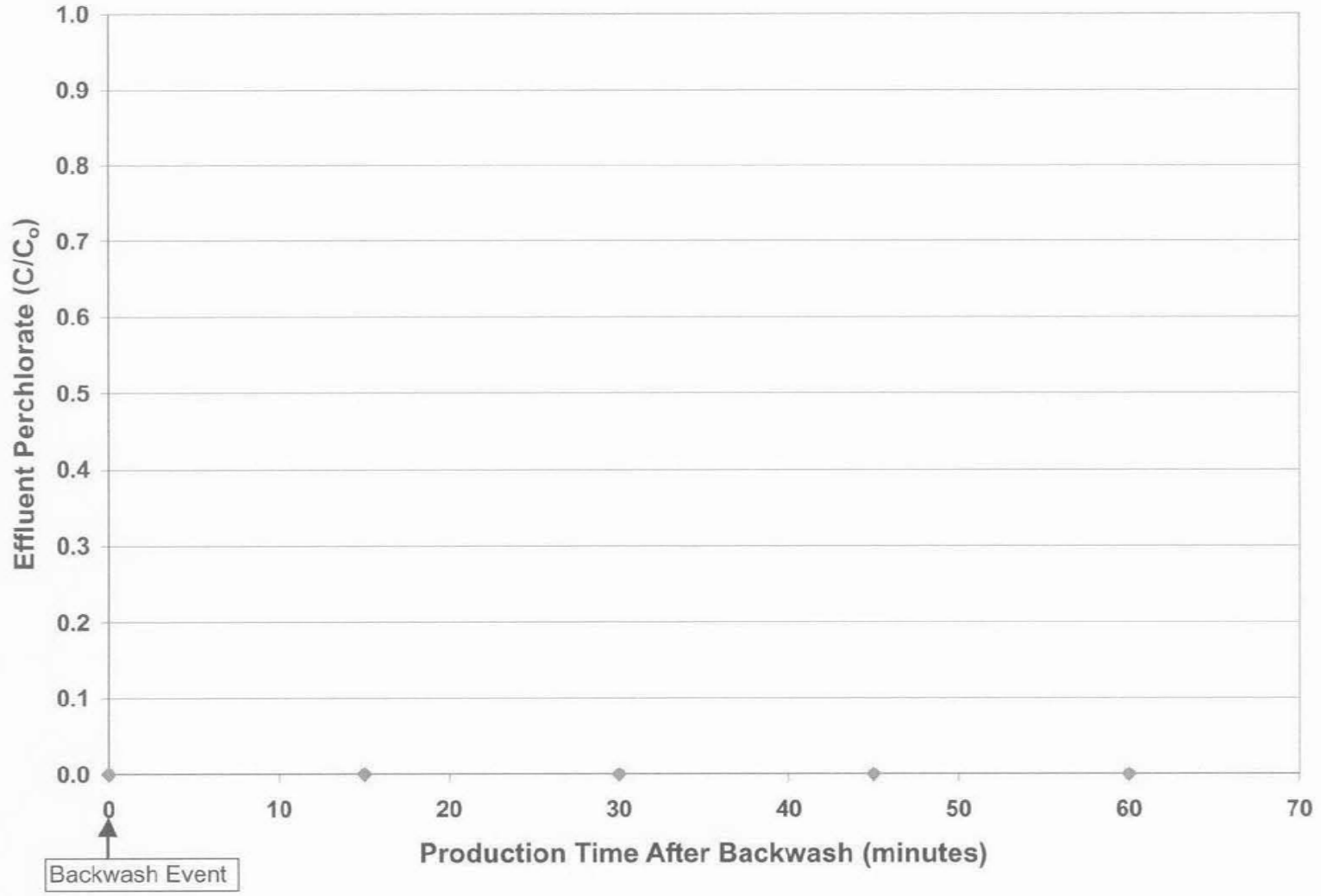

FIXED-BED BACKWASH CHALLENGE TEST

FIGURE 3.33

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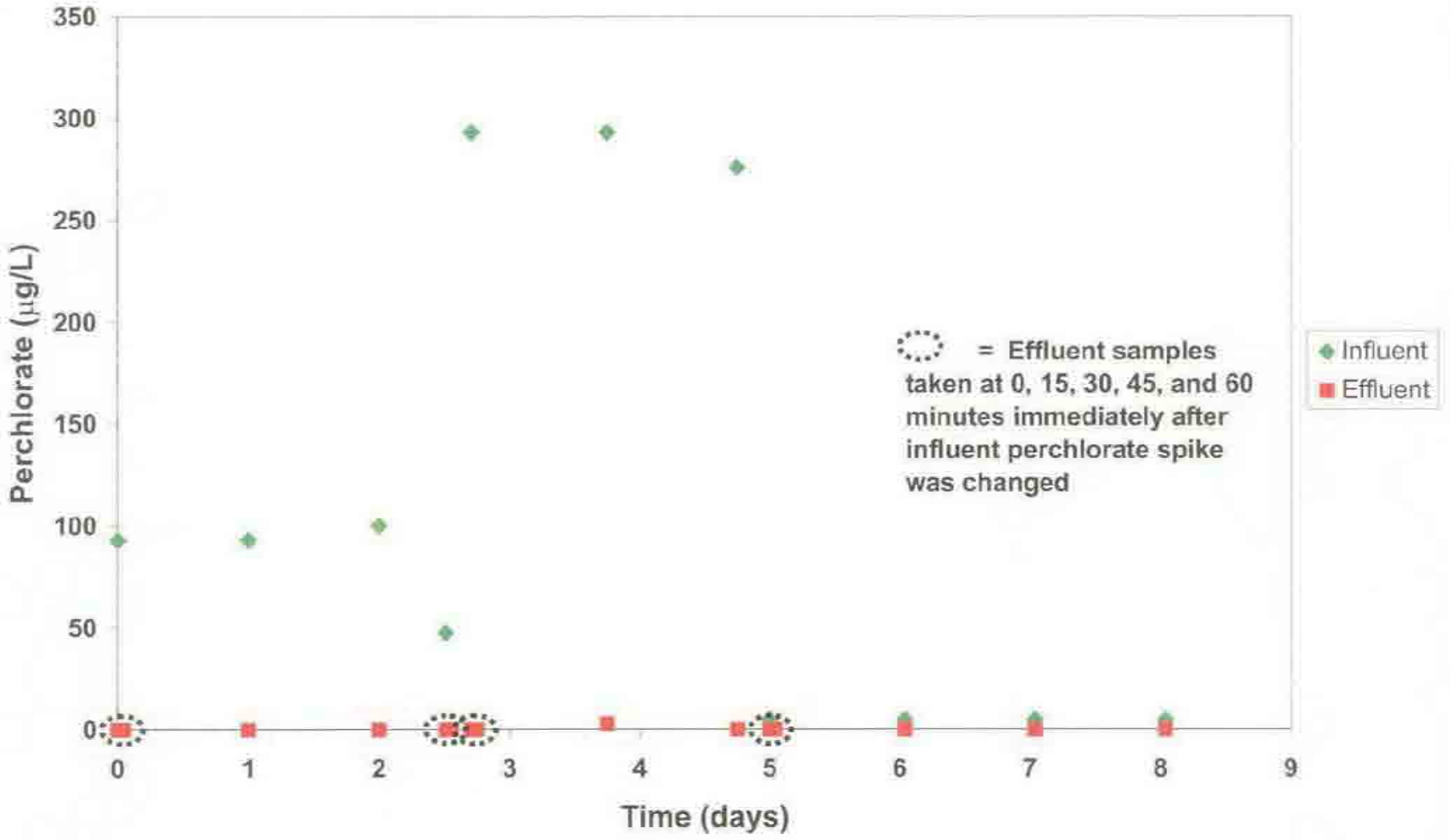

FIXED-BED PERCHLORATE SPIKE CHALLENGE TEST

FIGURE 3.34

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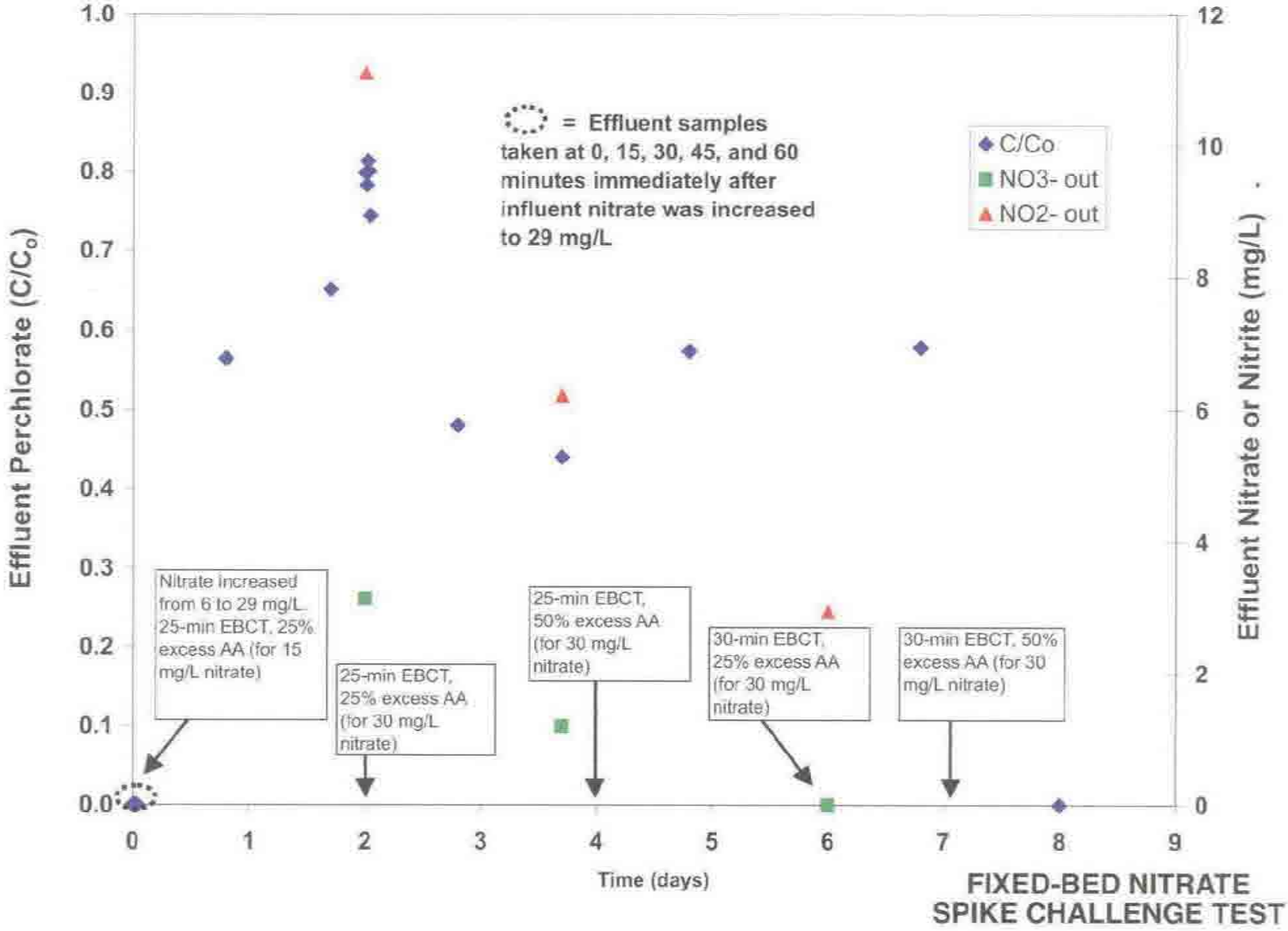
7.5.5.3 Nitrate Spiking

When the feed nitrate concentration was increased stepwise from 6 mg/L as NO_3 to 29 mg/L as NO_3, perchlorate was not detected in the high resolution samples taken up to an hour after the event (Figure 3.35). However, samples taken ≥ 24 hours after the step increase showed perchlorate, nitrate, and nitrite breakthrough. Increasing the acetic acid feed concentration and EBCT did not immediately recover perchlorate removal performance to below detection. Eight days after the feed nitrate concentration was increased by 23 mg/L as NO_3^-, complete removal of nitrate, nitrite, and perchlorate was again observed in the FXB. These data suggest two important phenomena:

1. When large step increases in feed oxidant concentrations occur, the biological FXB requires a period of bioacclimation before perchlorate removal to below detection can be reestablished and maintained. In other words, the bacterial mass in the FXB, which was equilibrated to a feed nitrate concentration of 6 mg/L as NO_3^-, was insufficient to handle a sudden increase in feed nitrate concentration of 23 mg/L as NO_3^-. The bacterial community had to grow and equilibrate with a much higher nitrate concentration before it could produce the redox conditions necessary for complete perchlorate removal.

2. Via adsorption, GAC provides a safety factor with respect to perchlorate removal in the FXB. This is supported by the lack of perchlorate detections immediately following the step nitrate increase. The primary perchlorate removal mechanism in the biological FXB is biological reduction. However, if the microbial activity in the filter is insufficient to remove perchlorate, the GAC can adsorb perchlorate for a period of time to prevent breakthrough. If perchlorate diffusion through the biofilm is fast, adsorption could be occurring near the top of the GAC bed, where the biological activity is highest. If perchlorate diffusion through the biofilm is slow, adsorption could be occurring in the lower portions of the GAC bed, where there is little biological activity. Sorption sites may be biologically regenerated when perchlorate reducing conditions return to the FXB. This may be the case even for adsorption sites in the lower portions of the bed, as GAC tends to migrate toward the top of the column during a backwash event, positioning it at depths of increased biological activity. This hypothesis explains why there might be perchlorate adsorption capacity available on the GAC after five months of pilot testing.

Large step changes in nitrate concentration, like the one tested during this experiment, are not typical for a groundwater system. Unintentional, gradual nitrate fluctuations were observed throughout pilot testing and did not impact perchlorate removal performance in the FXB.



FIXED-BED NITRATE SPIKE CHALLENGE TEST

FIGURE 3.35

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7.5.5.4 System Shut-Down

Figure 3.36 shows the results of the 24- and 48-hour shut-down tests. The pilot plant was turned off for 24 hours and then restarted using a 25-minute EBCT and 7.8 mg/L acetic acid carbon. No backwash was performed prior to restarting the FXB. Samples taken at 0, 15, 30, 45, and 60 minutes and 24 hours after the pilot was restarted showed no perchlorate breakthrough. However, 26 percent and 40 percent breakthrough occurred 48 and 72 hours after the pilot was put back into production. After the 72-hour sample, the pilot was turned off for a period of 48-hours and then restarted without a backwash. Samples taken at 0, 15, 30, 45, and 60 minutes, 24 hours, and 48 hours after the pilot was restarted showed no perchlorate breakthrough. The 72-hour sample showed 24 percent breakthrough and the 96-hour sample again showed perchlorate removal to below detection.

The 24-hour shut-down experiment was repeated, but included a backwash prior to restarting the system. As Figure 3.36 indicates, no perchlorate was detected in the effluent in the high resolution samples or in subsequent samples taken daily for five days. A review of previous data also revealed four periods over which the biological FXB pilot system was shut down unintentionally. These periods ranged from 12 to 62 hours, the biological FXB was backwashed prior to restarting after each period, and production EBCTs were 15 or 25 minutes. No effluent perchlorate was detected following the shut down periods (Figure 3.37).

The biological FXB was also shut down for a two-week period in December 2003. It was backwashed and restarted at a 25-minute EBCT. Consistent perchlorate removal was immediately observed and sustained; no effluent perchlorate was detected.

7.5.5.5 Electron Donor Feed Failure Simulation

To investigate the impact of the future of the electron donor addition on perchlorate removal performance in the FXB, the acetic acid feed was shut off and effluent perchlorate concentrations were monitored. Samples taken at 0, 15, 30, 45, and 60 minutes and 2, 3, 5 and 24-hours after the acetic acid pump was turned off showed no perchlorate breakthrough (Figure 3.38). The acetic acid pump was then restarted and perchlorate continued to be removed to below detection. The following hypothesis may account for the exceptional perchlorate removal performance in the biological FXB while no exogenous electron donor was being added to the system:

1. The bacterial community in the biological FXB was respiring endogenously. That is, bacteria were metabolizing their own cells for use as an electron donor. This often occurs when food sources are scarce.

2. Via adsorption, GAC was providing a safety factor with respect to perchlorate removal in the FXB. When the acetic acid pump was turned off, biologically reductive activity likely slowed in the filter, allowing adsorption to become a more active mechanism for perchlorate removal.

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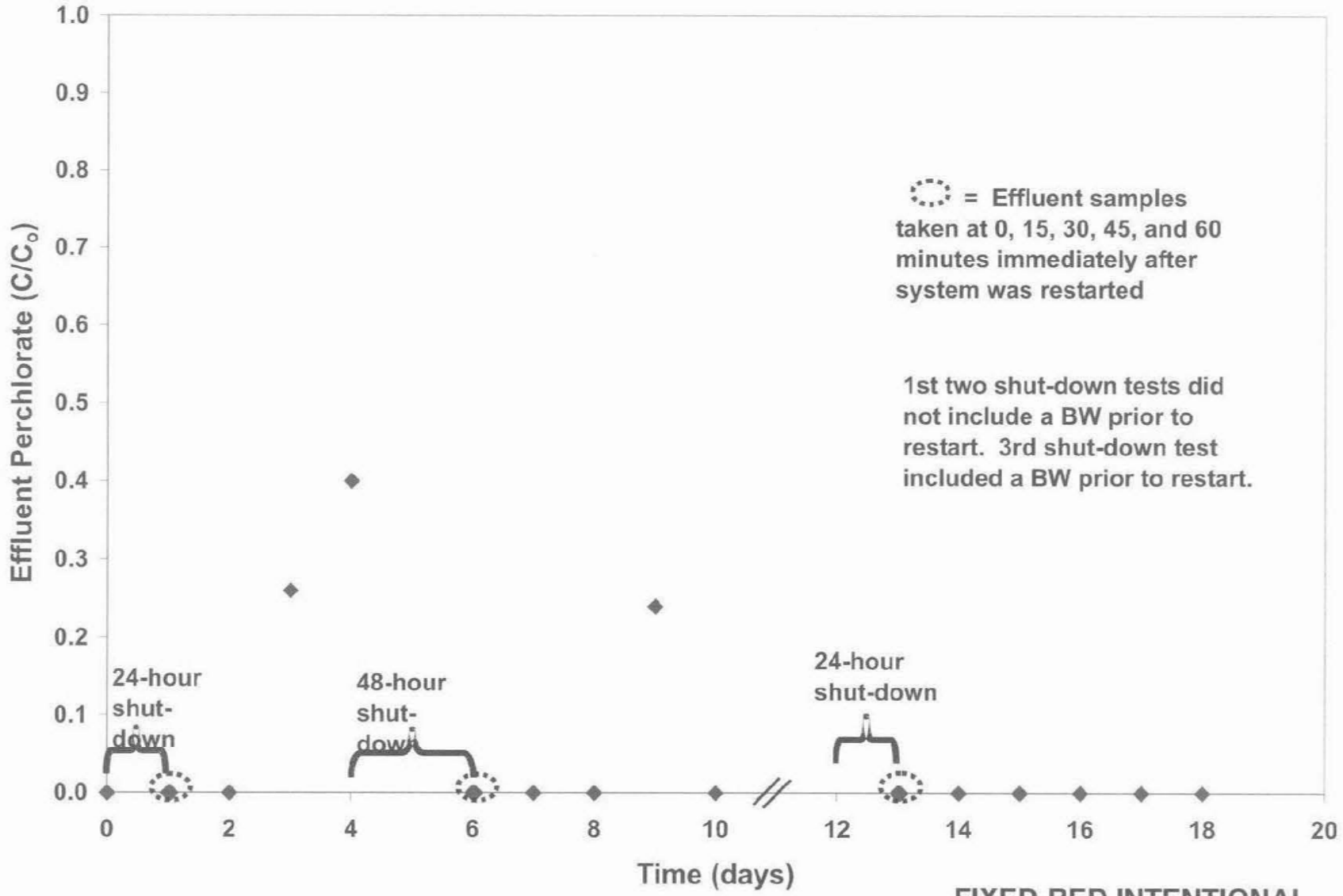

FIXED-BED INTENTIONAL SHUT-DOWN CHALLENGE TEST

FIGURE 3.36

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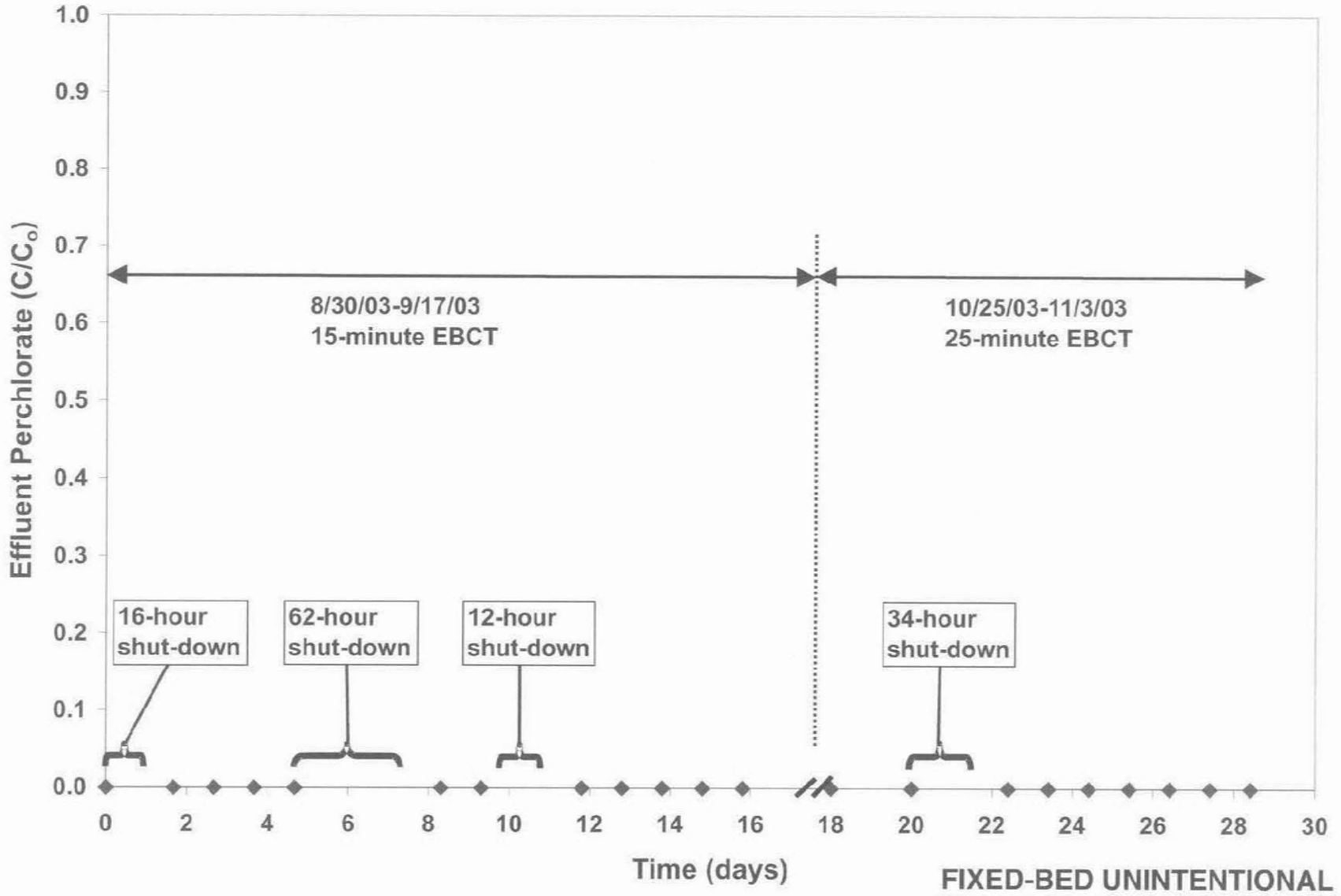

FIXED-BED UNINTENTIONAL SHUT-DOWN PERFORMANCE

FIGURE 3.37

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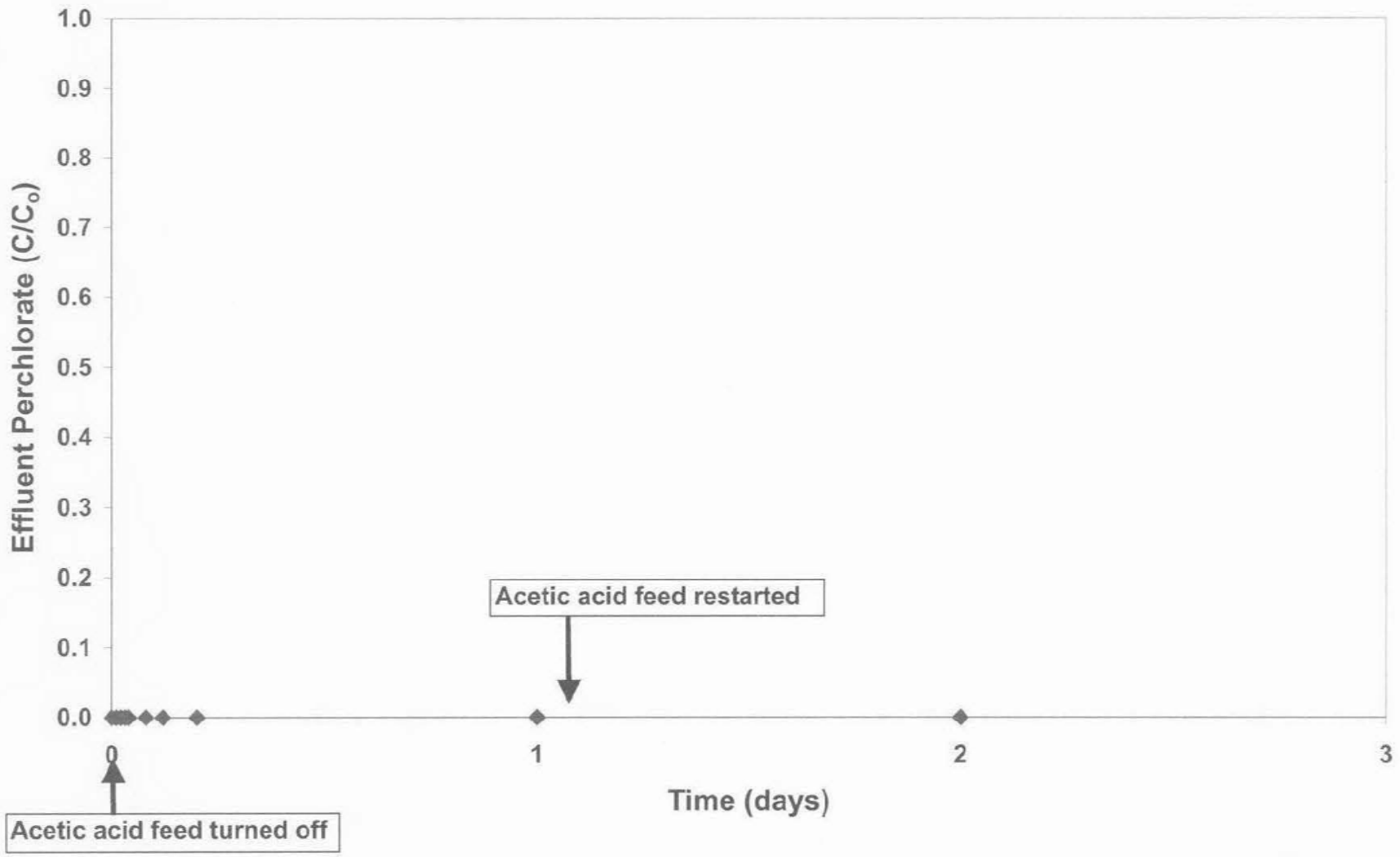

FIXED-BED ACETIC ACID FEED FAILURE CHALLENGE TEST

FIGURE 3.38

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It is possible that both of the above phenomena contributed to the 24-hour removal of perchlorate to below detection in the biological FXB while the acetic acid feed was shut off, though no experiments were performed to confirm this.

7.5.6 Backwash Water Quality

Table 3.22 lists backwash water quality data, as determined using composite samples of backwash water.

Table 3.22 Backwash Water Quality
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Range
Perchlorate (µg/L)	ND (two points)
AOC (mg/L)	1.0-2.5
COD (mg/L)	63-250
VSS (mg/L)	41-140
TSS (mg/L)	39
Total coliforms (MPN/100 mL)	4-110
Fecal coliforms (MPN/100 mL)	ND - 4

The level of perchlorate in the backwash water (ND) is below the Los Angeles County Sanitation District (LACSD) Phase I limit of 4 ppb. The values for COD and TSS are used in obtaining discharge permits for the disposal of the backwash water if the water is being discharged into LACSD lines.

7.5.7 Summary

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shutdowns, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 15 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter.

7.6 Fluidized Bed Reactor

7.6.1 Perchlorate Removal Performance

Over the course of pilot testing, the FBR achieved perchlorate removal to below detection for periods of up to 8 days. However, perchlorate removal performance generally fluctuated and sustained (i.e., ≥ 2 weeks) removal to below detection was not achieved (Figure 3.39).

7.6.1.1 Mechanical & Operational Adjustments

Numerous mechanical and operational adjustments were made throughout pilot testing to establish sustained perchlorate removal to below detection. A detailed list of these adjustments is provided in Table 3.23 followed by a description of the main mechanical and operational changes, reasons for their implementation, and their impact on perchlorate removal performance. Throughout the course of the study, changes made to the system were done under the direction of representatives from Shaw Environmental.

Table 3.23 FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Date (Day of operation)	Event
7/21/03 (0)	System started. 3 gpm.
8/2/03 (11)	Power outage at pilot caused system shutdown
8/4/03 (13)	System restarted, causing carbon to blow out top of reactor.
8/6/03 (15)	Phosphorous added to feed at 0.2 PO_4–P
8/11/03 (20)	Carbon ball-like mass observed in reactor.
8/13/03 (22)	Mechanical mixer observed to be missing
8/14/03 (24)	System put in recycle to scour carbon.
8/19/03 (29)	Carbon manually cleaned with PVC pole and air scour. Carbon/biomass mats broken up and biomass removed.
8/26/03 (36)	Biomass separator installed with 3/8" SS. Top of reactor removed to insert tubing. Designed to operate continuously by drawing carbon from the bottom of the reactor and place carbon back to top of bed.
8/28/03 (38)	Biomass separator clogged, shut down.
8/29/03 (39)	Biomass separator system changed to 3/4" PVC. Configuration changed to draw from top and put carbon back to bottom.
9/1/03 (41)	Solids recovery tank overflowed. Lowered flow to 1 gpm. Large mat of biomass observed in tank, possibly due to aerobic growth. Large amounts of growth in pump.
9/2/03 (42)	Feed and recycle lines and pump cleaned of biomass.
9/9/03 (49)	Nitrogen blanket added to the top of the reactor to minimize re-entrainment

Table 3.23	FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Date (Day of operation)	**Event**
	of oxygen.
9/16/03 (56)	Reconfigured system piping to bypass oxygenation vessel. Moved acetic acid injection point closer to bioreactor vessel. Biomass separator system to be operated for 1 hour per day.
9/17/03 (59)	Solids recovery tank overflowing, system shut down for 1 hour (recycle).
9/18/03 (58)	Acetic acid pump replaced. It had lost prime several times.
9/24/03 (64)	Phosphorous feed concentration increased to 3 mg/L PO_4-P
9/25/03 (65)	Excessive biogrowth in effluent line causing back-up of the solids recovery tank. Effluent line cleaned out.
9/26/03 (66)	Flow decreased to 2 gpm
9/29/03 (69)	Flow increased to 3 gpm. Large amounts of biomass floating on water surface in solids recovery tank. Mat removed from tank.
10/1/03 (71)	Water observed in nitrogen line. Water removed and nitrogen restarted. Flow decreased to 2.5 gpm.
10/3/03 (73)	Phosphorous feed concentration increased to 3.5 mg/L PO_4-P.
10/6/03 (76)	Small carbon ball mass observed in reactor. Ball broken up manually and with biomass separator.
10/8/03 (78)	Feed flow reduced to 1.5 gpm.
10/17/03 (87)	Feed flow reduced to 1.0 gpm.
10/21/03 (91)	Feed flow reduced to 0.8 gpm.
10/23/03 (93)	Samples sent to Shaw lab for analysis. Results corroborate results seen from CLWA lab.
10/24/03 (94)	Biomass separator to remain off to promote bed expansion.
10/30/03 (100)	Carbon removed from reactor and bottom of bioreactor removed to check for distribution header clogging. No clogging observed. Added 2 feet of carbon to the reactor for settled bed of 72" and expanded of 92". Flow changed to 2 gpm.
10/31/03 (101)	Flow increased to 3 gpm.
11/3/03 (104)	More carbon added to reactor for settled bed of 82" and expanded of 106".
11/5/03 (106)	Phosphorous feed concentration decreased to 2.5 mg/L PO_4-P
11/13/03 (114)	Micronutrients added to the feed water through electron donor feed.
11/26/03 (127)	Second dose of micronutrient added to system
11/28/03 (129)	Third dose of micronutrient added to system
12/3/03 (134)	Flow decreased to 1.5 gpm and mircronutrient eliminated from feed.

Table 3.23	FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Date (Day of operation)	**Event**
12/5/03 (136)	Flow increased to 3 gpm and acetic acid feed concentration lowered to 13.9 mg/L as C (15% dilution)
12/10/03 (141)	Plant shutdown for 3 hours. Electron donor decreased (94 grams/day).
12/15/03 (146)	Acetic acid feed concentration increased to 20% dilution (125 grams/day)
12/19/03 (150)	Acetic acid feed concentration increased to 30% dilution (185 grams/day)
12/22/03 (153)	Rapid bed expansion noticed in reactor.
12/23/03 (154)	Biomass separator pump turned on for 1 hour due to rapid bed expansion
12/27/03 (158)	Biomass separator pump turned on for 2 hours
12/30/03 (161)	Biomass separator pump turned on for ½ hour
12/31/03 (162)	System placed in recycle due to rapid bed expansion
1/2/04 (164)	System restarted at 3 gpm.
1/7/04 (169)	Acetic acid feed solution decreased to 20% dilution (125 grams/day)
1/9/04 (171)	Suspended biomass removed from top of the reactor
	Phosphate addition reduced by 50% to 1.25 mg/L PO_4-P
1/12/04 (174)	Acetic acid feed solution increased to 25% dilution (155 grams/day)
1/16/04 (178)	Due to phosphoric acid supply limitations, phosphate addition was reduced to 25 mL in 1 L total volume.
1/19/04 (181)	Flow decreased to 2 gpm w/ current donor addition remaining the same (25% dilution at 1 mL/min).
1/20/04 (182)	System reconfigured to bypass solids recovery tank due to high DO in recycle. New perchlorate stock solution mixed incorrectly, causing influent concentrations to be 20-25 ug/L. Increase of phosphate concentrations back to previous levels (>2 mg/L).
1/21/04 (183)	Flow increased to 3 gpm (1 mL/min 25% dilution for donor) and increased ClO4 back to 50 ug/L. Increased flow of donor to 7 strokes/min from 6 (160 grams/day).
1/24/04 (186)	Increased electron donor to 33% dilution. (210 grams/day)
2/2/04 (195)	Increased flow of donor to 8 strokes/min from 7 (225 grams/day).
2/3/04 (196)	Added micronutrient (~50 mL to 8 L)
2/4/04 (197)	Reduced flow of donor to 5 strokes /min from 8 (180 grams/day).
2/5/04 (198)	Reduced flow to 2 gpm.
2/6/04 (199)	System shutdown (recycle).

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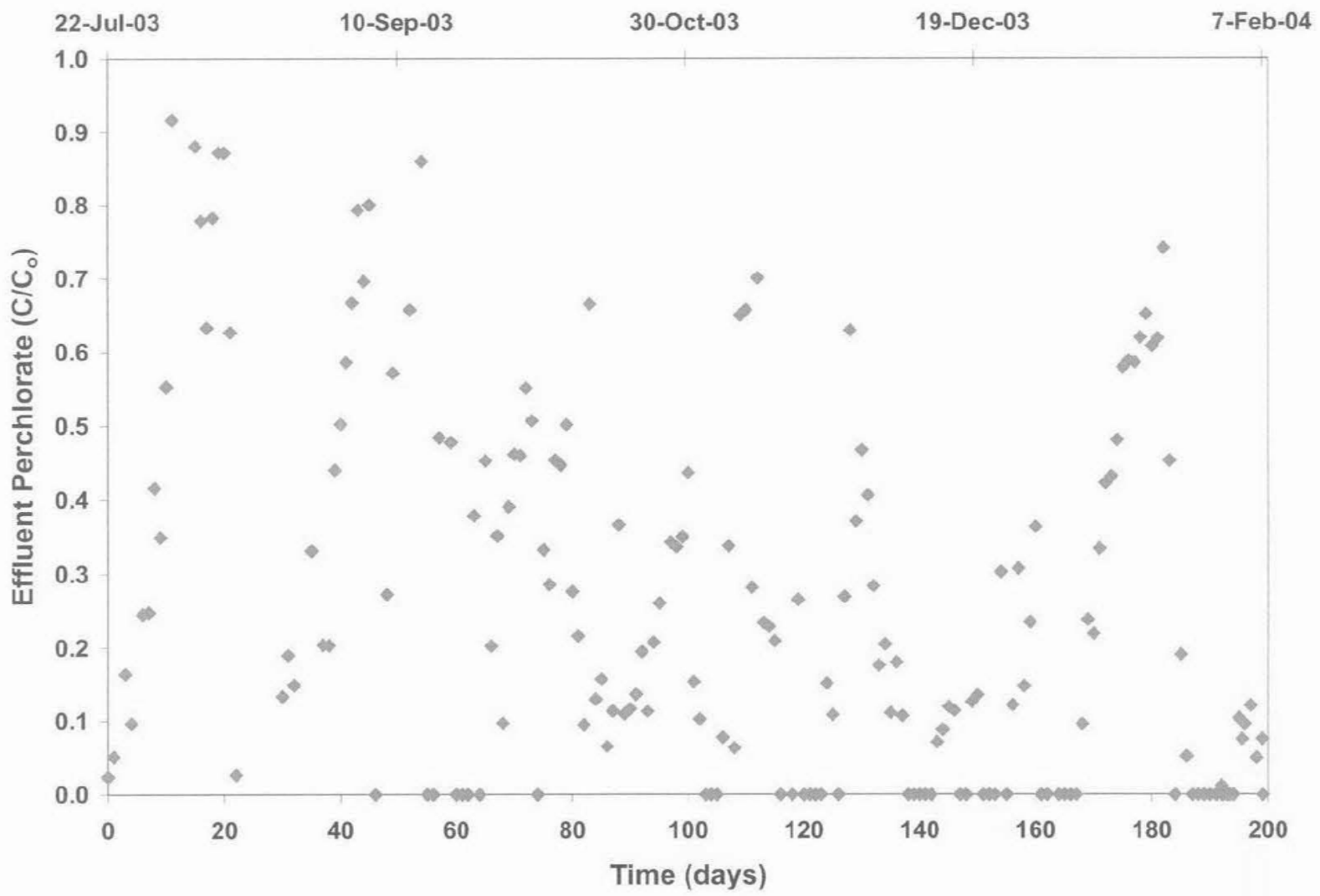

FLUIDIZED-BED PERCHLORATE

FIGURE 3.39

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Mechanical Adjustments:

- Concern: Excessive clumpy biogrowth was observed in the FBR, potentially causing clogging or short-circuiting. The mechanical mixer, which was designed to control overgrowth in the system, did not function properly.

  Adjustment: A biomass separator system was installed (Day 35) and used intermittently throughout pilot testing.

  Impact: The biomass separator was effective at controlling bed expansion and overgrowth. However, perchlorate removal performance did not appear to improve by the installation of the biomass separator system.

- Concern: Excessive biogrowth was observed across the entire FBR system, which was clogging pumps and piping and may have been causing short-circuiting in the reactor.

  Adjustments: On Day 29, the GAC was manually scoured using a PVC pipe and aeration. Piping and pumps were cleaned out on Days 42 and 65. Biomass clumps were removed from the solids recovery tank (Day 69) and from the reactor (Day 171). The acetic acid feed point was moved closer to the base of the reactor on Day 56.

  Impact: These adjustments were effective at controlling excessive biogrowth, though they did not appear to positively impact perchlorate removal performance.

- Concern: DO was being entrained between the top of the reactor and the recycle line. This could cause aerobic growth in the system and inhibit perchlorate reduction by increasing the redox potential.

  Adjustments: A nitrogen blanket was added to the top of the reactor on Day 49. The effluent/recycle piping was reconfigured to completely bypass the solids recovery tank on Day 182.

  Impact: Adding the nitrogen blanket and bypassing the oxygenation vessel lowered DO entrainment, and perchlorate removal performance improved slightly with each adjustment. Bypassing the solids recovery tank eliminated DO entrainment and appeared to improve perchlorate removal performance substantially. Four days after the system was reconfigured, perchlorate removal to below detection was achieved and sustained for eight days. However, electron donor was also being adjusted during this period and, after eight days of removal to below detection, perchlorate breakthrough was observed. Therefore, though controlling DO entrainment did appear to improve perchlorate removal performance in the FBR, it did not completely eliminate perchlorate breakthrough.

- Concern: The turbulent zone near the base of the FBR is essentially abiotic due to the high shear stresses generated by the feed jets. If this abiotic zone is a significant

fraction of the overall bed depth, then the depth of the anaerobic zone within the carbon bed might be insufficient to allow for the removal of perchlorate to below detection.

- Adjustment: Two feet of carbon were added to the top of the GAC bed on Day 100. An additional 10 inches of carbon were added to the top of the GAC bed on Day 104.

  Impact: Perchlorate removal performance appeared to improve for about a week after the carbon was added to the bed, though this may have been due to adsorption. Regardless, this improvement in perchlorate removal performance was not sustained beyond one week.

Operational Adjustments:

- Concern: Low phosphorous concentrations may be limiting biological activity in the FBR.

  Adjustment: Phosphorous was added to the feed at 0.2 mg/L PO_4-P beginning on Day 15. Phosphorous addition was increased to 3.0 mg/L PO_4-P on Day 64. Phosphorous addition was increased to 3.5 mg/L PO_4-P on Day 73 (Figure 3.40).

  Impact: Adjusting the concentration of phosphorous being added to the feed did not appear to impact perchlorate removal performance in the FBR. Feed PO_4-P was later reduced to 2.5 mg/L and then 1.25 mg/L for short periods of operation, without impacting perchlorate removal performance.

- Concern: The contact time may be insufficient to allow for sustained perchlorate removal to below detection.

  Adjustment: The feed flow was reduced gradually from 3.0 gpm to 0.8 gpm over a four-week period (Days 71 through 99).

  Impact: While increasing the HRT did appear to improve perchlorate removal performance initially, it did not effect perchlorate removal to below detection, and, eventually, perchlorate removal performance declined at the lower feed flow rates.

- Concern: Low concentrations of micronutrients may be limiting biological activity in the FBR.

  Adjustment: A micronutrient solution was added to the feed from Day 114 to Day 134. It was again added on Day 196 through the end of pilot testing. The micronutrient contained low concentrations of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt.

  Impact: The addition of the micronutrient feed might have caused improved perchlorate removal performance initially, though the impact was confounded due to the nearly simultaneous addition of fresh carbon to the bed. Regardless, perchlorate removal performance eventually declined in spite of the micronutrient feed.

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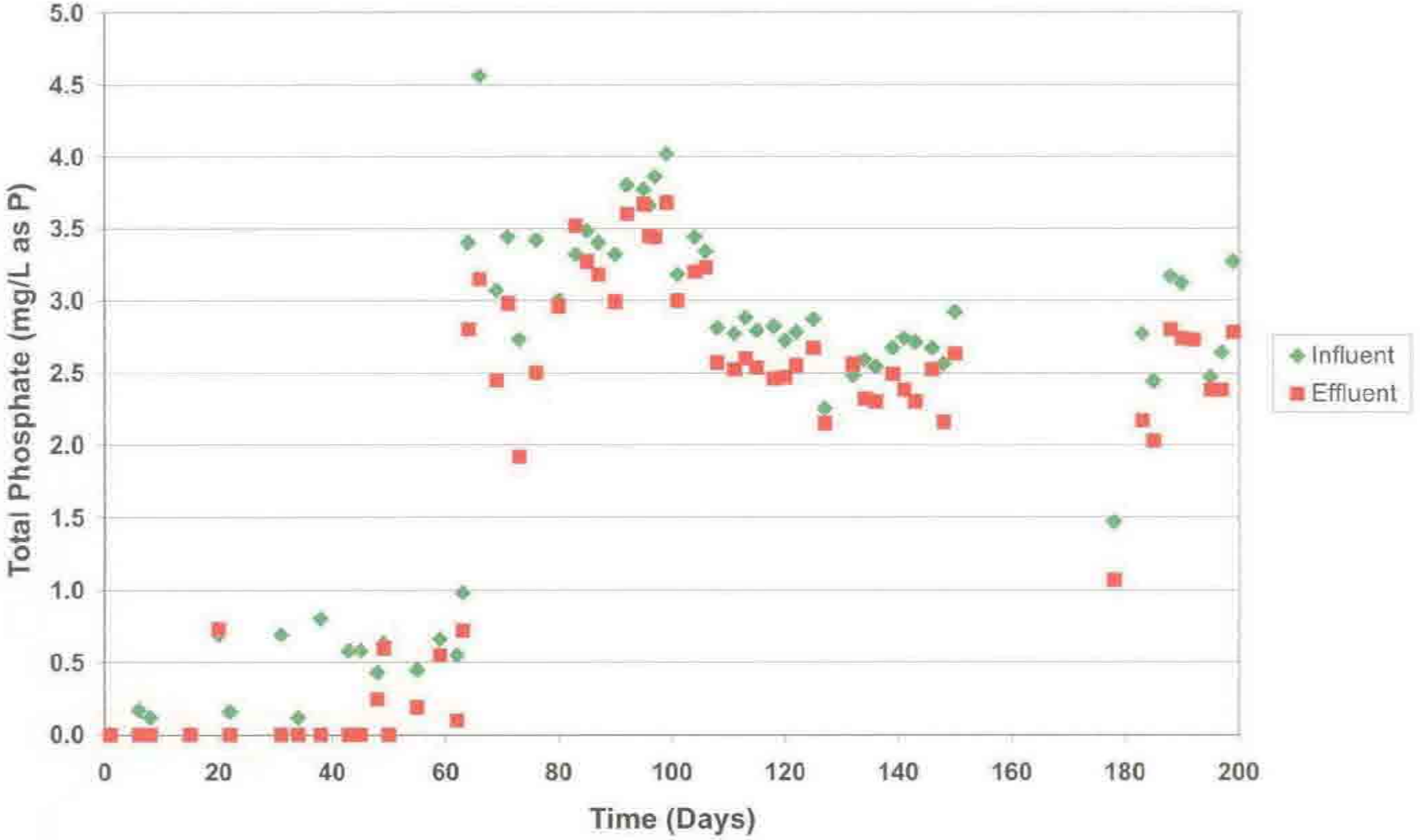

FLUIDIZED-BED PHOSPHOROUS

FIGURE 3.40

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- Concern: Over-excess acetic acid concentrations in the feed may have been selecting away from perchlorate-reducing bacteria and toward sulfate-reducing bacteria. As the feed nitrate concentration decreased during the pilot test period, the acetic acid concentration was not adjusted to account for the decreased oxidant demand in the system. It was theorized that this could help explain why only partial perchlorate removal was observed in spite of very low redox conditions (down to –200 mV). In other words, though complete DO and nitrate reduction and partial sulfate reduction was occurring in the reactor, only partial perchlorate reduction was observed (Figures 3.41 and 3.42), suggesting that the perchlorate-reducing community in the reactor was being depressed.

  Adjustment: Feed acetic acid concentration was lowered on Day 136.

  Impact: Perchlorate was removed to below detection for about a week after the acetic acid feed concentration was lowered. Subsequently, feed acetic acid concentrations were adjusted up and down as feed nitrate concentrations fluctuated. Though perchlorate removal was generally ≥ 90% during this period, sustained perchlorate removal to below detection was not achieved.

7.6.2 Other Parameters

The following non-anionic water quality observations were made during the course of FBR piloting:

- Effluent TOC concentrations were typically 1 to 9 mg/L (Figure 3.43).
- Effluent BDOC concentrations ranged from non-detect to 1.3 mg/L (Figure 3.44).
- On average, pH decreased by 0.5 units across the FBR bed (Figure 3.45). This was likely due to the addition of CO_2 to the water as acetic acid was oxidized.
- HPCs increased across the filter, resulting in counts between 50,000 and 870,000/mL (Figure 3.46).
- Total effluent coliforms ranged from non-detect to 900 MPN/100 mL, but were typically 300 MPN/100 mL or less (Figure 3.47). No fecal coliforms were detected.
- Average feed water turbidities were approximately 0.5 NTU. Effluent turbidities ranged from 2 to 70 NTU (Figure 3.48).

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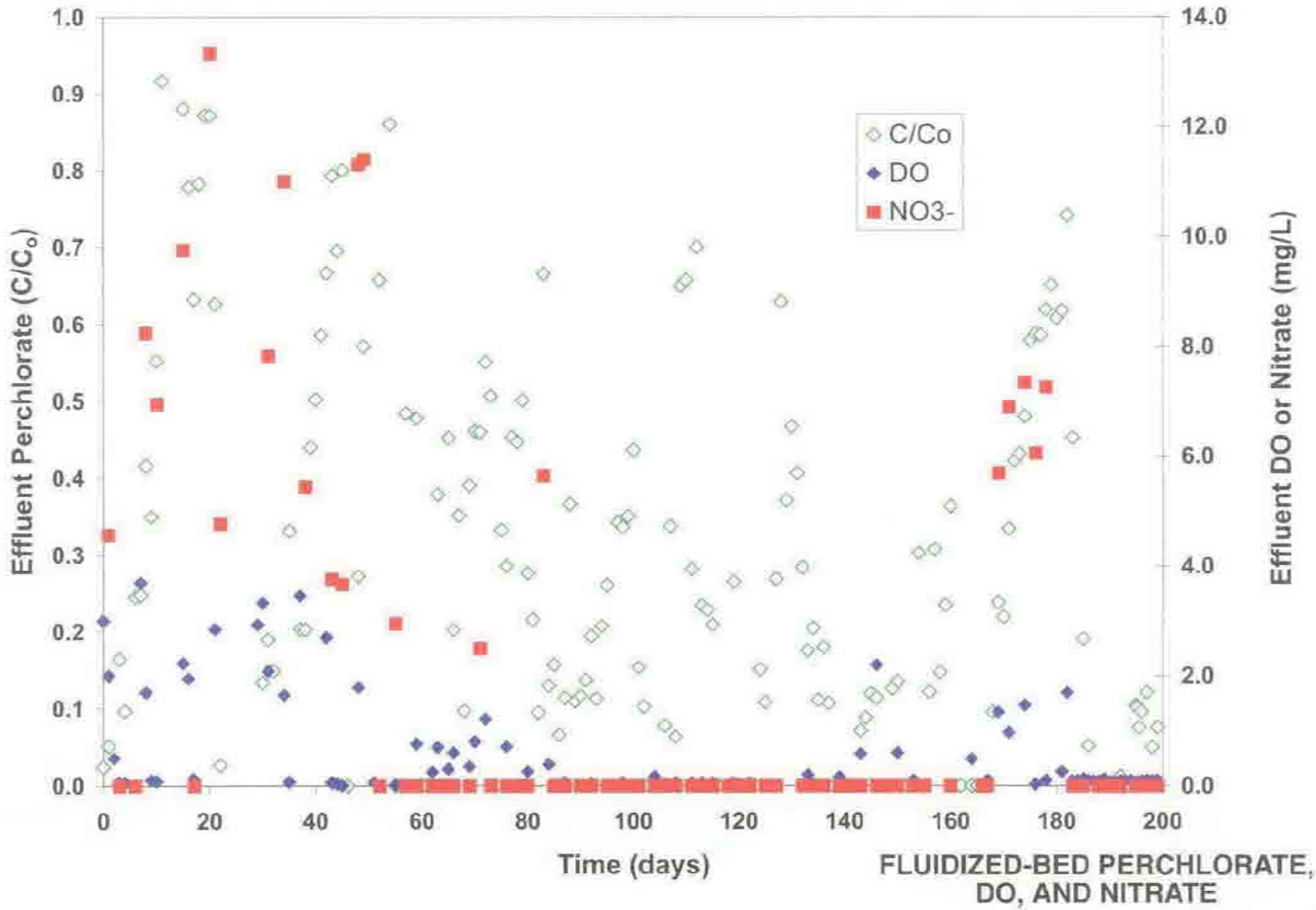

FLUIDIZED-BED PERCHLORATE, DO, AND NITRATE

FIGURE 3.41

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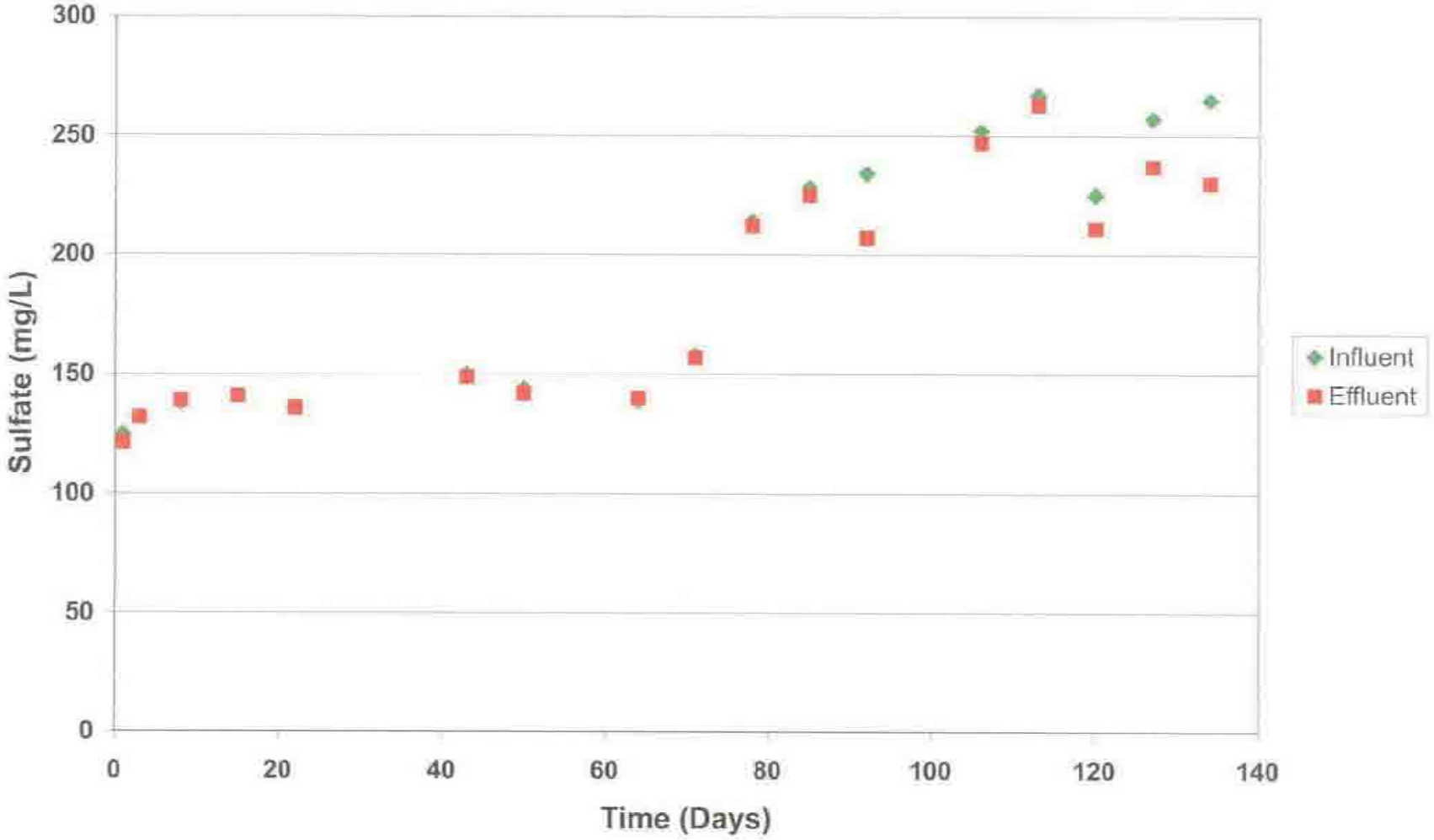

FLUIDIZED-BED SULFATE

FIGURE 3.42

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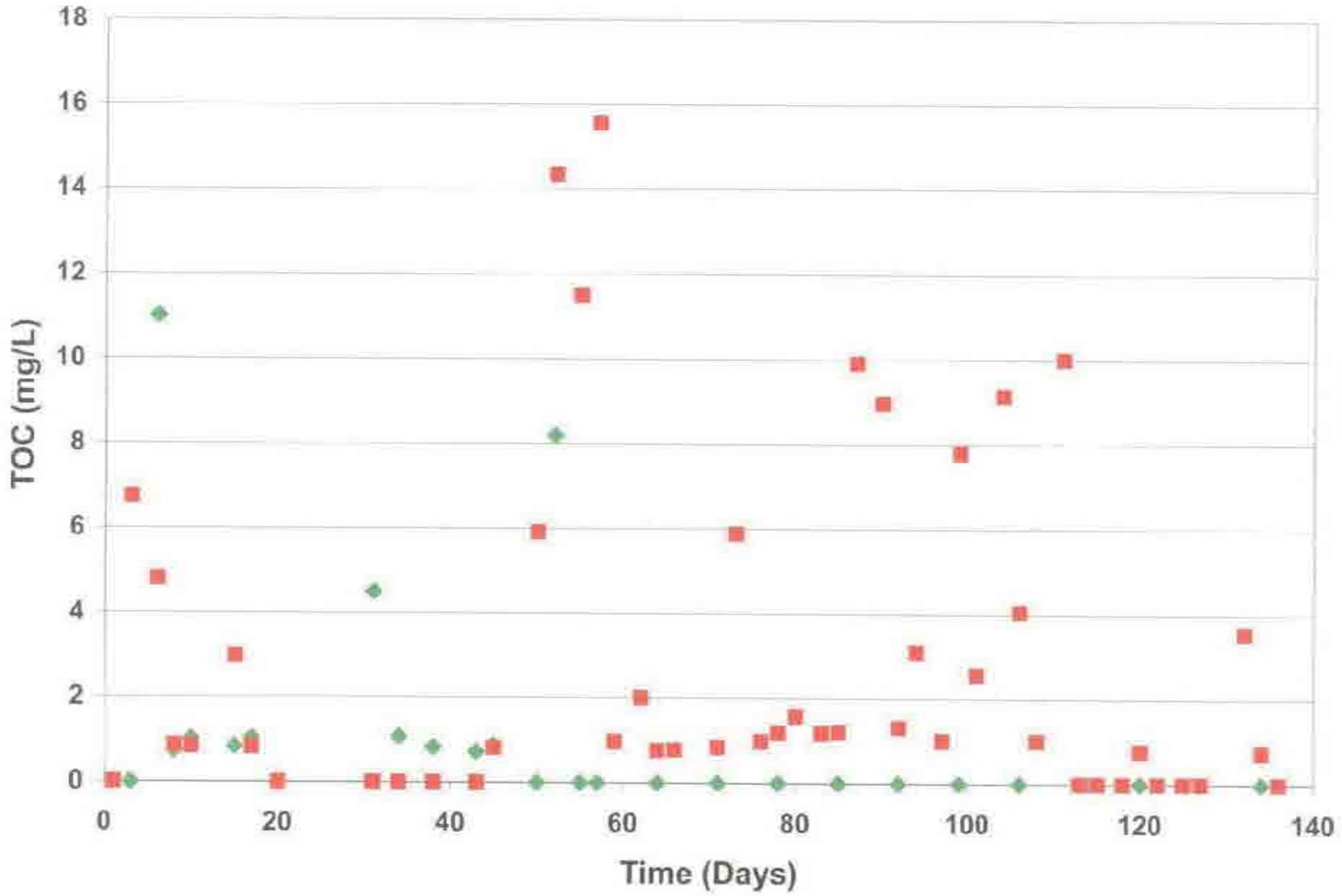

FLUIDIZED-BED TOC

FIGURE 3.43

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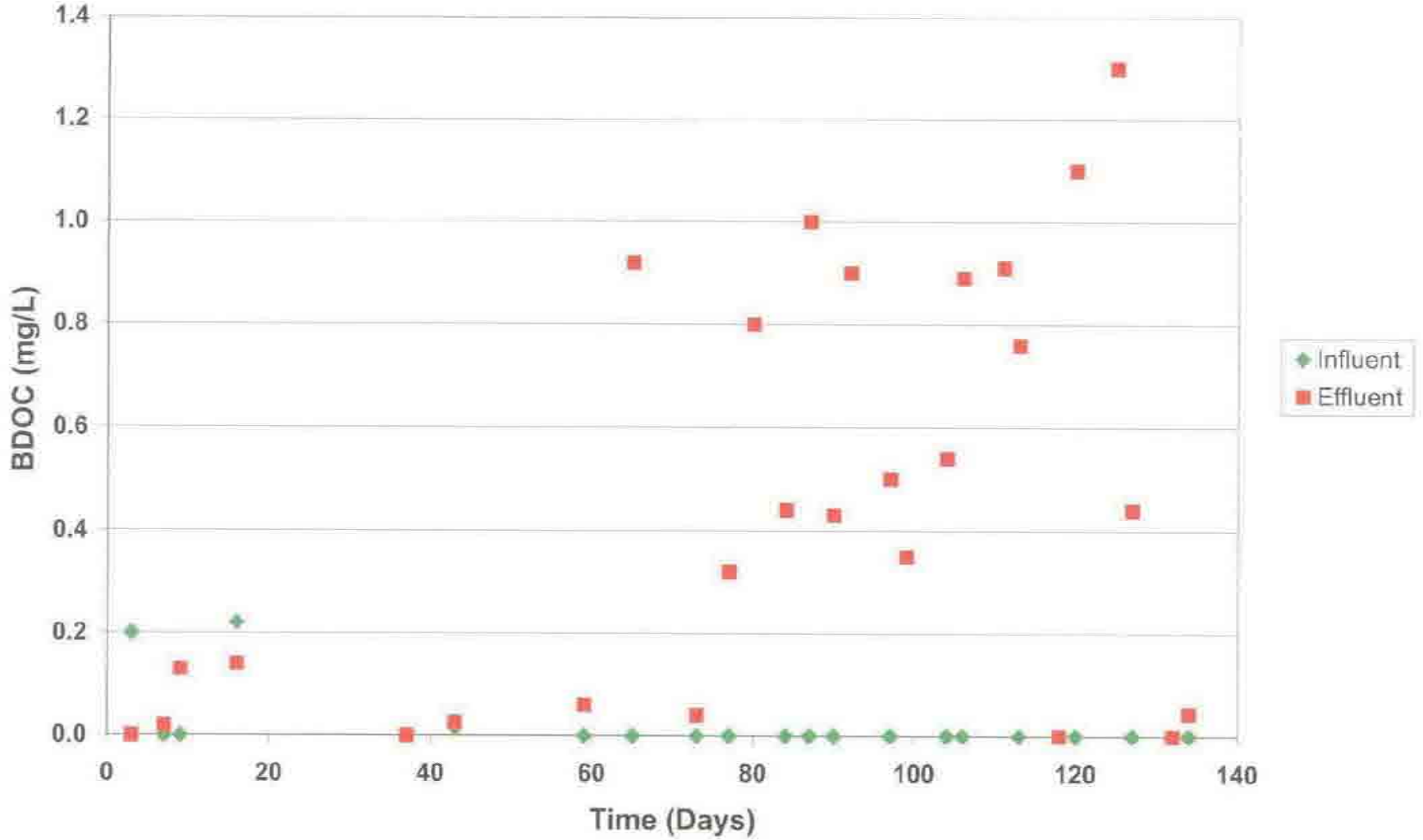

FLUIDIZED-BED BDOC

FIGURE 3.44

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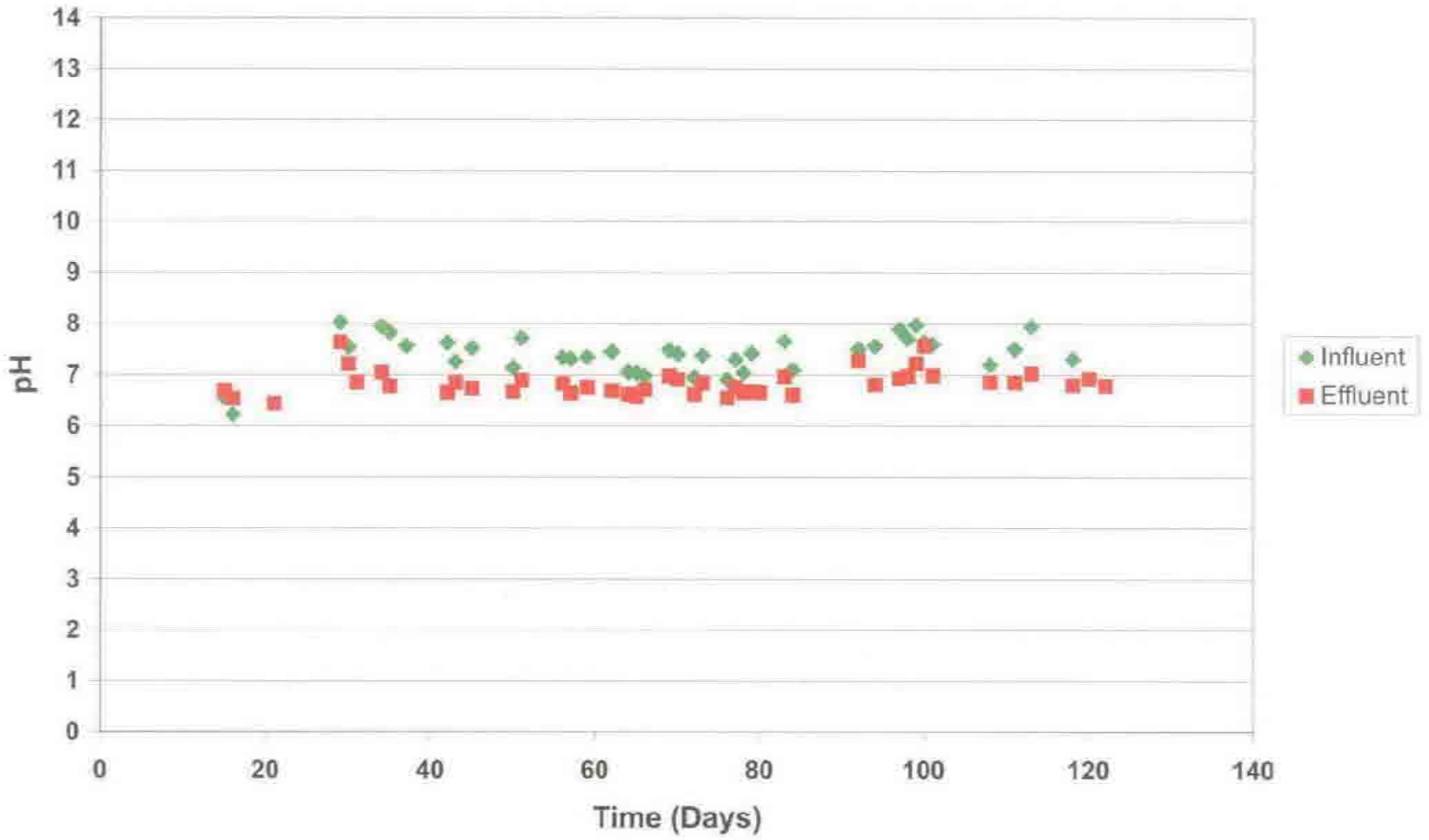
29073

20-CLWA234F3.45-6625A10.CDR



FLUIDIZED-BED pH

FIGURE 3.45

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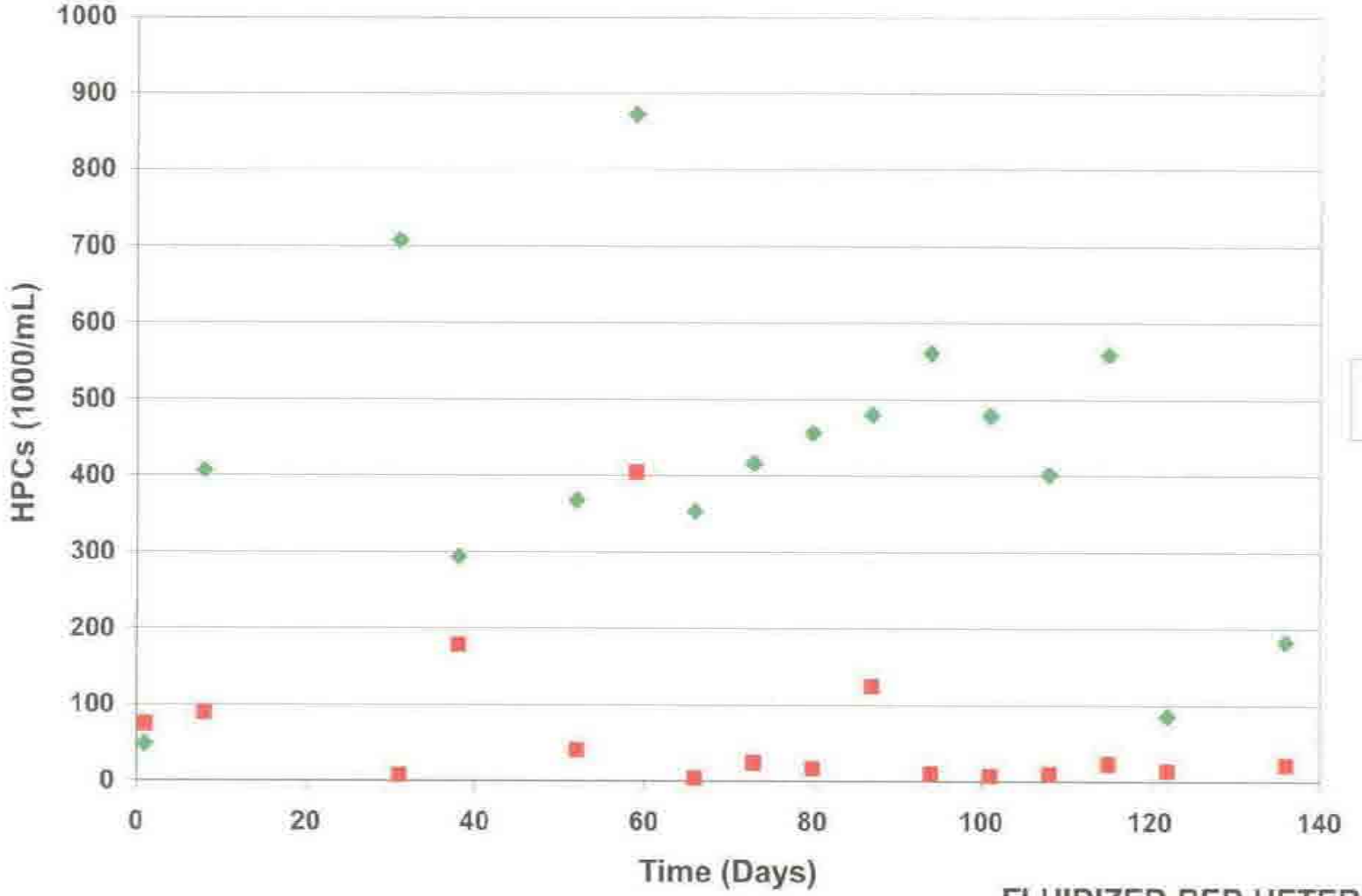

FLUIDIZED-BED HETEROTROPHIC PLATE COUNTS

FIGURE 3.46

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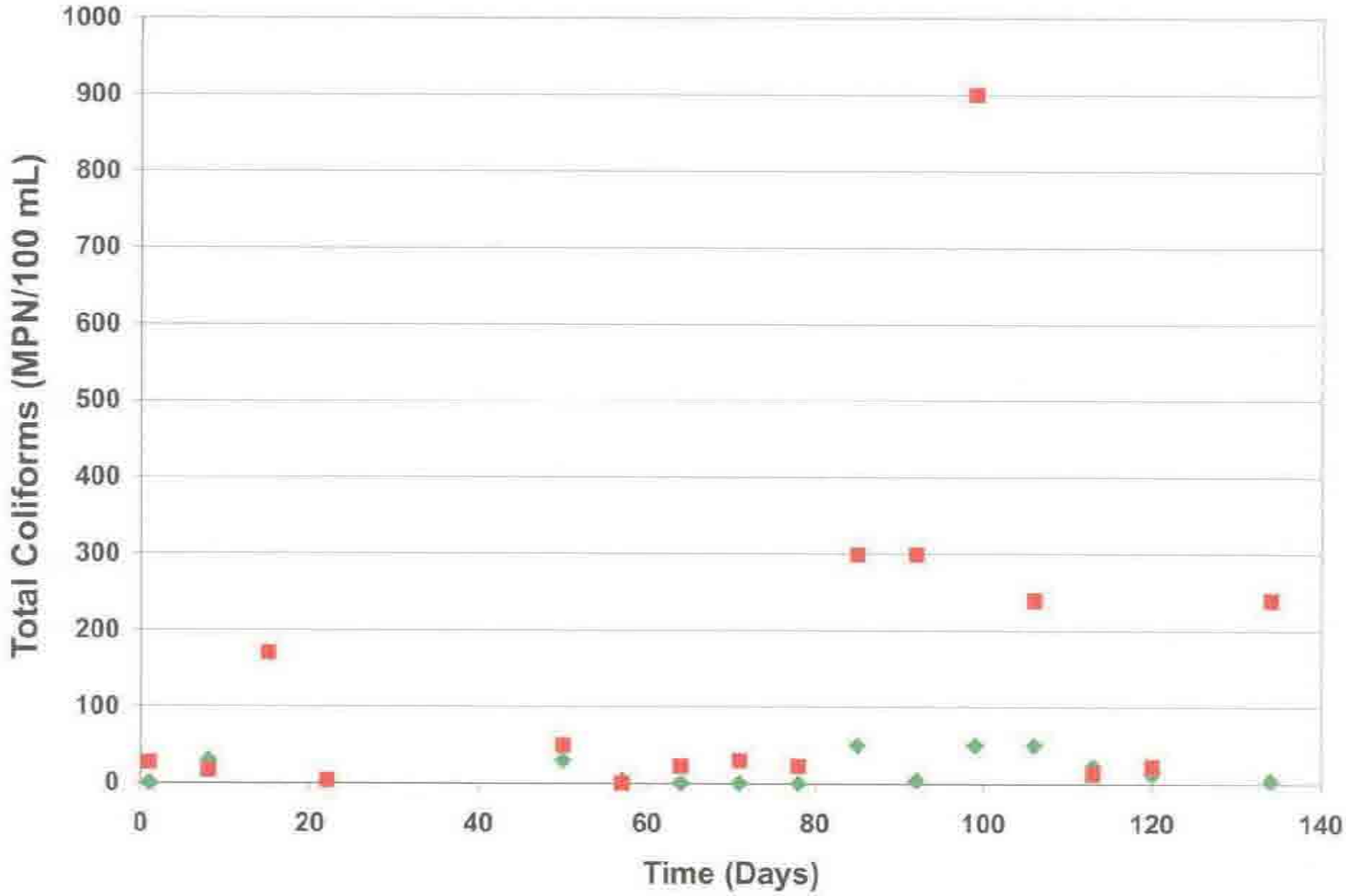

FLUIDIZED-BED TOTAL COLIFORMS

FIGURE 3.47

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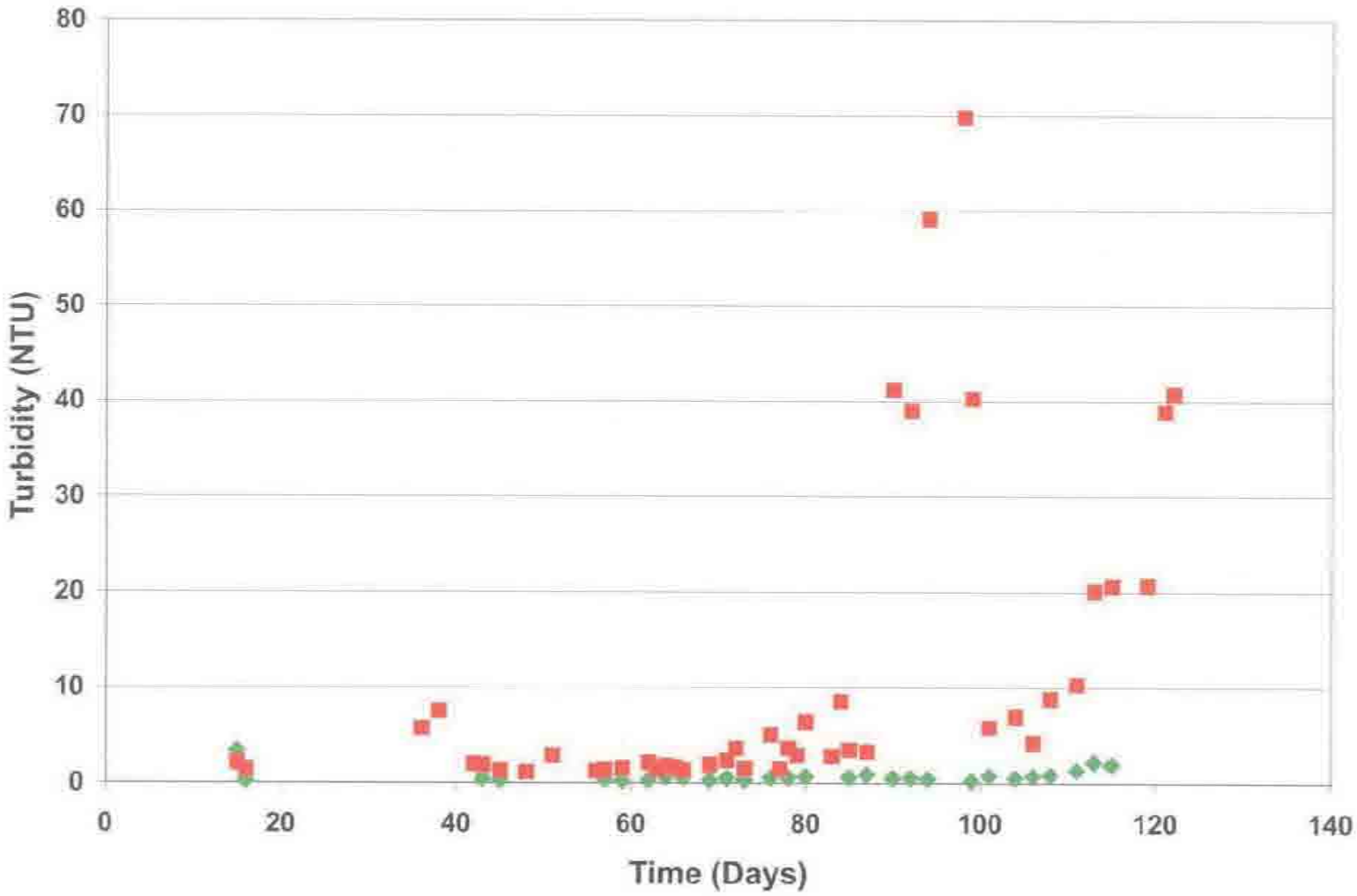

FLUIDIZED-BED TURBIDITY

FIGURE 3.48

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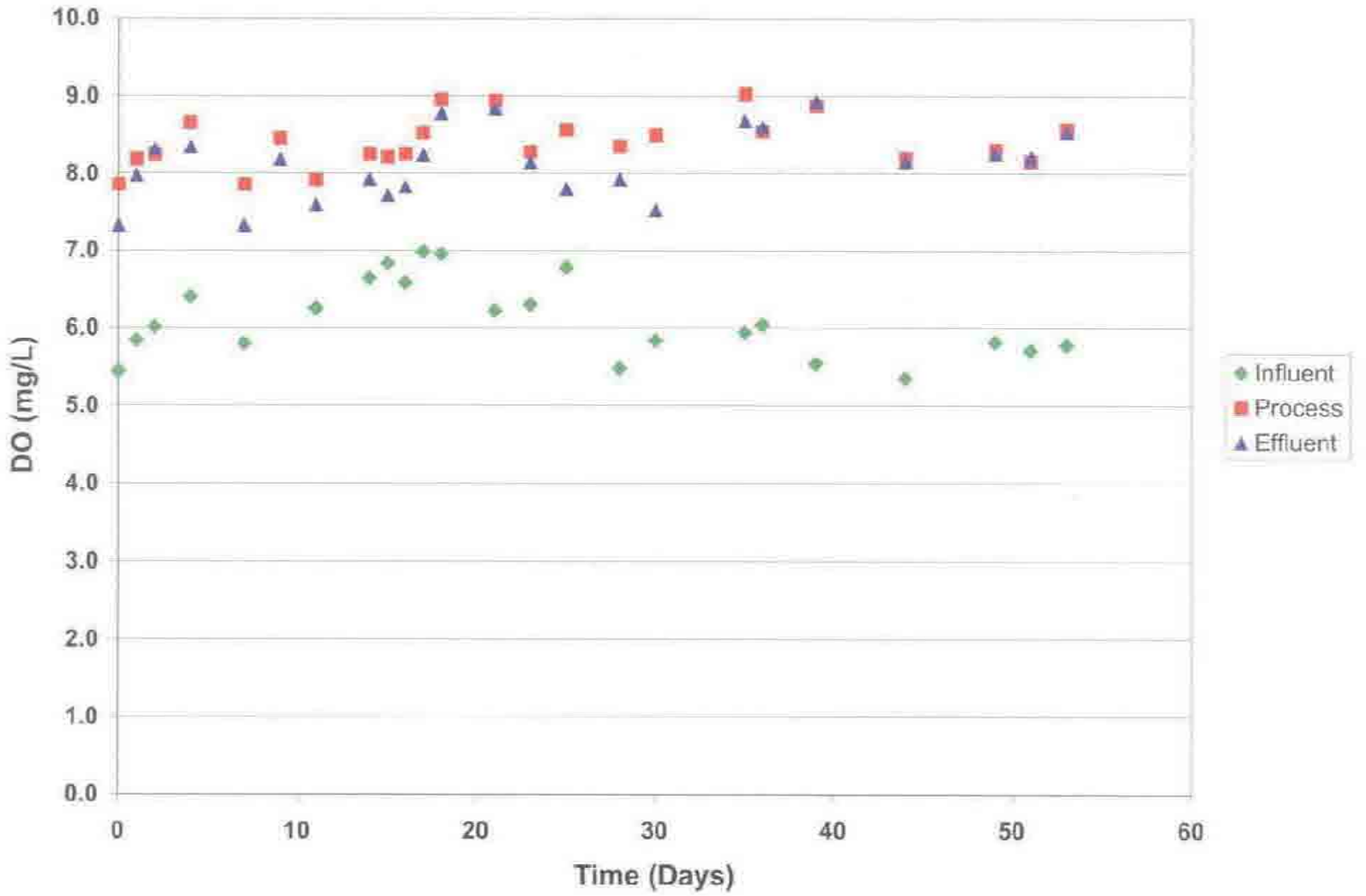

SMBR DISSOLVED OXYGEN

FIGURE 3.49

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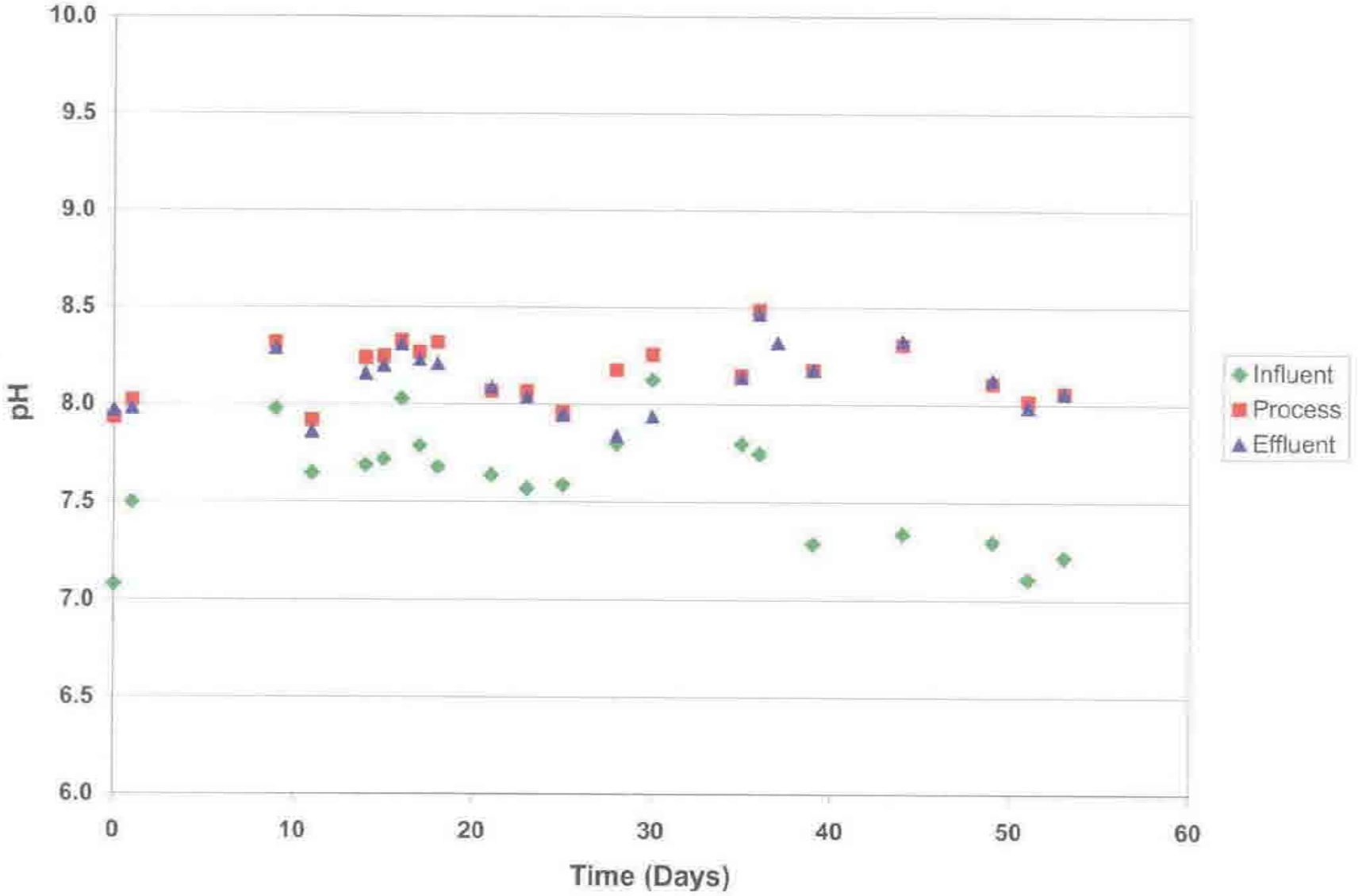

SMBR pH

FIGURE 3.50

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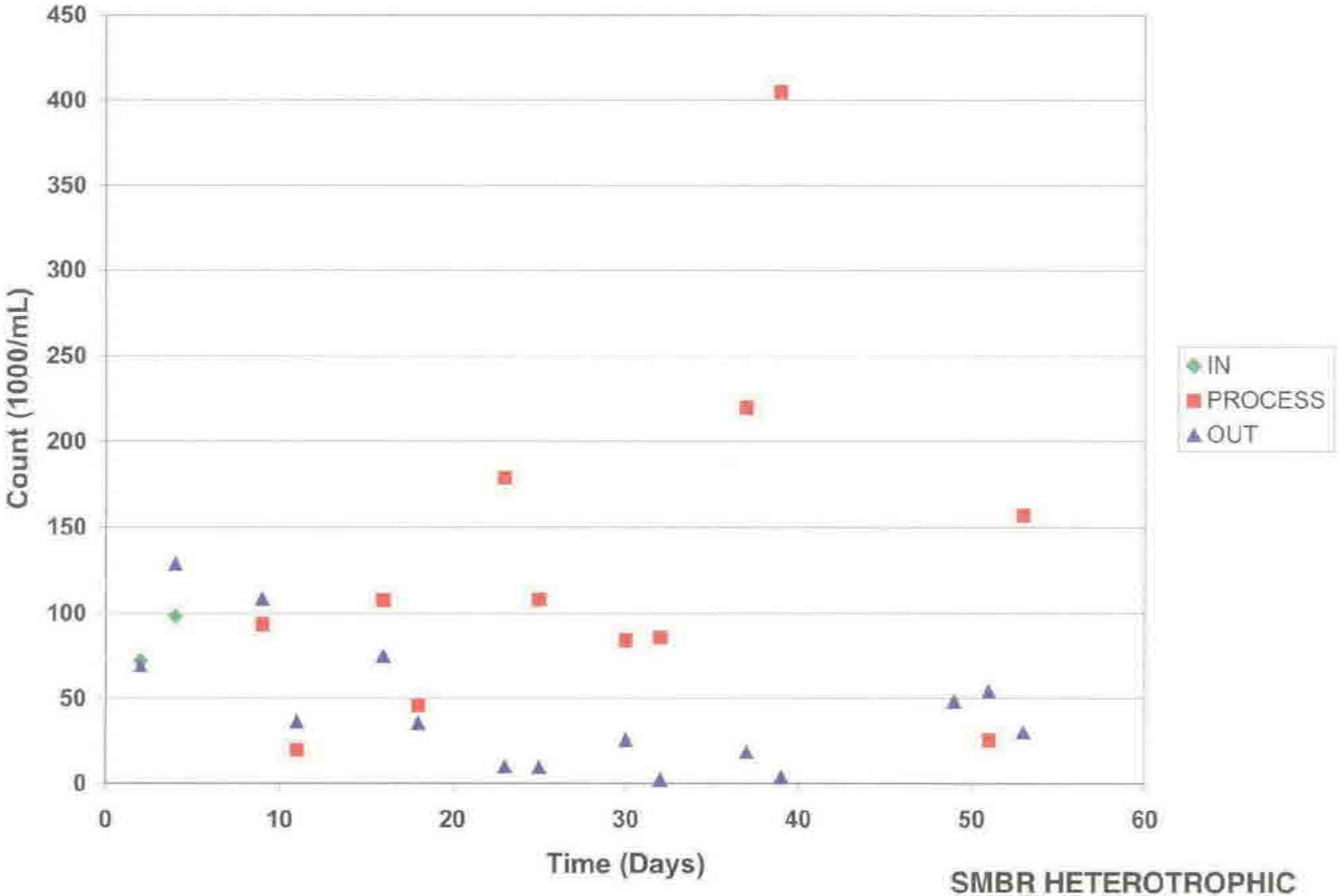

SMBR HETEROTROPHIC PLATE COUNTS

FIGURE 3.51

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7.6.3 Summary

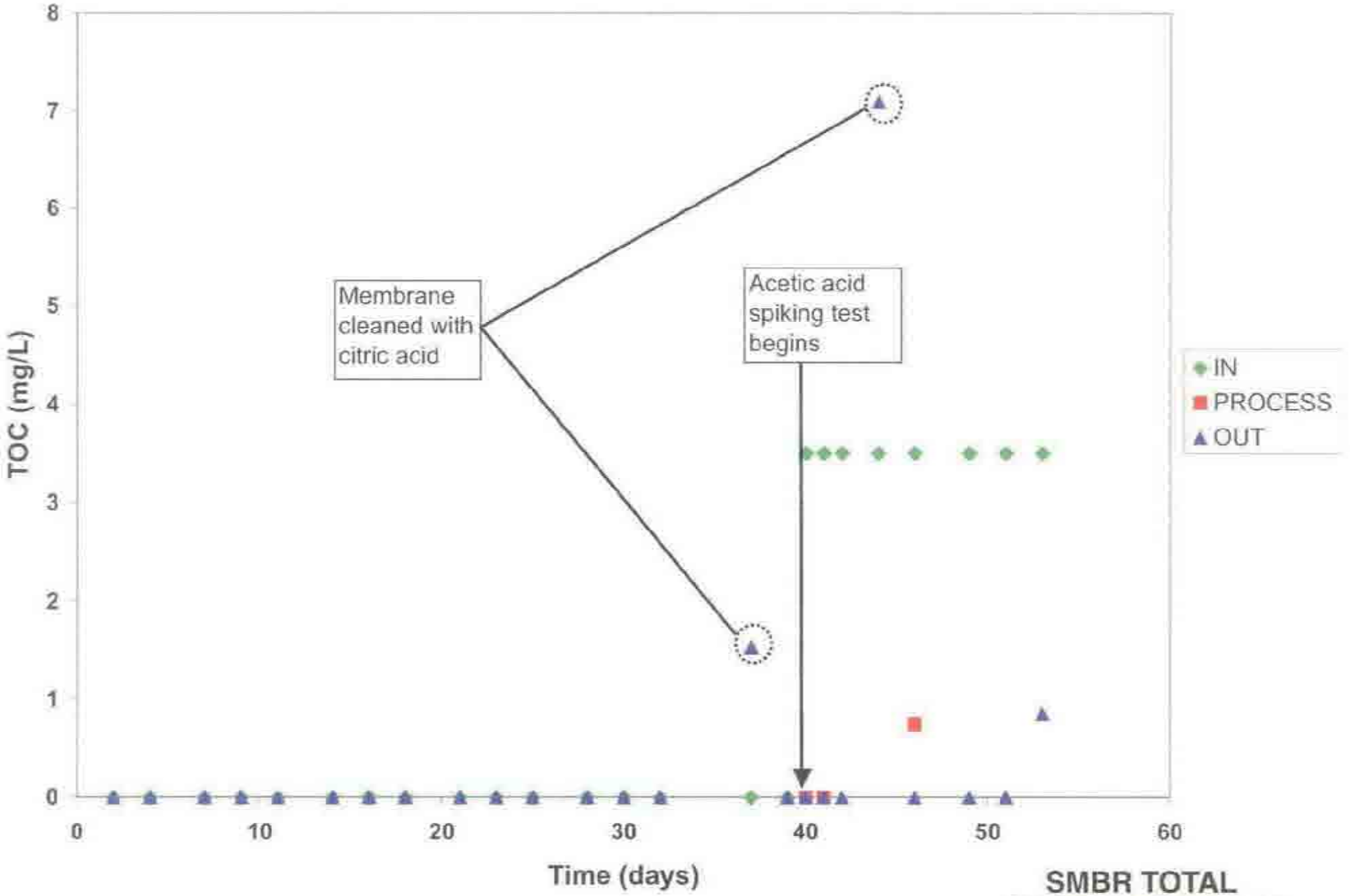
The fluidized-bed reactor did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

7.7 Submerged Membrane Bioreactor (Post-Treatment of FXB Effluent)

The SMBR was set up to provide post-treatment for the FXB effluent, as required by DHS, i.e., aeration, filtration, and biological degradation of excess BDOC. The SMBR was fed with effluent from the FXB biological filter, which was already partially reaerated due to exposure to atmospheric conditions in the backwash tank. As expected, DO concentrations further increased in the SMBR process tank (Figure 3.49). pH also increased during the post-treatment process (Figure 3.50). The water entering the process tank is likely supersaturated with CO_2, produced by the oxidation of acetic acid in the FXB. Aeration within the process tank volatilizes supersaturated CO_2, thus bringing the water into equilibrium with atmospheric conditions and increasing the pH. Figure 3.51 shows that HPCs were being reduced across the ultrafiltration membrane. The effluent HPC concentrations are typically lower than the values observed in the raw well water. (See Figure 3.29.) Additional removal of heterotrophic bacteria can be achieved through disinfection following the SMBR. Batch experiments were performed to assess chlorine demand and HPC reduction using SMBR effluent. The chlorine demand of SMBR effluent was < 1 mg/L in all but one case, and only low doses of chlorine were required to reduce HPCs below 500 counts/mL (Table 3.24).

Table 3.24 Testing Matrix for Bench-Scale Chlorination of SMBR Effluent Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Chlorine Dose (mg/L)	12/1/03		12/3/03		12/5/03	
	Residual (mg/L)	HPCs (counts/mL)	Residual (mg/L)	HPCs (counts/mL)	Residual (mg/L)	HPCs (counts/mL)
0	0	48,450	0	54,150	0	30,400
0.5	0	69,250	0.15	250	0.08	4
1.0	0.17	271	0.31	100	0.60	52
2.0	0.88	10	1.15	450	1.58	2



SMBR TOTAL ORGANIC CARBON

FIGURE 3.52

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Organic carbon concentrations in the effluent of the biological FXB were typically below detection throughout pilot testing. Therefore, 3.5 mg/L of acetic acid carbon was spiked to the SMBR process tank to evaluate the ability of the SMBR system to remove residual organic carbon. Figure 3.52 shows that in all but one instance, TOC concentrations were below detection in the SMBR effluent. Though some of the acetic acid may have volatilized, the lack of acetic acid smell in the vicinity of the process tank suggests that biological oxidation was the dominant mechanism of organic carbon removal in the SMBR.

Hydrogen sulfide odor was rarely detected in the feed to the SMBR and was never detected in the SMBR effluent. Analytical measurements resulted in no detectable sulfide (MRL = 0.1 mg/L). Any observed removal may have been due to volatilization. However, given a $pK_{a,1} = 7.1$ and an average process tank pH of 8.2, approximately 92 percent of the sulfide was in the HS^- form, thus minimizing the contribution of volatilization to sulfide removal. It is also possible that sulfide oxidation was occurring in the reactor, either spontaneously or via microbial catalysis. No effort was made to isolate the sulfide removal mechanism.

7.7.1 Summary

Demonstration testing showed that a submerged membrane bioreactor can meet several post-FXB treatment objectives in a single step: 1) aeration, 2) biomass separation, 3) residual organic carbon removal, and 4) hydrogen sulfide removal.

7.8 In-Line Ion Chromatographic Analysis

In addition to perchlorate analyses performed by CLWA and MWH labs, an in-line perchlorate analyzer was installed to provide real time perchlorate data. A Dionex DX-800 in-line ion chromatograph was used that can sample, analyze, and store data from up to 21 process streams. The system uses a 2 x 250 mm IonPac® AS16 analytical column (Dionex P/N 055378) with a 2 x 50 mm AG16 guard column. The sample volume was 1,000-mL with a flow rate of 0.4 mL/min. The effluent was an EG50-generated 50 mM potassium hydroxide (KOH) solution with a back pressure of approximately 2,500 psi. A 2-mm AMMS III suppressor operated in the chemical suppression mode and a CD20-PA Conductivity Detector was used for detection. The system was controlled by a CC81 controller. Run times for the samples were 30 minutes.

The instrument was initially connected directly to the FBR with samples being continuously drawn into the analyzer every 30 min for analysis. This created a problem due to the high amount of biomass being sloughed from the system. A rough prefilter was installed to complement the 20-µm pre-sample loop filter. This provided some removal of biomass but clogging continued to occur in the instrument, thus causing high excessive pressure build-up in the system. As a result, the system was configured to analyze only occasional grab samples for remainder of the project. This was beneficial in that the results were obtained in 30 minutes rather than 2 or 3 day for the CLWA lab or up to 1 month for MWH labs.

To test the accuracy of the instrument, split samples of raw water, spiked raw water, and effluents from each of the treatment alternatives were analyzed using the instrument. These samples were also sent to the CLWA lab and two different DHS labs. The results from the tests are provided in Table 3.25.

Table 3.25 Comparison of Perchlorate Results (μg/L) (<MRL indicates less than method reporting limit of 4 μg/L) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Sample	CLWA	DHS-LA	DHS-Berkley	In-Line Instrument
Raw water	<MRL	<MRL	<MRL	<MRL
IX-Spike	45.1	54.4	47.5	48.5
IX-C1	<MRL	<MRL	<MRL	<MRL
IX-C2	27.7	32.8	29.1	27.3
IX-C3	<MRL	<MRL	<MRL	<MRL
FXB-Spike	42.1	48.6	44.5	38.9
FXB-Out	<MRL	<MRL	<MRL	<MRL
FBR-Spike	41.8	50.2	43.2	42.4
FBR-Out	<MRL	34.2	26.8	<MRL

The results for the Dionex DX-800 were acceptable in most cases and correlated well with results from the other 3 labs. One sample, FBR out, read 27 and 34 mg/L from the two DHS labs, where the CLWA lab and the in-line monitor read below the reporting limit. This may be due to the lack of sample preservation of samples from the FBR. These samples were not preserved, therefore perchlorate degradation could have been an issue. In general, the Dionex instrument showed good correlation with measurements from other laboratories.

7.9 DBP Formation Potential Testing

7.9.1 Experimental Matrix

7.9.1.1 DBPFP Testing on FXB, FBR, and MBR Effluents

Conditions applied during the DBPFP testing conducted on the FXB effluent, the FBR effluent, and the MBR effluent are presented in Table 3.26. For each experiment, three samples were dosed with a range of free and combined chlorine concentrations in order to reach the target free and combined chlorine residual of 3 to 5 mg/L after an incubation period of 7 days. At the end of the incubation period, the sample with the chlorine residual closest to the target was used for DBP analysis and the other two samples were discarded.

Table 3.26 Conditions Applied during DBPFP testing Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Free Chlorine Testing					
Stream	**Free Cl_2 Dose (mg/L)**	**$[Cl_2]_{Free, 0}$ (mg/L)**	**Initial Demand (mg/L)**	**$[Cl_2]_{Free, 7}$ (mg/L)**	**7-day Demand (mg/L)**
FXB Effluent	10	7.4	2.6	8.6	0
FBR Effluent	24	15.5	8.5	8.0	7.5
MBR Effluent	12	7.4	4.6	7.6	0
Combined Chlorine Testing					
Stream	**Free Cl_2 Dose (mg/L)**	**NH_3-N Dose (mg/L)**	**$[Cl_2]_{Total, 0}$ (mg/L)**	**$[Cl_2]_{Total, 7}$ (mg/L)**	**7-day Demand (mg/L)**
FXB Effluent	8	2.0	6.3	3.0	3.3
FBR Effluent	12	3.0	5.1	3.1	2.0
MBR Effluent	6	1.5	6.4	3.2	3.2

Free chlorine demand was slightly overestimated, resulting in free chlorine residuals ranging from 7.6 to 8.6 mg/L after 7 days of incubation, which was considerably higher than expected. Instantaneous free chlorine demands ranged from 2.6 mg/L in the FXB effluent to 8.5 mg/L in the FBR effluent. This was expected, since the FBR effluent contained higher levels of organic matter relative to the FXB effluent. The free chlorine demand in the FXB effluent and the MBR effluent was satisfied immediately and no decay of free chlorine was measured thereafter. In the case where the initial free chlorine concentration for the fixed bed effluent was lower than after 7-days of incubation, this was most likely due to the error in the measurements. Sample above 5 mg/L free chlorine had to be diluted to fall within the linear range of the method. In contrast to the other systems, free chlorine continued to decay over the 7-day incubation period in the FBR effluent.

As expected, combined chlorine residuals were more stable, measuring at 3 mg/L after 7 days of incubation in all three streams. The initial combined chloramine demand was greater in the FBR effluent relative to the other two streams.

7.9.1.2 DBPFP Testing on Ozonated FXB Effluent

The ozone test was conducted on a blend of 90 percent SPW and 10 percent FXB effluent to simulate the feed of the biological reactor effluent into the Rio Vista WTP. Conditions applied during ozone testing are presented in Table 3.27. Ozone demand ranged from 1.2 to 1.4 mg/L.

Table 3.27 Conditions Applied During Ozonation Testing Perchlorate Treatment from Saugus Aquifer Castaic Lake Water Agency			
Stream	Transferred Ozone Dose (mg/L)	Ozone Residual (mg/L)	HRT (min)
FXB Effluent	1.76	0.37	5.4
FXB Effluent + Acetic Acid (AA)	1.72	0.54	5.3

Ozonated streams were further analyzed for critical parameters and subjected to DBPFP testing with free and combined chlorine. DBPFP conditions applied during ozone testing are presented in Table 3.28. Seven-day free chlorine residuals were higher than the target residual of 5 mg/L. Due to the limited availability of ozonated water, multiple bottles could not be incubated. Therefore, the DBP formation potential results are conservative. The free chlorine residual at time zero was not measured. Combined chlorine residuals ranged from 3.4 to 4.3 mg/L, falling within the target range of 3 to 5 mg/L.

Table 3.28 Conditions Applied During DBPFP Testing of Ozonated Waters Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Free Chlorine Testing					
Stream	Free Cl_2 Dose (mg/L)	$[Cl_2]_{Free, 0}$ (mg/L)	Initial Demand (mg/L)	$[Cl_2]_{Free, 7}$ (mg/L)	7-day Demand (mg/L)
Ozonated FXB Effluent	16	NA	NA	11.4	NA
Ozonated FXB Effluent+ AA	16	NA	NA	10.4	NA
Combined Chlorine Testing					
Stream	Free Cl_2 Dose (mg/L)	NH_3-N Dose (mg/L)	$[Cl_2]_{Total, 0}$ (mg/L)	$[Cl_2]_{Total, 7}$ (mg/L)	7-day Demand (mg/L)
Ozonated FXB Effluent	8	2	NA	4.3	NA
Ozonated FXB Effluent+ AA	8	2	NA	3.4	NA

7.9.2 *Analytical Results*

7.9.2.1 *DBPFP Testing on FXB, FBR, and MBR Effluents*

Control samples of each stream were analyzed for critical parameters (Table 3.28). Prior to chlorination, the FBR effluent contained a DOC concentration of 6 mg/L, whereas the other two streams contained negligible quantities of organic matter. It should be mentioned that DBPFP samples were collected from the FBR at a time before feed acetic acid concentration had been optimized. Since the acetic acid feed concentration was later reduced, the NOM and DBP results are conservative. A BDOC of 1.1 mg/L was measured in the FBR effluent. This BDOC level is higher than the 0.15 to 0.3 mg/L range of acceptable BDOC level for microbial growth in the distribution system. The AOC level in the FBR effluent of 178 μg/L is higher than the suggested 50 μg/L level to control coliform growth in distribution systems. The AOC concentration in the MBR effluent was higher than the AOC concentration in the MBR feed (i.e., FXB effluent), reflecting the fact that the MBR system was still being optimized at the time of the DBPFP tests. As expected, background THM4 and HAA5 levels (prior to chlorination) were non-detect.

Following free chlorine addition with an excess 7-day residual of 7.6 to 8.6 mg/L, THM4 and HAA5 levels were detected in all three streams. TTHM and HAA5 concentrations in the chlorinated FBR stream exceeded Stage 1 and Stage 2 D/DBP maximum contaminant levels of 80 μg/L and 60 μg/L, respectively. HAAs were the dominant DBPs in the biological and MBR effluents. All four TTHM species and all five HAA5 species were detected during the DBPFP testing with FBR effluent.

The reported 7-day TTHM and HAA concentrations are equivalent to formation potential levels since the concentrations on day zero (controls) were non-detect. It should be noted that a detectable level of DOC was measured in the FXB effluent, resulting in a BDOC of 0.23 mg/L. This is unexpected because the DOC in the control FXB effluent sample (i.e., prior to chlorination) was non-detect. THMs and HAAs in the MBR were below the Stage 1 and Stage 2 MCLs.

As expected, chloramination resulted in low levels of TTHMs and lower levels of HAA5 relative to free chlorination.

Table 3.29 DBPFP Testing Results
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

	Prior to Chlorination (Control)				
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**THM4, $_0$ (μg/L)**	**HAA5, $_0$ (μg/L)**
FXB Effluent	<0.5	ND	47	ND	ND
FBR Effluent	6.0	1.1	178	ND	ND
MBR Effluent	<0.5	ND	95	ND	ND

Table 3.29	DBPFP Testing Results Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Following DBPFP with Free Chlorine- Day 7					
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)***	**THM4, 7 (μg/L)**	**HAA5, 7 (μg/L)**
FXB Effluent	NA	NA	NA	20	26
FBR Effluent	NA	NA	NA	110	140
MBR Effluent	NA	NA	NA	24	39
Following DBPFP with Combined Chlorine- Day 7					
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)***	**THM4, 7 (μg/L)**	**HAA5, 7 (μg/L)**
FXB Effluent	NA	NA	NA	ND	17
FBR Effluent	NA	NA	NA	2.2	24
MBR Effluent	NA	NA	NA	ND	13
Notes: NA: not analyzed					

The DBPFP yields are presented in Table 3.30. The highest DBP formation yields were observed for the tests using FBR effluent. HAA formation yields were higher than THM yields for the same samples. Even though the DOC was non-detect in the MBR effluent, an HAA concentration of 13 μg/L was measured after chloramination, resulting in a yield of > 26 μg/mg DOC.

Table 3.30	DBPFP Yields Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
	THM4FP Yield (μg/mg DOC)		**HAA5FP Yield (μg/mg DOC)**	
Stream	**Free Chlorine**	**Combined Chlorine**	**Free Chlorine**	**Combined Chlorine**
FXB Effluent	5.0	0	6.6	4.3
FBR Effluent	32.0	2.1	40.7	7.0
MBR Effluent	0.2	0	0.4	>26(1)
Notes: (1) DOC was ND				

A follow-up 72-hr SDS test was conducted on the FBR effluent. A free chlorine dose of 2.6 mg/L was used, which resulted in a 3-day residual of 0.4 mg/L. The SDS-TTHM4 and SDS-HAA5 concentrations were 40 and 23 μg/L, respectively.

7.9.2.2 DBPFP Testing on Ozonated FXB Effluent

Following ozonation of the FXB effluent and the acetic acid-spiked FXB effluent samples, DBPFP testing was conducted with both free and combined chlorine (Table 3.32).

Bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L. The bromide levels of 200 μg/L for the blended water (i.e., 90 percent SPW and 10 percent FXB effluent) are on the higher side. For comparison, bromate concentrations measured following ozonation at the Rio Vista WTP are less than 5 μg/L.

Aldehydes were formed at moderate levels when the FXB effluent was ozonated. As expected, total aldehydes (acetaldehyde, formaldehyde, glyoxal, pyruvic aldehyde, and pentanal) were slightly higher in the ozonated FXB effluent spiked with acetic acid relative to the unspiked FXB effluent. It should be noted that the filtration process at the Rio Vista WTP downstream of ozonation may further reduce the aldehyde levels in the finished water.

Ozonation increased the concentration of BDOC and AOC, a phenomenon widely reported in the literature. In a full-scale treatment process, the biodegradable organic matter would be reduced through the filters prior to final chlorination by biological oxidation. Chlorination and chloramination of the samples resulted in a decrease in the BDOC concentration, probably as a direct result of NOM oxidation by the disinfectant.

High concentrations of TTHMs and HAAs were measured in the ozonated samples following DBP formation testing with free chlorine. It should be noted that since the measured free chlorine residuals after 7 days of incubation were higher than the target residual range of 3 to 5 mg/L, these DBP results are conservative. In addition, in a full-scale treatment process, the preozonated water would be filtered prior to final chlorination. This filtration process would be expected to remove some of the DBP precursors by biological oxidation, resulting in lower DBP levels than those shown in Table 3.31.

Table 3.31 DBPFP Testing Results-Ozone Test
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

	Raw Samples				
Stream	**TOC (mg/L)**	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**Bromide, low (mg/L)**
FXB Effluent	2.4	2.5	0.53	200	200
FXB Effluent+AA	9.2	8.8	2.5	1266	200

Table 3.31	DBPFP Testing Results-Ozone Test Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency								
Ozonated Samples Prior to Chlorination (Control)									
Stream	**DOC (mg/L)**	**TOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**Br (μg/L)**	**BrO_3 (μg/L)**	**Aldehyde (μg/L)**	**THM4, $_0$ (μg/L)**	**HAA5, $_0$ (μg/L)**
FXB Effluent	2.6	2.4	3.7	240	190	8.7	40	ND	ND
FXB Effluent +AA	3.2	8.8	5.6	1,446	200	1.8	54	ND	ND
Following DBPFP with Free Chlorine- Day 7									
Stream		**TOC (mg/L)**		**DOC (mg/L)**		**BDOC (mg/L)**	**THM4, $_7$ (μg/L)**	**HAA5, $_7$ (μg/L)**	
FXB Effluent		2.0		1.9		0.22	200	56	
FXB Effluent+AA		8.6		8.5		1.5	180	65	
Following DBPFP with Combined Chlorine- Day 7									
Stream		**TOC (mg/L)**		**DOC (mg/L)**		**BDOC (mg/L)**	**THM4, $_7$ (μg/L)**	**HAA5, $_7$ (μg/L)**	
FXB Effluent		2.3		2.2		0.38	23	12	
FXB Effluent+AA		8.8		9.0		0.50	25	13	

While HAAs were the dominant DBPs in the chlorinated FXB, FBR, and MBR effluents, TTHMs were the dominant DBPs in the blended FXB effluent samples, which is confirmed by typical DBP concentrations measured in the full-scale Rio Vista WTP distribution System (i.e., approximately 65 μg/L for THMs and 15 μg/L for HAAs).

7.9.3 Comparison of DBP Formation Results

THMFP and HAAFP results for all streams are plotted in Figures 3.53 and 3.54. It must be emphasized that the chlorination and ozone results are conservative. The HAA concentrations in the ozonated samples are lower than the TTHM concentrations, suggesting that the SPW water favors the formation of THMs over HAAs. Non-blended water tended to form HAAs over THMs.

In summary THMs and HAAs tend to form in the effluent of the biological systems upon the addition of free chlorine. The THMs and HAAs in the FXB effluent (which was already at steady-state operation) were lower than the current Stage MCLs. Higher DBP concentrations measured in the chlorinated and ozonated FBR effluent are premature since the FBR was not optimized.

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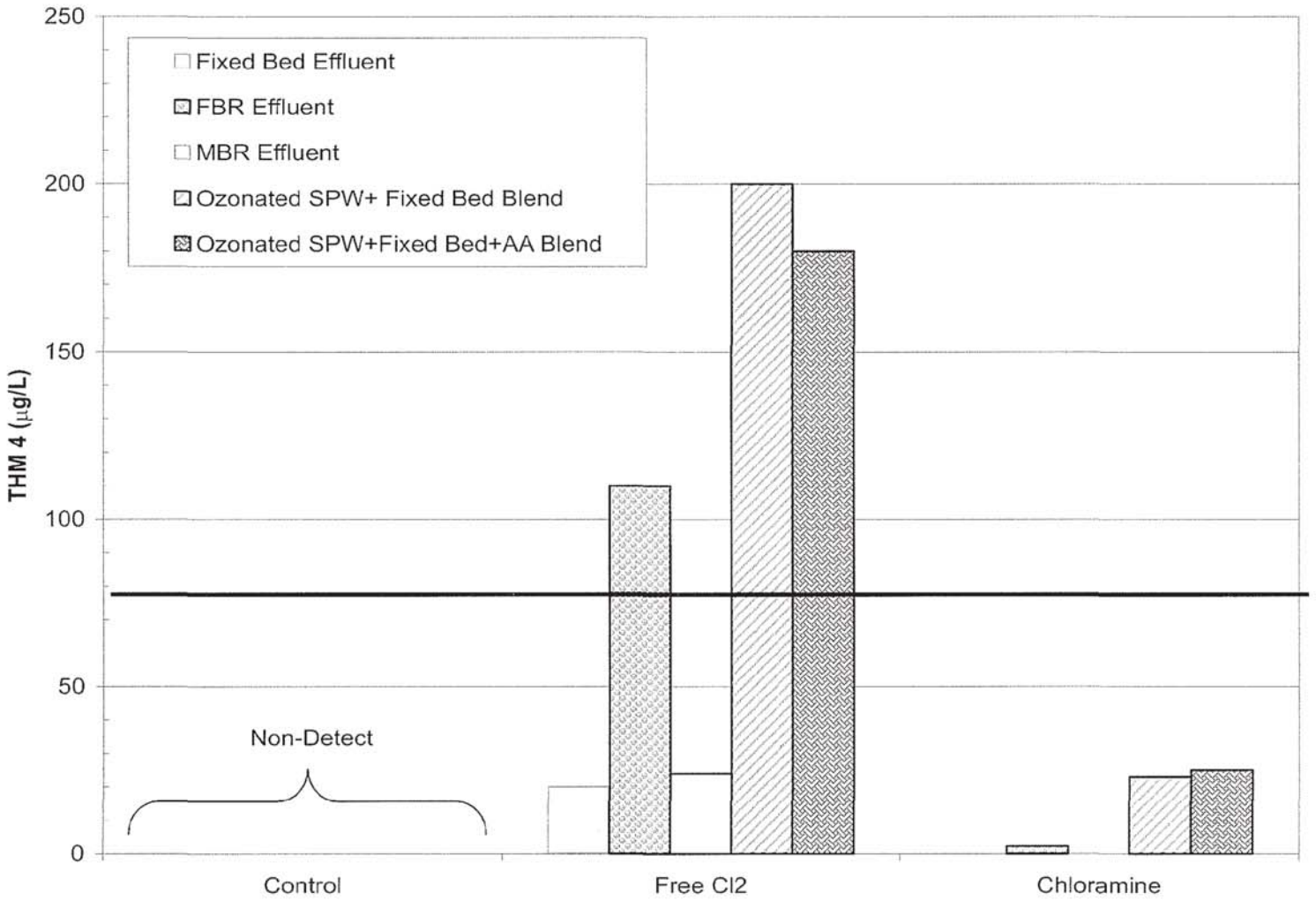

COMPARISON OF DBPFP THM4 SAMPLES FROM SEVERAL STREAMS

FIGURE 3.53

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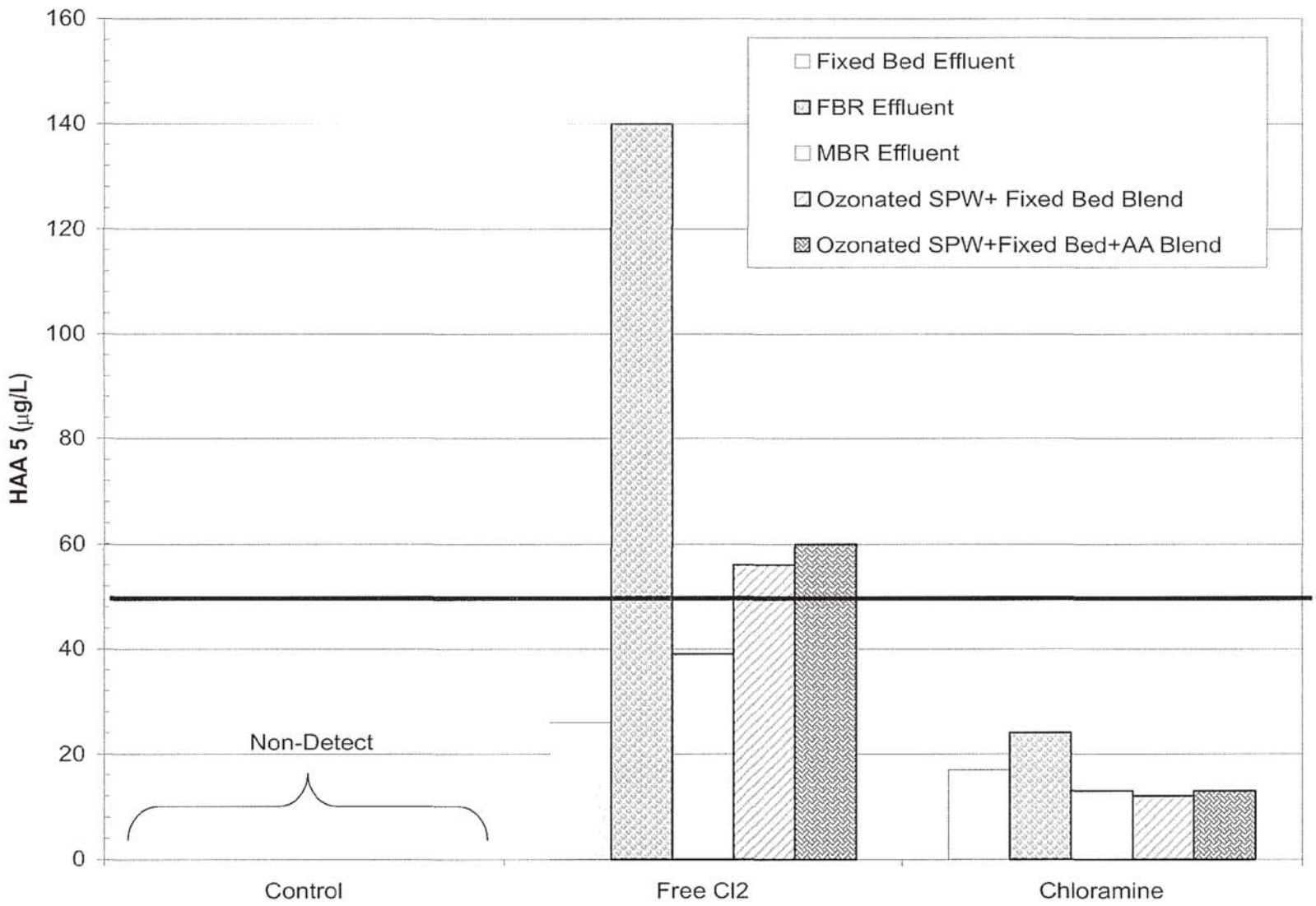

COMPARISON OF DBPFP HAA5 SAMPLES FROM SEVERAL STREAMS

FIGURE 3.54

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As expected, chloramination results in THM and HAA levels significantly lower than the Stage 2 MCLs.

7.10 Summary of DBPFP Results

7.10.1 DBPFP Testing on Fixed Bed, Fluidized Bed, and MBR Effluents

Following free chlorine addition with an excess residual after 7 days of incubation, DBP levels were formed in all streams, with levels in the FBR stream exceeding current MCLs of 80 μg/L and 60 μg/L for THMs and HAAs, respectively. It should be noted that the FBR was not optimized prior to the DBPFP tests. Because the FBR feed acetic acid concentrations were higher than ultimately required, the FBR DBPFP tests are considered conservative. HAAs were the dominant DBPs in the three samples. As expected, chloramination resulted in low levels of THMs and lower levels of HAAs as compared to free chlorination. Higher DBP formation yields were calculated in the FBR effluent relative to the FXB effluent. A follow-up 72-hour SDS test was conducted on the FBR effluent. The SDS-THM4 and SDS-HAA5 concentrations were lower than the D/DBPR Stage 2 MCLs, measured at 40- and 23-μg/L, respectively.

7.10.2 DBPFP Testing on Ozonated Fixed Bed Effluent

To simulate DBP formation potential of FXB effluent that is post-treated at the Rio Vista Water Treatment Plant (WTP), a blend of 90 percent State Project Water (SPW) and 10 percent FXB effluent was ozonated and contacted with free or combined chlorine. Following ozonation, bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L due to high bromide levels of 200 μg/L for the blended water. Aldehydes were formed at moderate levels, even in the effluent spiked with acetic acid. The ozonation of the samples resulted in an increase in the BDOC and AOC concentrations. It should be noted that the filtration process at the Rio Vista WTP downstream of ozonation may further reduce the aldehydes and BDOC levels in the finished water. High levels of THMs and HAAs were measured in the ozonated samples following DBP formation testing with free chlorine. THM4 concentrations were two times the Stage 2 MCL. However, residual chlorine concentrations were excessive during incubation and, more importantly, a large fraction of DBP precursors would likely be removed downstream of ozonation, prior to chlorination at the Rio Vista WTP. The HAA concentrations in the ozonated samples, although relatively high, were lower or equal to the Stage 2 MCL. Seven-day incubation of ozonated water with combined chlorine generated only 23 μg/L TTHM4 and 12 μg/L HAA5.

8.0 CONCLUSION

All three ion-exchange resins removed perchlorate to below detection for run times exceeding model predictions. Preliminary NDMA formation potential tests with pre- and post-disinfection, as well as spent resin characterization tests suggest that the operation and disposal of these resins under the conditions tested should not raise any concern. It

should be noted however that in a full-scale process, the temporal discharge of groundwater following a resin change-out may pose a challenge due to potential restrictions in chloride level imposed by the relative agency (e.g., county sanitation district or regional water quality control board).

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shut-downs, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 15 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter. A short-term post-treatment test performed on the FXB system with an SMBR demonstrated that the SMBR would be able to meet regulatory requirements in terms of aeration and filtration in a single step. DBP formation tests for the fixed bed reactor resulted in THM and HAA levels lower than the Stage 2 MCLs.

The fluidized-bed reactor did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

A number of critical design parameters have been established based on the test results. These will be used during the pre-design of a selected system. Based on the performance of these systems, preliminary budget level costs have been developed, which will be presented in the pre-design report.

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Castaic Lake Water Agency

Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer

TECHNICAL MEMORANDUM NO. 3 BENCH AND PILOT TEST RESULTS

February 2004

CASTAIC LAKE WATER AGENCY

TREATMENT OF PERCHLORATE CONTAMINATED GROUNDWATER FROM THE SAUGUS AQUIFER

TECHNICAL MEMORANDUM NO. 3

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1.0 EXECUTIVE SUMMARY

1.1 Background

A 6-month study was performed to evaluate the effectiveness of ion exchange (IX) and biological processes for treating perchlorate-contaminated water from the Saugus aquifer. Three single-pass perchlorate-selective IX resins were evaluated at the bench-scale while fixed-bed biological reactors (FXBs) and fluidized-bed biological reactors (FBRs) were tested at the pilot-scale. These processes were chosen due to their ability to remove perchlorate from groundwater without generating a perchlorate-laden waste stream or brine that needs to be discharged.

1.2 Ion Exchange

Breakthrough of most anions from the IX resins occurred in the first 24 hours of run time. No chromatographic peaking was observed for any of the critical anions. Chloride breakthrough decreased from 325 mg/L to background concentrations (~35 mg/L) after 280 bed volumes. Perchlorate breakthrough (i.e., greater than 1 μg/L) occurred at 25,000 to 76,000 bed volumes (26 to 79 days). This translates to treated water volumes of 187,000 to 569,000 gal/cu-ft resin.

Contacting IX effluent with free and combined chlorine for 2- and 24-hour incubation periods produced no detectable (i.e., < 2 ng/L) N-nitrosdimethylamine (NDMA) concentrations for all three resins tested, indicating that NDMA precursors did not leach from the resins. When 2 mg/L of free chlorine was dosed to the IX feed water, effluent NDMA concentrations were below or just over the detection limit. To evaluate the NDMA precursor leaching potential of the resins, 100 mL batches of fresh resin were incubated for four hours in deionized water and groundwater. NDMA was detected in only one sample, which measured at less than half the 10 ng/L Action Level.

A California Total Threshold Limit Concentration (TTLC) analysis showed that metals were mostly non-detect in all three spent resins. Chromium, vanadium, and zinc were detected in two of the spent resins at levels significantly below the regulatory TTLC threshold concentrations. Uranium levels in the spent resin leachate were significantly below the Title 22 MCL of 20 pCi/L. To investigate whether the spent resins would be classified as hazardous for transportation to an incineration facility, a mass balance of the uranium adsorbed and desorbed from the resin up to 50 percent perchlorate breakthrough was performed. The amount of uranium accumulated on the spent resins is far below the lowest permissible reporting quantity and A-value of the California Department of Transportation.

1.3 Biological Filtration

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shut-downs, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 23 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter.

Demonstration testing showed that a submerged membrane bioreactor (SMBR) can meet several post-FXB treatment objectives in a single step: 1) aeration, 2) biomass separation, 3) residual organic carbon removal, and 4) hydrogen sulfide removal.

The FBR did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

Disinfection by-product formation potential (DBPFP) tests were performed using effluent from the FXB, FBR, and SMBR reactors. After 7 days of incubation with an excess chlorine residual, DBPs were formed in all three streams, though only the FBR stream produced DBPs exceeding the current MCLs of 80 μg/L total trihalomethanes (TTHMs) and 60 μg/L HAA5s. It should be noted that the FBR was not optimized prior to the DBPFP tests. Because the FBR feed acetic acid concentrations were higher than ultimately required, the FBR DBPFP tests are considered conservative. DBPs formed in all three streams consisted primarily of haloacetic acids (HAAs). Seven-day incubation of process effluents with combined chlorine produced only low levels of THMs and HAAs. A follow-up 72-hour simulated distribution system (SDS) DBP formation test was conducted on the FBR effluent. The SDS-THM4 and SDS-HAA5 concentrations were 40 μg/L and 23 μg/L, respectively.

To simulate DBP formation potential of FXB effluent that is post-treated at the Rio Vista Water Treatment Plant (WTP), a blend of 90 percent State Project Water (SPW) and 10 percent FXB effluent was ozonated and contacted with free or combined chlorine. Bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L due to high bromide concentrations (200 μg/L) in the blended water. Aldehydes were formed at moderate levels, even in one sample that was spiked with 7.5 mg/L of acetic acid carbon prior to ozonation. High levels of THMs and HAAs were measured in the ozonated samples following a 7-day incubation with free chlorine. However, residual chlorine concentrations were excessive

during incubation and, more importantly, a large fraction of DBP precursors would likely be removed downstream of ozonation, prior to chlorination at the Rio Vista WTP. Seven-day incubation of ozonated water with combined chlorine generated only 23 μg/L TTHM4 and 12 μg/L HAA5.

2.0 INTRODUCTION

2.1 Overview

Castaic Lake Water Agency (CLWA) retained Carollo Engineers (Carollo) to screen available perchlorate treatment alternatives applicable to Saugus Aquifer water, test the most promising alternatives, and select a process train for predesign to treat perchlorate-impacted wells.

Carollo identified the following processes as potential treatment approaches for perchlorate:

- Conventional regenerable IX.
- "Throw-away" perchlorate selective IX.
- FBR biological filtration.
- FXB biological filtration.
- High-pressure membrane separation.

A desktop study was conducted to narrow the treatment alternatives. The benefits and issues related to each one of these approaches were presented at a workshop held at CLWA on February 3, 2003. During the workshop, participants from CLWA, member agencies (Newhall County Water District (NCWD), Valencia Water Company, and Santa Clarita Water Company), Carollo, and Kennedy/Jenks performed a process selection based on the following criteria:

- Effectiveness in treating other potential contaminants such as NDMA, HMX, RDX, TNT, etc.
- DHS approval (fast track implementation).
- O&M costs.
- Capital costs.
- Architectural, siting, and permitting issues.
- Robustness of the process.
- TDS and hardness removal ability.

Workshop participants performed a pair-wise comparison analysis to weight the relative importance of each criterion, and assigned criteria scores to each process. The following alternatives were recommended by the participants for bench and/or pilot testing.

- "Throw-away" perchlorate selective IX.
- FBR biological filtration.
- FXB biological filtration.

These alternatives were selected because they can treat perchlorate with minimal production of perchlorate-laden liquid waste or brine that needs to be discharged.

2.2 Project Objectives

The overall goal of bench and pilot testing at the CLWA was to develop design parameters for a treatment facility that is capable of removing perchlorate to below the action level (AL) at affected Santa Clarita Valley wells. The AL in the State of California is currently 4 µg/L. The method detection limit (MDL) used by the CLWA lab was 1 to 4 µg/L and the minimum reporting limit (MRL) for the standard analytical method (EPA 314.0) is currently 4 µg/L.

The specific objectives of this work were to:

1. Compare the perchlorate removal performance of three commercially available and NSF certified perchlorate-selective IX resins using water from the Saugus Aquifer under identical operational conditions by running a parallel bench-scale flow-through column test.
2. Determine the NDMA formation potential of the three IX resins when subject to pre- or post-chlorination at the bench-scale.
3. Determine characteristics of the spent IX resins.
4. Demonstrate the efficacy of FBR and FXB treatment for perchlorate removal from Saugus aquifer water (i.e., show consistent removal of perchlorate to below the MRL of 4 µg/L).
5. Verify that sufficient perchlorate-reducing biological activity can be developed in the pilot-scale reactors using microorganisms indigenous to the Saugus Aquifer.
6. Using pilot-scale FBRs and FXBs, develop full-scale design criteria for empty-bed contact time (EBCT), backwashing procedures, electron donor (acetic acid) addition, and nutrient addition.
7. Evaluate the robustness of the fluidized- and FXB biological process with respect to system upsets, such as electron donor feed failure, process shutdowns, and changes in the feedwater oxidant concentrations.

8. Compare overall process performance between a FXB and FBR configuration.

9. Demonstrate the efficacy and robustness of the FBR's on-line perchlorate analyzer in comparison to other laboratories.

10. Prepare planning-level capital and O&M cost analyses for biological- and IX-based treatment facilities to be incorporated in the pre-design report.

11. Determine post-treatment requirements for the IX, FBR, and FXB perchlorate removal processes (i.e., characterize process effluent quality and disinfection by-product formation potential).

3.0 BACKGROUND AND TEST SITING

3.1 Test Approach and Siting

The preliminary test program included two main testing protocols:

- Bench-scale IX testing using three perchlorate selective resins.
- Pilot-scale biological testing using two system configurations.

The perchlorate selective resins have a high capacity for perchlorate adsorption and depending on the influent perchlorate and sulfate concentrations, may experience extensive run-times to reach perchlorate breakthrough (i.e., perchlorate > 4 µg/L). To simplify testing logistics, IX testing was conducted at the bench-scale. The test was carried out in the chemical building at the Rio Vista WTP. This site also served as the pilot-scale testing site. Bench-sale IX data are readily scaleable. Factors considered in scaling-up the bench test are water quality, bed volumes until perchlorate breakthrough, EBCT, and separation factors specific to the selected resin. The controlling factor of the contaminants' diffusion into the resin matrix is the selectivity of the resin's positively charged quaternary amine functional group for a specific anion relative to the chloride anion. The order of elution of ions from the resin is determined solely by the selectivity sequence. The species exit the column in reverse preferential order, with the less preferred ions (smallest separation factors) emerging first. Other factors include charge of ion, valence of ion (mono- or divalent), and other resin-specific physical factors.

While the effectiveness of treating perchlorate using biological processes has been demonstrated extensively at the bench-scale, the scalability of these processes is not well established. This project evaluated the removal of perchlorate from Saugus Aquifer water using two pilot-scale biological system configurations (FXB and FBR).

3.2 Feed Water

Perchlorate-contaminated wells were not used for testing due to the complications and costs associated with the discharge requirements and the need for an extensive analysis of influent and effluent waters. Instead, a perchlorate-free operational well (NC-12) located near one of the perchlorate contaminated wells (NC-11) was used as feed water for both bench- and pilot-scale systems. Perchlorate was spiked to achieve a final target concentration of 50 µg/L for most of the study. NC-11 and NC-12 draw water from the Saugus Aquifer and have comparable raw water quality (chemistry). Sulfate was spiked to the feed of the ion-exchange unit to achieve a final target concentration of 300 mg/L. This mimics the highest average sulfate concentration measured in Saugus wells. Sulfate is a critical parameter in the ion-exchange process since it competes with the perchlorate ion. NC-11 and NC-12 were sampled and characterized in February and March 2003, respectively (Table 3.1). NC-12 well water was transferred to four 6,500-gallon storage tanks located outside the chemical building at the Rio Vista WTP via a 6,000-gallon stainless steel tanker truck which was filled at the well site and transferred to the pilot site. The tanker used for transferring the raw feed water was washed with hot water or a caustic solution and then rinsed prior to use, to ensure no impact on the raw water quality. The water stored in the baker tanks at the site was delivered to the test equipment via Schedule 80 PVC. To maintain a consistent water temperature, feed flows were routed through an ITT Standard heat exchanger, Model SX200. The water was used at a rate varying from 2,900 to 5,800 gallons per day (2 to 4 gpm).

Table 3.1 Water Quality Parameters in the Groundwater at Newhall 11 and 12 Wells Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

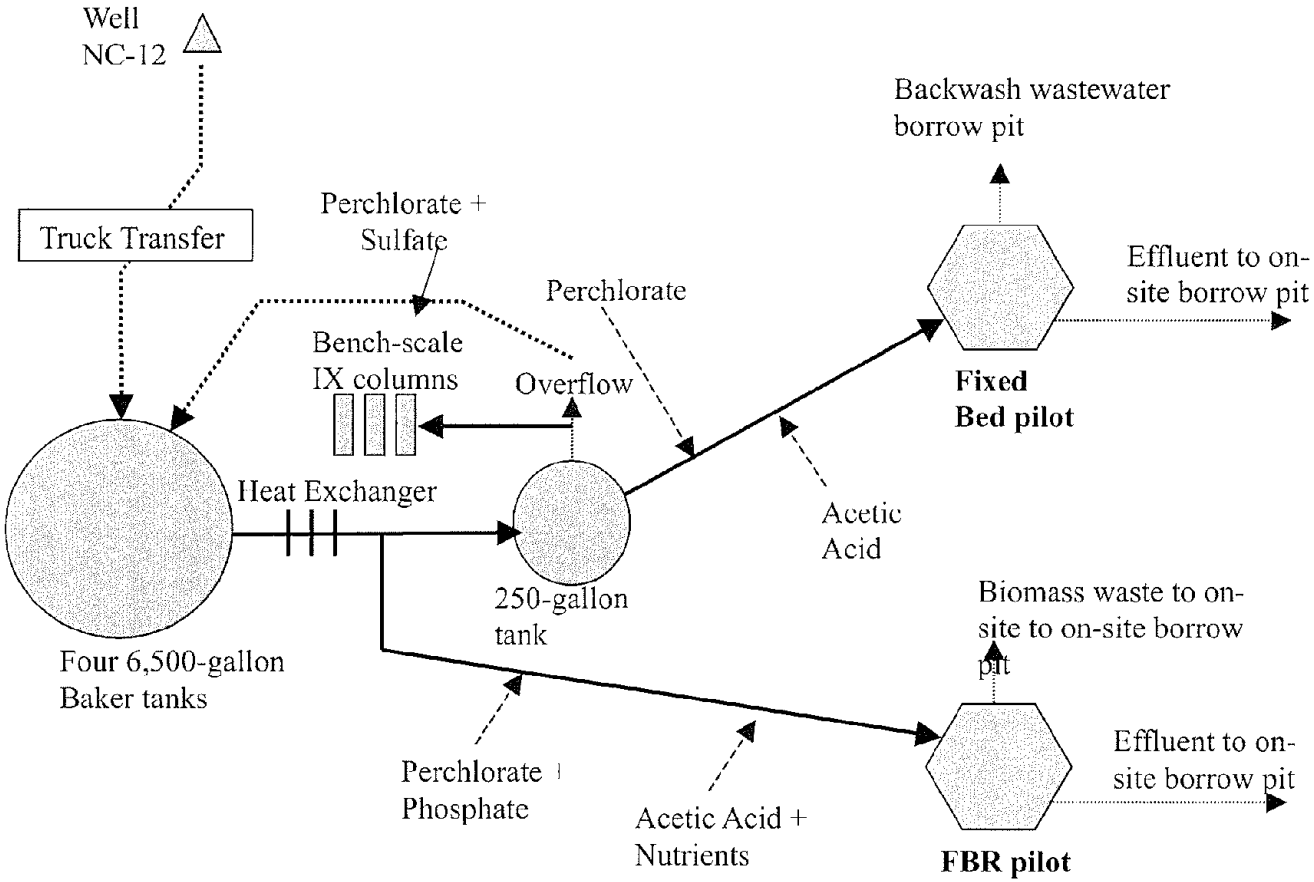
Parameter	Units	NC-12 (March 2003)	NC-11 (Feb 2003)	NC-11 (Historic)
Perchlorate	µg/L	ND(1)	17-20	13-23
Nitrate-NO_3^-	mg/L	14.6	18-20	14-30
Sulfate	mg/L	131	309-330	255-443
Bicarbonate	mg/L	199	220	232-235
Chloride	mg/L	38	28	29-38
Alkalinity	mg/L as $CaCO_3$	163	180	182-280
pH	–	7.5	7.4	7.5-7.7
Conductivity	µhom/cm	846	1,120-1,138	980-1,116
Temperature	degrees C	19	16	
Uranium	pCi/L	0.679	2.887-4.368	NA

Table 3.1	Water Quality Parameters in the Groundwater at Newhall 11 and 12 Wells Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Units**	**NC-12 (March 2003)**	**NC-11 (Feb 2003)**	**NC-11 (Historic)**
Arsenic	µg/L	1.3	<1.0-1.0	<2.0-2.0
TOC[2]	mg/L	<0.7	2.0[3]	N/A[4]

Notes:
(1) Not detected.
(2) Total Organic Carbon.
(3) After approximately three hours of flushing.
(4) Not available.

A process flow schematic for bench- and pilot-testing is provided in Figure 3.1. The water was pumped from the four 6,500-gal tanks to a 250-gallon tank inside the building. The flow was then split two ways into the FXB and the FBR pilots. Schedule 80 PVC was used to hard pipe the baker tank to the feed pump of each biological pilot skid. Perchlorate stock solution was prepared as necessary by spiking reagent grade sodium perchlorate (Fischer Scientific, Hanover Park, Illinois) to 1 liter of deionized, distilled water from the CLWA laboratory. Peristaltic pumps (Ismatec, Northbrook, Illinois) dosed the perchlorate stock solution near the front end of each pilot feed line for adequate mixing. Perchlorate was dosed independently to each pilot skid to maintain flexibility in the pilot testing protocol. For example, using this configuration, perchlorate spiking tests were applied to one pilot without having to be applied to the other. Technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) was used as the stock electron donor solution and dosed to the pilot feed lines just before entry to the biological reactors using a peristaltic pump. This acetic acid is undergoing ANSI/NSF 60 certification, which should be completed by the mid-2004. ANSI/NSF 60 - certified, food-grade phosphoric acid (Prayon, Inc., Augusta, Georgia) was also dosed to the pilot feed lines using peristaltic pumps. For the FBR system, a micronutrient mixture was added to the phosphoric acid solution for selected tests. The micronutrient mixture contained trace amounts of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt. The main PVC feed pipes were fitted with a static mixer downstream of the chemical injection points.

For the bench-scale IX tests, water was collected from the pilot feed tank in two 55-gallon tanks (approximately 1 week's supply). The tanks were filled from the overflow line of the 250-gallon tank. A 1,000-mg/L perchlorate stock solution was prepared by adding reagent-grade sodium perchlorate salt to distilled deionized water obtained from the CLWA laboratory. This solution was spiked directly into the containers to result in a final concentration of 50 µg/L. Additional sulfate was also added to the containers by dissolving reagent sodium sulfate (Na_2SO_4) in distilled-deionized water to reach a final sulfate concentration of 300 mg/L.



PROCESS FLOW SCHEMATIC FOR BENCH- AND PILOT-SCALE TESTING

FIGURE 3.1

3.3 Discharge Streams

All process effluents (i.e., bench-scale effluent, pilot-scale effluents, and backwash wastewater) were pumped to a borrow pit on the Rio Vista plant site. The discharge waters were first directed to off-site GAC drums to remove any residual perchlorate prior to ultimate disposal in the borrow pit. The backwash water from the pilot-scale systems was first directed to a 100-gallon drum to allow for settling, and the decant wastewater was then directed to the feed of the GAC drums. The effluent stream from the GAC drums was analyzed for perchlorate once per week. Additional tanks with approximately 300 pounds of Virgin GAC were installed before the discharge point to treat any perchlorate that may be present in the effluents. If perchlorate was detected in the GAC effluent, the spent GAC was removed and replaced with virgin GAC. The borrow pit has no surface discharge and allows negligible percolation due to the presence of a heavy clay soil lining. There was no discharge to the sewer system or Santa Clara River. Spent resins were sent to a certified laboratory for further characterization and disposal.

4.0 EQUIPMENT DESCRIPTION AND CAPABILITIES

4.1 Ion Exchange

4.1.1 Bench-Scale Flow-Through Column Testing Unit

A bench-scale flow-through column apparatus was used to evaluate the removal of perchlorate and other anions by IX (Figures 3.2 and 3.2(a)). This equipment was used to determine performance and cost data for three commercially-available perchlorate-selective, IX resins.

Three glass columns were set up to run in parallel, each with a different resin. The columns are 15 mm in diameter, 30 cm in length, and were filled to a depth of 12.7 cm with resin media (22.5 mL of resin). The media was supported with stainless steel screens. Each column was first half-filled with distilled water. Resin was then added from the top and allowed to settle to the bottom of the column. Resin was added until the settled resin level reached the 12.7-cm mark. Resin was added with excess water in the column to prevent the formation of air-gaps in the packed resin. Once the full amount of resin was added, the column was filled with distilled water. An in-line pre-filter (9.824-inch Osmonics Flotrex-GF pleated 3.0 μm absolute Model FGF031AAS) was installed after the feed pump to remove suspended material from the feed water. To monitor headloss, pressure gauges were installed upstream and downstream of the filter housing unit, and pressure relief valves were used to prevent pressure build-up. A three-way valve was also installed in the effluent line to provide a location for manual sampling.

BENCH-SCALE FLOW-THROUGH ION EXCHANGE EQUIPMENT

FIGURE 3.2

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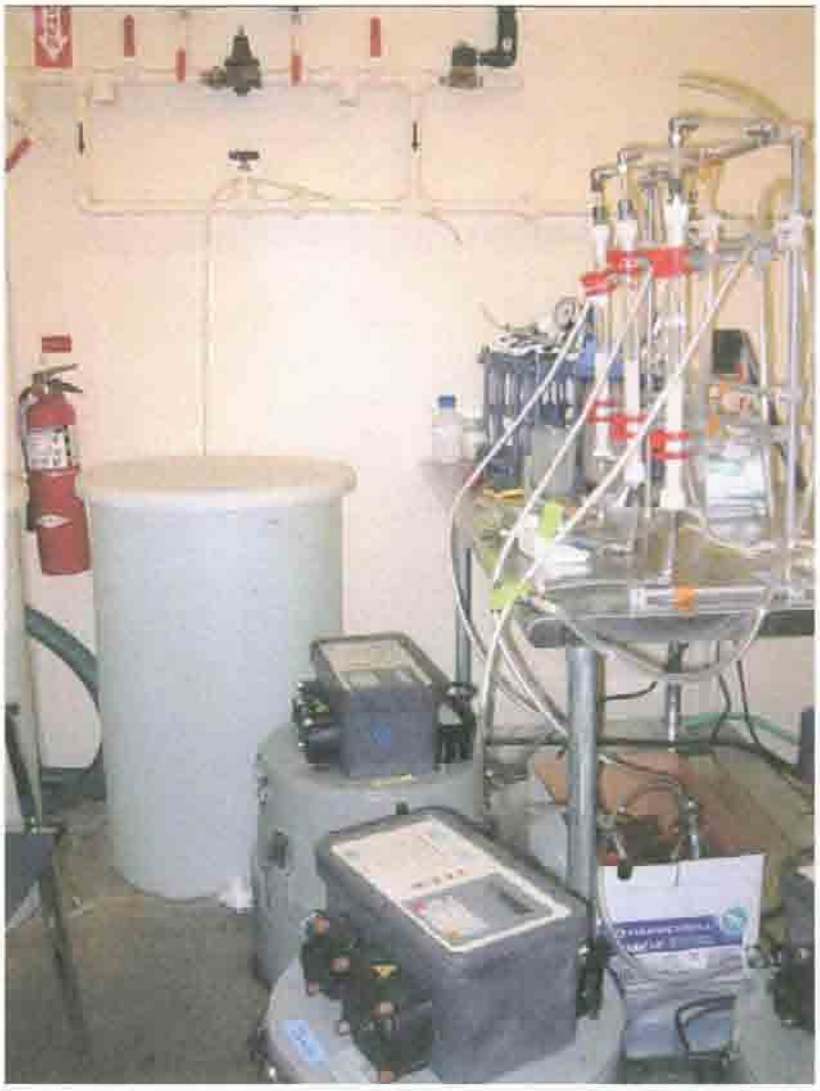


BENCH-SCALE COLUMN SETUP AND AUTOSAMPLERS

FIGURE 3.2(a)

The columns were set up to run in parallel such that perchlorate spiked water was delivered from the two 55-gallon storage tanks to the head of the columns using an LMI model QG 400 piston lab pump. Flow-rates from each column were measured using a stopwatch and a 5-mL graduated cylinder. Volumetric measurements were taken on a daily basis. The flow was adjusted as necessary using a needle valve located at the effluent of each column. Timed effluent water samples were collected by autosamplers (leased from ISCO, Lincoln, Nebraska) during the first week of testing. The autosamplers were used to collect a one-hour composite batch from each column over a period of 24 hours. This process was repeated over the entire first week. The sampling intervals were determined from modeling results provided by the resin suppliers and/or generated by IX Pro Software using the Saugus water quality and separation factors associated with a perchlorate-selective resin as inputs.

4.1.2 Resins

There are several commercial resin manufacturers/suppliers. Based on the raw water quality in the Saugus Aquifer (i.e., perchlorate, sulfate, nitrate, TDS) and the lack of a dedicated line for disposing spent brine produced from conventional ion-exchange systems, perchlorate-selective, throw-away ion-exchange resins were selected for further evaluation using bench-scale testing. The following three resins were tested in parallel based on the availability for use in packaged systems, vendor recommendations and applicability to treating Saugus groundwater based on modeling results:

- US Filter K-9710 (US Filter Corporation, Rockford, Illinois): USF K-9710 is a strong base quarternary amine macroporous anion resin consisting of a styrene divinylbenzene matrix. The resin was tested at the Edwards Air Force Base. This resin, which received on NSF-61 certification in July 2003, can be supplied directly through a system manufacturer (e.g., US Filter, Calgon Carbon). A full-scale system using this resin is operational in the City of Rialto, California. The resin has a unique dual functionality exhibiting very high selectivity for oxy anions, such as perchlorate and pertechnate, that allows for efficient removal in a relatively high TDS background. US Filter recommends the use of this resin for single pass applications.

- Calgon Carbon Cal Resin 2 Resin 2100 Series (Calgon Carbon Corporation, Pittsburgh, Pennsylvania): This resin consists of a trimethylamine functionalized, chloromethylated copolymer of styrene and divinylbenzene in the chloride form. DHS approved packaged treatment systems are located at the City of Riverside and at California Domestic Water Company. Cal 2100 Series resins are NSF certified (NSF/ANSI Standard 61) through WQA.

- US Filter K-9708 resin (US Filter Corporation, Rockford, Illinois): USF K-9708 is a strong base quarternary amine macroporous anion resin consisting of a styrene divinylbenzene matrix. The resin has a special functionality which exhibits high

selectivity for perchlorates and nitrates over sulfates. This selectivity allows the resin to remove perchlorates and nitrates preferentially over sulfates with no potential for perchlorate or nitrate dumping. The resin is initially in the chloride form. USF K-9708 is an NSF-certified resin.

4.1.3 Autosamplers

During the first week of testing, sample collection from each column was automated using 3700 Portable Isco autosamplers (Isco, Inc., Lincoln, NE). Effluent samples were drawn every hour from 2-L glass Erlenmeyer flasks into the custom-fit polypropylene bottles located within the autosampler. Selected samples were stored at 4 degrees C in amber glass bottles until they were analyzed by CLWA or MWH laboratories. Samples were preserved by laboratory personnel with the exception of TOC/DOC samples for which 8 drops of 50 percent HCl were added on site to reduce the pH to less than 2.

During the remainder of the weeks, samples were manually collected by allowing the effluent to flow directly into the sampling bottles using three-way valves.

4.1.4 NDMA Formation Potential Testing

Bench-scale NDMA formation potential tests were conducted during the later phases of the ion-exchange testing. Post-chlorination testing with free and combined chlorine was conducted on each column effluent, as well as pre-chlorination testing with free chlorine. In addition, resin leaching testing in groundwater and DI water without the addition of chlorine was conducted for baseline comparison.

4.1.4.1 Post-Chlorination Testing with Free Chlorine

A 2,000 mg/L free chlorine stock solution was prepared from a 17,000 mg/L hypochlorite solution provided by CLWA. Two 1-L samples were collected from each column effluent. A 1-mL volume of chlorine stock solution was added to each of the bottles, resulting in a 2 mg/L free chlorine dose. The bottles were incubated for 24 hours in the dark under ambient room temperature. Free chlorine residuals were measured after 2 hours of incubation and after 24 hours of incubation. Samples were sent to MWH Laboratories for NDMA analysis. All chlorine stock solutions, doses, and residuals were measured on-site using a Hach DPD field test kit.

4.1.4.2 Post-Chlorination Testing with Chloramines

An ammonium chloride stock solution was prepared by dissolving 1.9 g of reagent-grade anhydrous NH_4Cl (also provided by CLWA laboratory) in 500 mL water. A chlorine:ammonia-N ratio of 4.0 on a weight basis was used (i.e., 2 mg/L chlorine and 0.5 mg/L ammonia-nitrogen) and 2-hour and 24-hour incubation periods were used as described above. Free and total chlorine residuals were measured in the bottles at the end of the incubation period. Bottles were sent to MWH Laboratories for NDMA analysis.

4.1.4.3 Pre-Chlorination Testing with Free Chlorine

Toward the end of the study, a 2 mg/L free chlorine dose was added to the 55-gallon drum, which fed the IX columns. Two samples were collected over a 4-day time period from each column effluent for NDMA analysis. Free chlorine residuals were measured in the bottles.

4.1.4.4 Fresh Resin Batch Testing

To evaluate the leaching potential of fresh resin, approximately 100 mL of fresh resin was added to 1 L of DI water and 1 L of feed groundwater. Bottles were allowed to incubate for a period of 4 hours. Samples were shipped to MWH Laboratories for NDMA analysis.

4.1.5 Spent Resin Characterization

TTLC and Soluble Threshold Limit Concentration (STLC) are used when determining the hazardous waste characterization of a substance under California State regulations as outlined in Title 26 of the California Code of Regulations (CCR). The three spent resins were shipped to MWH Laboratories (TTLC analyses were subcontracted to Columbia Labs in Canoga Park, California) for the following characterizations:

- TTLC Analysis for CAM 17 Metals (in California): This analysis determines the total concentration of each target analyte in a sample. Resin samples were homogenized and 5 grams of each sample were digested and analyzed for the TTLC metals according to standardized EPA methods (EPA Methods 6020 for most metals, 6010B for cooper, lead, and zinc, and 7471A for mercury). When any target analyte exceeds the TTLC limits (Table 3.19 in the Results Section), the waste is classified as hazardous and its waste code is determined by the compound(s) that failed TTLC. The results of this analysis can be used to determine if analysis for STLC level is necessary by comparing 10 times the STLC limit to the TTLC results. A factor of ten is necessary to compensate for a 1:10 dilution factor that is present in one analysis but not the other. If the TTLC results do not exceed 10 times the STLC limit, then normally no further STLC analysis is required.

- STLC Analysis for Perchlorate, Nitrate, and Uranium: This analysis determines the amount of each analyte that is soluble in the "Waste Extraction Test" (WET) leachate. This WET leachate procedure is used for solid samples or for samples containing more than 0.5 percent solids. The sample is tumbled in 10 times its weight of a 0.2 M sodium citrate buffer for 48 hours.

- Approximately 100 mL of STLC extract was obtained from each resin sample. These extracts were returned to MWH Labs for analysis of perchlorate, nitrate, and radioactive uranium.

4.2 Biological Fixed-Bed Filter

4.2.1 Pilot Skid

A photo of the FXB granular media filtration skid is provided in Figure 3.3. Important process components are identified.

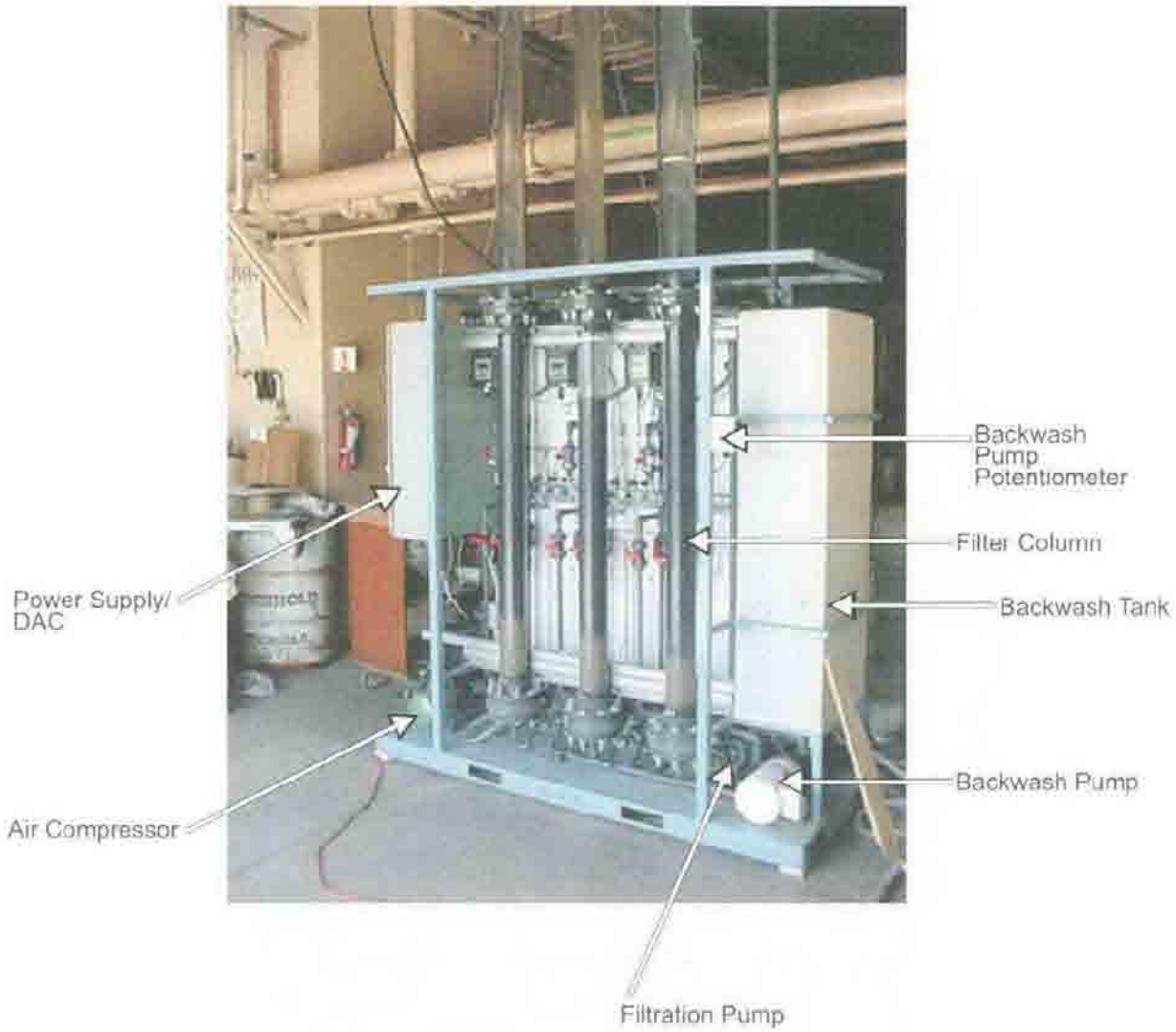
Design criteria and technical specifications for the FXB biological filtration skid are provided in Tables 3.2 and 3.3, respectively.

Table 3.2 Fixed-Bed Filter Design Criteria
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Value/Description
Filter dimensions	4" diameter, 14' tall
Number of filters per skid	3
Number of independent feed pumps	3
Maximum flow per filter	1.5 gpm
Hydraulic loading rate	2-17 gpm/ft^2
Media support mechanism	Retention plate
Backwash type	Air and/or water
Air supply	On-board compressor (with 5 μm filter)
Backwash water tank volume	20 gallons
Parameters measured by in-line meters	Flow Effluent turbidity Effluent particle counts Headloss across the filters

Table 3.3 Fixed-Bed Filter Technical Specifications
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Value/Description
Skid weight	750 lbs
Skid dimensions (LxWxH)	6'6"x2'6"x14'
Electrical requirements	3-phase, 30A, 208-Volt, AC power (Y connection)
Influent, effluent, overflow connections	1" Cam Lock



FIXED-BED BIOLOGICAL FILTRATION PILOT PLANT

FIGURE 3.3

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A schematic of the FXB pilot is shown in Figure 3.4. The FXB skid is configured for down-flow operation. Initially, all three columns on the skid were utilized for pilot testing.

However, because sampling and other daily pilot tasks required for three columns were too onerous for a single operator, two of the columns were shut down one month into the piloting period. Stock perchlorate and (temporarily) phosphate solutions were added upstream of an in-line static mixer using an Ismatec ISM 832B two-channel eight-roller peristaltic pump together with Pharmed 0.020-inch ID peristaltic pump tubing. A second head was added to the peristaltic pump to add acetic acid to the system. Initially, acetic acid was also added at the same location as the perchlorate stock solution. However, excessive growth in the feed lines prompted a relocation of the acetic acid feed to the top of the column one month into the piloting period. Filter effluent turbidity and particle counts were monitored continuously by dedicated turbidimeters and particle counters. A pressure transducer mounted on the pilot skid monitored head loss development across the filter; backwashes, which could include air scour, were initiated manually. The pilot skid is equipped with a data acquisition and control (DAC) system, which stores and manages data. For each filter column, the DAC continuously logs date/time, flow, headloss, effluent turbidity, and effluent particle counts. The skid includes a touch screen interface to monitor and control pilot operations.

4.2.2 Media

The columns were filled to a depth of 7 feet (approximately 0.6 ft^3) with virgin Calgon F-400 granular activated carbon (GAC). This allowed for bed expansion up to 50 percent. F-400 is a bituminous-based carbon commonly used in the United States. The GAC was stored overnight in 5-gallon buckets to wet the surface and internal pores. The filter columns were filled with NC-12 well water and the GAC was dosed slowly into the columns until the 7-foot depth was reached. Once the columns were packed with GAC, they were backwashed for a period of 24 hours at a 45 percent bed expansion to remove carbon fines from the GAC bed.

4.2.3 Stock Solutions

For the biological pilot systems, an intermediate stock perchlorate solution of 136.17 g/L ClO_4^- was made using reagent grade sodium perchlorate salt and distilled deionized water. Individual stock solutions were made as necessary in 2-L glass bottles using the intermediate stock solution. During periods where phosphorus was added to the feed stream, 75 percent pure food-grade phosphoric acid was added directly to the perchlorate stock solution. For the acetic acid stock solutions, technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) was used. Stock solutions were stored in 2-L glass bottles that were flame sterilized using ethanol.

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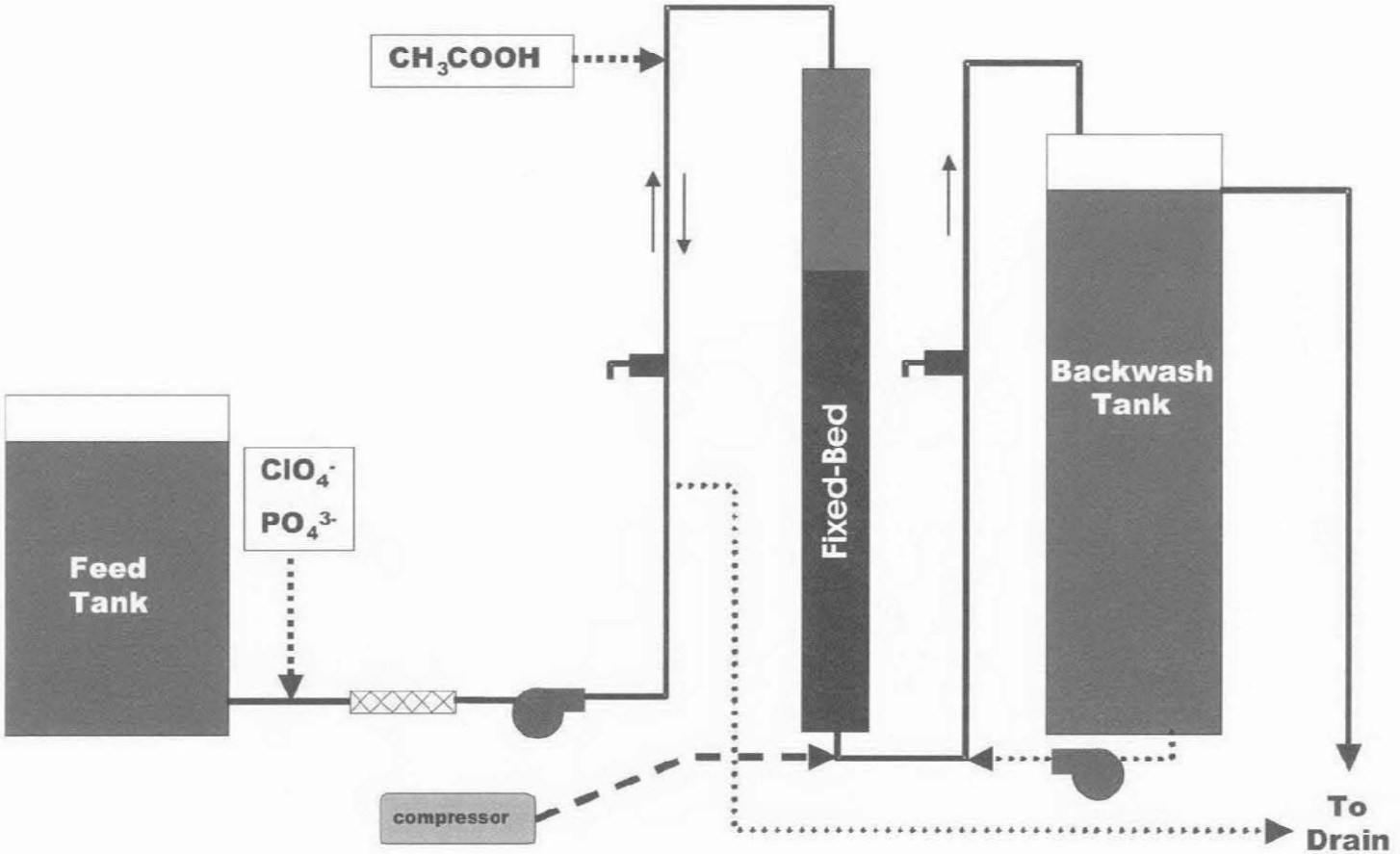

FIXED-BED BIOLOGICAL FILTRATION PILOT SCHEMATIC (NOT TO SCALE)

FIGURE 3.4

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4.3 Biological Fluidized-Bed Reactor

4.3.1 Pilot Skid

The basic components of the pilot FBR system included the bioreactor, bed height control component (when required), biomass separator, a fluid distribution system at the bottom of the reactor, a feed pump, and chemical feed systems (Figure 3.5). The bed of GAC media is hydraulically fluidized to reduce its resistance to flow and to improve substrate/biomass contact by directing liquid flow upward into the bed. The fluidization rate is controlled to maintain a 25 to 30 percent bed expansion over the resting bed height. Feed flow is supplemented with recycle flow to provide the appropriate up-flow velocity for fluidization. When biofilm growth occurs on the GAC media, the particle diameter increases and the effective density of the particle decreases, which causes further expansion of the bed. It is necessary to manage film thickness to control or prevent bed carryover. In full-scale FBR systems, bed height is managed in the top portion of the bed by mechanically shearing the biomass from the GAC through a valve. The "cleaned" GAC particles settle back into the bed, ready to support more biofilm growth, and the sloughed biomass is discharged. In the pilot test unit, mechanical mixing or pump shear was used to perform this task.

Perchlorate and phosphorous stock solutions were added directly to the feed line upstream of the recycle line connection using a diaphragm metering pump. A second diaphragm metering pump was used to add acetic acid stock solution to the feed line. Initially, the acetic acid was injected just prior to the feed pump, but was later moved closer to the bioreactor to minimize biofouling in the feed lines.

4.3.2 Media

The FBR bioreactor uses a proprietary coconut shell based carbon that meets Shaw Environmental-Envirogen specifications for hardness, apparent density, effective size, iodine number, and uniformity coefficient.

4.3.3 Stock Solutions

For the biological pilot systems, an intermediate stock perchlorate solution of 136.17 g/L ClO_4^- was made using reagent grade sodium perchlorate salt and distilled deionized water. Individual stock solutions were made as necessary in 2-L glass bottles using the intermediate stock solution. Food-grade phosphoric acid (Prayon, Inc., Augusta, Georgia) was added directly to the perchlorate stock solution. Acetic acid stock solutions were prepared using technical-grade acetic acid (Eastman Chemical Company, Kingsport, Tennessee) and were stored in a 10-L polypropylene carboy. Before stock solutions were prepared, these carboys were rinsed with rubbing alcohol for sterilization. For selected tests, a micronutrient mixture (GrowMore, Gardena, California) was added directly to the acetic acid stock solution. The micronutrient mixture contained trace amounts of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt.

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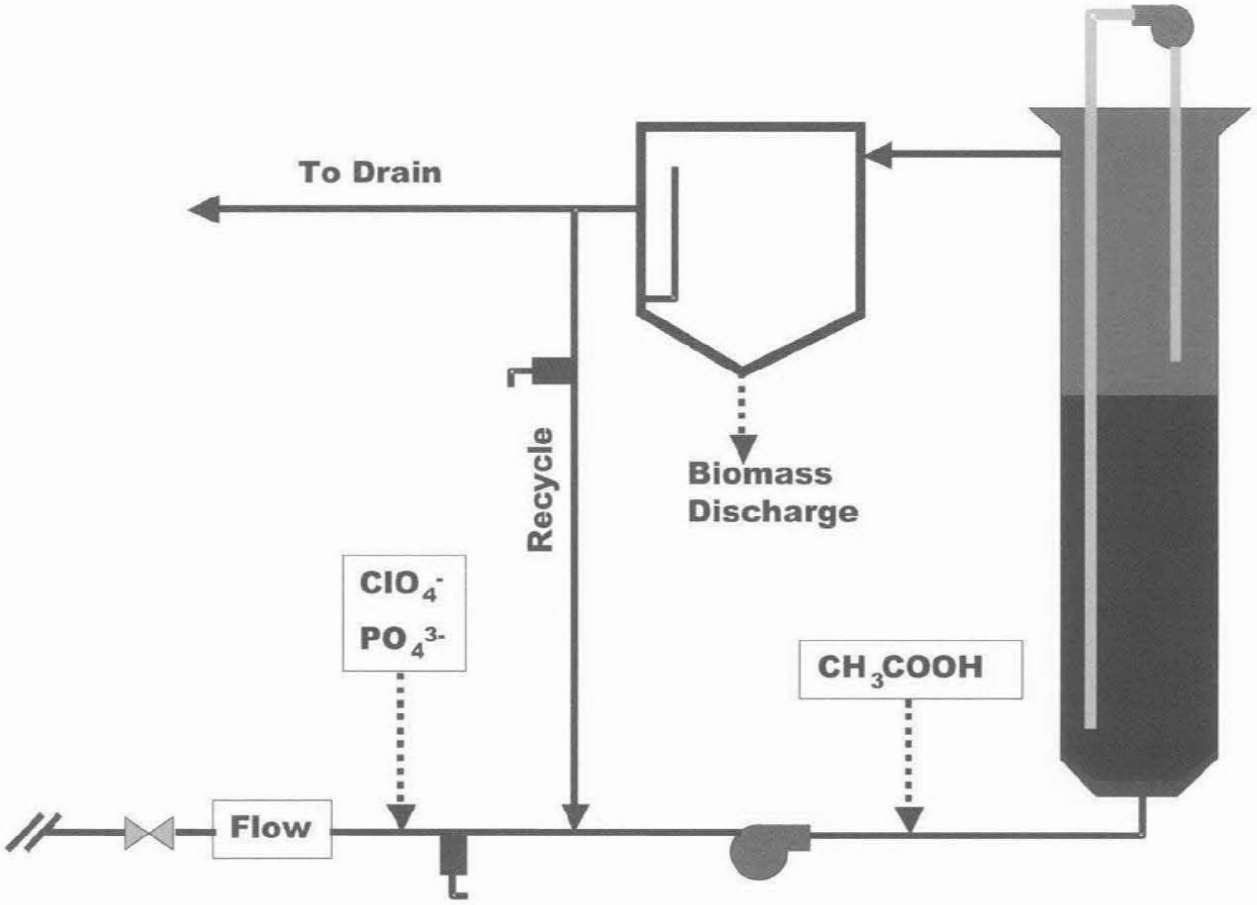

FLUIDIZED-BED BIOLOGICAL FILTRATION PROCESS SCHEMATIC (NOT TO SCALE)

FIGURE 3.5

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4.4 Submerged Membrane Bioreactor

4.4.1 Objectives

Zenon Zeeweed® membranes, operating in an SMBR configuration, were evaluated as an alternative combined treatment step for post-treatment of effluent from the biological filtration process. The post-treatment process must achieve four treatment goals:

1. Aeration: Since biological perchlorate reduction requires anaerobic conditions, DO must be supplied during the post-treatment process.

2. Residual Organic Carbon Removal: Organic substrate is added to the FXB to achieve perchlorate reduction. Therefore, to prevent regrowth problems and to minimize the formation of DBPs, the effluent water must be stabilized biologically.

3. Sulfide Removal: Under anaerobic conditions, sulfate can be reduced to sulfide, which generates a rotten-egg odor. Therefore, the post-treatment process must be able to remove sulfide, which can be accomplished via biological oxidation or air stripping.

4. Biomass Separation: The post-treatment process must provide a barrier for removal of biological matter (HPC bacteria) that sloughs from the biological filters.

4.4.2 System Description

The ZeeWeed® water treatment process is a proprietary ZENON process technology that involves the production of treated water by drawing water through ZeeWeed® "outside-in" hollow fiber membranes that are immersed in the feed water. The ZeeWeed® ultrafiltration membranes have nominal and absolute pore sizes of 0.04 and 0.10 mm, respectively. The membranes act as a physical barrier that prohibits particulate matter exceeding 0.1 μm in size, including *Giardia* cysts and *Cryptosporidium* oocysts, from entering the treated water supply. The small pore size ensures the removal of a high percentage of impurities, including some viruses (typically 2 to 4.5 log reduction), which are removed by a combination of adsorption onto the solids in the process tank and membrane filtration.

The ZeeWeed® membrane filtration system operates under a low-pressure vacuum that is induced within the hollow membrane fibers by a connection to the inlet (suction) side of a centrifugal permeate pump. The treated water is drawn through the membrane by vacuum, enters the hollow fibers and is pumped out to distribution by the permeate pumps. Airflow is introduced at the bottom of the membrane module to create turbulence that scrubs and cleans the outside of the membrane fibers. This reduces the solids accumulation on the membrane surface, thereby allowing the membrane to operate for extended periods at high permeate fluxes. The air also has the beneficial side effect of oxidizing iron and other organic compounds that may be present. It also provides mixing within the process tank to maintain solids in suspension. The membranes are periodically backwashed which consists

of passing permeate through the membranes in the reverse direction to dislodge solids from the membrane surface.

The ZeeWeed® Ultrafiltration system provides a single step process, effectively replacing both the clarification and granular media type (sand) filtration processes found in conventional water treatment plants. The membrane pore size is extremely small and effectively provides a physical barrier to solids present in the water. Therefore, there is no need to create flocculated particles that are large enough to settle in clarifiers or large enough to be captured by granular media filters. Also, as the membranes are immersed directly in the process tank and under only low vacuum, high levels of suspended solids do not foul the membrane.

The ZeeWeed® membranes, operating in an MBR configuration, were considered in this case as an alternative combined treatment step for post-treatment of the effluent from the biological filtration processes. Post-treatment has three main purposes:

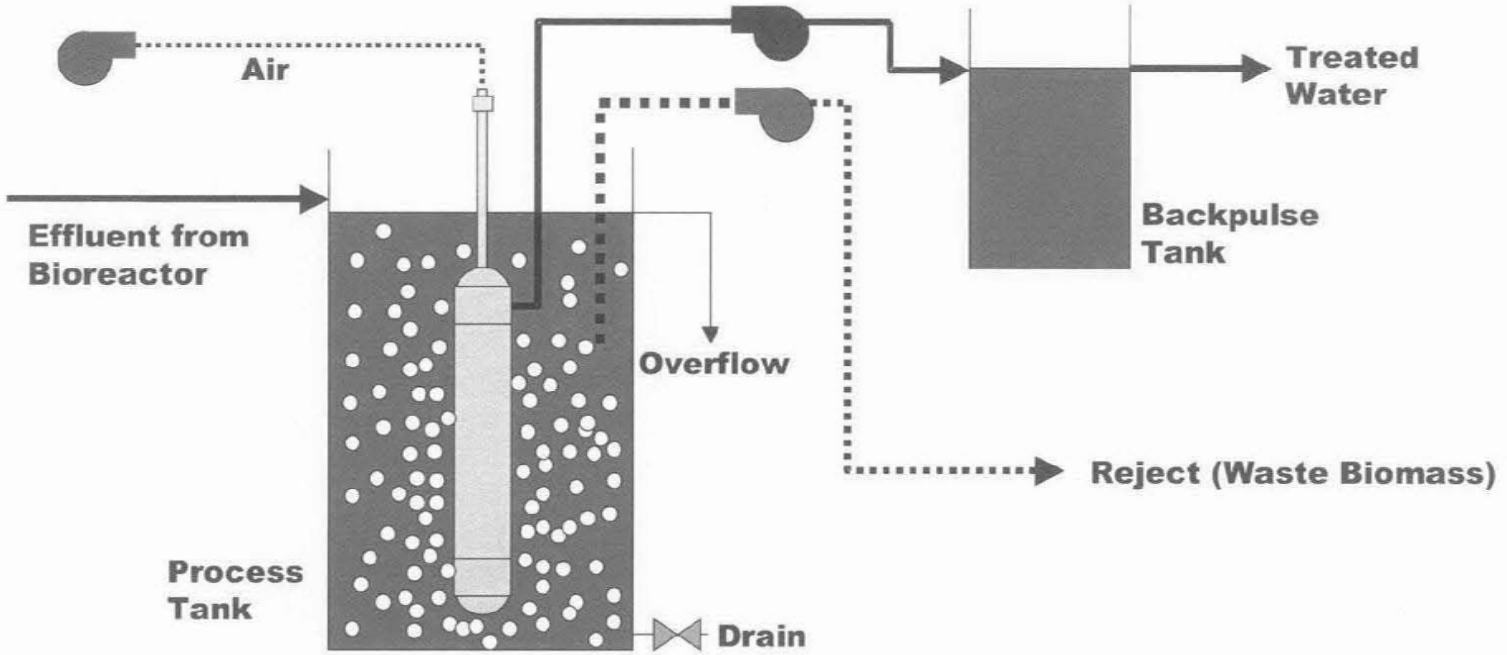
- To provide biological oxidation of excess substrate (acetic acid) fed to the filters;
- To re-oxygenate the water; and
- To provide a barrier for removal of biological matter (HPC bacteria) present in effluent from the biological filters.

A flow schematic for the ZeeWeed®-based post biological FXB filtration process is presented in Figure 3.6.

4.4.3 System Components and Specifications

The unit is equipped with:

- Coagulant Feed Pump and Chemical Tank.
- Cleaning Chemicals.
- Process Tank (hydraulic retention time is 3 to 5 hours).
- Membrane Air Scour Blower.
- Dual head, variable speed, reversible, metering pump for permeate and reject.
- One ZeeWeed®-10 Ultrafiltration Membrane.
- Backpulse Tank.
- Instrumentation and Control Panel.



POST-FXB TREATMENT MBR SCHEMATIC (NOT TO SCALE)

FIGURE 3.6

ZW-10 module and system specifications are listed in Tables 3.4 and 3.5, respectively. Table 3.6 lists system operating limits.

Table 3.4	**SMBR ZW-10 Module Specifications Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency**
Model	ZW-10, Submersible Module
Configuration	Outside/In Hollow Fiber
Dimensions (length x width x height)	6'x4'x5'
Nominal Membrane Surface Area	0.93 m^2 (10 ft^2)
Absolute Pore Size	0.1 micron
Weight of Module (Drained)	1.9 kg (4.2 lb)
Weight of Module (Wet)	2.1 kg (4.6 lb)
Permeate (Fiber Side) Hold-up Volume	0.13 liters (0.033 gal)

Table 3.5	**SMBR ZW-10 System Specifications Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency**
Designation	ZW-10 Bench Test Unit
Electrical service required	115 V, 60 Hz, 2A
Process tank total volume	220 L (58 usg)
Process tank working volume, nominal	190 L (50 usg)
Backpulse tank total volume	20 L (5 usg)
Backpulse tank working volume	15 L (4 usg)
Shipping weight	75 kg (160 lb)
Operating weight	300 kg (660 lb)
Process tank size (with backpulse tank)	75 cm Ø x 160 cm H (30"Ø x 60" H)
Process pump size	40 cm x 15 cm x 15 cm (16" x 6" x 6")
Blower size	40 cm x 25 cm x 25 cm (16" x 10" x 10")
Control panel size	38 cm x 38 cm x 20 cm (15" x 15" x 8")

Table 3.6	SMBR ZW-10 System Operating Limits Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Maximum pump capacity	2 liters/minute (0.53 gpm)
Maximum Transmembrane Pressure	62 kPa (9.0 psig) @ 40°C (104°F)
Typical Operating TMP	10-50 kPa (1.0-7.0 psi) @ 40°C (104°F)
Maximum Operating Temperature	40°C (104°F)
Operating pH range	5-9
Maximum Cleaning Temperature	40°C (104°F)
Cleaning pH Range	2-10.5
Maximum OCl^- Exposure(1)	1,000 mg/L
Maximum TMP Back Wash Pressure	55 kPa (8.0 psi)
Maximum Aeration Flow per Module	3.6 m^3/h (2 scfm)

Notes:
(1) Higher OCl^- concentrations can occasionally be used.

4.5 DBP Formation Potential Testing

4.5.1 Source Waters

DBPFP is defined as the difference between the TTHM or HAA concentration after 7 days of incubation with excess free or combined chlorine residual and the initial TTHM or HAA concentration. Free chlorine and combined chlorine DBPFP tests were conducted using the following source waters:

- FXB and FBR Effluent: This test served as a worst-case scenario test (i.e., no post-treatment downstream to remove excess electron donor).
- SMBR Effluent: This test simulated on-site post-treatment with an aerated SMBR.
- Ozonated FXB and FBR Effluent: This test simulated post-treatment at the Rio Vista WTP.

4.5.2 Formation Potential Method

Test waters were subjected to formation potential evaluation of trihalomethanes and haloacetic acids. The trihalomethane formation potential method (THMFP) is described in the 20th Edition of Standard Methods (Method 5710B). All samples for DBP formation potentials were subjected to the standard methodology for THM formation potential:

"Under standard conditions, samples are buffered at pH 7.0 ±0.2, chlorinated with an excess of free chlorine, and stored at 25 ± 2 degrees C for 7 days to allow the reaction to approach completion. As a minimum, pH is buffered at a defined value and a free chlorine residual of 3 to 5 mg/L exists at the end of the reaction time and THMFP = TTHM at day 7-TTHM at day 0."

In the same manner, HAAFP = THAA at day 7 – THAA at day 0. The same conditions were be used for THMFP and HAAFP with combined chlorine (w:w, chlorine:ammonia = 4).

4.5.3 DBPFP Yield

The THMFP and HAAFP TOXFP yields are a measure of DBP formation potential per mg dissolved organic carbon and are defined as the following:

THMFP yield = THMFP/DOC, where DOC = dissolved organic carbon;

HAAFP yield = HAAFP/DOC and TOXFP yield = TOXFP/DOC.

The yield is a way to estimate the fraction of natural organic matter that is a precursor to formation of halogenated disinfection by-products. It was determined as part of this test.

4.5.4 Chlorine Demand

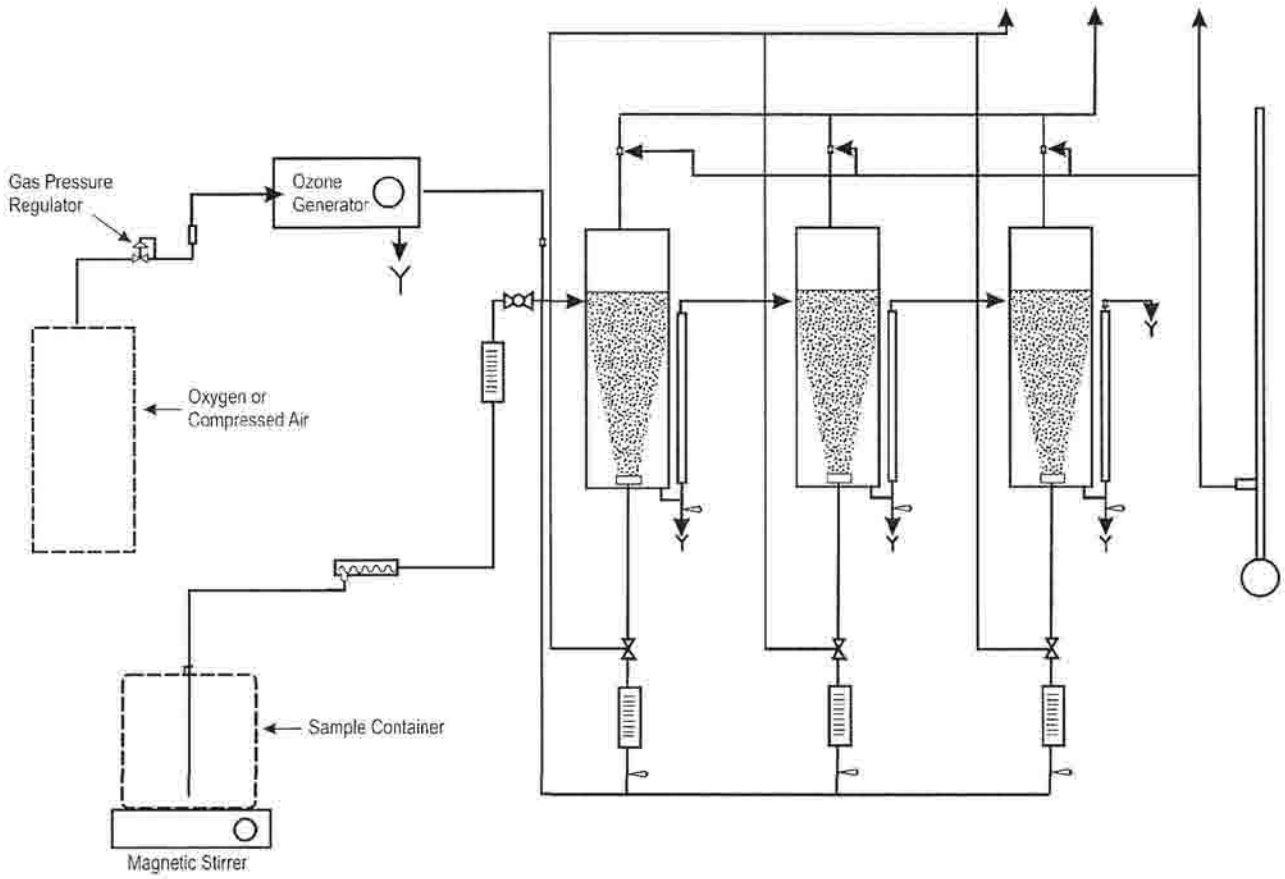
The 7-day chlorine demand was determined by the following procedure:

- Upon receipt of the samples, each sample was analyzed for ammonia, total and free chlorine, and TOC/DOC. The one-hour chlorine demand was measured at day 0. A chlorine:DOC ratio ranging from 2.5 to 5 was used. The results of this preliminary evaluation were used to estimate the required chlorine dose to achieve a 3 to 5 mg/L free chlorine residual at the end of the 7-day incubation period. It was assumed that once the instantaneous free chlorine demand is satisfied, the free chlorine decay would be much slower over the 7-day incubation period.

  A total chlorine residual of 3 to 5 mg/L after the 7-day incubation period was targeted. A chlorine:ammonia ratio of 4 was used.

4.5.5 Ozone Testing

An ozone demand test was conducted on two blended water samples that simulated the feed of the biological effluent to the Rio Vista Surface Water Treatment Plant: 90 percent SPW with 10 percent fixed bed reactor effluent and 90 percent SPW with 10 percent fixed bed effluent spiked with acetic acid. Carollo's bench-scale, continuous-flow, three-chamber ozone contactor was used (Figure 3.7). The hydraulic retention time in the bench-scale contactor was set at 6 minutes, and the test was conducted at ambient water temperature and ambient pH. The applied ozone dose (1.5 mg/L) was equally split between the three chambers. Ozone residuals were measured at the effluent of the third chamber. The



CAROLLO'S CONTINUOUS BENCH-SCALE OZONE REACTOR (NOT TO SCALE)

FIGURE 3.7

20-CLWA204F3.7-6625A10.CDR

effluent of the third ozone chamber was sampled for parameters listed in Table 3.7. Effluent samples were taken after a minimum of three nominal hydraulic retention times (HRTs) were achieved. The ozonated waters were then subjected to chlorine and chloramines for formation potential testing.

Table 3.7 DBPFP Analytical Matrix
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	FXB and FBR BIO Effluent	MBR Effluent	Ozonated Effluent	Lab
TOC/DOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
BDOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	MWH
AOC	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	MWH
TTHM	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
HAA5	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	7-day Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
Free/Total Chlorine				On-site
	After Cl_2/NH_2Cl (time 0 and time 7 day)	After Cl_2/NH_2Cl (time 0 and time 7 day)	After Cl_2/NH_2Cl (time 0 and time 7 day)	
Ammonia	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	On-site
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
pH	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	On-site
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
UV_{254} Absorbance	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
Alkalinity	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
Bromide	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	Before Cl_2/NH_2Cl	CLWA
	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	After Cl_2/NH_2Cl	
Bromate			Before Cl_2/NH_2Cl	CLWA/MWH
Aldehydes			Before Cl_2/NH_2Cl	MWH

4.5.6 Water Quality Analysis

Each sample was analyzed according to the matrix presented in Table 3.7 for full characterization before the addition of disinfectant and 7 days after addition. Ozonated waters were analyzed for bromate and aldehydes. On day 7 of the test following application of chlorine or chloramines, samples were analyzed for free and total chlorine residual, THM4, HAA5, pH, and bromide.

4.6 Simulated Distribution System Test

A follow-up SDS test was conducted on the FBR effluent with free chlorine to confirm the high THM4 and HAA5 levels measured in the FBR effluent during the DBPFP test. Free chlorine was added to the FBR effluent to satisfy the initial demand (approximately 8 mg/L) and to result in a free chlorine residual of 0.3 to 0.5 mg/L after an incubation period of 72 hours. This free chlorine residual and incubation period mimic the free chlorine residuals and maximum hydraulic residence time in the distribution system served by Newhall County Water District wells. The SDS test was conducted at ambient room temperature.

5.0 ANALYTICAL METHODS

Water quality data were measured on-site using bench-top equipment, on-line instruments, and laboratory analyses. The CLWA lab performed the majority of the laboratory analyses. Initial samples for nitrate, sulfate, chloride and bicarbonate were sent to MWH Laboratories in Monrovia, California, in addition to routine analysis for BDOC, sulfide, AOC, VSS, COD, NDMA, uranium, HAAs, TTHMs, and split perchlorate samples. For laboratory analyses, samples were collected in amber glass or polypropylene bottles. Samples sent to MHW labs were placed in bottles supplied by the laboratory and stored at 4 degrees C until analyzed.

5.1 pH

pH was measured on-site using Standard Method 4500-H + B. The pH meter was an Oakton 300 series with a single junction pH electrode. A 2-point calibration of the pH meter was performed daily.

5.2 Temperature

Temperature was measured in accordance with Standard Method 2550 B. This was done daily to check in-line temperature transmitters on the pilot plants. Temperature measurements were made daily using an Oakton 300 series pH/Conductivity meter with a built-in automatic temperature compensation ATC element.

5.3 Turbidity

Feed and permeate water in-line turbidity measurements were logged continuously on the pilot plant using Hach 1720 D low range process turbidimeters. The feed and permeate turbidimeters were calibrated after each run using primary calibration standards purchased from the manufacturer. Turbidimeter sensor lenses were cleaned every two weeks according to the manufacturer's instructions. Turbidimeter flow rates were checked daily to insure that they were within the range required by the manufacturer. Daily bench-top turbidity analyses were performed using a Hach 2100 P field turbidimeter. The instrument was calibrated before measurements using primary turbidity standards (0, 20, 100, 800 NTU).

5.4 Perchlorate

Perchlorate was measured by the CLWA laboratory using EPA method 3.14.0 with a minimum reporting limit of 4 µg/L.

5.5 Common Anions

Analysis for nitrate, nitrite, sulfate, bicarbonate, chloride, and phosphate were provided by CLWA using EPA method 300.0A.

5.6 Dissolved Oxygen

On-site DO measurements were taken using a YSI 5500 portable dissolved oxygen (DO) meter that was calibrated daily.

5.7 Metals

Calcium, magnesium, iron, chromium, and manganese measurements were analyzed using EPA method 200.7 by the CLWA laboratory.

5.8 Sulfide

Total sulfide measurements were made by MWH laboratories using EPA method 376.2.

5.9 NDMA

Analysis for NDMA was made using EPA method 1625 at MWH laboratory.

5.10 Uranium

Uranium analysis was performed by MWH using EPA method 908.1.

5.11 Total Suspended Solids

Total suspended solids (TSS) were measured at CLWA laboratory according to Standard Method 2540 D.

5.12 Total Alkalinity

Total alkalinity was measured at CLWA laboratory according to Standard Method 2320 B.

5.13 Total Hardness

Total hardness was measured at CLWA laboratory according to EPA Method 200.7 and Standard Method 2340 B.

5.14 Organic Carbon

Total organic carbon (TOC) and dissolved organic carbon (DOC) were measured at CLWA laboratory according to EPA Method 415.1. CLWA uses a Shimadzu TOC-5050 Total Organic Carbon Analyzer. The minimum reporting level was 0.7 mg/L. Biodegradable DOC was measured by MWH using the Servais method.

5.15 UV_{254} Absorbance

UV_{254} absorbance was measured at CLWA laboratory according to Standard Method 5910 B. The instrument used for measurements was a Shumadzu UV-1201 UV-VIS Spectrophotometer.

5.16 Total and Free Chlorine

Total and free chlorine concentrations were measured using an on-site, HACH DR 890 field spectrophotometer. High range measurements (0 to 5 mg/L) for total and free chlorine were made in accordance with HACH methods 10070 and 10069, respectively (adapted from Standard Methods). Measurements for total and free chlorine concentrations from 0 to 2.00 mg/L were made using HACH methods 8167 and 8021, respectively (equivalent to Standard Method 4500-Cl G).

5.17 Microbial Parameters

Heterotrophic plates counts (HPCs) and total and fecal coliform counts were measured according to Standard Methods 9215B and 9221 D, respectively by CLWA and MWH laboratories.

5.18 Particle Counts

FXB in-line particle count measurements of the effluent water were logged continuously using a Hach 2200 PCX particle counter. Continuous maintenance of the particle counter (cleaning and flow adjustment) ensured accurate readings.

5.19 Disinfection By-Products

TTHMs and HAAs were measured by MWH laboratories according to EPA Methods 502.2 and 552.2, respectively.

5.20 Ozone Residual

Ozone residual was measured according to the Indigo Blue Method (Standard Method 4500-O3 B). Hach accuvacs were used that withdraw 10 mL of samples directly reacting with the Indigo Powder in the ampule.

5.21 COD

Chemical oxygen demand (COD) analysis was performed at MWH laboratories using EPA method 410.4.

6.0 OPERATING PROTOCOL

6.1 Ion-Exchange Columns

6.1.1 Experimental Design

The bench-scale IX study was conducted by Carollo. There were four objectives for this work:

1. Evaluate the efficiency of three ion-exchange resins for perchlorate removal under the identical feed water, flow rate, and EBCT.
2. Establish the perchlorate breakthrough curves for Saugus Aquifer water using three perchlorate-selective, throw-away resins.
3. Determine the NDMA formation potential of treating Saugus Aquifer water with these resins.
4. Determine characteristics of the spent resin.

- Phase 1 (Perchlorate Breakthrough: Approximately 2 to 4 Months): The columns were fed at a constant flow rate with perchlorate- and sulfate-spiked groundwater and sufficient influent and effluent samples were taken to establish a complete breakthrough curve for each anion. The columns were shut off once perchlorate breakthrough in all columns reached approximately 20 percent of the feed concentration. This translates into an effluent perchlorate concentration of 10 µg/L.

  The operating conditions for each ion-exchange column are listed in Table 3.8. The columns were operated at a service loading rate of 5 gpm/ft^3. With a resin volume of 22.5 mL in each column, the flow rate to each column was approximately 15 mL/min, which equates to an EBCT of 1.5 minutes.

Table 3.8	Breakthrough of Anions Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Parameter	**Value**
EBCT	1.5 min
Service Flow Rate	15 mL/min
Service Loading Rate	5 gpm/ft^3
Surface Loading Rate	2.1gpm/ft^2
Run Length- from Preliminary Modeling	> 20,000 BVs
Batch Feedwater Volume per Column	40 gal/week
Total Batch Feedwater Volume	119 gal/week

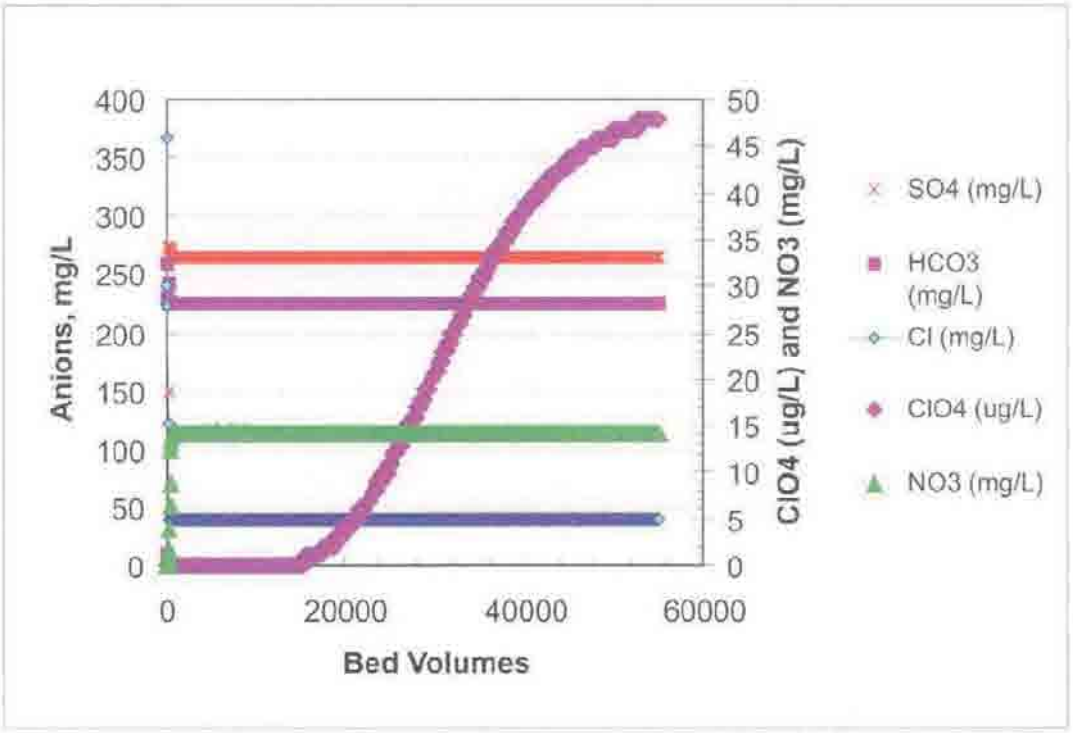
The breakthrough profiles of the various anions depend on the resins selected. Breakthrough modeling data (IX Pro Software) for a generic perchlorate selective resin are tabulated and plotted in Table 3.9 and Figure 3.8, respectively. The anticipated anionic breakthrough order was as follows: bicarbonate, sulfate, nitrate, perchlorate. The inputs to the modeling program were: component concentration, component separation factor (or selectivity coefficient); resin capacity; number of plates; and run length. The separation factors were based on the research conducted by Tripp et al. (2003).

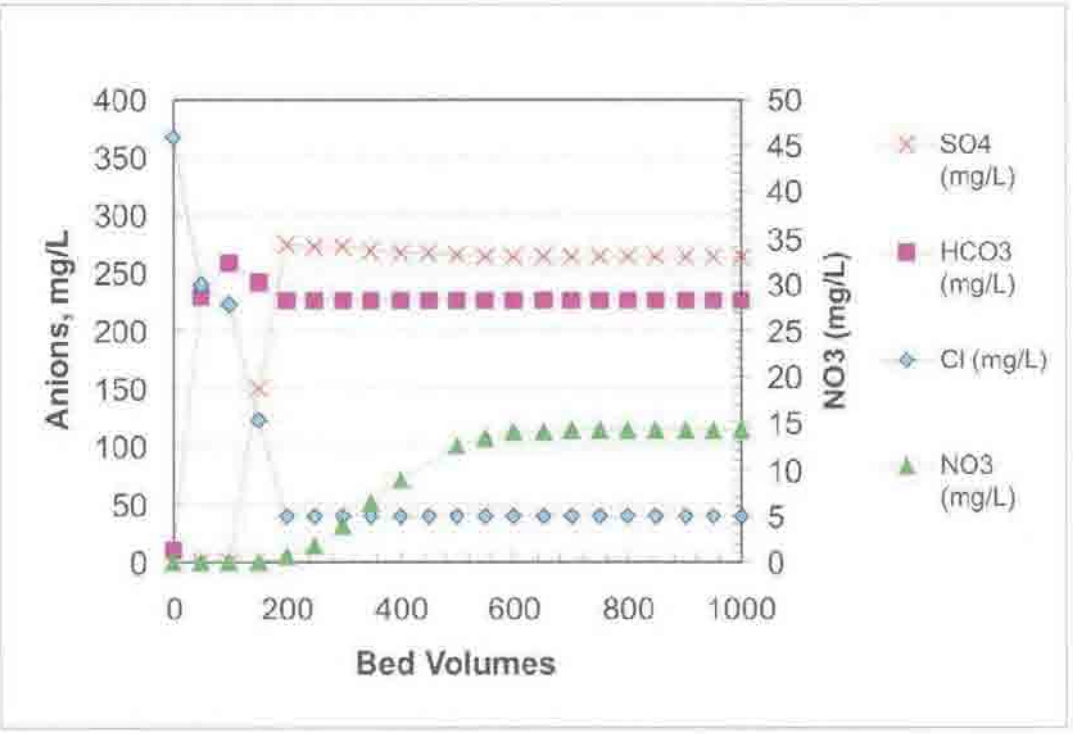
Table 3.9	Breakthrough of Anions for a Generic Perchlorate Selective Resin Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency	
Anions	**Bed Volumes (BVs)**	**Equivalent Time (EBCTxBVs)**
Bicarbonate	40 BVs for complete breakthrough	1 hr
Sulfate	200 BVs for complete breakthrough	5 hours
Nitrate	600 BVs for complete breakthrough	15 hours
Perchlorate	>20,000 BVs for breakthrough up to 4 μg/L	21 days

6.1.2 Sampling

Carollo staff was responsible for day-to-day operation and sampling of the bench-scale IX columns during regular weekdays (excluding holidays). CLWA staff checked on the columns during the weekend and holidays. To address emergencies during off-hours, CLWA staff contacted the lead Carollo operator. Operator log sheets were used daily to record flow rates and sample collection times.

Perchlorate-spiked raw water was analyzed once per week for perchlorate, nitrate, sulfate, bicarbonate, chloride, pH, and conductivity.





ANITICIPATED BREAKTHROUGH CURVES FOR KEY ANIONS

FIGURE 3.8

Sampling frequencies for column effluents were established so that breakthrough profiles for sulfate, bicarbonate, chloride, nitrate, and perchlorate were captured. Sampling frequencies were as follows:

- First 48 hours: One sample per hour. Analyzed 12 (every 3 to 4 hours) samples for nitrate, sulfate, chloride, and bicarbonate. Perchlorate was analyzed three times per week.
- After the first two days of operation, sample frequencies were decreased to six samples per day, depending on whether the parameter has broken through. Perchlorate was analyzed three per week.

Table 3.10 lists the sampling frequencies and locations from Day 3 until 20 percent perchlorate breakthrough occurred. This sampling schedule was adequate to capture breakthrough of all anions for all three types of resins. During the first week of operation (i.e., the time-sensitive breakthrough period for bicarbonate, chloride, sulfate, and nitrate), samples were collected with a timed autosampler. Subsequently, all samples were collected manually at the frequencies describe in Table 3.10.

Table 3.10 Testing Matrix for Bench-Scale Ion Exchange Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Chemical Parameter	Lab	Sampling Frequency from Each Column Effluent		
		Day 3-Day 7	Weeks 2-5	Weeks 6-10
pH[1]	-	1/day	1/day	1/day
Temperature[1]	-	1/day	1/day	1/day
Conductivity[1]	-	1/day	1/day	1/day
Perchlorate	CLWA & MWH	2/week	3/week	1/day
Nitrate	CLWA	6/day	3/week	1/week
Sulfate	CLWA	6/day	3/week	1/week
Bicarbonate	CLWA	6/day	3/week	1/week
Chloride	CLWA	6/day	3/week	1/week
Alkalinity	CLWA	2/week	1/week	1/week
Hardness	CLWA	1/week	1/week	1/week
Iron	CLWA	1/week	1/week	1/week
Manganese	CLWA	1/week	1/week	1/week
Calcium	CLWA	1/week	1/week	1/week
Magnesium	CLWA	1/week	1/week	1/week

Table 3.10 Testing Matrix for Bench-Scale Ion Exchange Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Chemical Parameter	Lab	Sampling Frequency from Each Column Effluent		
		Day 3-Day 7	Weeks 2-5	Weeks 6-10
Turbidity	CLWA	1/week	1/week	1/week
TOC	CLWA	1/week	1/week	1/week
Chromium	CLWA	As needed	As needed	As needed
NDMA	MWH	As needed	As needed	As needed
Bromide	CLWA	As needed	As needed	As needed
Arsenic	CLWA	As needed	As needed	As needed
Uranium	MWH	As needed	As needed	As needed

Note:
(1) Measured on-site.

Table 3.10 also identifies the laboratory that was responsible for analyzing each parameter. The majority of parameters were analyzed at CLWA, while perchlorate checks, NDMA, and uranium were measured at MWH laboratories. All samples not analyzed immediately were stored at 4 degrees C for no more than the recommended holding time before analysis.

6.2 Biological Fixed-Bed Filter

6.2.1 Experimental Design

A 6-month biological FXB filtration pilot study was conducted. The overall objective of this study was to demonstrate the efficacy of biological FXB filtration for perchlorate removal from Saugus aquifer water. A more specific objective was to determine whether biologically acclimating the GAC with indigenous microorganisms would be sufficient to achieve efficient perchlorate reduction in the filter. Once these objectives were achieved, a testing protocol was employed to determine requirements for EBCT, backwashing protocol, and acetic acid addition. A series of short-term experiments were also performed to evaluate the robustness of the process with respect to system upsets.

During the first 2 weeks of pilot-testing, acetic acid was fed to each filter at a concentration twice that required to stoichiometrically reduce all influent DO and nitrate ($(O_2 \Rightarrow H_2O$, $NO_3^- \Rightarrow N_2$; for calculation purposes, it was assumed that no electron donor is used for cell synthesis). This ensured that electron donor was not limiting. EBCT and acetic acid feed were optimized during Phase 2 of the FXB pilot study. Perchlorate was spiked to the influent at 50 μg/L except during the perchlorate spiking tests (see Phase 3 of this section). Phosphoric acid was added for a two-month portion of the pilot study. No other chemicals were added to the process system during the pilot study.

- Phase 1 (Biological Acclimation): The purpose of this phase was to determine whether or not efficient perchlorate-reducing biological activity could be developed in the GAC filters using microorganisms indigenous to the Saugus Aquifer. Once the filtration skid was mobilized, the filters began treating Saugus Aquifer water from Well NC-12 spiked with perchlorate. Technical-grade acetic acid (electron donor) was added to the feed water. An EBCT of 15 minutes was used during the first few weeks of the acclimation phase to allow for the rapid saturation of sorption sites on the surface of the GAC and to promote rapid growth of the microbial community in the biological FXB filter.

- Phase 2 (EBCT and Acetic Acid Optimization): The purpose of this phase was to determine the minimum EBCT required to achieve perchlorate removal to below the 4 μg/L reporting limit ($EBCT_{critical}$). Acetic acid was initially added at 100 percent excess relative to the emperical stoichiometric influent DO and nitrate demand (based on an influent DO concentration of 7.0 mg/L and an influent nitrate concentration of 15 mg/L). EBCT was incrementally lowered until perchlorate breakthrough was observed. Once $EBCT_{critical}$ was found, the feed acetic acid concentration was incrementally lowered until perchlorate breakthrough was observed ($AC_{critical}$).

- Phase 3 (Robustness Characterization): The purpose of this phase was to determine how the FXB system responds to various process up-sets. The $EBCT_{critical}$ and $AC_{critical}$ were set as operating parameters throughout this phase of testing. Five process upsets were tested: 1) backwashing, 2) perchlorate spiking, 3) nitrate spiking, 4) electron donor feed failure simulation, and 5) a total system shutdown.
  - Backwashing: These tests were designed to evaluate perchlorate removal performance immediately after backwash episodes. Because backwashes remove perchlorate-reducing biomass from the filter, it is possible that perchlorate breakthrough would occur after backwashes until the biological community in the filter had sufficient time to regrow. This test was performed twice, one-month apart. Samples were taken a 0, 15, 30, 45, and 60 minutes after the filter was put into production following a backwash.
  - Perchlorate Spiking: These tests were designed to evaluate perchlorate removal performance during periods of transient perchlorate loading episodes. Perchlorate was spiked to the feed at 100 μg/L for a 48-hour period and effluent perchlorate concentrations were monitored. Influent perchlorate concentration was then readjusted to 50 μg/L and the system was allowed to stabilize (i.e., reestablish pre-spiking, perchlorate removal performance), if necessary. A 48-hour spiking test was then performed using 300 μg/L perchlorate, followed by a 5 mg/L perchlorate spiking test. The 5 μg/L perchlorate spiking test was designed to: 1) demonstrate perchlorate removal performance at a low-end feed perchlorate concentration, 2) initiate the desorption of perchlorate from the carbon surface (if any) as the bed equilibrated with a lowered feed perchlorate concentration. Along

with the regular daily samples, samples were taken at 0, 15, 30, 45, and 60 minutes after the filter was put into production following a change in feed perchlorate concentration.

- Nitrate Spiking: This test was designed to evaluate perchlorate removal performance during periods of transient nitrate loading episodes. Over a 48-hour period, nitrate was spiked to the feed to reach a final influent concentration of 30 mg/L (the historical Saugus aquifer maximum concentration) and effluent perchlorate concentrations were monitored. During the first part of the test, EBCT and acetic acid concentration were not adjusted to account for the increased nitrate in the feed. A second nitrate spiking test was performed during which the EBCT and acetic acid were both adjusted to achieve perchlorate removal to below detection. Along with the regular daily samples, samples were taken at 0, 15, 30, 45, and 60 minutes after the filter was put into production following a change in feed nitrate concentration.
- Electron Donor Feed Failure Simulation: This test was designed to evaluate perchlorate removal performance during a period of simulated electron donor feed system failure. The acetic acid feed was shut off for 48 hours and effluent perchlorate concentrations were monitored. The acetic acid feed was then restarted and the time required to reestablish efficient perchlorate reduction was evaluated. Along with the regular daily samples, samples were taken at 0, 15, 30, 45, 60, 120, 180, 240, and 630 minutes after the filter was put into production following a change in feed perchlorate concentration.
- System Shutdown: This test was designed to evaluate perchlorate removal performance after the system has been shut down for 1-day, 2-day, and 2-week periods. The time required to reestablish efficient perchlorate reduction in the filters was evaluated.

- Backwashing Protocol: Backwashes were performed using effluent water stored in the pilot backwash tank (see Figure 2.4). Backwashes were performed approximately every 48 hours. If run times did not reach 48 hours due to rapid headloss build-up, operating parameters were adjusted (i.e., EBCT and acetic acid concentration). Backwashes consisted of a 10-minute air scour period using ~0.1-0.2 scfm, followed by a 20-minute backwash at 0.8 gpm (9 gpm/ft^2), which resulted in a 45 percent bed expansion.

6.2.2 Sampling

Table 3.11 lists the various water quality parameters that were measured, sampling location and frequency, and the associated laboratory responsible for the analysis. Increased perchlorate sampling frequencies during the challenge tests are described above.

Table 3.11 Sampling Schedule for Fixed-Bed Biological Pilot Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
ClO_4^-	Feed	Once per 2 days	CLWA and occasional checks with MWH
	Effluent	Daily	
	Backwash	As Needed	
NO_3^-	Feed	2/week	CLWA
	Effluent	3/week	
DO	Feed	Daily	On-site
	Effluent	Daily	
NO_2^-	Feed	1/week	CLWA
	Effluent	1/week	
PO_4^{3-}	Feed	1/week	CLWA
	Effluent	1/week	
SO_4^{2-}	Feed	1/week	CLWA
	Effluent	1/week	
NH_3	Feed	1/week	CLWA
	Effluent	2/week	
H_2S	Feed	1/week	MWH
	Effluent	1/week	
TOC/DOC	Feed	3/week	CLWA
	Effluent	3/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPC	Feed	2/week	CLWA
	Effluent	2/week	
Total coliforms	Feed	1/week	CLWA & MWH
	Effluent	1/week	
	Backwash	1/backwash	
Fecal coliforms	Feed	1/week	CLWA & MWH
	Effluent	1/week	
	Backwash	1/backwash	
Turbidity	Feed	3/wk	Dedicated in-line HACH 1720D turbidimeters and Bench-top turbidimeter
	Effluent	Continuous	
Total particle counts	Effluent	Continuous	In-line particle counter

Table 3.11 Sampling Schedule for Fixed-Bed Biological Pilot Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Sampling Location**	**Sampling Frequency**	**Lab**
pH	Feed	Daily	On-site
	Effluent	Daily	
Headloss	Across FXB	Continuous	In-line pressure transducer
Backwash volatile suspended solids (VSS)	Backwash water	Once per backwash	CLWA
Assimilable Organic Carbon	Backwash water	Once per backwash	MWH
Chemical Oxygen Demand	Backwash water	Once per backwash	MWH
Total Suspended Solids	Backwash water	Once per backwash	MWH

Given that adjustments to process operation were made based on perchlorate removal performance in the filters, it was important to maintain a short turn-around time for perchlorate samples throughout pilot testing. Therefore, perchlorate samples was taken for analysis at the CLWA laboratory to expedite the acquisition of perchlorate data. However, since the CLWA laboratory has partial certification for perchlorate analysis, duplicate samples were set weekly to MWH for analysis. Bacterial samples, TOC/DOC, and anions were transported to the laboratory every Tuesday. Additional anion samples were transported to the lab every 3 days (i.e., Monday, Wednesday, and Friday) due to the short holding time of nitrate (48 hours).

The on-line ion chromatography perchlorate analyzer (DX-800 Process Analyzer), which was generally used to continuously monitor FBR effluent perchlorate concentrations, was configured to accept manual injections of FXB samples. Thus, near real-time perchlorate removal performance was monitored during the majority of FXB pilot testing.

6.3 Biological Fluidized-Bed Reactor

6.3.1 Experimental Design

A 6-month biological FBR pilot study was conducted using Shaw Environmental-Envirogen/US Filter/Envirex Products' low-flow FBR. The overall objective of this study was to demonstrate the efficacy of an FBR biological process for perchlorate removal from Saugus aquifer water. A more specific objective was to determine whether biologically acclimating the GAC with indigenous microorganisms is sufficient to achieve efficient perchlorate reduction in the FBR. The testing protocol was also designed to optimize HRT and acetic acid addition, and to test the robustness of the process during system upsets.

However, establishing consistent perchlorate removal to below detection required the entire length of the pilot testing period.

The FBR system was monitored using a Dionex On-Line Ion Chromatography Perchlorate analyzer (DX-800 Process Analyzer). The use of the DX-800 analyzer provided a better understanding of the instrument's capabilities in a field setting. The testing of this system also allowed for immediate operational responses based on FBR performance.

- Phase 1 (Biological Acclimation): During start-up, the FBR system was filled with NC-12 groundwater. Carbon was added to provide a desired settled bed height of approximately 5 feet. The system was then started in recycle and the carbon hydraulically fluidized 1.25 to 1.30 times the settled bed height. The feed and recycle rates required to meet this bed expansion were documented and utilized as a baseline for future bed growth measurements. Following this procedure, nutrients and electron donor were added to the reactor in batch mode to allow the microbial consortium to develop over a period of two days. The system was then put into continuous operation mode at a feed flow of 1 gpm and a recycle flow of 8 to 9 gpm. The feed flow was set between 1 and 3 gpm throughout pilot testing and the recycle flow was typically set so that total flow was approximately 10 gpm.

- Phase 2 (Continuous Operation): This phase was initially intended to determine optimal feed and recycle flow rates as well as optimal feed phosphorous and acetic acid concentrations. During the bulk of this phase, Carollo worked with Shaw Environmental (formerly Envirogen) staff to make mechanical and operational changes designed to improve the perchlorate removal performance of the FBR.

- Phase 3 (Robustness Characterization): FBR robustness characterization testing did not occur for the FBR as stable performance was not achieved during the 6-month period.

6.3.2 Sampling

Table 3.12 lists the various water quality parameters that were measured once start-up was completed, the sampling location and frequency, and the associated laboratory responsible for the analysis.

Table 3.12 Fluidized-Bed Sampling Matrix
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
Perchlorate	Feed	Once per 2 days	CLWA and occasional checks with MWH + on-line ion chromatograph
	Effluent	Daily	

Table 3.12 Fluidized-Bed Sampling Matrix
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
Nitrate	Feed	3/week	CLWA
	Effluent	3/week	
Nitrite	Feed	1/week	CLWA
	Effluent	1/week	
Phosphate	Feed	1/week	CLWA
	Effluent	1/week	
Sulfate	Feed	-	CLWA
	Effluent	-	
DO	Influent	Daily	On-site analysis
	Effluent	Daily	
H_2S	Influent	1/week	MWH
	Effluent	1/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPC	Feed	1/week	CLWA
	Effluent	1/week	
Total Coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Fecal Coliforms	Feed	1/week	CLWA
	Effluent	1/week	
TOC	Feed	-	CLWA
	Effluent	2/week	
TSS	Feed	-	CLWA
	Effluent	-	
Ammonia	Feed	1/week	CLWA
	Effluent	1/week	
Total phosphorous	Feed	1/week	CLWA
	Effluent	2/week	

6.4 Submerged Membrane Bioreactor

6.4.1 Experimental Design

Due to the short SMBR testing period, the experimental design focused only on demonstration, not optimization, of the SMBR process. Operational settings for the SMBR are listed in Table 3.13.

Table 3.13 SMBR ZW-10 System Operating Parameters Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Value
Q_{FEED} (mL/min)	300-680
$Q_{PERMEATE}$ (mL/min)	300-680
Recovery (%)	80-99
HRT (hours)	4.7-10.6
Aeration rate (scfm)	1-2

For the majority of SMBR testing, the biological FXB filter was operated using $EBCT_{critical}$ and $AC_{critical}$. SMBR backpulses were initiated every 15 minutes, for a duration of 15 seconds. The system was operated continuously and monitored regularly for two months to determine whether each of the four post-treatment objectives was being met. A three-week acetic acid spiking test was performed after it was observed that biological FXB filter effluent contained non-detect concentrations of TOC. During this test, 3.5 mg/L of acetic acid carbon was continuously spiked to the SMBR process tank using a peristaltic pump to validate residual organic removal efficiency.

6.4.2 Sampling

Table 3.14 lists the various water quality parameters that were measured, sampling location and frequency, and the associated laboratory responsible for the analysis.

Table 3.14 SMBR Sampling Matrix Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Parameter	Sampling Location	Sampling Frequency	Lab
DO	Feed	Daily	On-site
	Effluent	Daily	
H_2S	Feed	1/week	CLWA & qualitative (i.e., by nose)
	Effluent	1/week	

Table 3.14 SMBR Sampling Matrix Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
Parameter	**Sampling Location**	**Sampling Frequency**	**Lab**
TOC/DOC	Feed	3/week	CLWA
	Effluent	3/week	
BDOC	Feed	2/week	MWH
	Effluent	2/week	
HPCs	Feed	2/week	CLWA
	Effluent	2/week	
Total coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Fecal coliforms	Feed	1/week	CLWA
	Effluent	1/week	
Turbidity	Feed	3/week	Bench-top turbidimeter
	Effluent	3/week	
pH	Feed	2/week	On-site probe
	Effluent	2/week	
Process tank volatile suspended solids	Process tank	2/week	CLWA

7.0 TEST RESULTS

7.1 Ion-Exchange Testing Results

7.1.1 Feed Water Quality

The range of constituent concentrations in the feed water to the ion-exchange columns is presented in Table 3.15. The feed water is characterized as low in organic matter, moderately hard and buffered, and moderate in iron and bromide. It should be noted that during the month of October 2003 the NC-12 groundwater quality was observed to slowly change over a 4-week period before returning to its steady-state quality at the end of the bench-scale study. The nitrate concentration decreased from 3.3 mg/L as N to 1.7 mg/L as N, sulfate increased from 290 mg/L to 373 mg/L (after sulfate spike), and the chloride concentration increased from 35 mg/L to 45 mg/L.

Table 3.15	Range of Constituent Concentration in Feedwater to the IX System Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Chemical Parameter	**Unit**	**Count**	**Average**	**Min**	**Max**
Perchlorate	µg/L	18	45.5	42.6	52.9
Nitrate-N	mg/L	18	3.0	1.7	3.4
Sulfate	mg/L	18	301	276	373
Bicarbonate	mg/L	18	199	171	221
Chloride	mg/L	18	37	32	45
pH	—	18	8.1	7.9	8.4
Alkalinity	mg/L as $CaCO_3$	18	165	152	181
TOC	mg/L			<0.7	<0.7
DOC	mg/L			<0.7	<0.7
Arsenic	µg/L			ND	ND
Iron	µg/L	9	15.3	7	27
Manganese	µg/L	9		<1	<1
Hardness	mg/L as $CaCO_3$	2		282	315
Calcium	mg/L	3	84	77	94
Magnesium	mg/L	3	17.7	17	18
Uranium	pCi/L			ND	1.03
NDMA	ng/L			ND	ND
Vanadium	µg/L	3	10.7	2.0	15.0
Bromide	mg/L	2		0.22	0.24
Turbidity	NTU	12	0.337	0.180	0.580
Conductivity	µmhos/cm	15	1043	1003	1158

7.1.2 Operational Data

Two operational parameters were recorded on a daily basis for the ion-exchange setup: flowrate through the columns (Figure 3.9) and pressure buildup. The pump setting and/or the needle valves connected downstream of the columns were adjusted when the measured flow rate deviated by more than 10 percent from the target flow rate of 15 mL/min. The flow rate ranged from 13.5 to 16.5 mL/min during the course of the study, which resulted in an EBCT range of 1.4 to 1.6 minutes. The pressure drop remained constant at 5 psi throughout most of the project duration, and increased to 7 psi during the last two weeks of testing. The level of water in the 55-gal feed tanks was monitored daily. The experimental apparatus was monitored for the presence of air bubbles and leaks.

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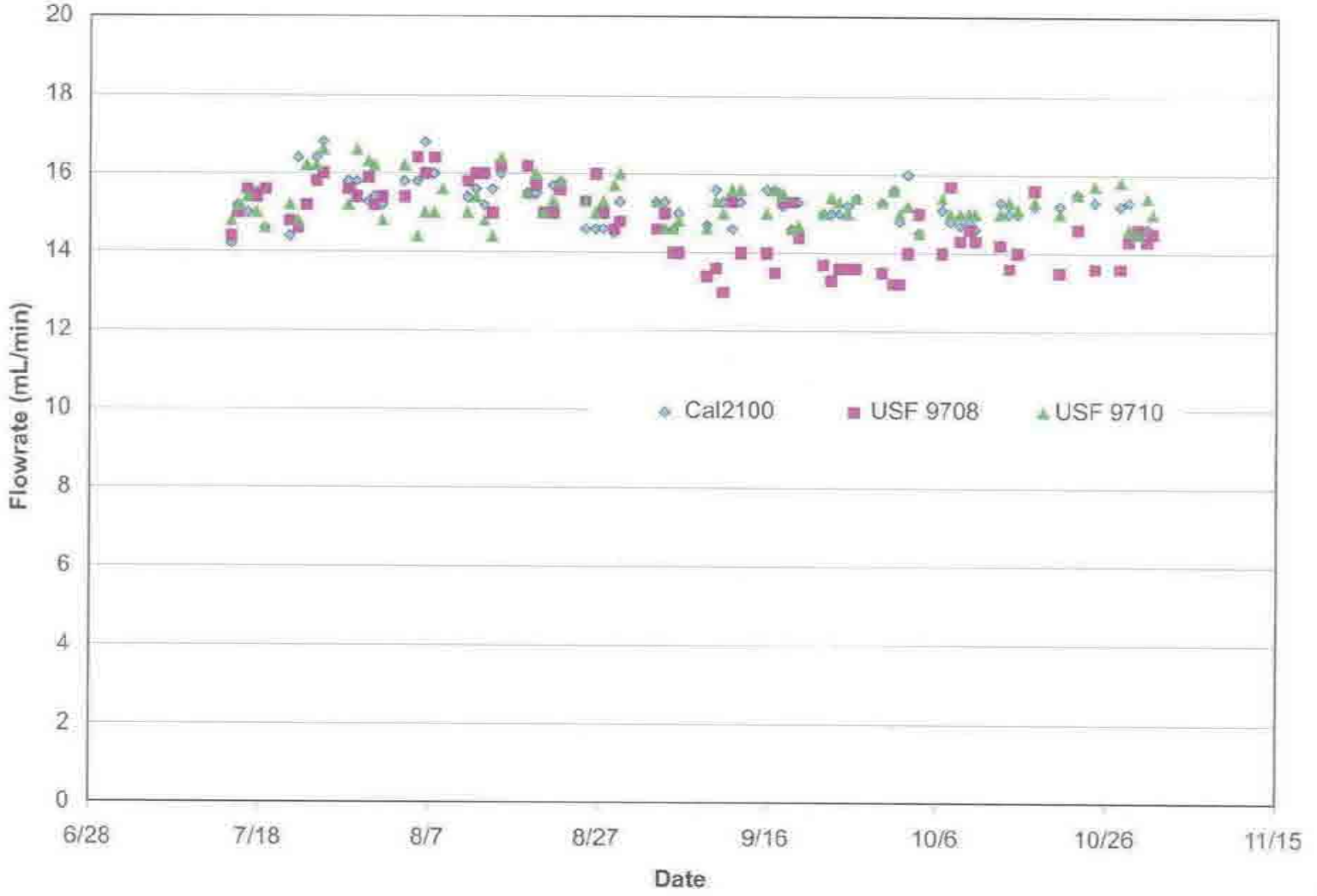

FLOW RATES MEASURED THROUGH THE THREE ION-EXCHANGE COLUMNS

FIGURE 3.9

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7.1.3 Temperature

The temperature, which was measured in the effluent of the three columns over the course of the study, ranged from 32 degrees C (89 degrees F) in the summer months to 16 degrees C (61 degrees F) in the fall (Figure 3.10).

7.1.4 pH Values

pH was measured in the feed and effluent of the three columns, and both ranged from 7.6 to 8.4 (Figure 3.11), indicating only minor impact on pH by the resins.

7.1.5 Breakthrough Curves

Breakthrough curves of key anions were developed for the ion-exchange resins under identical conditions of water quality, flowrate, and EBCT. The three columns were operated in parallel using one feed pump. The columns ran continuously with minimal shut-down periods. A 45-hour shut-down period was simulated at the end of the study to investigate its potential effect on breakthrough.

7.1.5.1 High-Resolution Breakthrough Curves of Key Anions

As predicted by the IXPro Model, the breakthrough of most anions (with the exception of perchlorate) was very fast and occurred in the first 24 hours of operation. This breakthrough sequence was similar for the three resins tested, as illustrated in Figures 3.12 through 3.14. The figures are plotted for the first 2,000 bed volumes of run time.Bicarbonate was the first anion to break through reaching its background value of 220 mg/L after 80 to120 bed volumes. Sulfate was next to breakthrough after 80 bed volumes and reached its steady-state concentration of 300 mg/L after 280 to 310 bed volumes. The nitrate breakthrough rate was somewhat different for the three columns. Nitrate broke through after 280 bed volumes, 440 bed volumes, and 600 bed volumes from USF 9708, USF 9710, and Cal 2100 resins, respectively. Steady-state concentrations were reached after 1,000 bed volumes for all three tested resins. No chromatographic peaking was observed for any of the critical anions within the test conditions.

Chloride concentration dropped from a high of approximately 325 mg/L to background levels of approximately 35 mg/L after 280 bed volumes. The highest measured chloride levels in the first 280 bed volumes did not exceed the Title 22 Secondary Maximum Contaminant Level of 500 mg/L. However, they did exceed the Los Angeles County Sanitation District (LACSD) maximum acceptable chloride level of 100 mg/L in the Santa Clara Valley Basin.

In a full-scale application, following a resin change-out, the new resin may need to be flushed over a few days to meet DHS requirements. This flushed water, which will contain higher concentrations of chloride during the first few hours of flushing (as illustrated in Figures 3.12 to 3.14), will need to be dealt with by discharge to a sewer, for example. The flushed water will be free of perchlorate.

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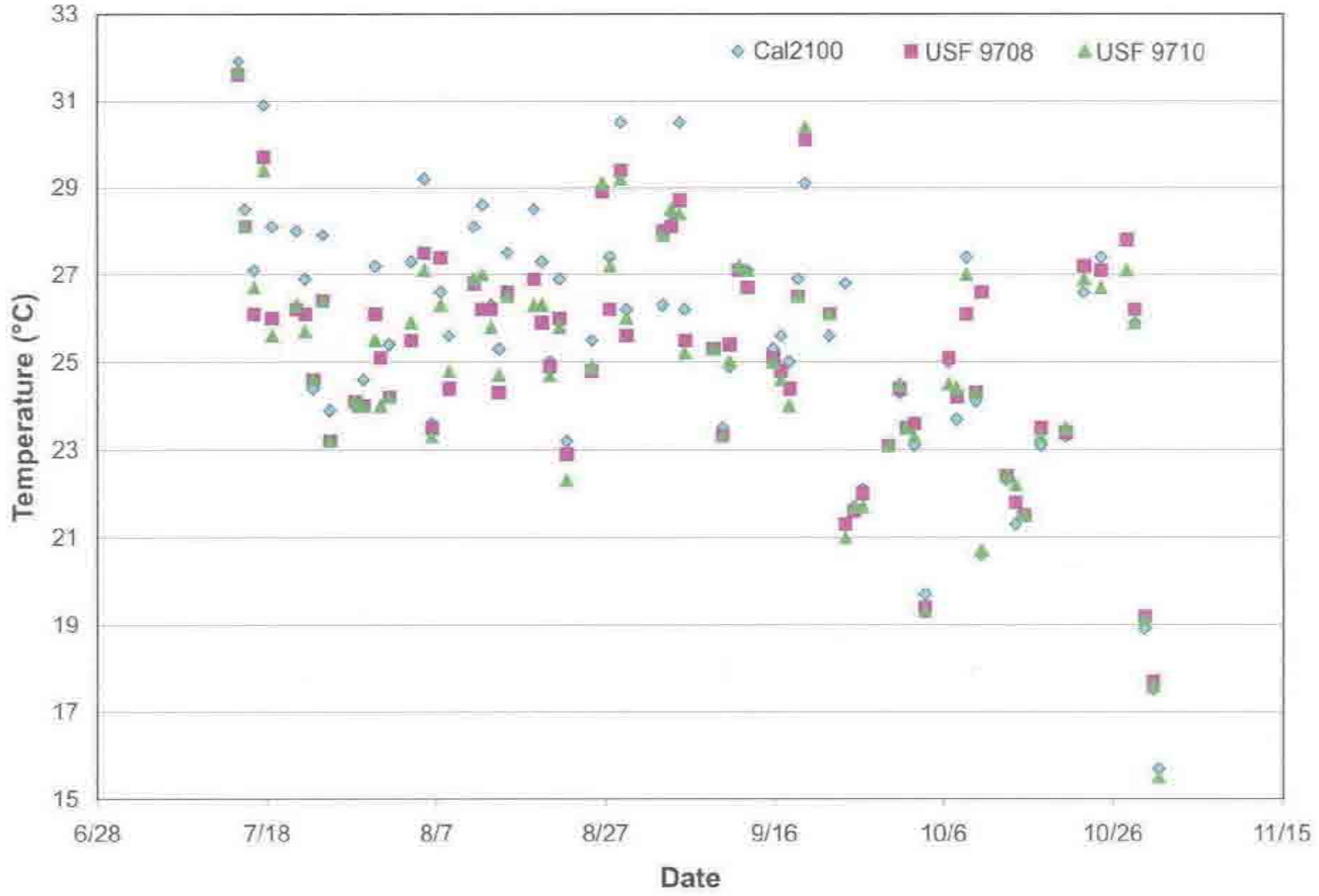

COLUMN EFFLUENT TEMPERATURE MEASURED OVER THE COURSE OF THE STUDY

FIGURE 3.10

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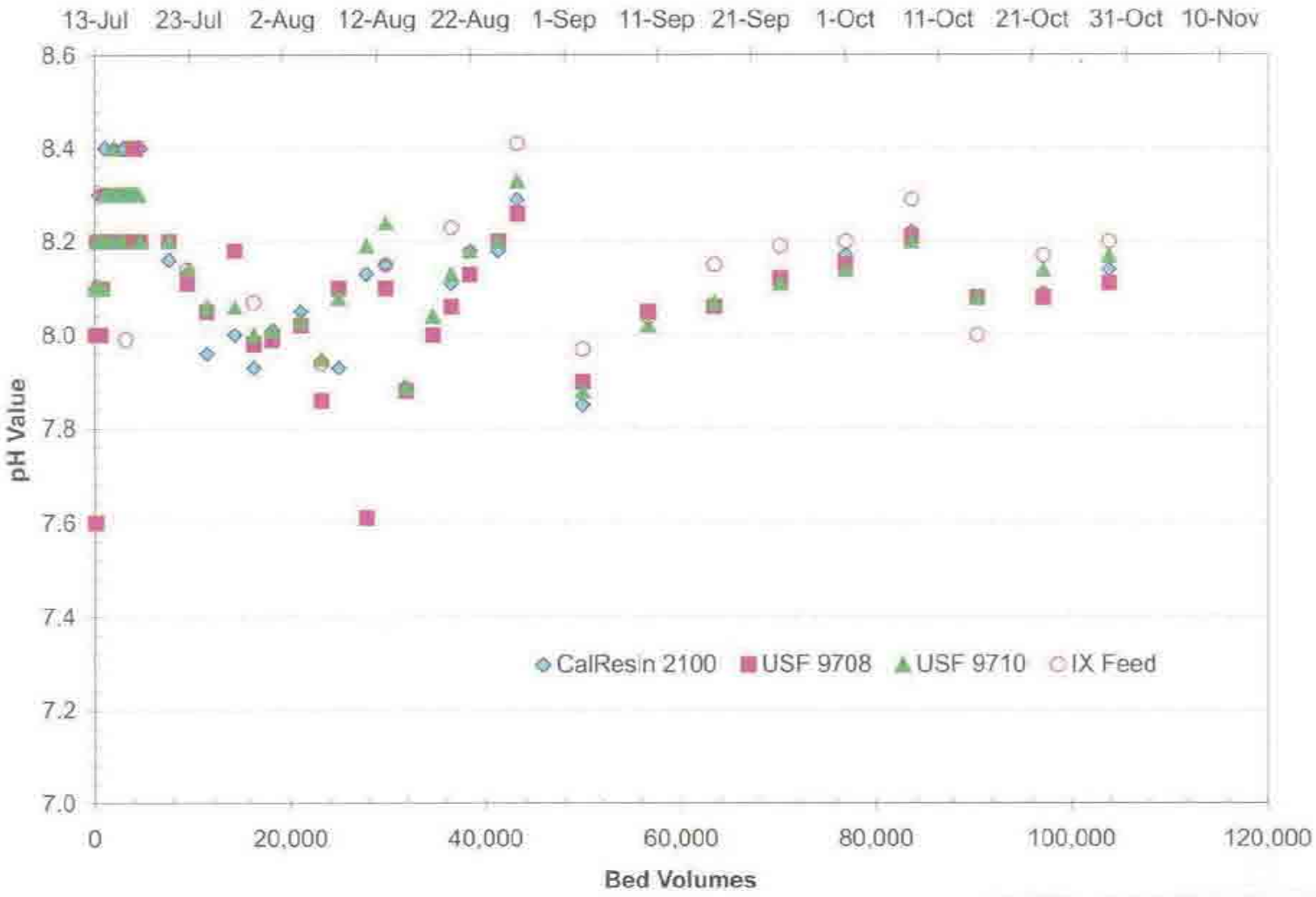
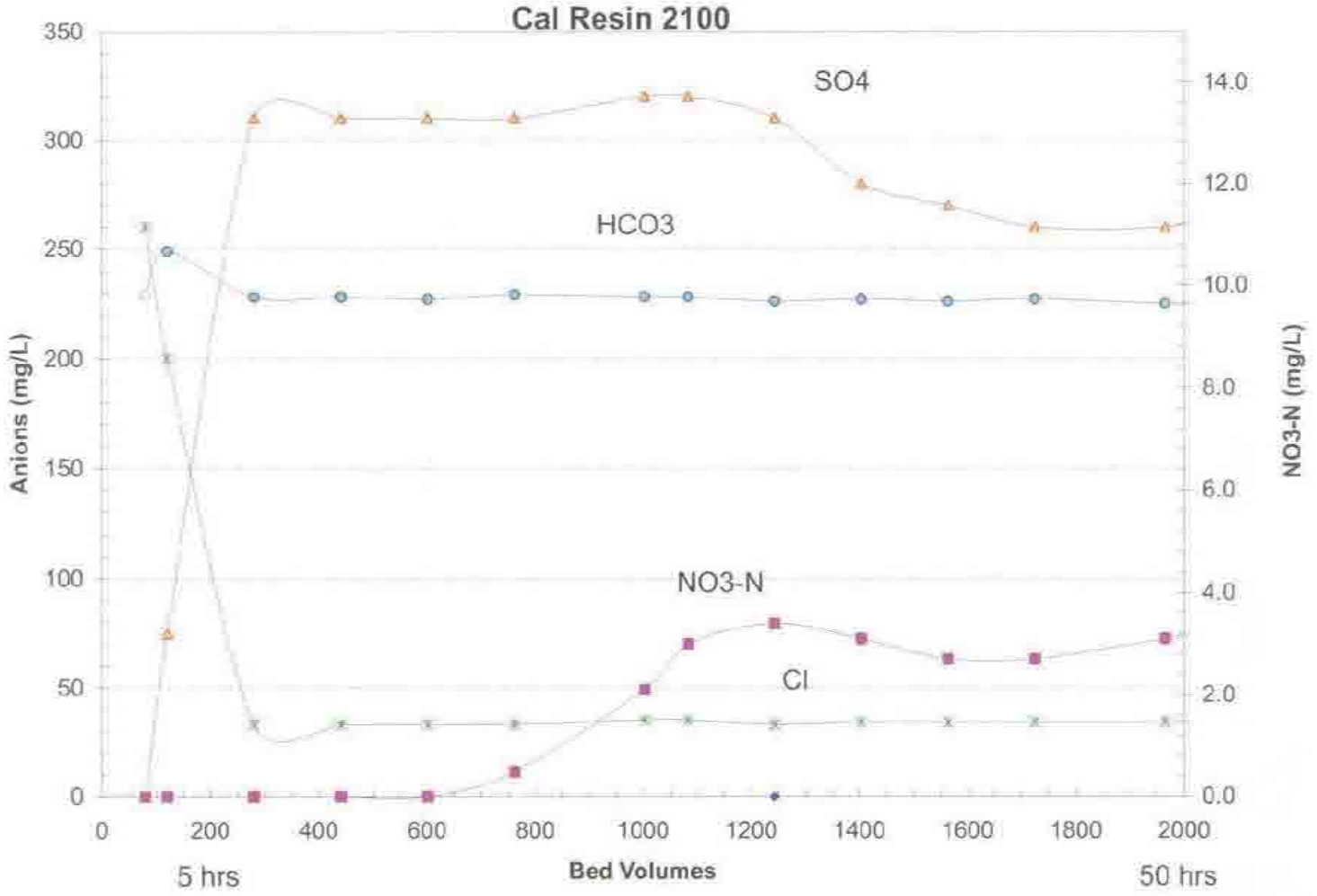


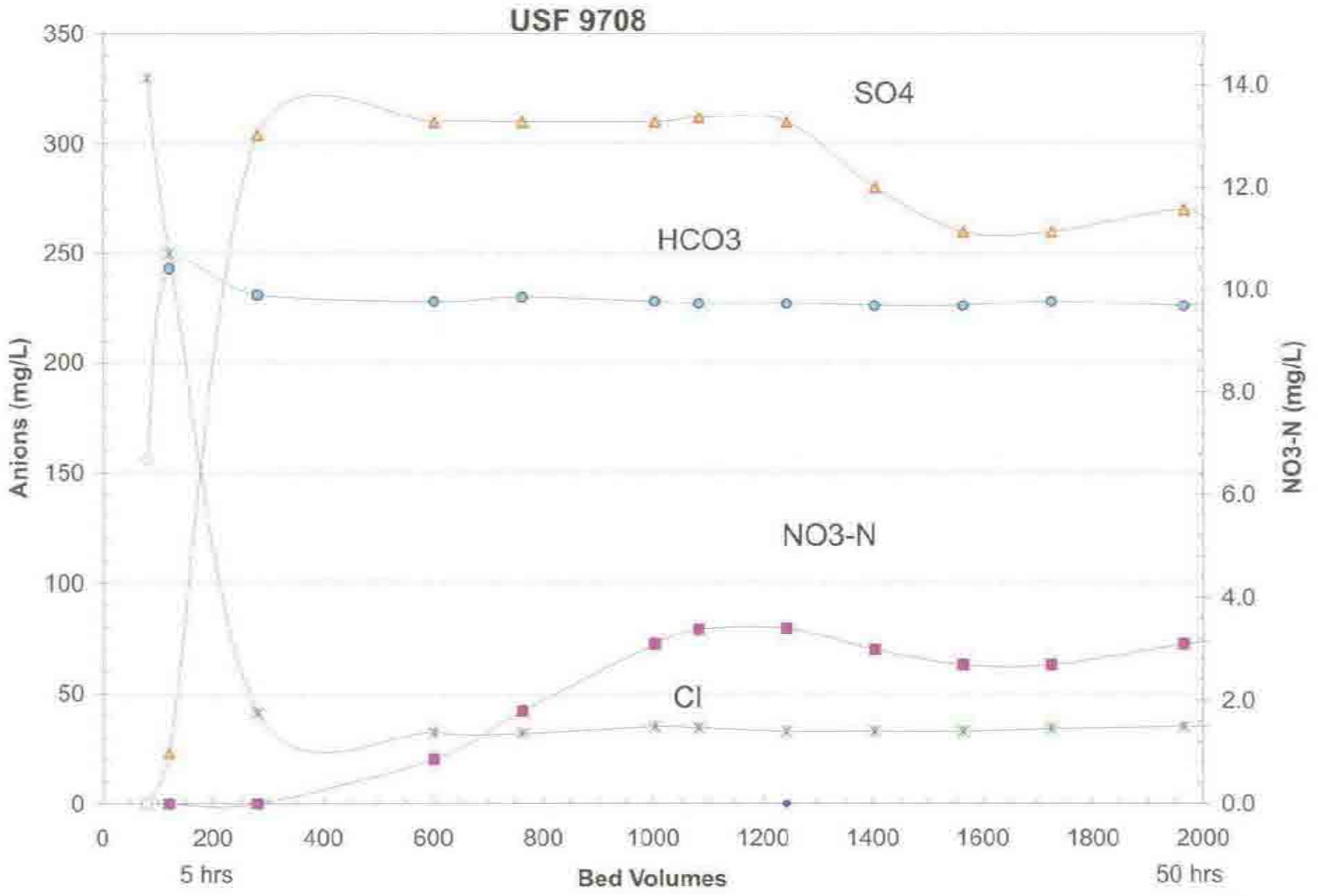
pH VALUES MEASURED IN THE FEED AND IX COLUMN EFFLUENT

FIGURE 3.11



BREAKTHROUGH OF MAJOR ANIONS FROM CAL 2100 SERIES RESIN IN THE FIRST 2000 BVs

FIGURE 3.12



BREAKTHROUGH OF MAJOR ANIONS FROM 9708 RESIN IN THE FIRST 2000 BVs

FIGURE 3.13

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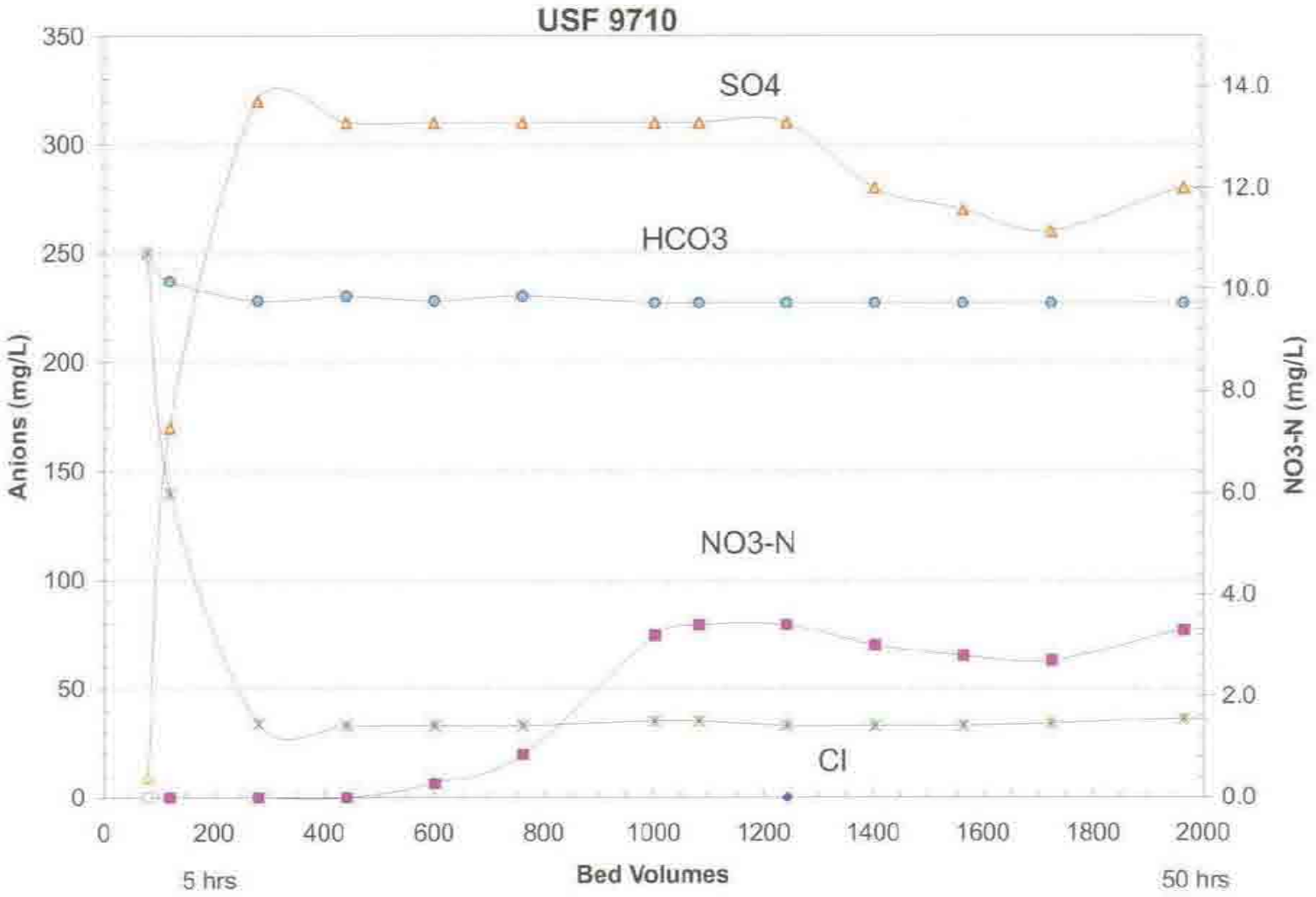

BREAKTHROUGH OF MAJOR ANIONS FROM 9710 RESIN IN THE FIRST 2000 BVs

FIGURE 3.14

7.1.5.2 Breakthrough Curves of Perchlorate and Other Anions

Perchlorate breakthrough curves for the three ion-exchange resins are illustrated in Figure 3.15. As expected, perchlorate breakthrough did not occur until several thousand bed volumes had been treated by the resin. Actual run lengths were longer than those predicted by the IX-Pro Model. Bed volumes to perchlorate breakthrough (greater than 1 μg/L) were 25,000 bed volumes (26 days), 72,000 bed volumes (75 days), and 76,000 bed volumes (79 days) for USF 9708 resin, USF 9710 resin, and CalResin 2100, respectively. The details of run lengths until perchlorate breakthrough are presented in Table 3.16.

Table 3.16 Run Lengths Until Perchlorate Breakthrough (1 μg/L) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Resin	Bed Volumes	Treated Water Volumes (gal)	Treated Volume gal/cu-ft resin
USF 9708	25,000	145.3	187,045
USF 9710	72,000	418.5	538,735
CalResin 2100	76,000	441.7	568,600

A temporal change in raw well water quality occurred between 85,000 and 100,000 bed volumes. However, this did not seem to impact the breakthrough of anions, with the possible exception of the USF 9708 perchlorate breakthrough curve, for which a noticeable drop in perchlorate concentration was measured in the effluent during that period.

At the end of the study, a 45-hour shutdown period was simulated by shutting off the feed pump. During this period, the resins were allowed to sit in the columns containing the groundwater. Critical anions were measured immediately after the shut-down period and breakthrough curves were developed for all key anions after restarting the columns. Breakthrough curves of all major anions for USF 9710 are illustrated in Figure 3.16. An increase in chloride concentration (45 to 72 mg/L) was observed upon column restart. Similar trends were observed for USF 9708 and CalResin 2100, indicating leaching from the IX resins.

7.2 NDMA Formation Potential Testing

7.2.1 Post-Chlorination Testing

The results from the post-chlorination testing with free chlorine are plotted in Figure 3.17. Free chlorine residuals ranged from 1.8 to 1.9 mg/L after 24 hours of incubation. The 2- and 24-hour NDMA concentrations in all three ion-exchange column effluents were below the 2 ng/L detection limit. Therefore, precursors did not leach from the resin to form NDMA upon post-chlorination with free chlorine.

The results from the post-chlorination testing with combined chlorine are plotted in Figure 3.18. Total chlorine residuals ranged from 1.6 to 2.2 mg/L after 24 hours of

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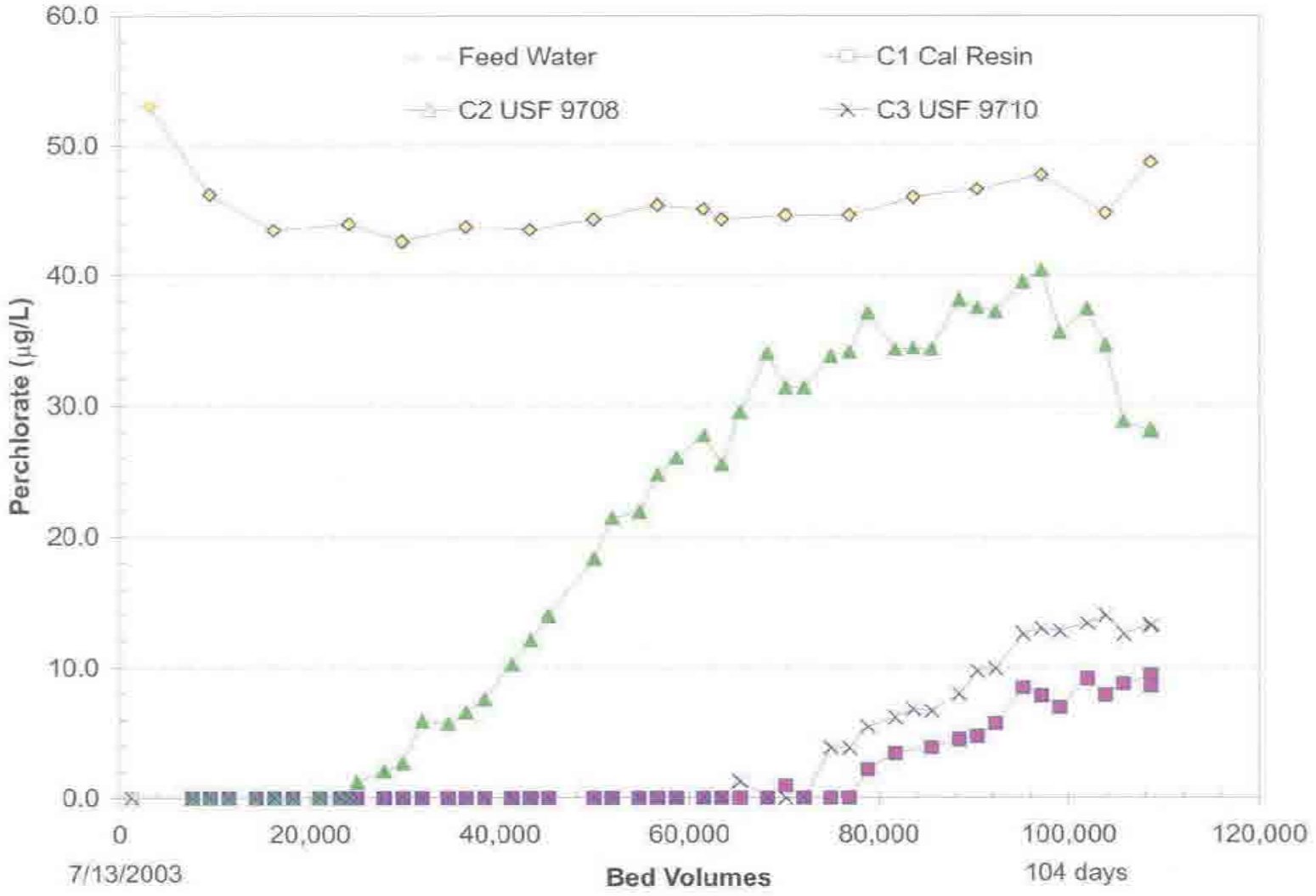

COMPARISON OF PERCHLORATE BREAKTHROUGH CURVES

FIGURE 3.15

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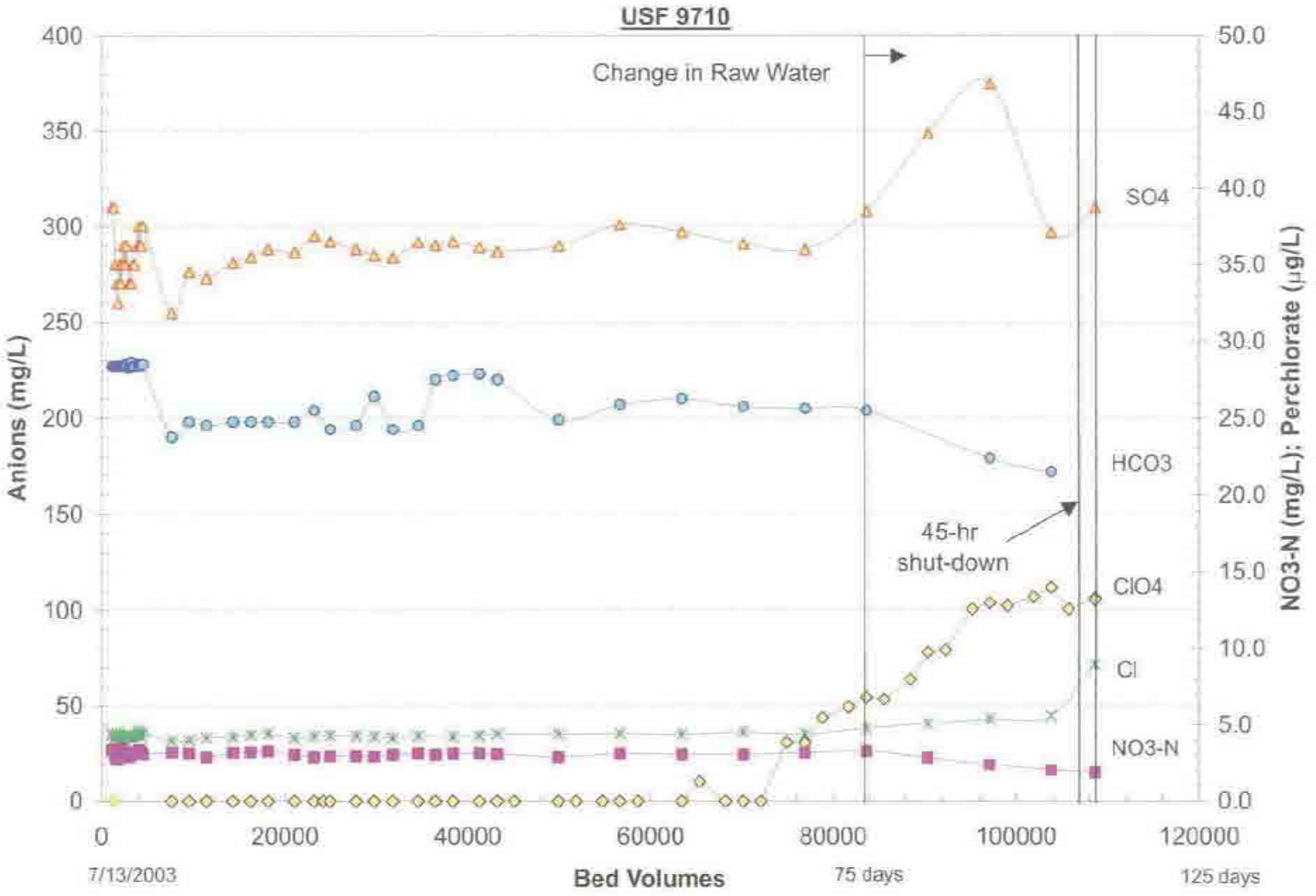

BREAKTHROUGH OF CRITICAL ANIONS FROM USF 9710

FIGURE 3.16

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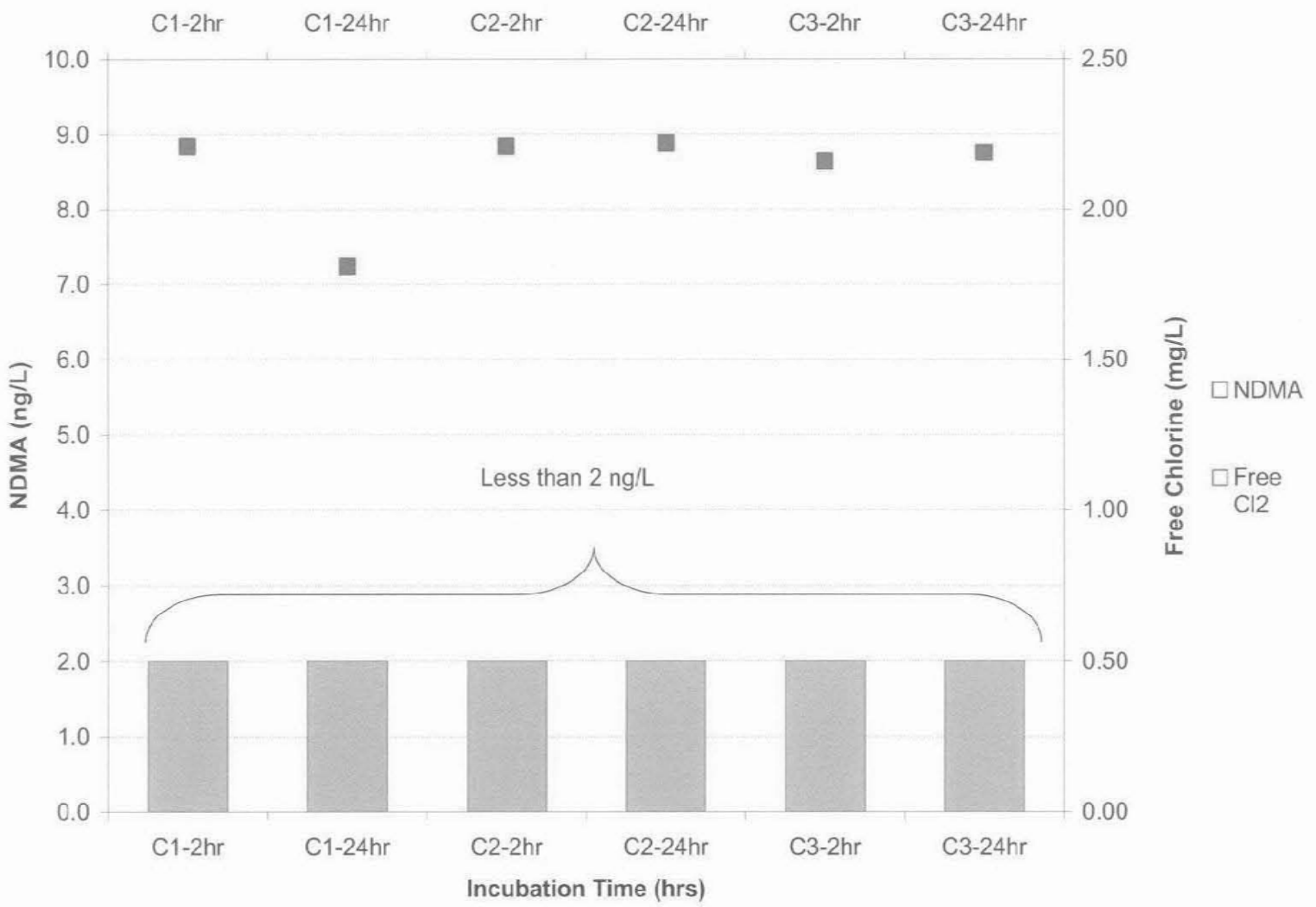

POST-CHLORINATION TESTING WITH FREE CHLORINE NDMA RESULTS

FIGURE 3.17

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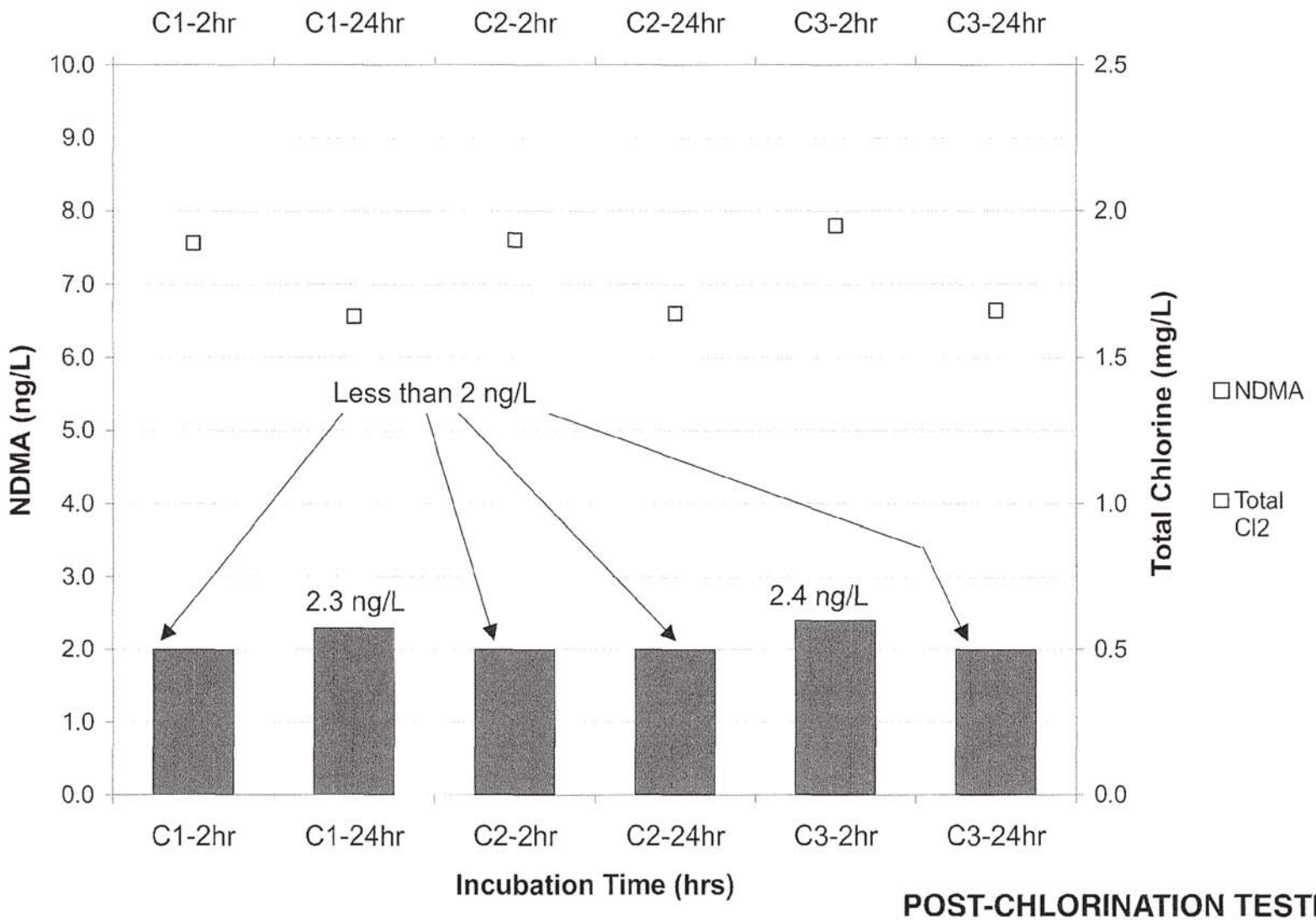

POST-CHLORINATION TESTING WITH COMBINED CHLORINE NDMA RESULTS

FIGURE 3.18

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incubation. The 2- and 24-hour NDMA concentrations in all three ion-exchange column effluents were below or just above the detection limit of 2 ng/L.

7.2.2 Pre-Chlorination Testing

To test the effect of prechlorinated water on the resins, chlorinated feedwater was allowed to run through the columns for a period of 2 hours. After that time, samples were collected and analyzed for NDMA. No detectable free chlorine residual was measured at the column effluents. This experiment was repeated four days later by adding a second 2 mg/L dose of free chlorine (duplicate samples). NDMA results are plotted in Figure 3.19. Measured levels were below or just over the detectable limit of 2 ng/L. The NDMA concentration in the feedwater (control sample) was non-detect.

7.2.3 Fresh Resin Batch Testing

Each resin was tested to determine if leaching of NDMA occurred from precursors in the resin functional sites. These results are plotted in Figure 3.20. Although NDMA was detected in one sample (CalResin), the result was less than half the current Action Level of 10 ng/L.

7.3 Spent Resin Characterization

7.3.1 Lab Results

Table 3.17 presents the Federal Toxicity Characteristic Leaching Procedure (TCLP) toxicity limits, TTLC, and STLC threshold values defined in the California Code of Regulations, Title 22, Chapter 11, Article 3, Section 66261.24, as well as the results from the actual TTLC metal concentrations measured in the three ion-exchange spent resins. TTLC results indicate the total bulk amount of each constituent per unit mass of solid waste. If the TTLC (or bulk) content is low, then the solid waste when subjected to leaching tests (STLC, TCLP) does not produce significant amounts of contaminants in the leachate. Since TTLC results are very low, there would not be any problem with the STLC or TCLP. These soluble limits, however, are listed in the table for comparison.

Most values for the TTLC analysis were non-detect. Chromium, vanadium, and zinc were detected in USF 9708 and USF 9710 spent resins at levels just above minimum reporting limits, but these values are several orders of magnitude below the regulatory TTLC threshold concentrations. Given that the TTLC metal concentrations were 10 times lower than the STLC limits, no further metals analysis for STLC was needed.

Due to the limited quantity of resin samples, TTLC for uranium, which required separate analysis, was not performed by the lab. However, projected total amount of uranium was calculated to be well below the regulatory limit (see Table 3.21). The leachate from spent resins was further analyzed for perchlorate, nitrate, and uranium (Table 3.18). Uranium

levels in the spent resin leachate were significantly below the drinking water Title 22 maximum contaminant limit of 20 pCi/L.

Table 3.17 Comparison of TTLC Metals in Spent Resins to Federal and State Toxicity Limits
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

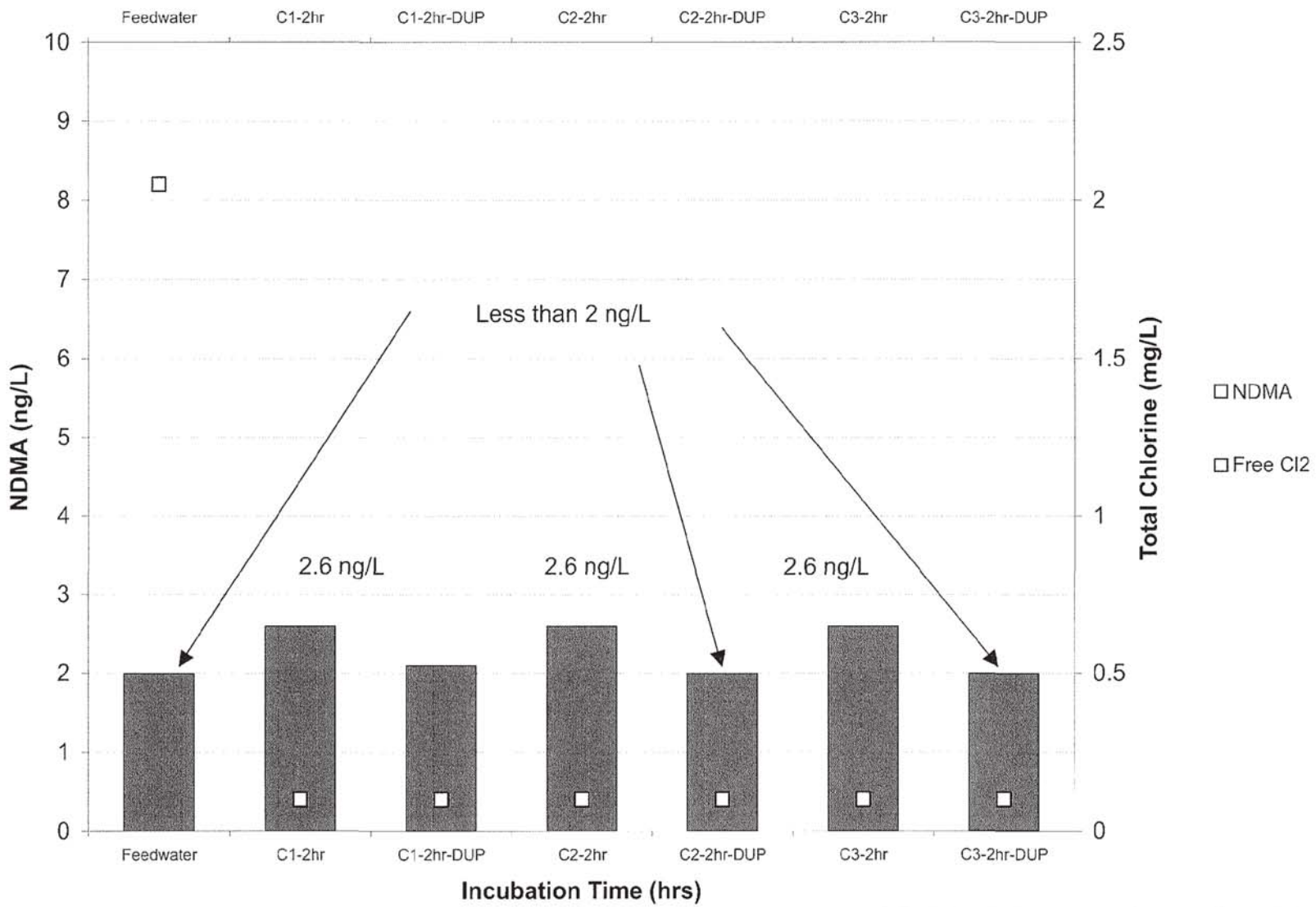
	Actual TTLC Metals Concentrations Measured in Spent Resins (mg/kg)			Federal and State Regulatory Limits		
Contaminant	Cal 2100 Series	USF 9708	USF 9710	TTLC Threshold Concentration (mg/kg)	STLC Threshold Concentration (mg/L)	TCLP Regulatory Level (mg/L)
Antimony	<4	<4	<4	500	15	
Arsenic	<0.5	<0.5	<0.5	500	5.0	5.0
Barium	<0.3	<0.3	<0.3	10,000	100	100.0
Beryllium	<0.2	<0.2	<0.2	75	0.75	
Cadmium	<0.2	<0.2	<0.2	100	1.0	1.0
Chromium	<0.3	**0.4**	<0.3	2,500	5	5.0
Chromium VI				500	5	
Cobalt	<1	<1	<1	8,000	80	
Copper	<4	<4	<4	2,500	25	
Lead	<10	<10	<10	1,000	5.0	5.0
Mercury	<0.05	<0.05	<0.05	20	0.2	0.2
Molybdenum	<2	<2	<2	3,500	350	
Nickel	<2	<2	<2	2,000	20	
Selenium	<3	<3	<3	100	1.0	1.0
Thallium	<0.2	<0.2	<0.2	700	7.0	
Vanadium	<0.5	**0.6**	<0.5	2,400	24	
Zinc	<4	<4	**7.8**	5,000	250	

Table 3.18 Comparison of Perchlorate, Nitrate and Uranium in Spent Resins Leachates Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Contaminant	**Cal 2100 Series**	**USF 9708**	**USF 9710**	**CA-T22 MCL**	**DHS Action Level**
Perchlorate (μg/L)	< 4,000	< 4,000	< 4,000	—	4
Nitrate-N (mg/L)	21	19	22	10	—
Uranium (pCi/L)	3.0 ± 0.307	7.35 ± 0.752	4.06 ± 0.419	20	—

Table 3.19 Radionuclides Reportable Quantities (Table 2 of Appendix A under CERCLA) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency		
Radionuclide	**Atomic Number**	**RQ (Ci)**
Uranium 230	92	1
Uranium 231	92	1,000
Uranium 232	92	0.01
Uranium 233	92	0.1
Uranium 234	92	0.1
Uranium 235	92	0.1
Uranium 236	92	0.1
Uranium 237	92	100
Uranium 238	92	0.1
Uranium 239	92	1000
Uranium 240	92	1000

7.3.2 Uranium Accumulation

To further assess any challenges of transporting spent resins from the treatment plant to an incineration facility, a mass balance was performed to calculate the amount of uranium accumulated on the resins for comparison to the Department of Transportation's (DOT's) reportable quantities (which define whether or not a substance is hazardous) and A-Values (values used during shipping of hazardous substances).



POST-CHLORINATION TESTING
NDMA RESULTS

FIGURE 3.19

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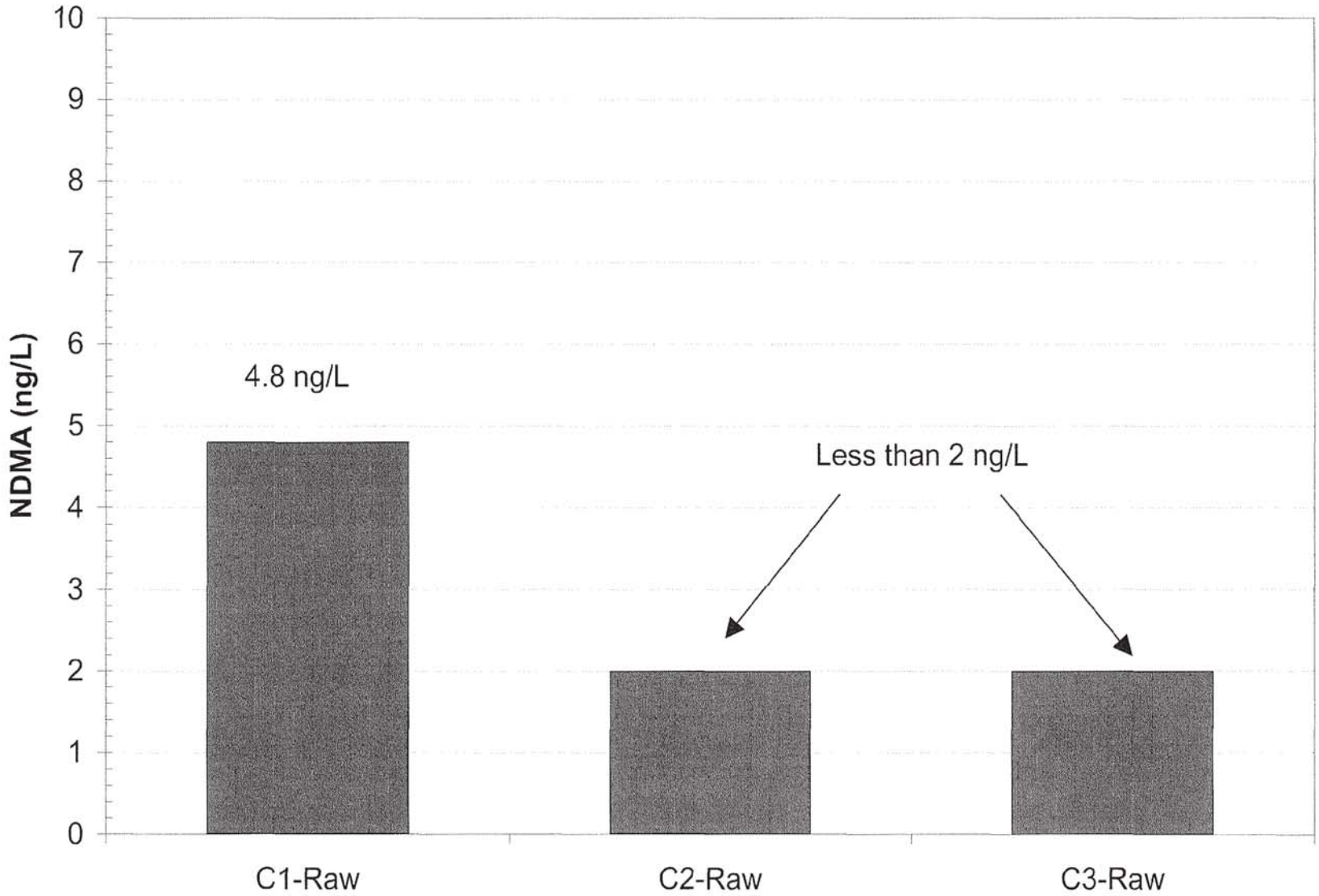

RESIN LEACH TEST RESULTS

FIGURE 3.20

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According to DOT's Hazardous Materials Regulations, 49 Code of Regulation SubChapter C (Hazardous Materials Regulations), subpart §171.8 (Definitions), a hazardous substance means a material, including its mixtures and solutions, that:

1. Is listed in the Appendix A to subpart §172.101 of the subchapter (Purpose and use of hazardous materials table).

2. Is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) listed in the Appendix A to §172.101 of the subchapter.

Appendix A lists materials and their corresponding RQs that are listed or designated as "hazardous substances" under section 101(14) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9601(14) (CERCLA; 42 U.S.C. 9601 et seq). Table 2 of Appendix A lists radionuclides that are hazardous substances and their corresponding RQs. The RQs in Table 2 for radionuclides are expressed in units of curies, and are shown in Table 3.20.

Table 3.20 A1 and A2 Values for Radionuclides- Shipments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Radionuclide	Atomic Number	A1 (Ci)	A2 (Ci)	Specific Activity (Ci/g)
Uranium 230	92	1,080	0.270	27,000
Uranium 232	92	81.1	0.00811	22
Uranium 233	92	270	0.027	9,700
Uranium 234	92	270	0.027	6,200
Uranium 235	92	Unlimited	Unlimited	0.0000022
Uranium 236	92	270	0.027	0.000065
Uranium 238	92	Unlimited	Unlimited	0.00000034
Uranium Natural	92	Unlimited	Unlimited	0.00000071

As far as transportation of hazardous substances, in Part 173 (Shippers- General Requirements for Shipments and Packaging), Subpart § 173.435, the values of A1 and A2 for radionuclides are defined. A1 means the maximum activity of special form Class 7 (radioactive) material permitted in a Type A package. A2 means the maximum activity of Class 7 (radioactive) material, other than special form, Low-Specific Activity (LSA) or Surface Contaminated Object (SCO), permitted in a Type A package, see Table 3.21.

Table 3.21 Calculated Accumulated Amount of Uranium on the Spent Resins Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Resin	Days Until 50% ClO_4^- Breakthrough	Projected Uranium Accumulation (Ci)	Lowest RQ (Ci)	Lowest A Value (Ci)
Cal Resin	146(1)	1.6E-09	0.01	0.027
USF 9708	60	3.1E-09	0.01	0.027
USF 9710	138(1)	1.2E-09	0.01	0.027

Note:
(1) Extrapolated from perchlorate breakthrough plots

A mass balance of the uranium adsorbed and desorbed from each of the three resins up to 50 percent perchlorate breakthrough was performed based on an influent concentration range of 1.0 to 3.9 pCi/L and measured effluent uranium concentrations from each of the columns. The amount of uranium accumulated on the resins through 50 percent perchlorate breakthrough was calculated and is presented in Table 3.21. Accumulated uranium is far below the lowest permissible reporting quantity and A-value. The resins are thus not classified as hazardous and their transportation and disposal to an incineration facility should not pose a challenge to CLWA.

7.4 Summary of Ion-Exchange Testing Results

7.4.1 Feed Water Quality

The feed water is low in organic matter, has moderate hardness and alkalinity, and contains moderate levels of iron and bromide. The raw water quality was stable over the testing period with the exception of the month of October 2003, during which period pumping rates at the NC-12 well were temporarily reduced, causing a decrease in nitrate concentration, and increases in sulfate and chloride concentrations.

7.4.2 Operational Data

The flow rate ranged from 13.5 to16.5 mg/L during the course of the study, which resulted in EBCTs of 1.4 to 1.6 minutes (the target was 1.5 min).The pressure drop across the column remained constant at 5 psi during most of the project. The water temperature ranged from 32 degrees C (89 degrees F) in the summer months to 16 degrees C (61 degrees F) in the fall. pH ranged from 7.6 to 8.4.

7.4.3 Focused Breakthrough Curves of Nitrate, Sulfate, Chloride, and Bicarbonate

The breakthrough of most anions (with the exception of perchlorate) occurred in the first 24 hours of run time. Bicarbonate broke through immediately, followed by sulfate at 80 bed volumes. Nitrate broke through after 280 bed volumes, 440 bed volumes, and 600 bed

volumes from USF 9708, USF 9710, and Cal 2100 resins, respectively. No chromatographic peaking was observed for any of the critical anions. Chloride level dropped from a high of approximately 325 mg/L to background concentrations (~35 mg/L) after 280 bed volumes.

7.4.4 Long-Term Breakthrough Curves of Perchlorate and Other Anions

Bed volumes to reach perchlorate breakthrough (greater than 1 μg/L) were 25,000 (26 days), 72,000 (75 days), and 76,000 (79 days) for USF 9708 resin, USF 9710 resin, and CalResin 2100, respectively. This translates in treated water volumes of 187,000 gal/ft^3, 540, 000 gal/ft^3, and 569,000 gal/ft^3, respectively. A small increase in chloride concentration was observed after a simulated 45-hour shutdown period, likely due to leaching from the resin.

7.4.5 NDMA Results

The results from the post-chlorination testing with free chlorine (residual of 1.8 to 2.2 mg/L after 24 hours) and with combined chlorine (residual of 1.6 to 1.9 mg/L after 24 hrs) showed that NDMA concentrations in all three ion-exchange column effluents after 2- and 24-hour incubation times were below the detection limit of 2 ng/L. Therefore NDMA precursors did not leach from the resin .

To investigate the formation potential of NDMA upon the reaction of chlorine with DBP precursors in the water or leaching from the resin, a 2-mg/L free chlorine dose was added directly to the feed water. Measured NDMA levels were below or just over the detectable limit of 2 ng/L.

To evaluate the NDMA precursor leaching potential of the resins, 100 mL batches of fresh resin were incubated for four hours in deionized water and groundwater. NDMA was detected in only one sample, which measured at less than half the 10 ng/L Action Level.

7.4.6 Spent Resin Characterization

The California TTLC metal concentration values were mostly non-detect in all three spent resins. Chromium, vanadium, and zinc were detected in USF 9708 and USF 9710 spent resins at levels significantly below the regulatory TTLC threshold concentrations. Uranium levels in the spent resin leachate were significantly below the Title 22 MCL of 20 pCi/L. To investigate whether the spent resins would be classified as hazardous for transportation to an incineration facility, a mass balance of the uranium adsorbed and desorbed from the resin up to 50 percent perchlorate breakthrough was performed. The amount of uranium accumulated on the spent resins is far below the lowest permissible reporting quantity and A-value of the California DOT.

7.5 Fixed-Bed Filter

7.5.1 Biological Acclimation

Figure 3.21 shows FXB perchlorate removal performance during the biological acclimation and optimization phases[1]. Perchlorate was initially removed by adsorption onto the virgin GAC, and began to break through after 12 days as the carbon's adsorption capacity diminished. These data are consistent with other perchlorate/GAC breakthrough curves reported in the literature (Na et al., 2002, Brown et.al, 2002). During the subsequent month of biological acclimation, run times were less than 24 hours due to rapid headloss development in the filter. The pilot feed lines were experiencing heavy biological growth, and the biofilm from the feedlines would occasionally detach and clog the bed. The acetic acid feed concentration was lowered during the acclimation phase (Figure 3.22) to minimize growth. However, excessive biogrowth in the feed lines continued to generate rapid headloss build-up. Phosphoric acid was added at 0.2 mg/L PO_4-P to select away from filamentous organisms suspected of causing the overgrowth and clogging problems. Simultaneously, the electron donor feed was repositioned so that acetic acid was fed directly to the top of the filter column instead of upstream of the static mixer, thus minimizing biofilm growth in the feed line. Consequently, biogrowth was isolated to the filter bed, headloss development rates decreased, and 48-hour run times were achieved. Within 10 days of adding phosphoric acid and repositioning the acetic acid feed, steady perchlorate removal to below detection was achieved in the filter. The phosphoric acid feed was removed during the optimization tests without affecting perchlorate removal performance, indicating that phosphorous in the natural water did not limit biological activity in the filter. Therefore, repositioning the acetic acid feed was likely the key to effectively acclimating the FXB filter for biological perchlorate removal. If this electron donor feed configuration had been used from time zero, it is estimated that steady-state biological perchlorate removal to below detection would have required 3 to 4 weeks of operation.

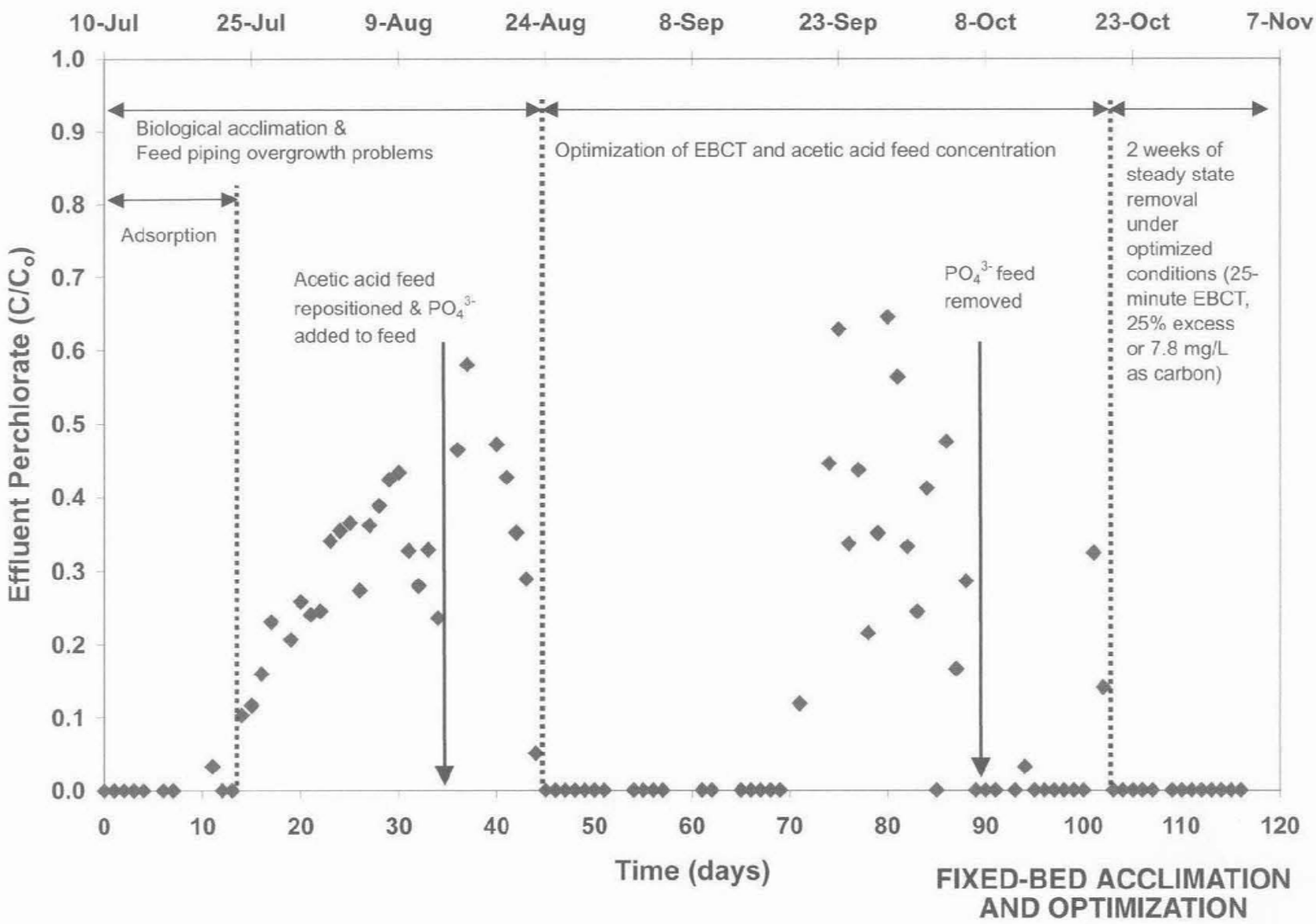
7.5.2 Optimization

During the two months of piloting after the acclimation period, EBCT and acetic acid feed concentrations were optimized (Figures 3.21 and 3.22). The minimal acetic acid concentration that still allowed removal of perchlorate to below detection was 7.8 mg/L as carbon (25% excess).[2] EBCTs as low as 15 minutes allowed for the consistent, complete removal of perchlorate to below detection, although only 24-hour run times were achieved. To lengthen run times, the EBCT was increased to 20 minutes. However, short-circuiting of the filter was observed throughout this period, resulting in perchlorate breakthroughs from 20 to 65 percent. While the 15-minute EBCT operation resulted in rapid headloss development (i.e., < 24-hour run times) but no perchlorate breakthrough, the 20-minute EBCT resulted in short-circuiting and variable perchlorate breakthrough. It appears that the

[1] All perchlorate detections (even those lower than the 4 μg/L MRL) are shown in the FXB and FBR figures.

[2] Assumes complete reduction of 7.0 mg/L of feed DO and 15 mg/L of feed nitrate.

20-CLWA204F3.21-6625A10.CDR



FIXED-BED ACCLIMATION AND OPTIMIZATION

FIGURE 3.21

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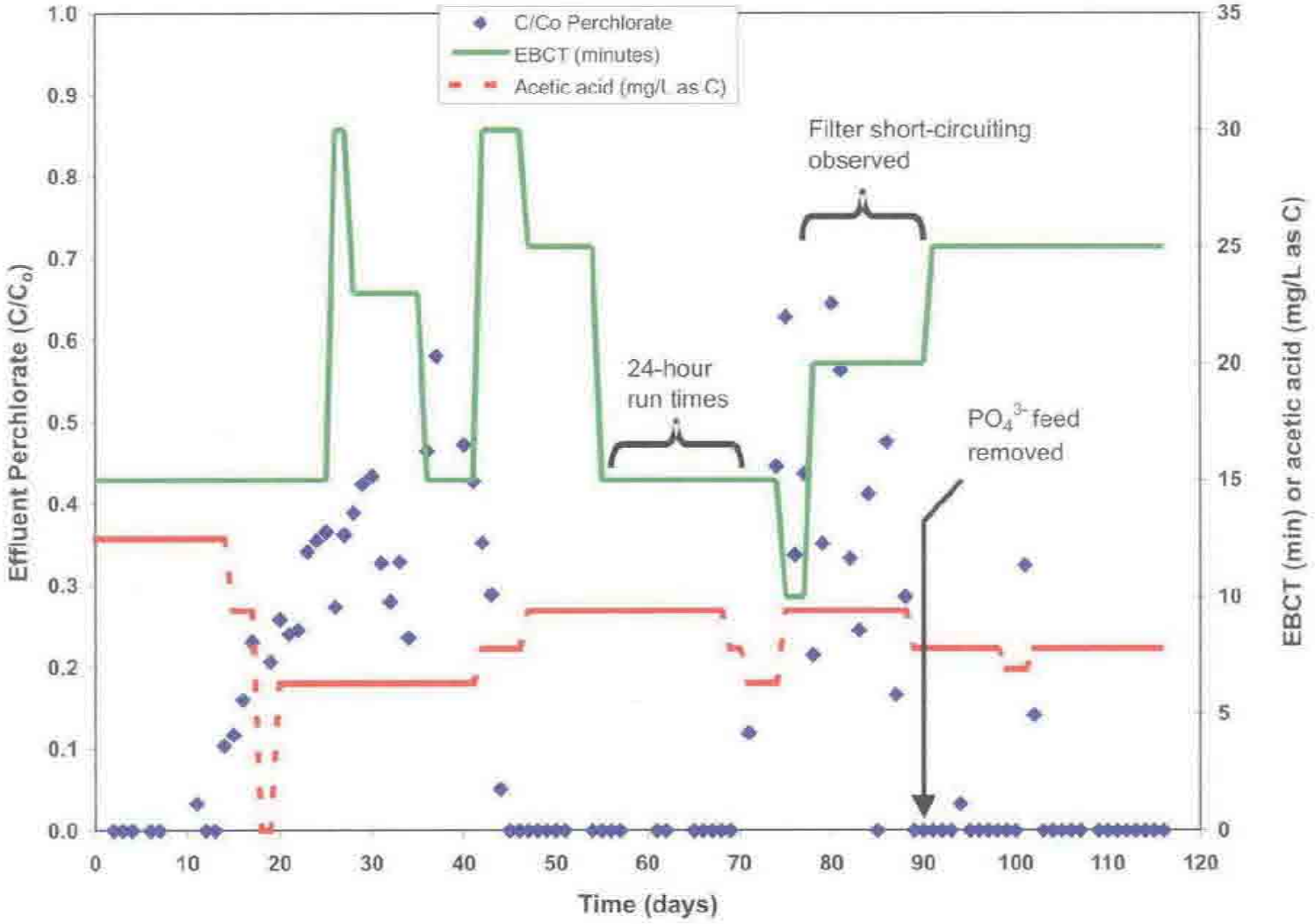
29039



FIXED-BED EBCT AND ACETIC ACID SET-POINTS

FIGURE 3.22

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higher flow rate promoted more uniform hydraulic loading in the filter, which distributed growth evenly across the bed. Instead of passing through the filter evenly, feedwater pumped at lower flow rates followed preferential paths that produced the observed channeling. The shortest EBCT that allowed ≥ 48-hour run times while consistently removing perchlorate to below detection was 25 minutes. Though some channeling was observed under 25-minute EBCT conditions, it was less extensive than that observed during 20-minute EBCT operation. After the optimization period, the filter was run for two weeks using a 25-minute EBCT and 7.8 mg/L acetic acid carbon. Removal of perchlorate to below detection was observed throughout this period as well.

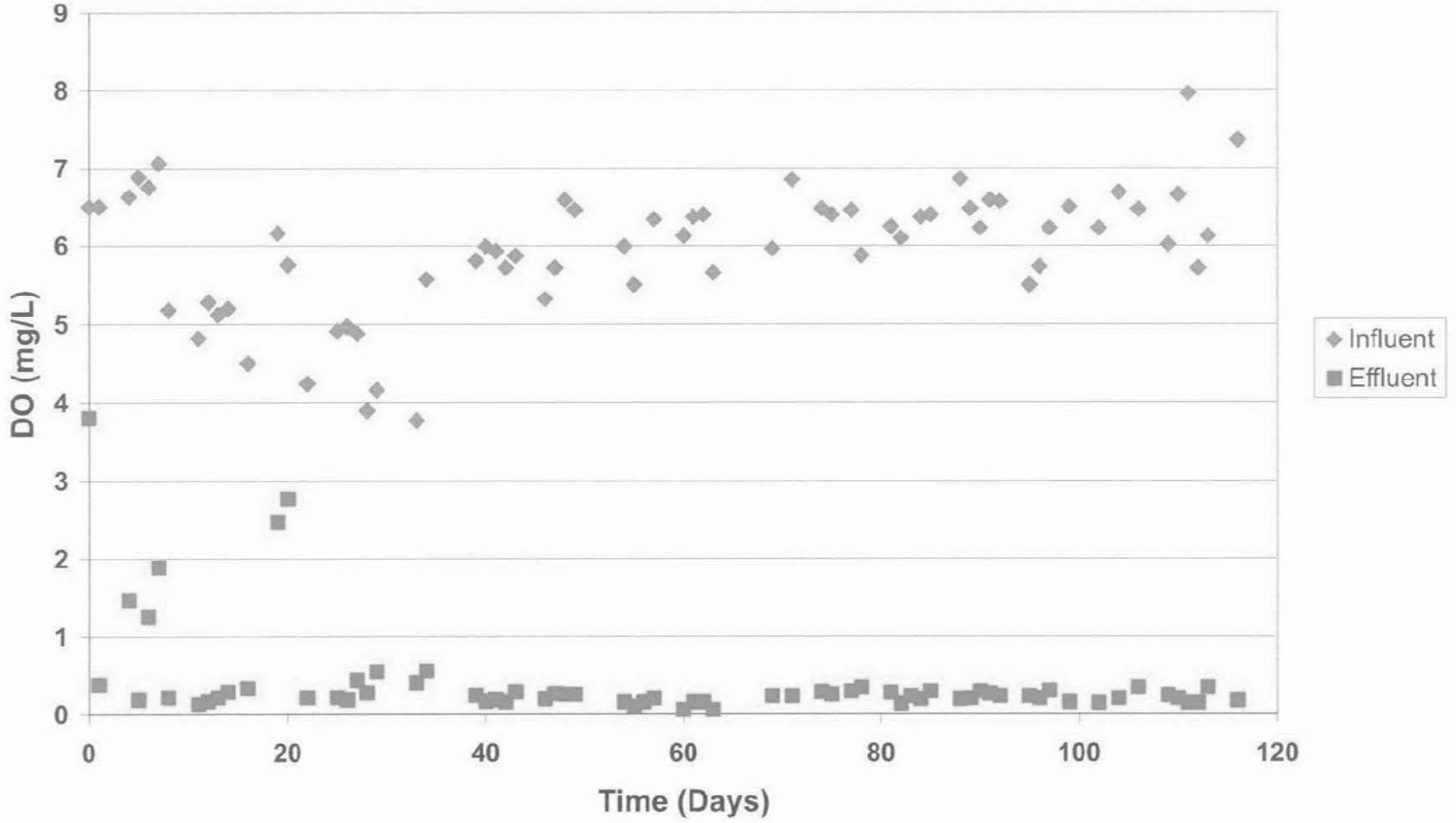
7.5.3 Dissolved Oxygen and Nitrate

All perchlorate-reducing bacteria described in the literature are facultative aerobes or microaerophiles. Thus, oxygen can inhibit biological perchlorate reduction by acting as a competing electron acceptor. Similar to oxygen, nitrate has a high redox potential that allows it to compete with perchlorate for use as an electron acceptor. Research has confirmed the occurrence of this competitive inhibition by demonstrating that DO and nitrate concentrations must be very low to achieve efficient perchlorate reduction in biological reactors (Brown et al., 2001, Herman and Frankenberger, 1999). Therefore, influent and effluent DO and nitrate concentrations were monitored closely during pilot testing.

Effluent DO concentrations were generally low during the acclimation phase (Figure 3.23). DO was likely reacting with the surface of the GAC initially, and was being reduced biologically as bacteria colonized the bed. Influent DO concentrations ranged from 4 to 8 mg/L and were reduced to 0.2 percent 0.3 mg/L throughout most of the pilot testing period. While effluent DO concentrations were steady, Figure 3.24 shows that effluent nitrate concentrations were variable. It was also observed that when effluent nitrate concentrations were detected, effluent perchlorate concentrations were also detected. These data: 1) indicate that DO was preferentially reduced over nitrate, and 2) confirm that DO and nitrate inhibit biological perchlorate reduction, as has been widely reported in the literature.

Figure 3.24 also reveals that feed nitrate concentrations gradually declined to approximately 7 mg/L as NO_3 after operating for 80 days at 15 mg/L as NO_3. The decline in feed nitrate concentrations coincided with a change in the NC-12 pumping schedule. After Day 80 of pilot operation, NC-12 was no longer pumped continuously for production, but rather was turned on periodically only to produce water for pilot plant operation. The resultant decrease in NC-12 production may have caused the variable background nitrate as well as sulfate (Figure 3.27).

20-CLWA204F3.23-6625A10.CDR



FIXED-BED DISSOLVED OXYGEN

FIGURE 3.23

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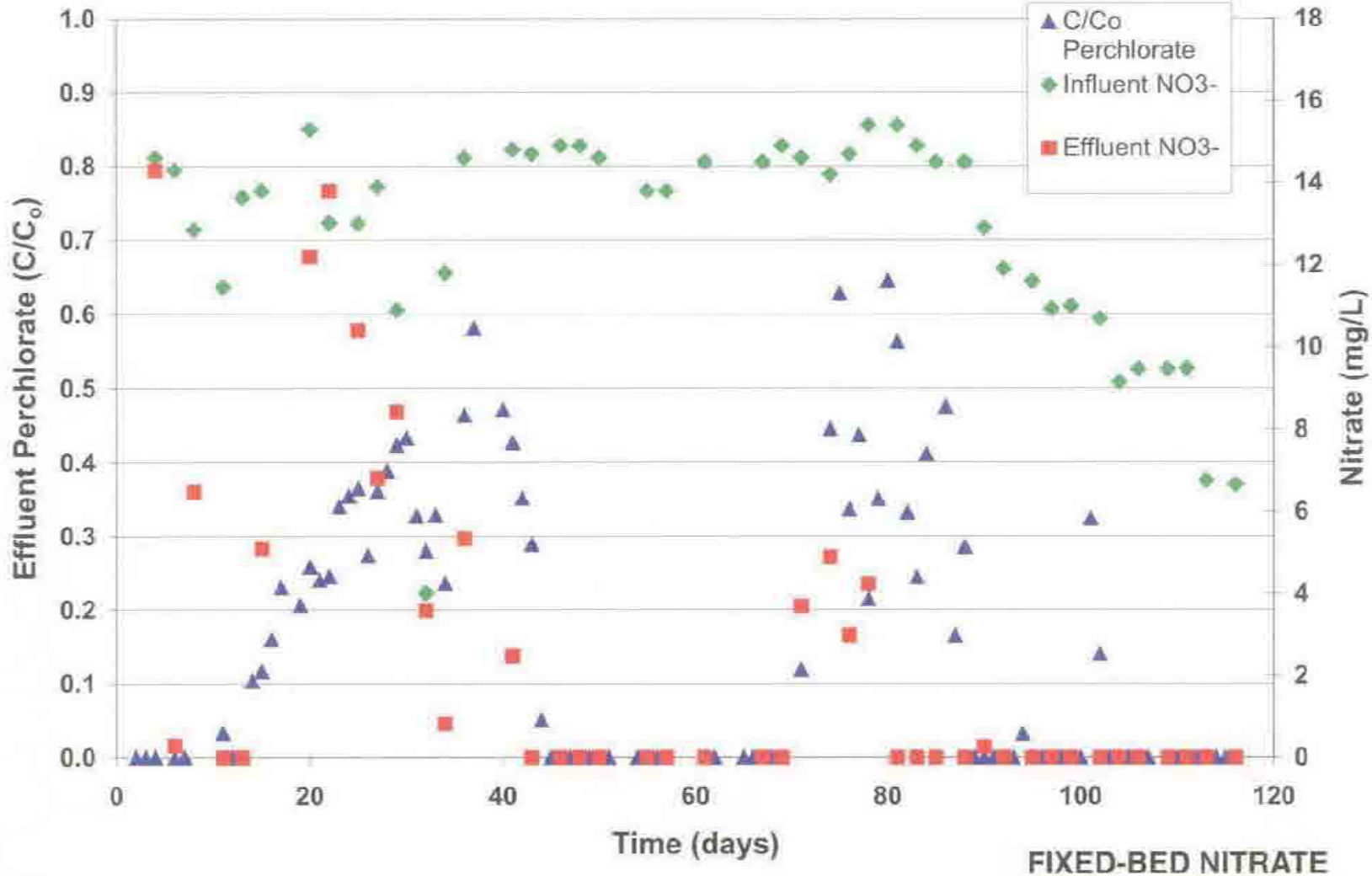
29042



FIXED-BED NITRATE AND PERCHLORATE

FIGURE 3.24

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7.5.4 Other Parameters

The following water quality observations were made during acclimation and optimization phases of FXB piloting:

- Effluent TOC concentrations were very low (Figure 3.25); generally non-detect (i.e, ≤ 0.7 mg/L). Effluent BDOC concentrations were non-detect (Figure 3.26). These data indicate that effluent from the FXB filter is biologically stable, and suggest that the post-treatment steps may be somewhat simplified to aeration and disinfection.
- Sulfate concentrations and pH were not significantly impacted across the filter (Figures 3.27 and 3.28, respectively). However, sulfide was occasionally detectable by smell.
- HPCs increased across the filter, resulting in counts between 70,000 and 650,000/mL (Figure 3.29).
- With the exception of two data points, total coliforms were not detected in the feed or effluent of the filter (Figure 3.30). The two detections indicated that coliforms in the feed water were partially removed across the filter. No fecal coliforms were detected.
- Average feed water turbidities were approximately 0.5 NTU. Average effluent turbidities were approximately 0.6 NTU (Figure 3.31). Average effluent particle count (>2 µm) was 99 counts/mL (Figure 3.31). The particle counter malfunctioned after 80 days of operation.
- Headloss across the filter ranged from < 2 feet to 30 feet (Figure 3.32). Under optimal operating EBCT and acetic acid conditions, headloss peaked at 25 feet, but was typically between 5 and10 feet.

7.5.5 Robustness Characterization

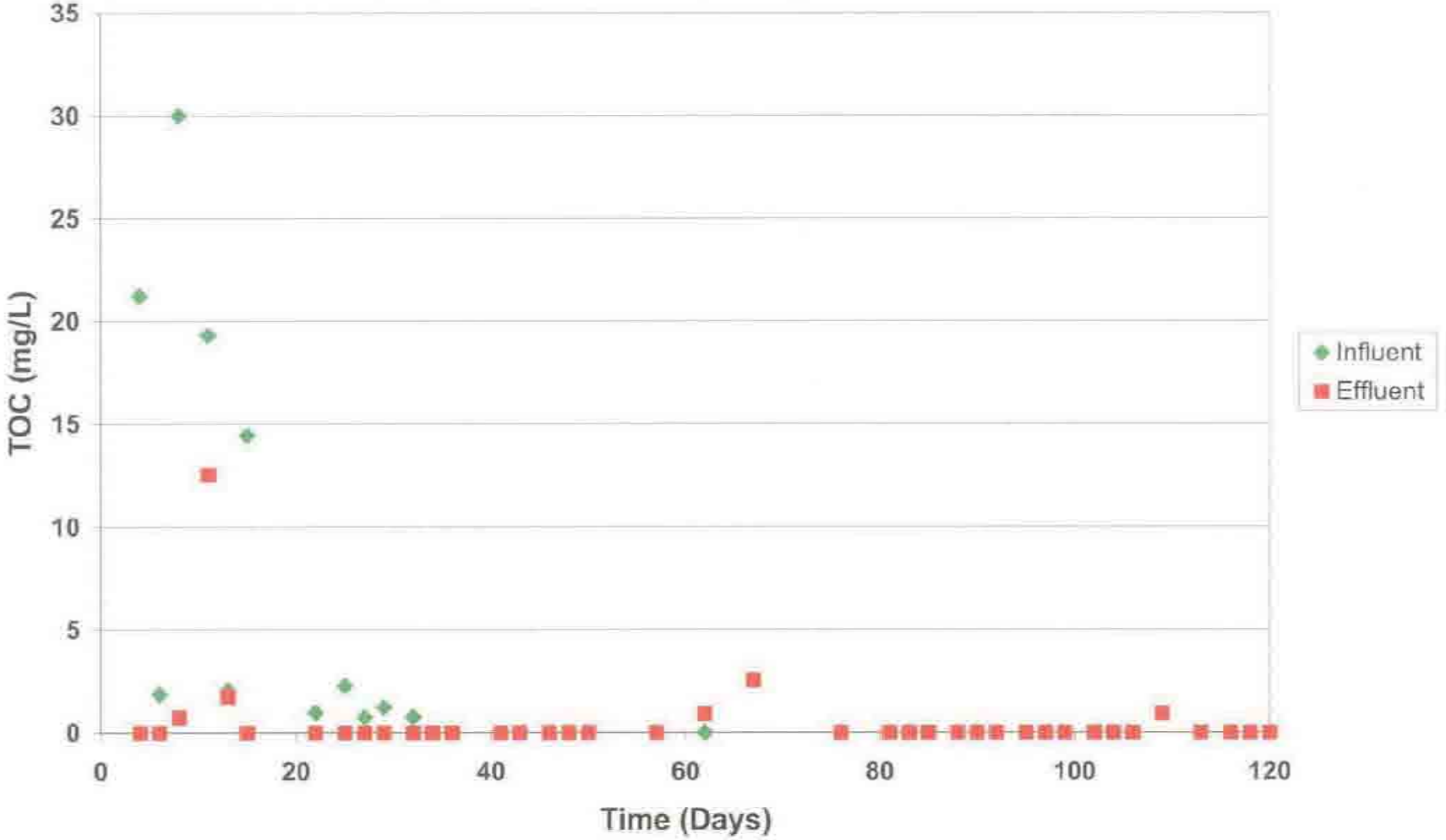
7.5.5.1 Backwashing

The results of the backwash challenge tests are shown in Figure 3.33. After the filter was put back into production following a backwash event, samples were taken every 15 minutes for an hour. No perchlorate was detected. This experiment was repeated one month after the first backwash challenge test with the same result.

7.5.5.2 Perchlorate Spiking

Transient perchlorate loading episodes did not impact perchlorate removal performance in the FXB filter (Figure 3.34). The feed perchlorate concentration was varied from 50 µg/L to 100 µg/L to 50 µg/L to 300 µg/L to 5 µg/L while EBCT and feed acetic acid concentration were maintained at 25 minutes and 7.8 mg/L as carbon, respectively. No perchlorate was detected in the effluent, even for the high resolution samples (i.e., samples taken at 0, 15, 30, 45, and 60 minutes) taken immediately after the influent perchlorate concentration was changed.

20-CLWA204F3.25-6625A10.CDR



FIXED-BED TOTAL ORGANIC CARBON

FIGURE 3.25

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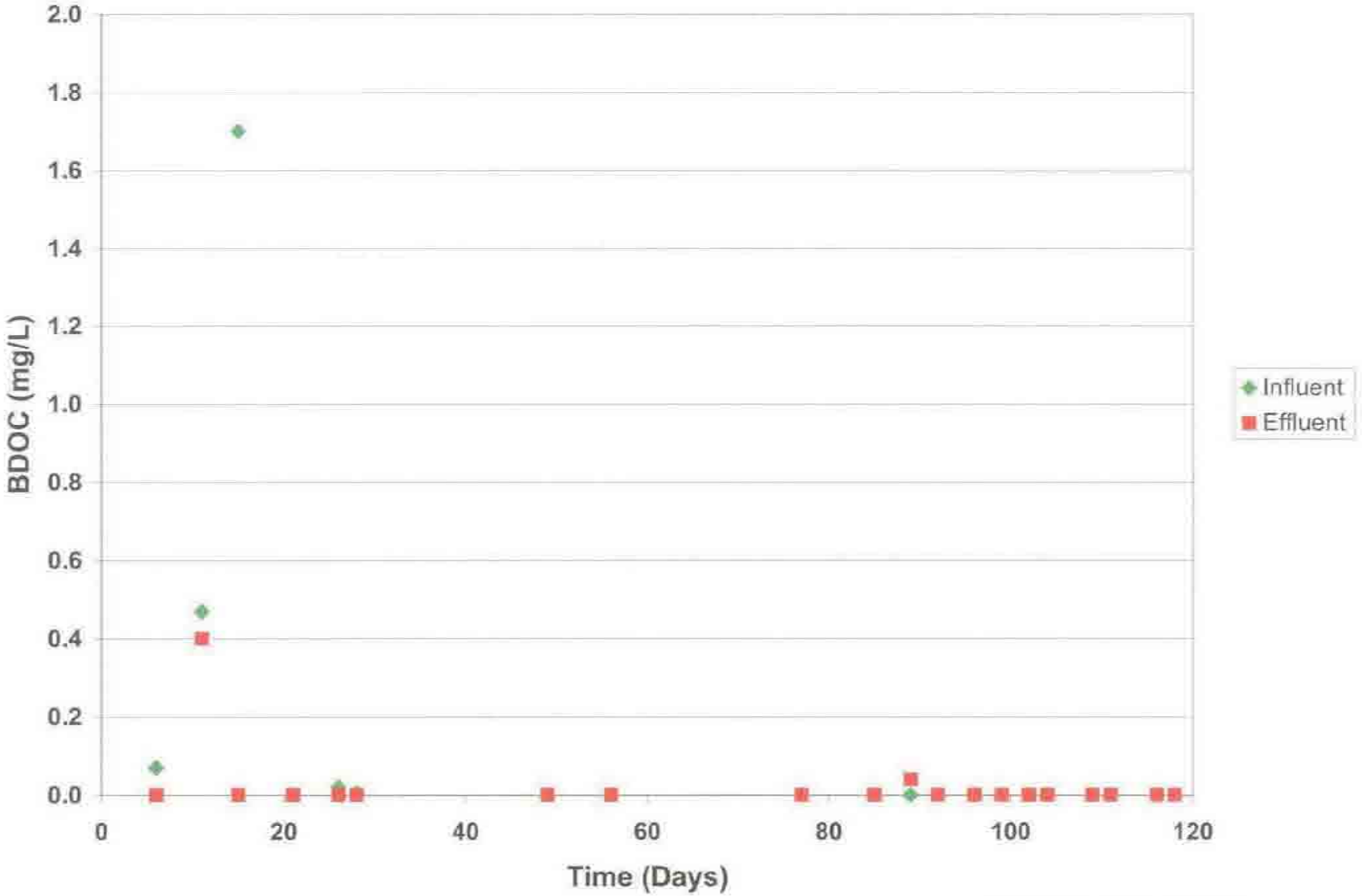
20 CLWA264F3.26-6625A10.CDR



FIXED-BED BDOC

FIGURE 3.26

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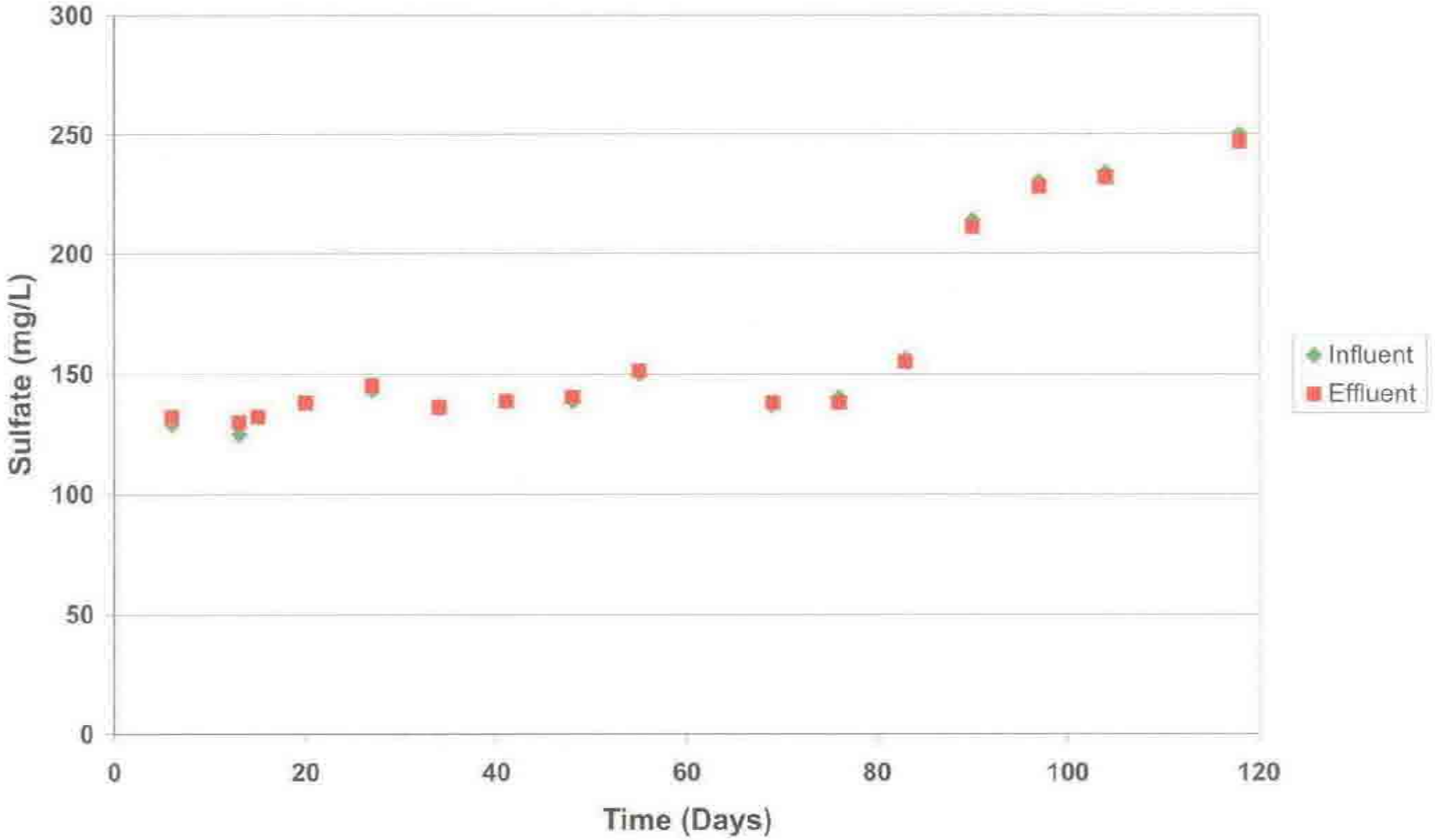
20-CLWA204F3.27-6625A10.CDR



FIXED-BED SULFATE

FIGURE 3.27

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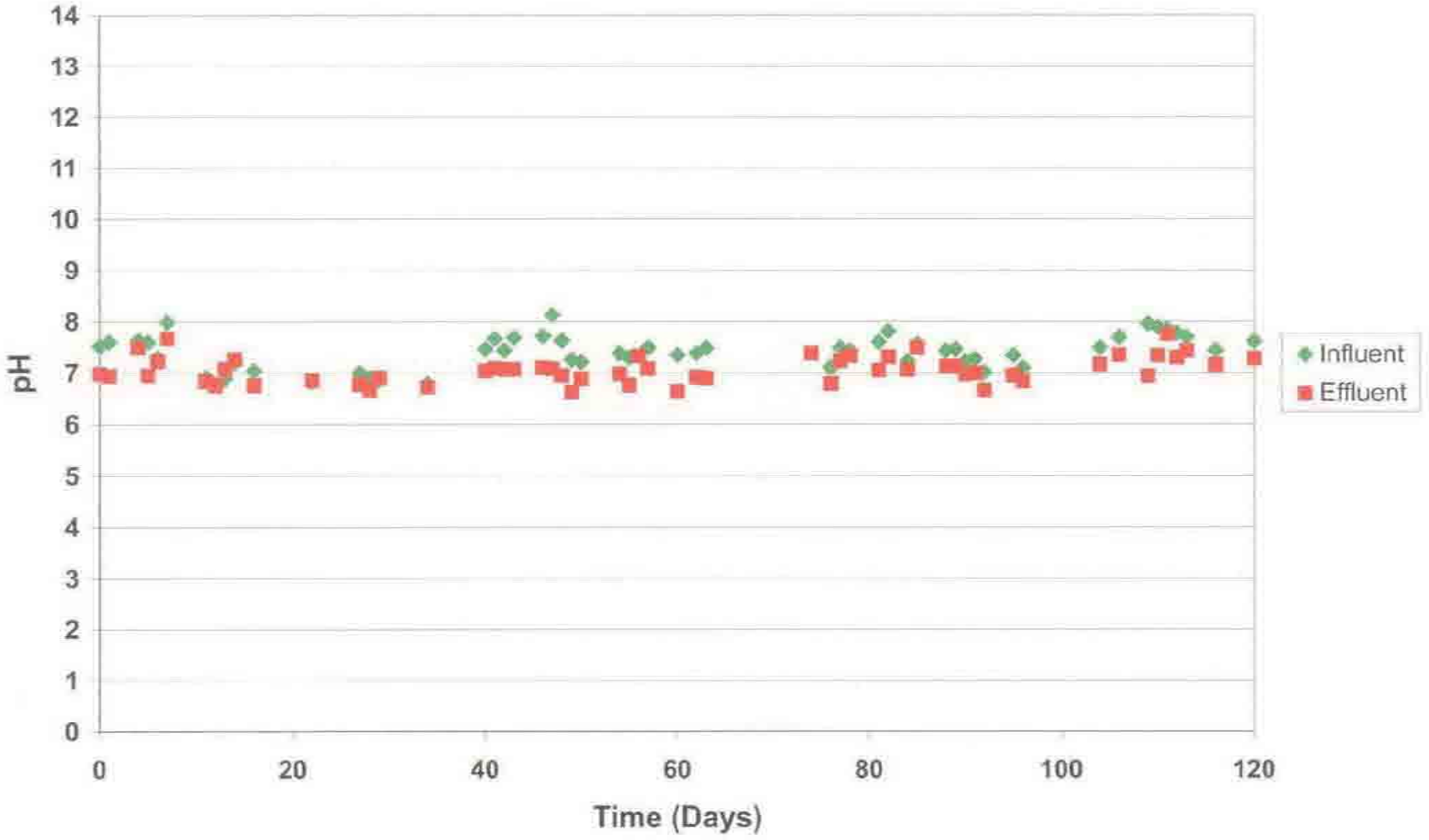
29047

20/CLWA204F3.28-8625A10.CDR



FIXED-BED pH

FIGURE 3.28

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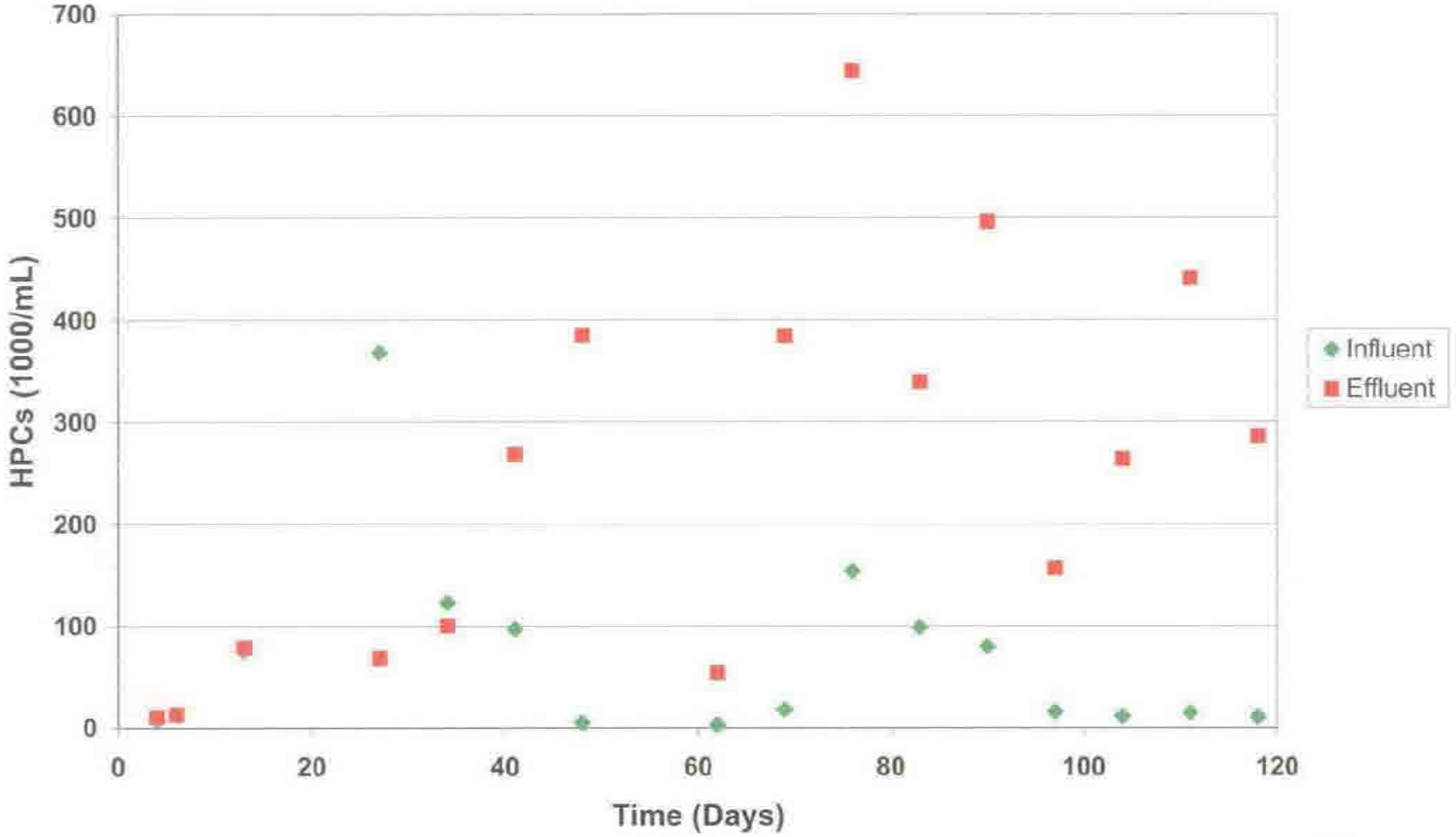
20-CLWA204F3.29-6825A10.CDR



FIXED-BED HETEROTROPHIC PLATE COUNTS

FIGURE 3.29

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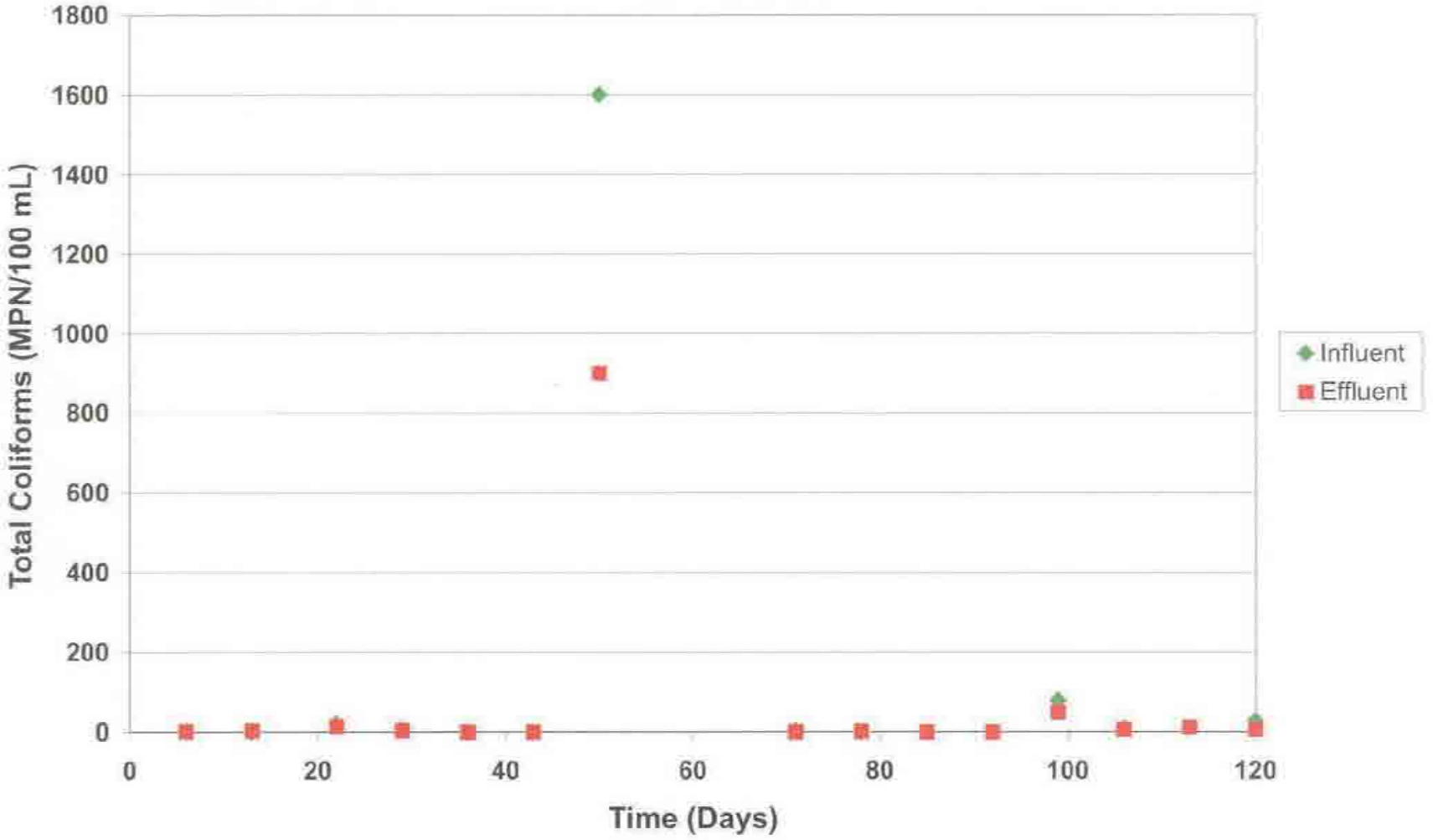
29049

30-CLWA204F3 30-6625A16.CDR



FIXED-BED TOTAL COLIFORMS

FIGURE 3.30

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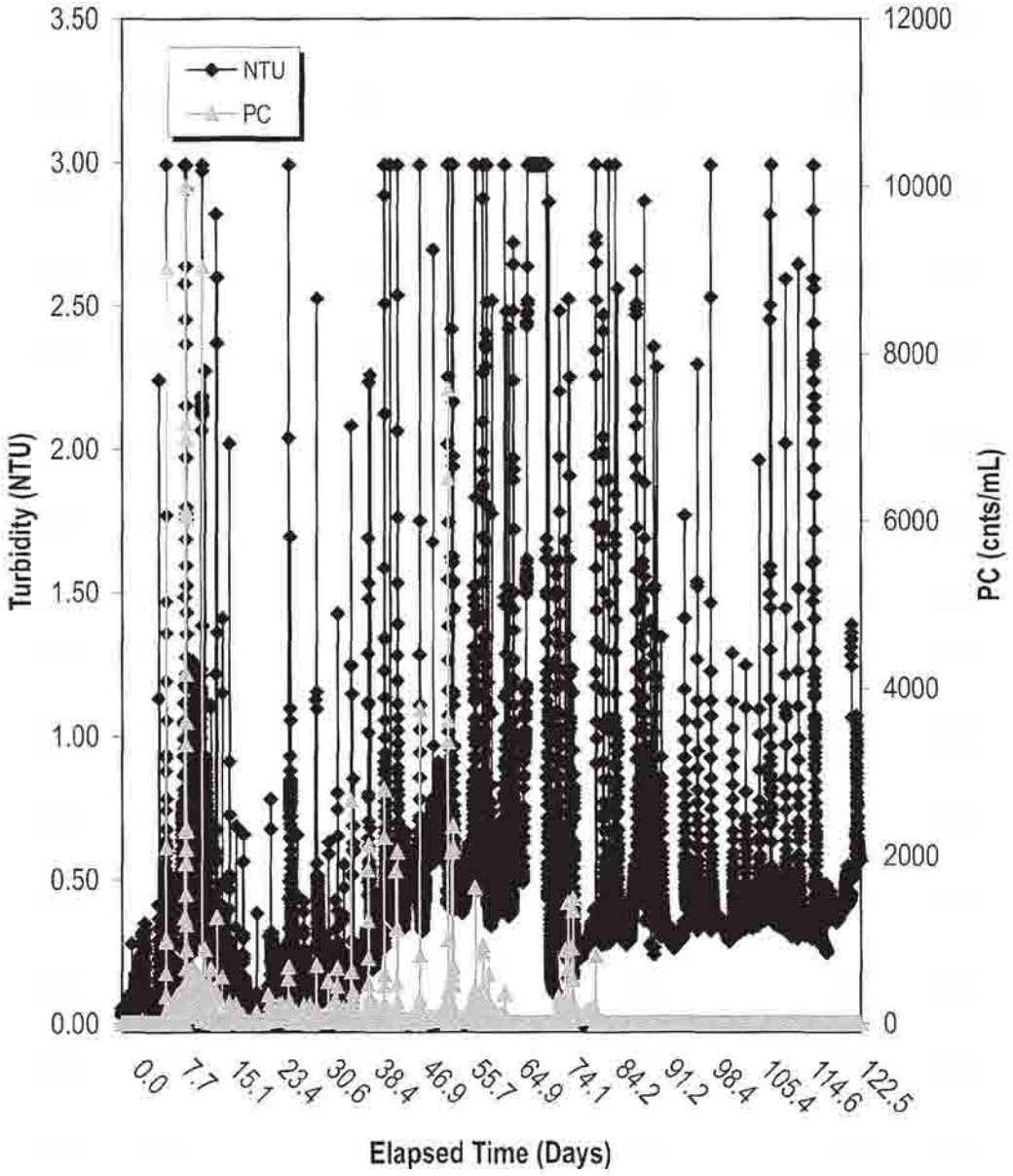
29050



FIXED-BED EFFLUENT TURBIDITY AND PARTICLE COUNTS

FIGURE 3.31

20-C1WA204P3.31-6625A10.CDR

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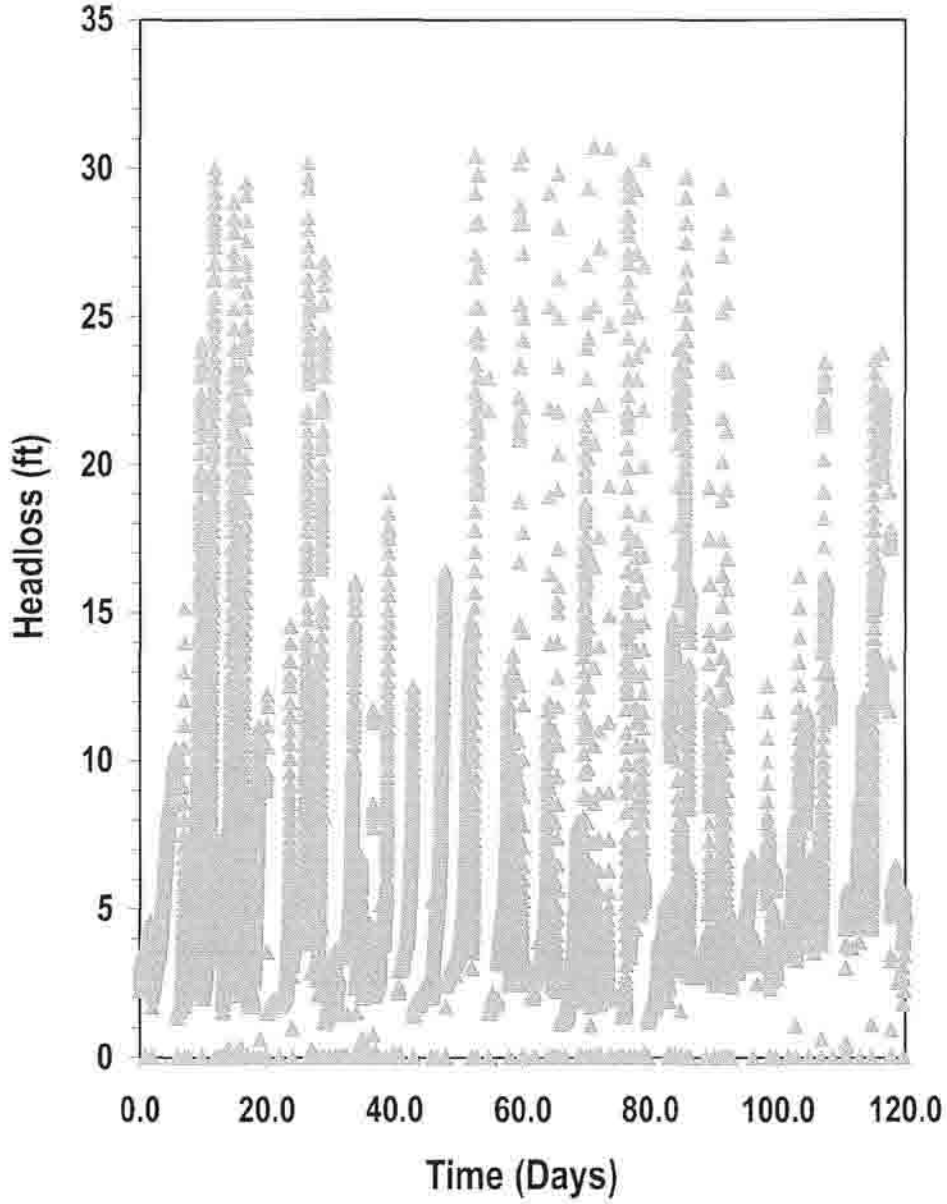
29051



FIXED-BED HEADLOSS

FIGURE 3.32

20-CLWA204F3.32-6625A10.CDR

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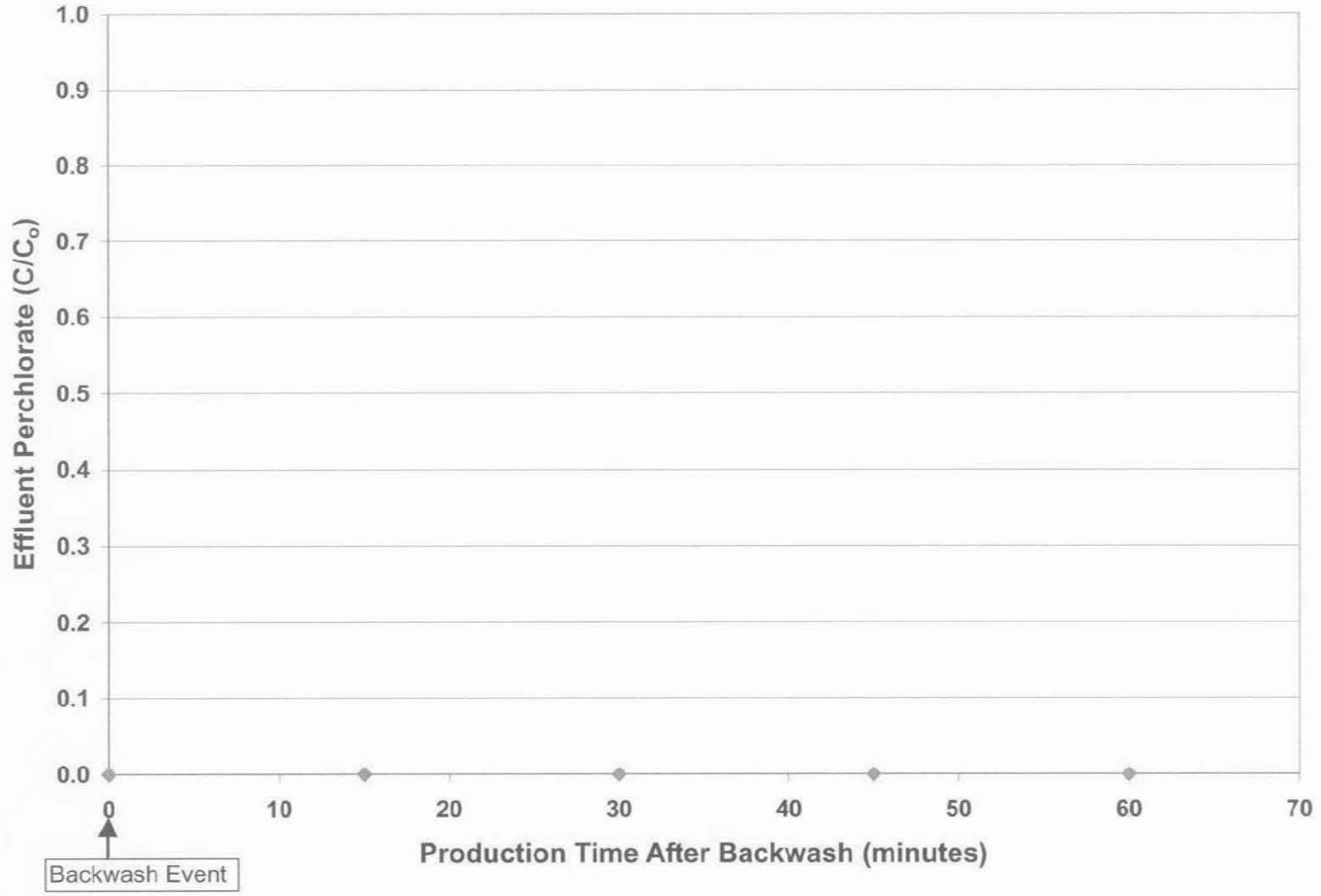
20-CLWA204F3.33-6525A10.CDR



FIXED-BED BACKWASH CHALLENGE TEST

FIGURE 3.33

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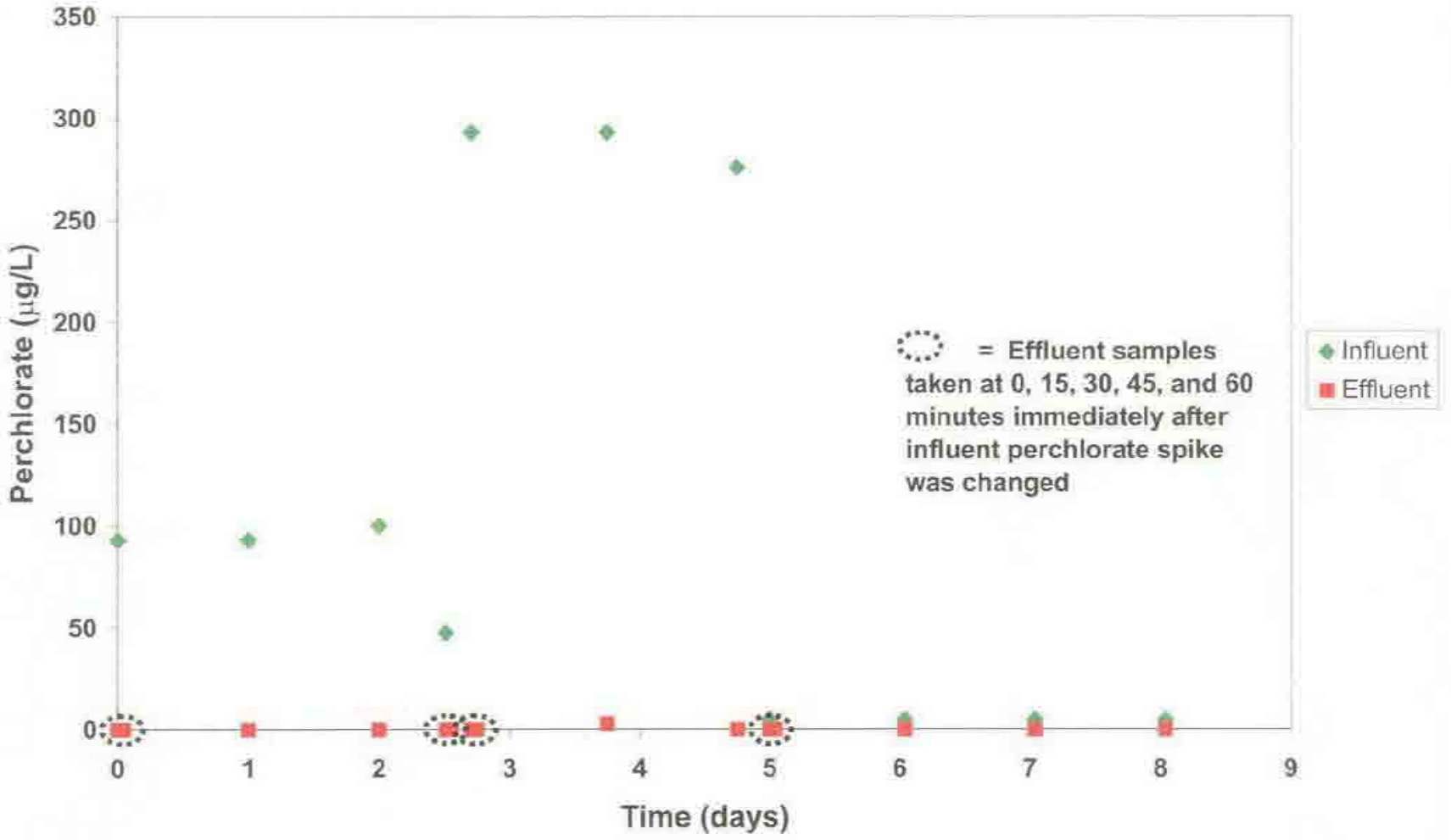
20-CLWA204F3.34-6625A10.CDR



FIXED-BED PERCHLORATE SPIKE CHALLENGE TEST

FIGURE 3.34

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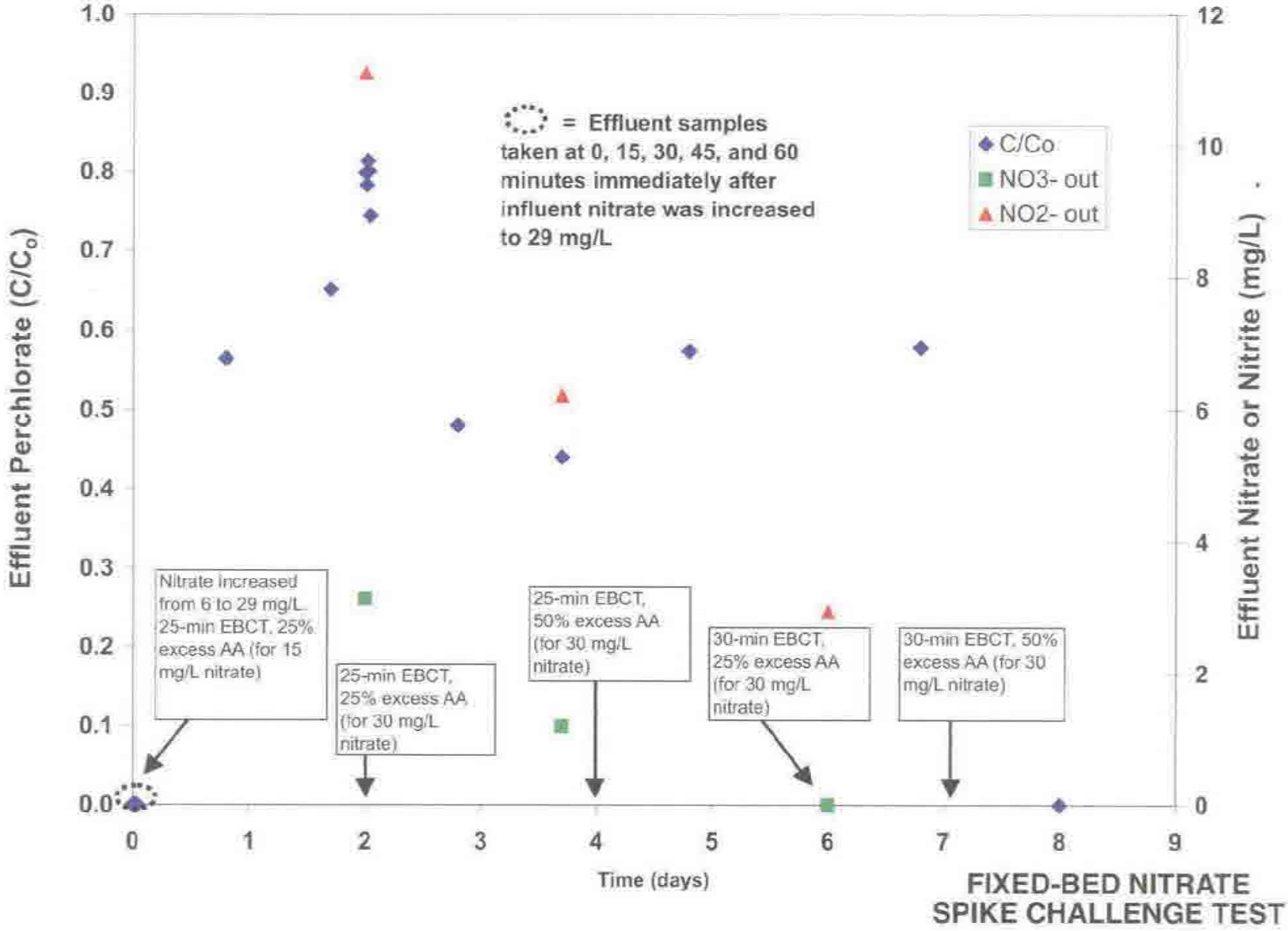
7.5.5.3 Nitrate Spiking

When the feed nitrate concentration was increased stepwise from 6 mg/L as NO_3 to 29 mg/L as NO_3, perchlorate was not detected in the high resolution samples taken up to an hour after the event (Figure 3.35). However, samples taken ≥ 24 hours after the step increase showed perchlorate, nitrate, and nitrite breakthrough. Increasing the acetic acid feed concentration and EBCT did not immediately recover perchlorate removal performance to below detection. Eight days after the feed nitrate concentration was increased by 23 mg/L as NO_3^-, complete removal of nitrate, nitrite, and perchlorate was again observed in the FXB. These data suggest two important phenomena:

1. When large step increases in feed oxidant concentrations occur, the biological FXB requires a period of bioacclimation before perchlorate removal to below detection can be reestablished and maintained. In other words, the bacterial mass in the FXB, which was equilibrated to a feed nitrate concentration of 6 mg/L as NO_3^-, was insufficient to handle a sudden increase in feed nitrate concentration of 23 mg/L as NO_3^-. The bacterial community had to grow and equilibrate with a much higher nitrate concentration before it could produce the redox conditions necessary for complete perchlorate removal.

2. Via adsorption, GAC provides a safety factor with respect to perchlorate removal in the FXB. This is supported by the lack of perchlorate detections immediately following the step nitrate increase. The primary perchlorate removal mechanism in the biological FXB is biological reduction. However, if the microbial activity in the filter is insufficient to remove perchlorate, the GAC can adsorb perchlorate for a period of time to prevent breakthrough. If perchlorate diffusion through the biofilm is fast, adsorption could be occurring near the top of the GAC bed, where the biological activity is highest. If perchlorate diffusion through the biofilm is slow, adsorption could be occurring in the lower portions of the GAC bed, where there is little biological activity. Sorption sites may be biologically regenerated when perchlorate reducing conditions return to the FXB. This may be the case even for adsorption sites in the lower portions of the bed, as GAC tends to migrate toward the top of the column during a backwash event, positioning it at depths of increased biological activity. This hypothesis explains why there might be perchlorate adsorption capacity available on the GAC after five months of pilot testing.

Large step changes in nitrate concentration, like the one tested during this experiment, are not typical for a groundwater system. Unintentional, gradual nitrate fluctuations were observed throughout pilot testing and did not impact perchlorate removal performance in the FXB.



FIXED-BED NITRATE SPIKE CHALLENGE TEST

FIGURE 3.35

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7.5.5.4 System Shut-Down

Figure 3.36 shows the results of the 24- and 48-hour shut-down tests. The pilot plant was turned off for 24 hours and then restarted using a 25-minute EBCT and 7.8 mg/L acetic acid carbon. No backwash was performed prior to restarting the FXB. Samples taken at 0, 15, 30, 45, and 60 minutes and 24 hours after the pilot was restarted showed no perchlorate breakthrough. However, 26 percent and 40 percent breakthrough occurred 48 and 72 hours after the pilot was put back into production. After the 72-hour sample, the pilot was turned off for a period of 48-hours and then restarted without a backwash. Samples taken at 0, 15, 30, 45, and 60 minutes, 24 hours, and 48 hours after the pilot was restarted showed no perchlorate breakthrough. The 72-hour sample showed 24 percent breakthrough and the 96-hour sample again showed perchlorate removal to below detection.

The 24-hour shut-down experiment was repeated, but included a backwash prior to restarting the system. As Figure 3.36 indicates, no perchlorate was detected in the effluent in the high resolution samples or in subsequent samples taken daily for five days. A review of previous data also revealed four periods over which the biological FXB pilot system was shut down unintentionally. These periods ranged from 12 to 62 hours, the biological FXB was backwashed prior to restarting after each period, and production EBCTs were 15 or 25 minutes. No effluent perchlorate was detected following the shut down periods (Figure 3.37).

The biological FXB was also shut down for a two-week period in December 2003. It was backwashed and restarted at a 25-minute EBCT. Consistent perchlorate removal was immediately observed and sustained; no effluent perchlorate was detected.

7.5.5.5 Electron Donor Feed Failure Simulation

To investigate the impact of the future of the electron donor addition on perchlorate removal performance in the FXB, the acetic acid feed was shut off and effluent perchlorate concentrations were monitored. Samples taken at 0, 15, 30, 45, and 60 minutes and 2, 3, 5 and 24-hours after the acetic acid pump was turned off showed no perchlorate breakthrough (Figure 3.38). The acetic acid pump was then restarted and perchlorate continued to be removed to below detection. The following hypothesis may account for the exceptional perchlorate removal performance in the biological FXB while no exogenous electron donor was being added to the system:

1. The bacterial community in the biological FXB was respiring endogenously. That is, bacteria were metabolizing their own cells for use as an electron donor. This often occurs when food sources are scarce.

2. Via adsorption, GAC was providing a safety factor with respect to perchlorate removal in the FXB. When the acetic acid pump was turned off, biologically reductive activity likely slowed in the filter, allowing adsorption to become a more active mechanism for perchlorate removal.

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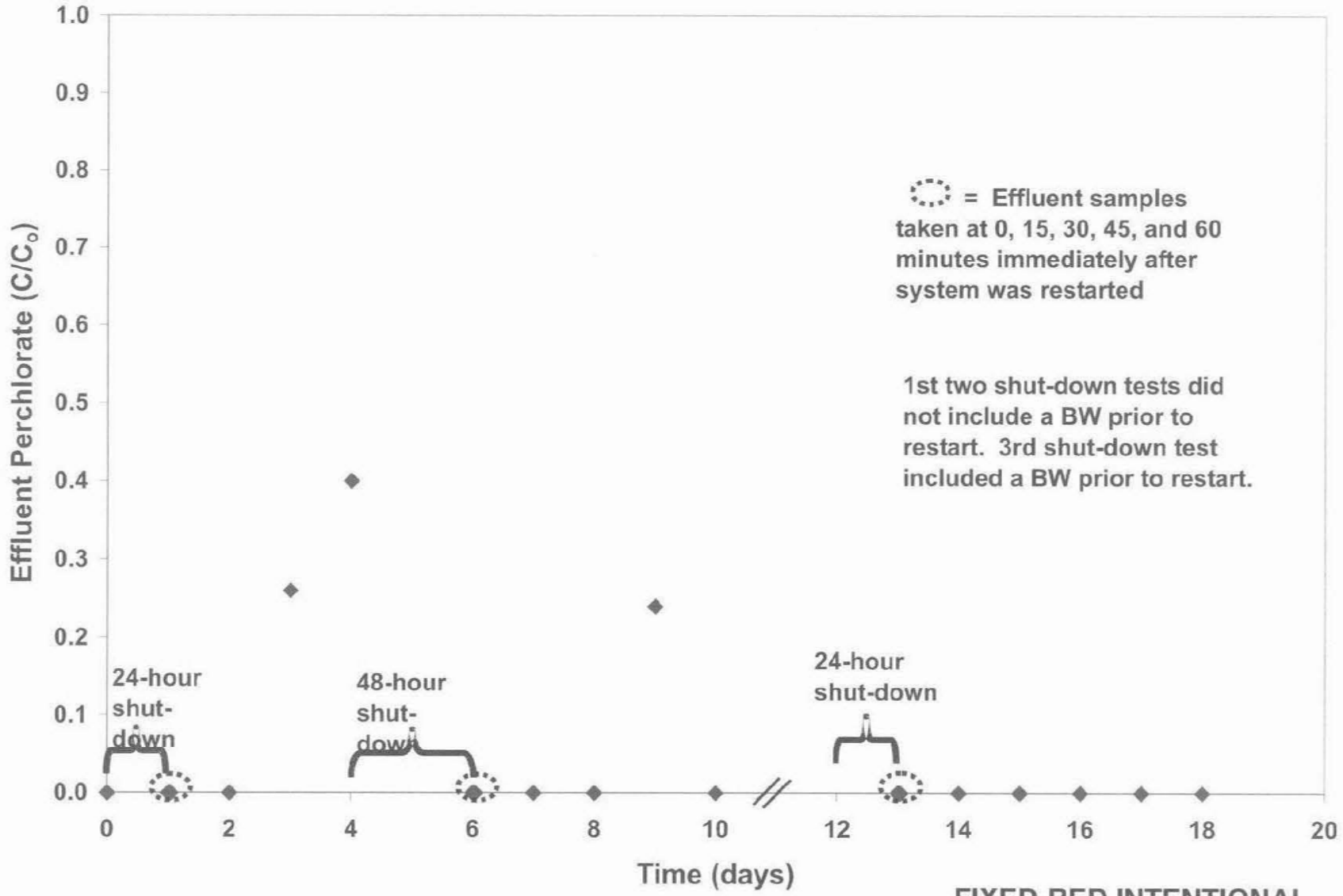

FIXED-BED INTENTIONAL SHUT-DOWN CHALLENGE TEST

FIGURE 3.36

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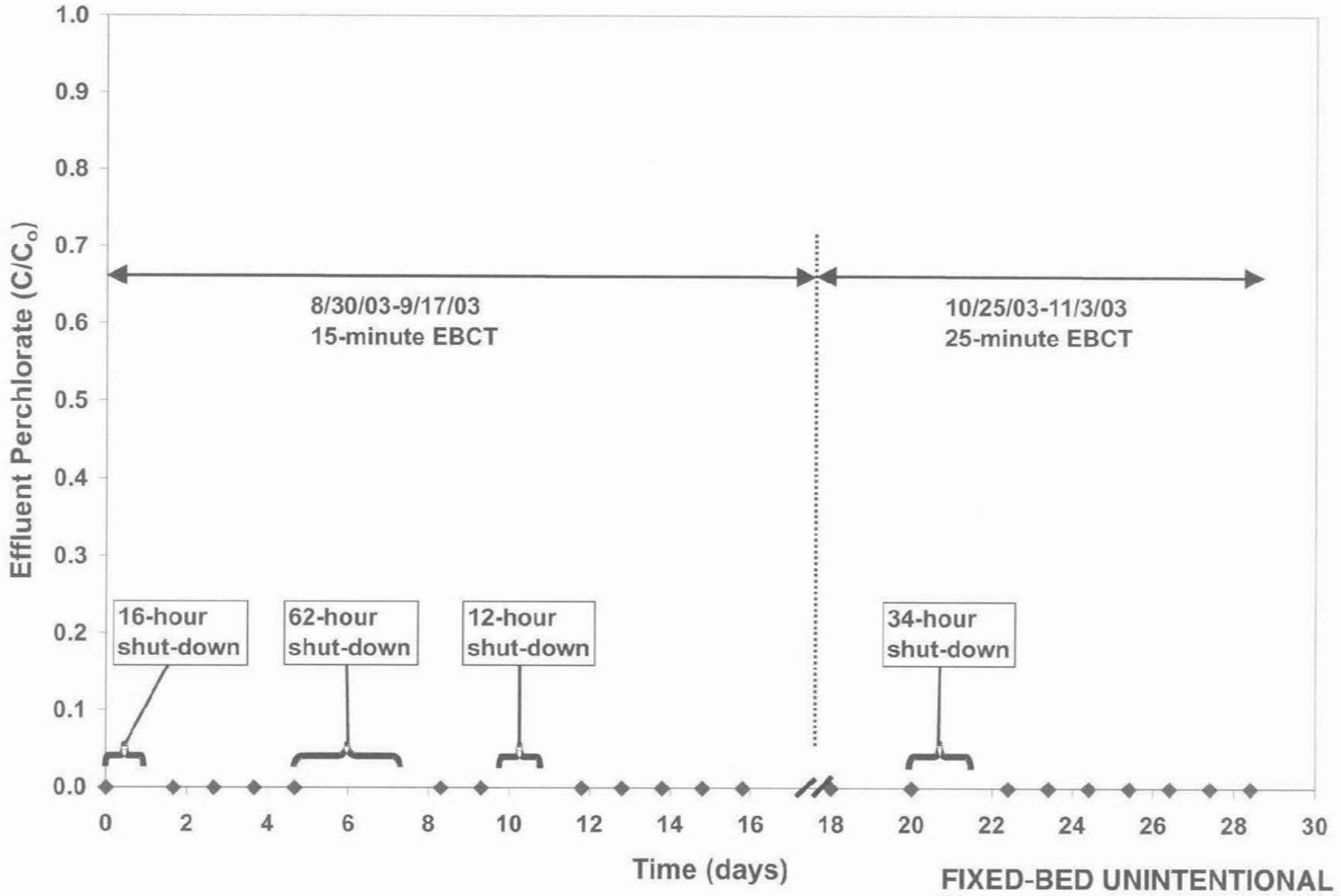
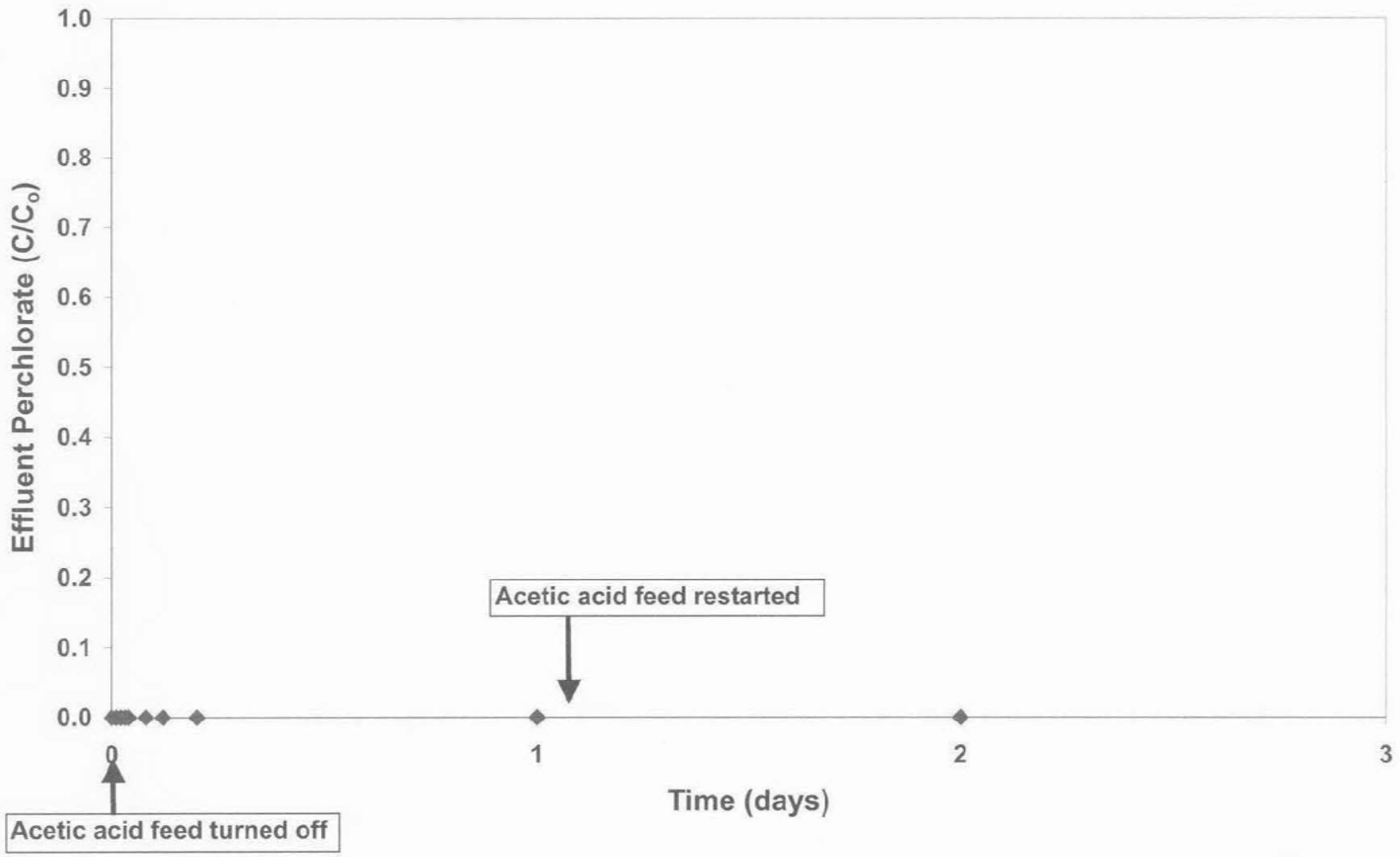


FIXED-BED UNINTENTIONAL SHUT-DOWN PERFORMANCE

FIGURE 3.37

20-CLWA204F3.38-6625A10.CDR



FIXED-BED ACETIC ACID FEED FAILURE CHALLENGE TEST

FIGURE 3.38

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It is possible that both of the above phenomena contributed to the 24-hour removal of perchlorate to below detection in the biological FXB while the acetic acid feed was shut off, though no experiments were performed to confirm this.

7.5.6 Backwash Water Quality

Table 3.22 lists backwash water quality data, as determined using composite samples of backwash water.

Table 3.22 Backwash Water Quality
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

Parameter	Range
Perchlorate (µg/L)	ND (two points)
AOC (mg/L)	1.0-2.5
COD (mg/L)	63-250
VSS (mg/L)	41-140
TSS (mg/L)	39
Total coliforms (MPN/100 mL)	4-110
Fecal coliforms (MPN/100 mL)	ND - 4

The level of perchlorate in the backwash water (ND) is below the Los Angeles County Sanitation District (LACSD) Phase I limit of 4 ppb. The values for COD and TSS are used in obtaining discharge permits for the disposal of the backwash water if the water is being discharged into LACSD lines.

7.5.7 Summary

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shutdowns, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 15 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter.

7.6 Fluidized Bed Reactor

7.6.1 Perchlorate Removal Performance

Over the course of pilot testing, the FBR achieved perchlorate removal to below detection for periods of up to 8 days. However, perchlorate removal performance generally fluctuated and sustained (i.e., ≥ 2 weeks) removal to below detection was not achieved (Figure 3.39).

7.6.1.1 Mechanical & Operational Adjustments

Numerous mechanical and operational adjustments were made throughout pilot testing to establish sustained perchlorate removal to below detection. A detailed list of these adjustments is provided in Table 3.23 followed by a description of the main mechanical and operational changes, reasons for their implementation, and their impact on perchlorate removal performance. Throughout the course of the study, changes made to the system were done under the direction of representatives from Shaw Environmental.

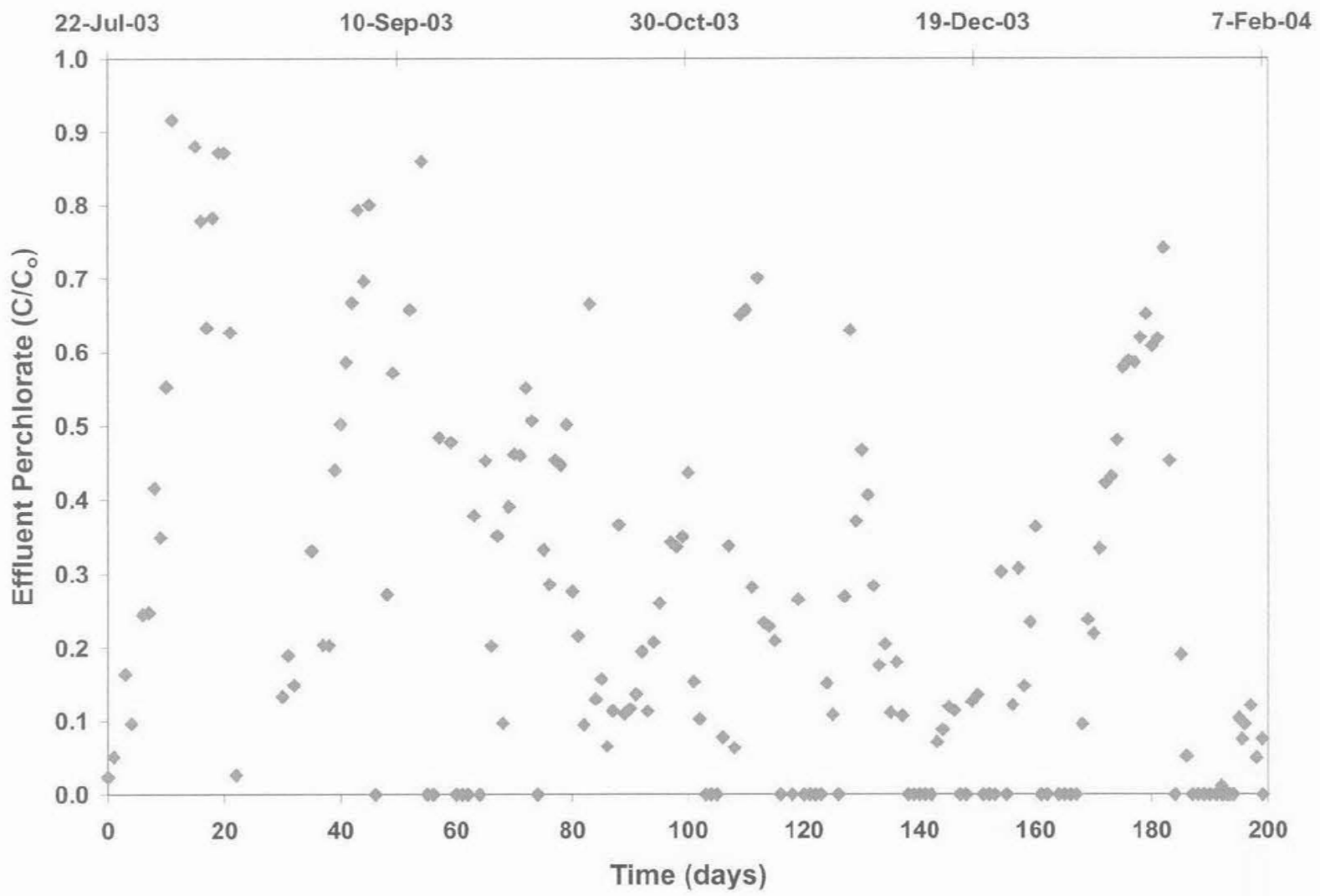
Table 3.23 FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Date (Day of operation)	Event
7/21/03 (0)	System started. 3 gpm.
8/2/03 (11)	Power outage at pilot caused system shutdown
8/4/03 (13)	System restarted, causing carbon to blow out top of reactor.
8/6/03 (15)	Phosphorous added to feed at 0.2 PO_4–P
8/11/03 (20)	Carbon ball-like mass observed in reactor.
8/13/03 (22)	Mechanical mixer observed to be missing
8/14/03 (24)	System put in recycle to scour carbon.
8/19/03 (29)	Carbon manually cleaned with PVC pole and air scour. Carbon/biomass mats broken up and biomass removed.
8/26/03 (36)	Biomass separator installed with 3/8" SS. Top of reactor removed to insert tubing. Designed to operate continuously by drawing carbon from the bottom of the reactor and place carbon back to top of bed.
8/28/03 (38)	Biomass separator clogged, shut down.
8/29/03 (39)	Biomass separator system changed to 3/4" PVC. Configuration changed to draw from top and put carbon back to bottom.
9/1/03 (41)	Solids recovery tank overflowed. Lowered flow to 1 gpm. Large mat of biomass observed in tank, possibly due to aerobic growth. Large amounts of growth in pump.
9/2/03 (42)	Feed and recycle lines and pump cleaned of biomass.
9/9/03 (49)	Nitrogen blanket added to the top of the reactor to minimize re-entrainment

Table 3.23	FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Date (Day of operation)	**Event**
	of oxygen.
9/16/03 (56)	Reconfigured system piping to bypass oxygenation vessel. Moved acetic acid injection point closer to bioreactor vessel. Biomass separator system to be operated for 1 hour per day.
9/17/03 (59)	Solids recovery tank overflowing, system shut down for 1 hour (recycle).
9/18/03 (58)	Acetic acid pump replaced. It had lost prime several times.
9/24/03 (64)	Phosphorous feed concentration increased to 3 mg/L PO_4-P
9/25/03 (65)	Excessive biogrowth in effluent line causing back-up of the solids recovery tank. Effluent line cleaned out.
9/26/03 (66)	Flow decreased to 2 gpm
9/29/03 (69)	Flow increased to 3 gpm. Large amounts of biomass floating on water surface in solids recovery tank. Mat removed from tank.
10/1/03 (71)	Water observed in nitrogen line. Water removed and nitrogen restarted. Flow decreased to 2.5 gpm.
10/3/03 (73)	Phosphorous feed concentration increased to 3.5 mg/L PO_4-P.
10/6/03 (76)	Small carbon ball mass observed in reactor. Ball broken up manually and with biomass separator.
10/8/03 (78)	Feed flow reduced to 1.5 gpm.
10/17/03 (87)	Feed flow reduced to 1.0 gpm.
10/21/03 (91)	Feed flow reduced to 0.8 gpm.
10/23/03 (93)	Samples sent to Shaw lab for analysis. Results corroborate results seen from CLWA lab.
10/24/03 (94)	Biomass separator to remain off to promote bed expansion.
10/30/03 (100)	Carbon removed from reactor and bottom of bioreactor removed to check for distribution header clogging. No clogging observed. Added 2 feet of carbon to the reactor for settled bed of 72" and expanded of 92". Flow changed to 2 gpm.
10/31/03 (101)	Flow increased to 3 gpm.
11/3/03 (104)	More carbon added to reactor for settled bed of 82" and expanded of 106".
11/5/03 (106)	Phosphorous feed concentration decreased to 2.5 mg/L PO_4-P
11/13/03 (114)	Micronutrients added to the feed water through electron donor feed.
11/26/03 (127)	Second dose of micronutrient added to system
11/28/03 (129)	Third dose of micronutrient added to system
12/3/03 (134)	Flow decreased to 1.5 gpm and mircronutrient eliminated from feed.

Table 3.23	FBR Mechanical and Operational Adjustments Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency
Date (Day of operation)	**Event**
12/5/03 (136)	Flow increased to 3 gpm and acetic acid feed concentration lowered to 13.9 mg/L as C (15% dilution)
12/10/03 (141)	Plant shutdown for 3 hours. Electron donor decreased (94 grams/day).
12/15/03 (146)	Acetic acid feed concentration increased to 20% dilution (125 grams/day)
12/19/03 (150)	Acetic acid feed concentration increased to 30% dilution (185 grams/day)
12/22/03 (153)	Rapid bed expansion noticed in reactor.
12/23/03 (154)	Biomass separator pump turned on for 1 hour due to rapid bed expansion
12/27/03 (158)	Biomass separator pump turned on for 2 hours
12/30/03 (161)	Biomass separator pump turned on for ½ hour
12/31/03 (162)	System placed in recycle due to rapid bed expansion
1/2/04 (164)	System restarted at 3 gpm.
1/7/04 (169)	Acetic acid feed solution decreased to 20% dilution (125 grams/day)
1/9/04 (171)	Suspended biomass removed from top of the reactor
	Phosphate addition reduced by 50% to 1.25 mg/L PO_4-P
1/12/04 (174)	Acetic acid feed solution increased to 25% dilution (155 grams/day)
1/16/04 (178)	Due to phosphoric acid supply limitations, phosphate addition was reduced to 25 mL in 1 L total volume.
1/19/04 (181)	Flow decreased to 2 gpm w/ current donor addition remaining the same (25% dilution at 1 mL/min).
1/20/04 (182)	System reconfigured to bypass solids recovery tank due to high DO in recycle. New perchlorate stock solution mixed incorrectly, causing influent concentrations to be 20-25 ug/L. Increase of phosphate concentrations back to previous levels (>2 mg/L).
1/21/04 (183)	Flow increased to 3 gpm (1 mL/min 25% dilution for donor) and increased ClO4 back to 50 ug/L. Increased flow of donor to 7 strokes/min from 6 (160 grams/day).
1/24/04 (186)	Increased electron donor to 33% dilution. (210 grams/day)
2/2/04 (195)	Increased flow of donor to 8 strokes/min from 7 (225 grams/day).
2/3/04 (196)	Added micronutrient (~50 mL to 8 L)
2/4/04 (197)	Reduced flow of donor to 5 strokes /min from 8 (180 grams/day).
2/5/04 (198)	Reduced flow to 2 gpm.
2/6/04 (199)	System shutdown (recycle).

20-CLWA204F3.39-6625A10.CDR



FLUIDIZED-BED PERCHLORATE

FIGURE 3.39

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Mechanical Adjustments:

- Concern: Excessive clumpy biogrowth was observed in the FBR, potentially causing clogging or short-circuiting. The mechanical mixer, which was designed to control overgrowth in the system, did not function properly.

  Adjustment: A biomass separator system was installed (Day 35) and used intermittently throughout pilot testing.

  Impact: The biomass separator was effective at controlling bed expansion and overgrowth. However, perchlorate removal performance did not appear to improve by the installation of the biomass separator system.

- Concern: Excessive biogrowth was observed across the entire FBR system, which was clogging pumps and piping and may have been causing short-circuiting in the reactor.

  Adjustments: On Day 29, the GAC was manually scoured using a PVC pipe and aeration. Piping and pumps were cleaned out on Days 42 and 65. Biomass clumps were removed from the solids recovery tank (Day 69) and from the reactor (Day 171). The acetic acid feed point was moved closer to the base of the reactor on Day 56.

  Impact: These adjustments were effective at controlling excessive biogrowth, though they did not appear to positively impact perchlorate removal performance.

- Concern: DO was being entrained between the top of the reactor and the recycle line. This could cause aerobic growth in the system and inhibit perchlorate reduction by increasing the redox potential.

  Adjustments: A nitrogen blanket was added to the top of the reactor on Day 49. The effluent/recycle piping was reconfigured to completely bypass the solids recovery tank on Day 182.

  Impact: Adding the nitrogen blanket and bypassing the oxygenation vessel lowered DO entrainment, and perchlorate removal performance improved slightly with each adjustment. Bypassing the solids recovery tank eliminated DO entrainment and appeared to improve perchlorate removal performance substantially. Four days after the system was reconfigured, perchlorate removal to below detection was achieved and sustained for eight days. However, electron donor was also being adjusted during this period and, after eight days of removal to below detection, perchlorate breakthrough was observed. Therefore, though controlling DO entrainment did appear to improve perchlorate removal performance in the FBR, it did not completely eliminate perchlorate breakthrough.

- Concern: The turbulent zone near the base of the FBR is essentially abiotic due to the high shear stresses generated by the feed jets. If this abiotic zone is a significant

fraction of the overall bed depth, then the depth of the anaerobic zone within the carbon bed might be insufficient to allow for the removal of perchlorate to below detection.

- Adjustment: Two feet of carbon were added to the top of the GAC bed on Day 100. An additional 10 inches of carbon were added to the top of the GAC bed on Day 104.

  Impact: Perchlorate removal performance appeared to improve for about a week after the carbon was added to the bed, though this may have been due to adsorption. Regardless, this improvement in perchlorate removal performance was not sustained beyond one week.

Operational Adjustments:

- Concern: Low phosphorous concentrations may be limiting biological activity in the FBR.

  Adjustment: Phosphorous was added to the feed at 0.2 mg/L PO_4-P beginning on Day 15. Phosphorous addition was increased to 3.0 mg/L PO_4-P on Day 64. Phosphorous addition was increased to 3.5 mg/L PO_4-P on Day 73 (Figure 3.40).

  Impact: Adjusting the concentration of phosphorous being added to the feed did not appear to impact perchlorate removal performance in the FBR. Feed PO_4-P was later reduced to 2.5 mg/L and then 1.25 mg/L for short periods of operation, without impacting perchlorate removal performance.

- Concern: The contact time may be insufficient to allow for sustained perchlorate removal to below detection.

  Adjustment: The feed flow was reduced gradually from 3.0 gpm to 0.8 gpm over a four-week period (Days 71 through 99).

  Impact: While increasing the HRT did appear to improve perchlorate removal performance initially, it did not effect perchlorate removal to below detection, and, eventually, perchlorate removal performance declined at the lower feed flow rates.

- Concern: Low concentrations of micronutrients may be limiting biological activity in the FBR.

  Adjustment: A micronutrient solution was added to the feed from Day 114 to Day 134. It was again added on Day 196 through the end of pilot testing. The micronutrient contained low concentrations of iron, copper, magnesium, manganese, zinc, boron, sulfur, molybdenum, and cobalt.

  Impact: The addition of the micronutrient feed might have caused improved perchlorate removal performance initially, though the impact was confounded due to the nearly simultaneous addition of fresh carbon to the bed. Regardless, perchlorate removal performance eventually declined in spite of the micronutrient feed.

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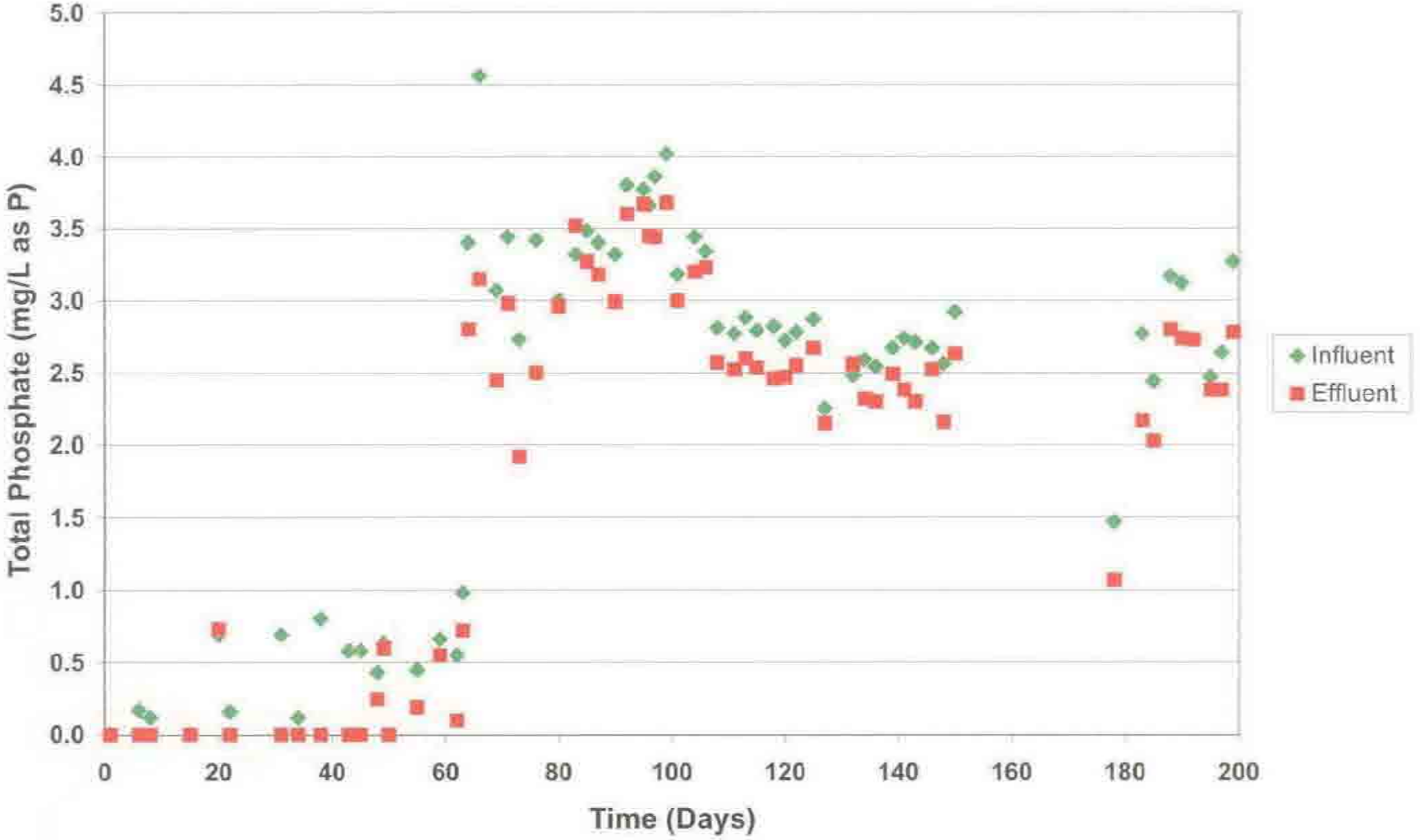

FLUIDIZED-BED PHOSPHOROUS

FIGURE 3.40

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- Concern: Over-excess acetic acid concentrations in the feed may have been selecting away from perchlorate-reducing bacteria and toward sulfate-reducing bacteria. As the feed nitrate concentration decreased during the pilot test period, the acetic acid concentration was not adjusted to account for the decreased oxidant demand in the system. It was theorized that this could help explain why only partial perchlorate removal was observed in spite of very low redox conditions (down to –200 mV). In other words, though complete DO and nitrate reduction and partial sulfate reduction was occurring in the reactor, only partial perchlorate reduction was observed (Figures 3.41 and 3.42), suggesting that the perchlorate-reducing community in the reactor was being depressed.

  Adjustment: Feed acetic acid concentration was lowered on Day 136.

  Impact: Perchlorate was removed to below detection for about a week after the acetic acid feed concentration was lowered. Subsequently, feed acetic acid concentrations were adjusted up and down as feed nitrate concentrations fluctuated. Though perchlorate removal was generally ≥ 90% during this period, sustained perchlorate removal to below detection was not achieved.

7.6.2 Other Parameters

The following non-anionic water quality observations were made during the course of FBR piloting:

- Effluent TOC concentrations were typically 1 to 9 mg/L (Figure 3.43).
- Effluent BDOC concentrations ranged from non-detect to 1.3 mg/L (Figure 3.44).
- On average, pH decreased by 0.5 units across the FBR bed (Figure 3.45). This was likely due to the addition of CO_2 to the water as acetic acid was oxidized.
- HPCs increased across the filter, resulting in counts between 50,000 and 870,000/mL (Figure 3.46).
- Total effluent coliforms ranged from non-detect to 900 MPN/100 mL, but were typically 300 MPN/100 mL or less (Figure 3.47). No fecal coliforms were detected.
- Average feed water turbidities were approximately 0.5 NTU. Effluent turbidities ranged from 2 to 70 NTU (Figure 3.48).

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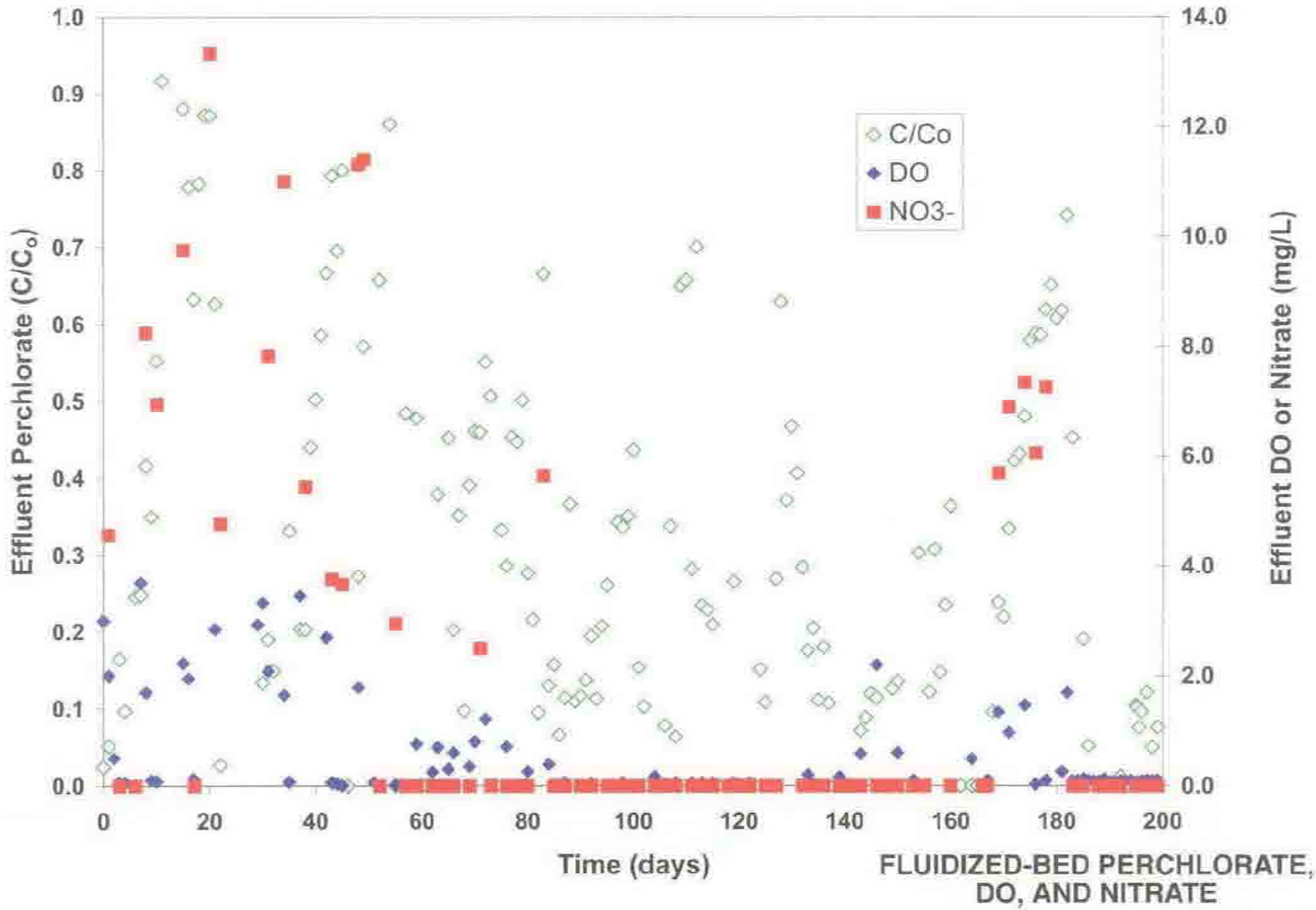

FLUIDIZED-BED PERCHLORATE, DO, AND NITRATE

FIGURE 3.41

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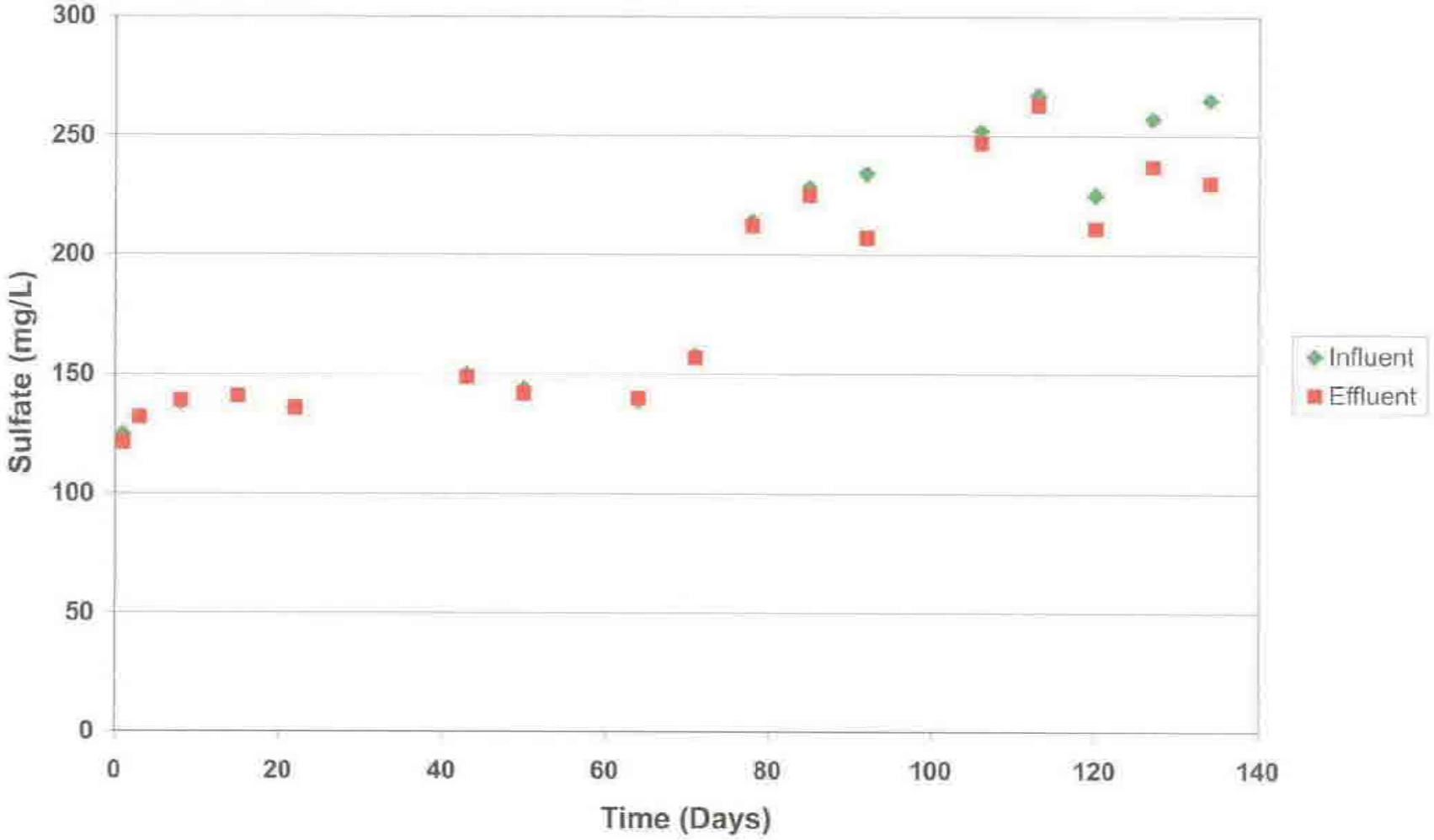

FLUIDIZED-BED SULFATE

FIGURE 3.42

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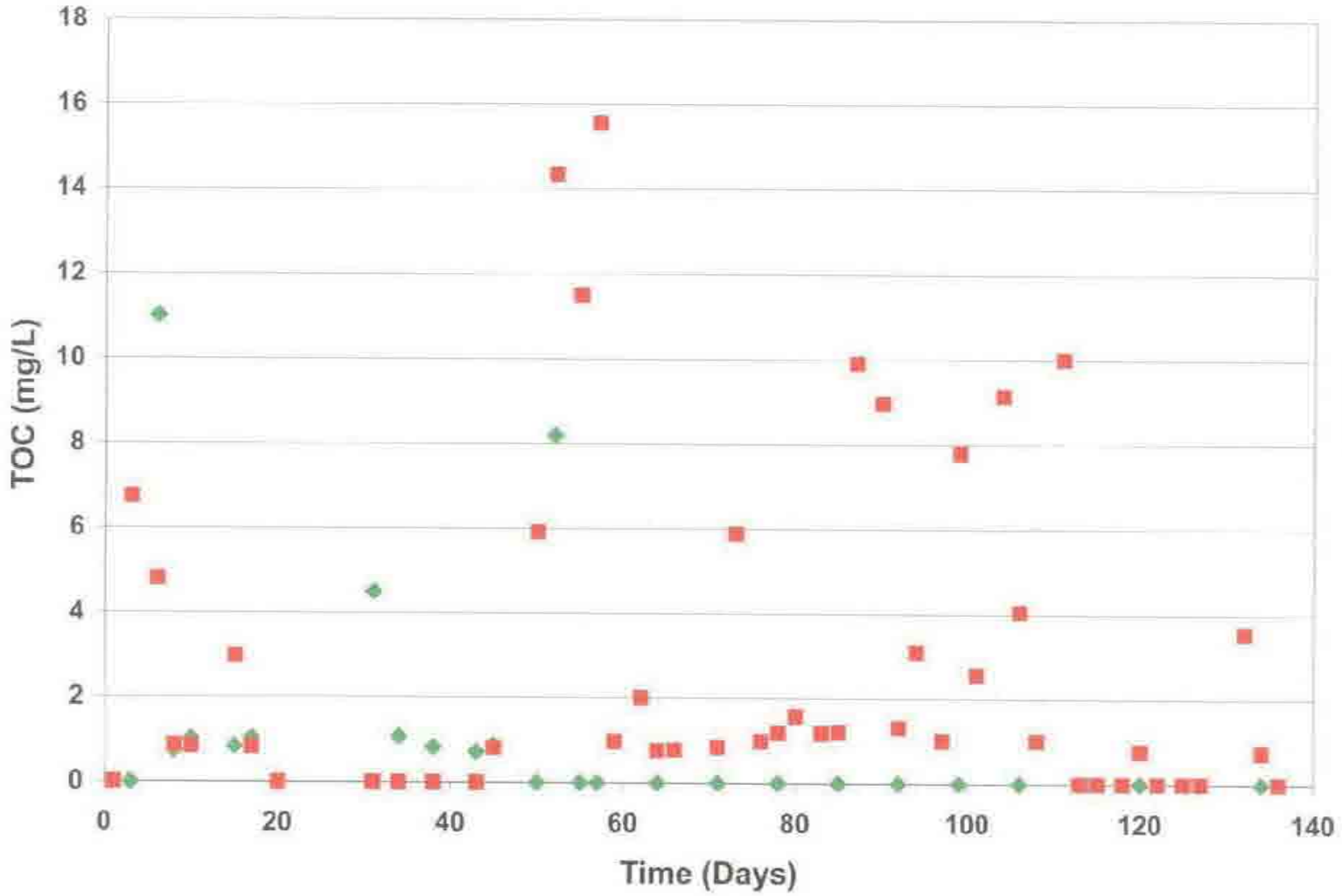

FLUIDIZED-BED TOC

FIGURE 3.43

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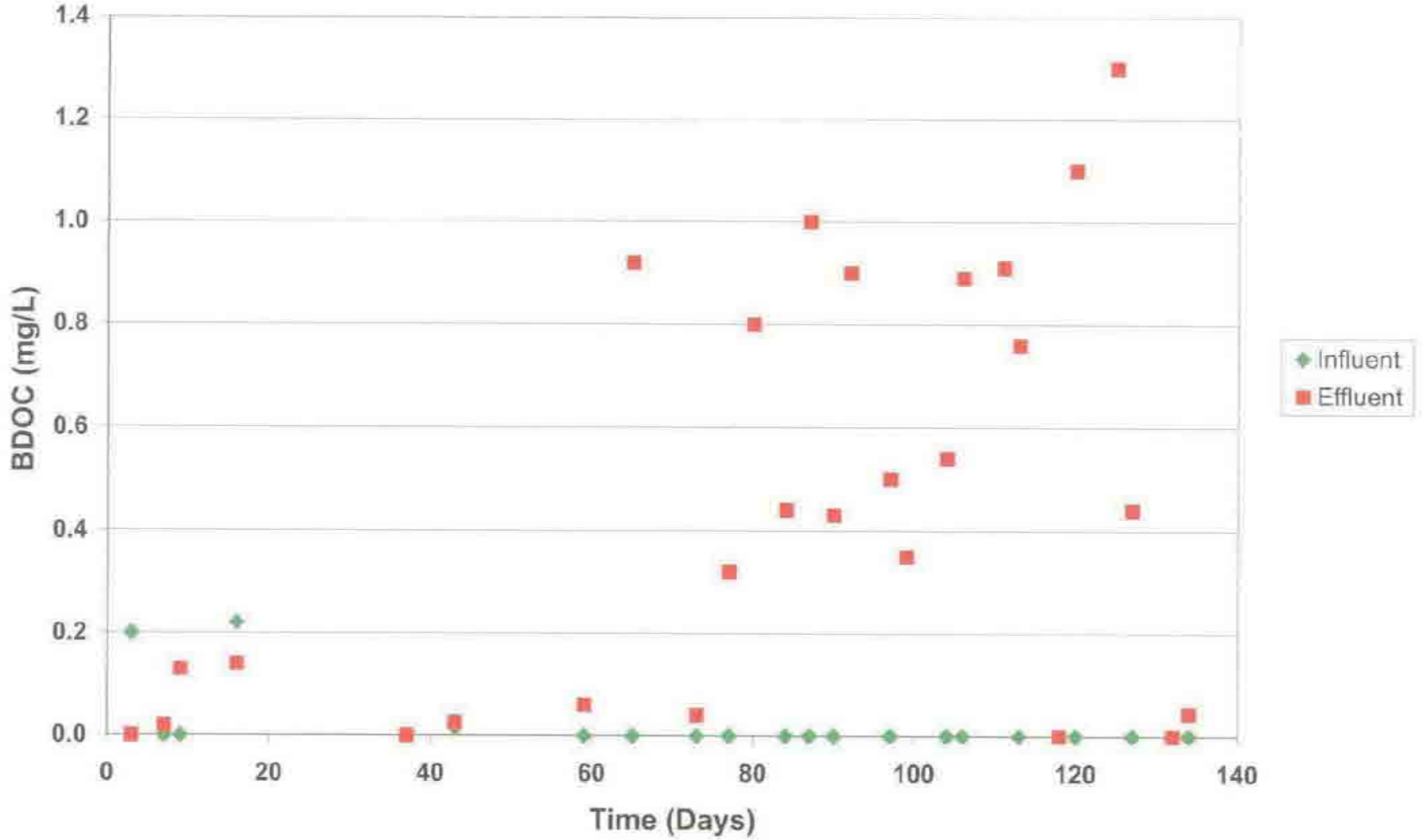

FLUIDIZED-BED BDOC

FIGURE 3.44

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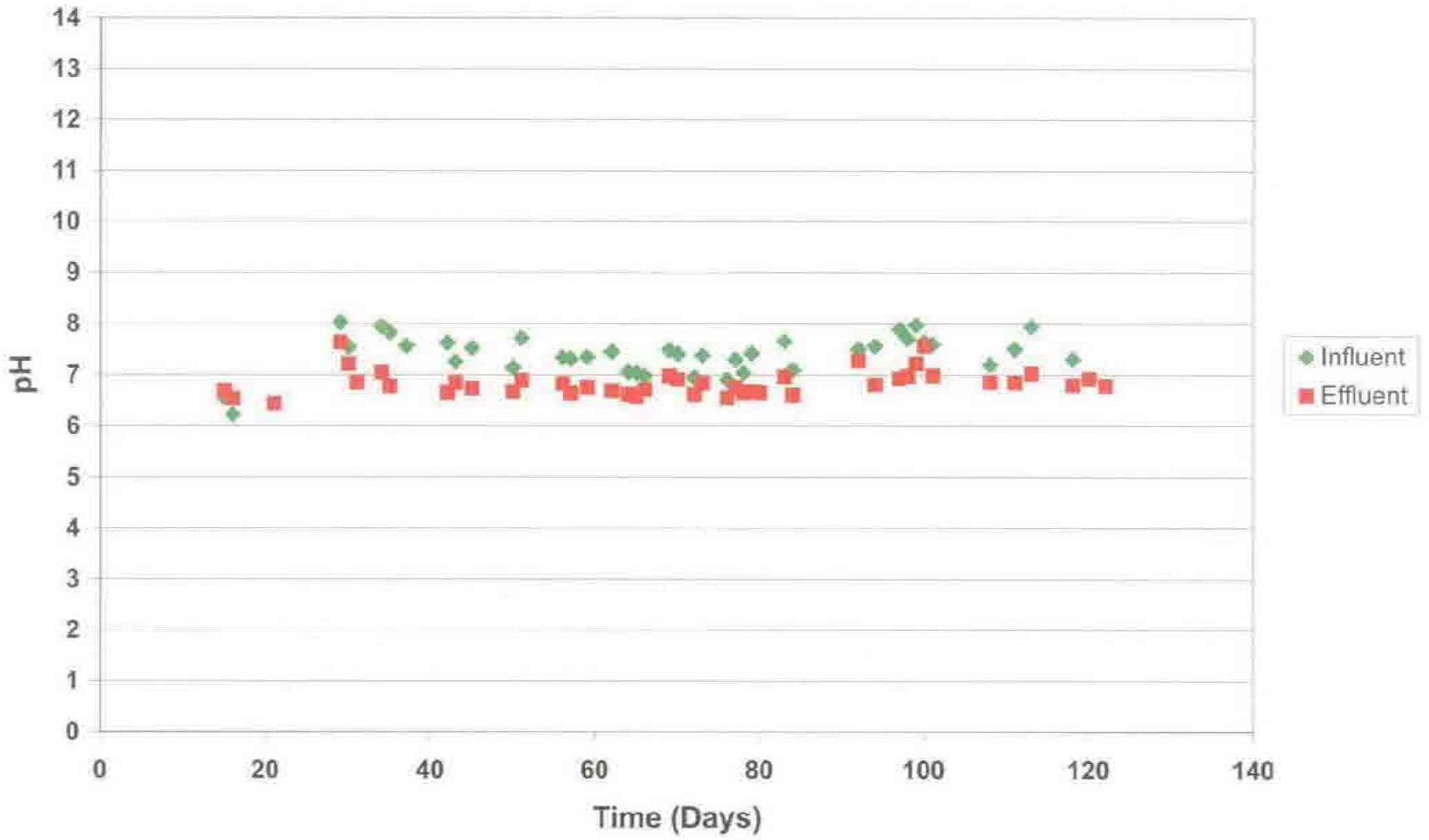

FLUIDIZED-BED pH

FIGURE 3.45

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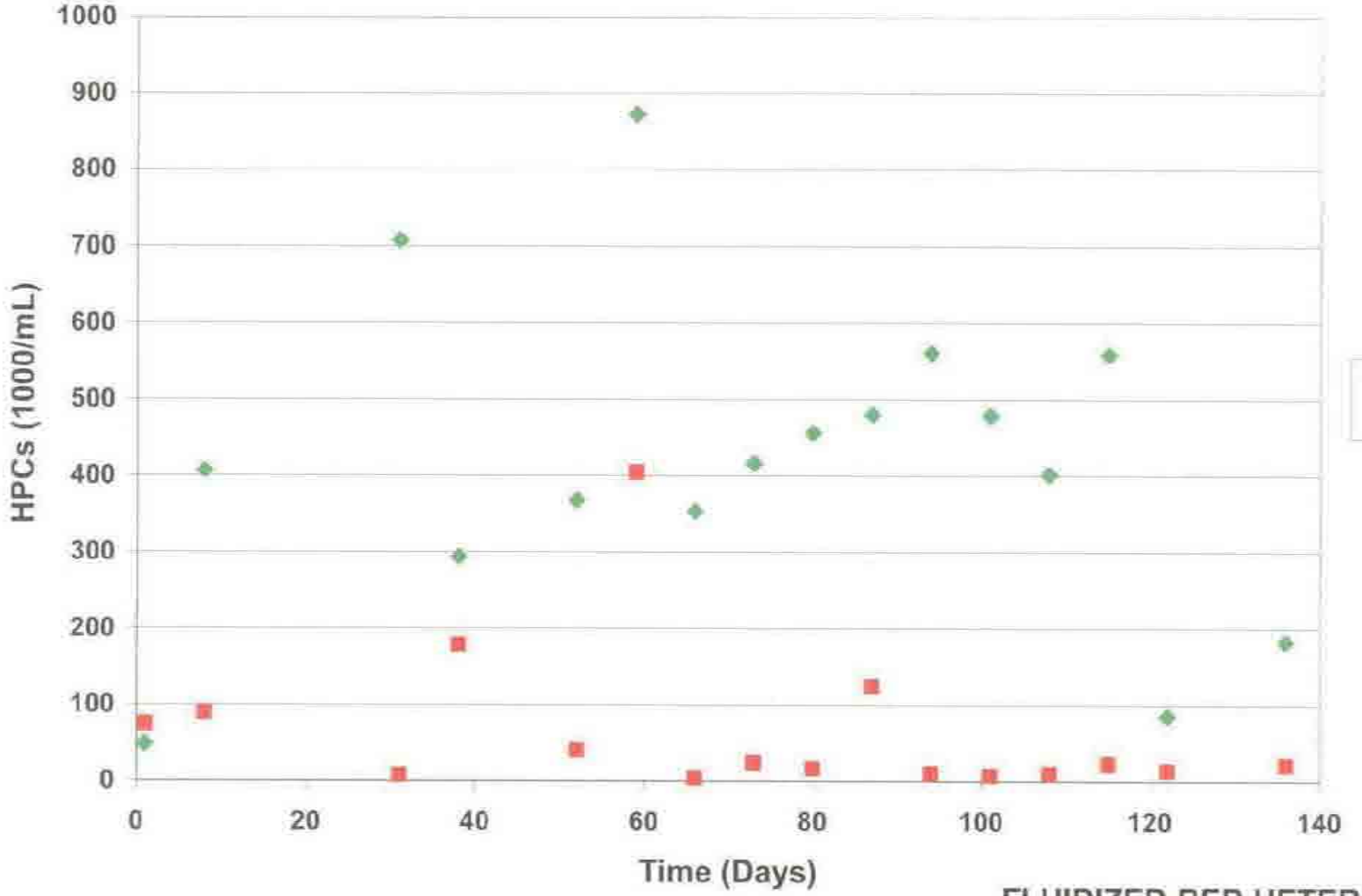

FLUIDIZED-BED HETEROTROPHIC PLATE COUNTS

FIGURE 3.46

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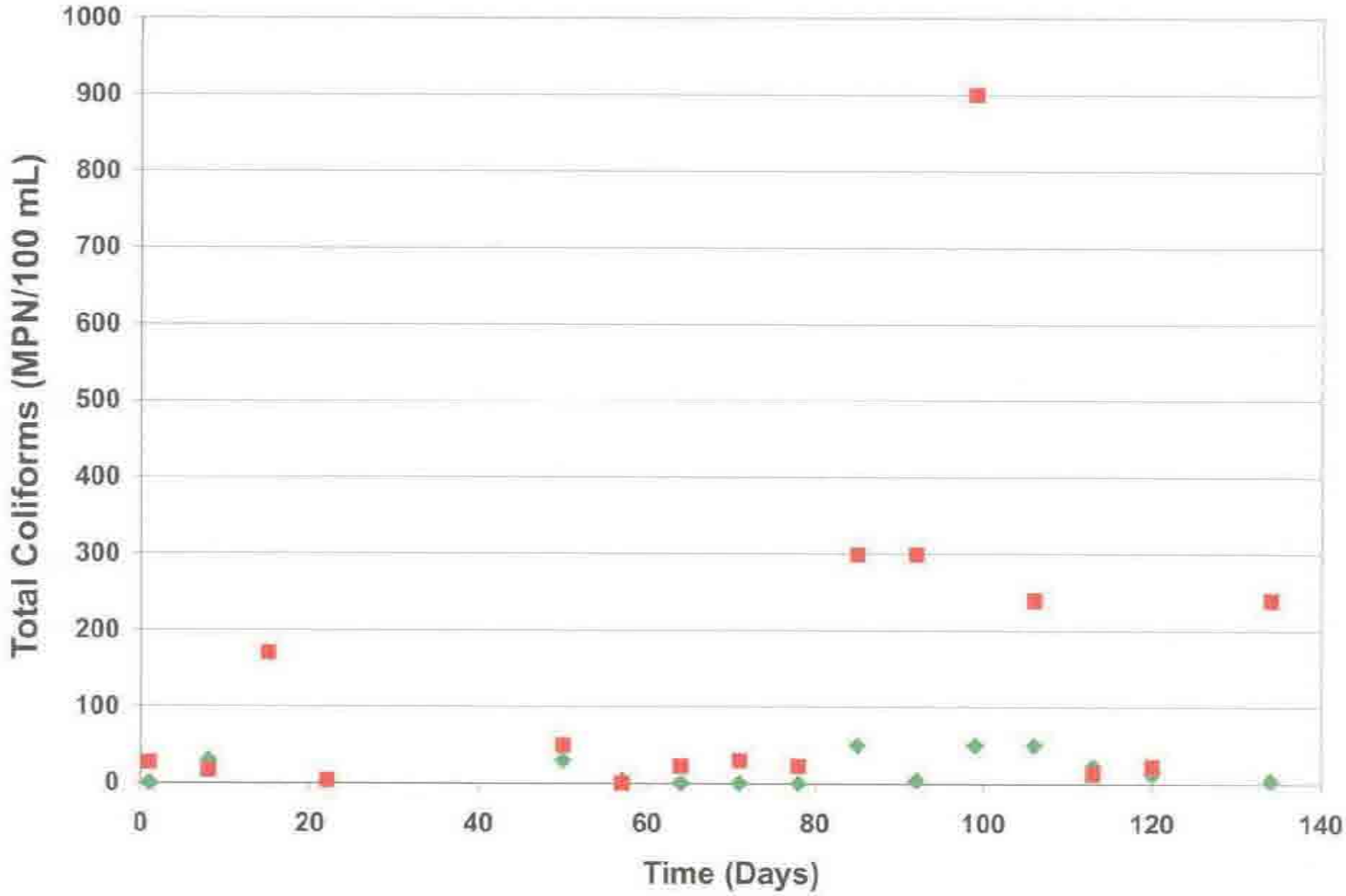

FLUIDIZED-BED TOTAL COLIFORMS

FIGURE 3.47

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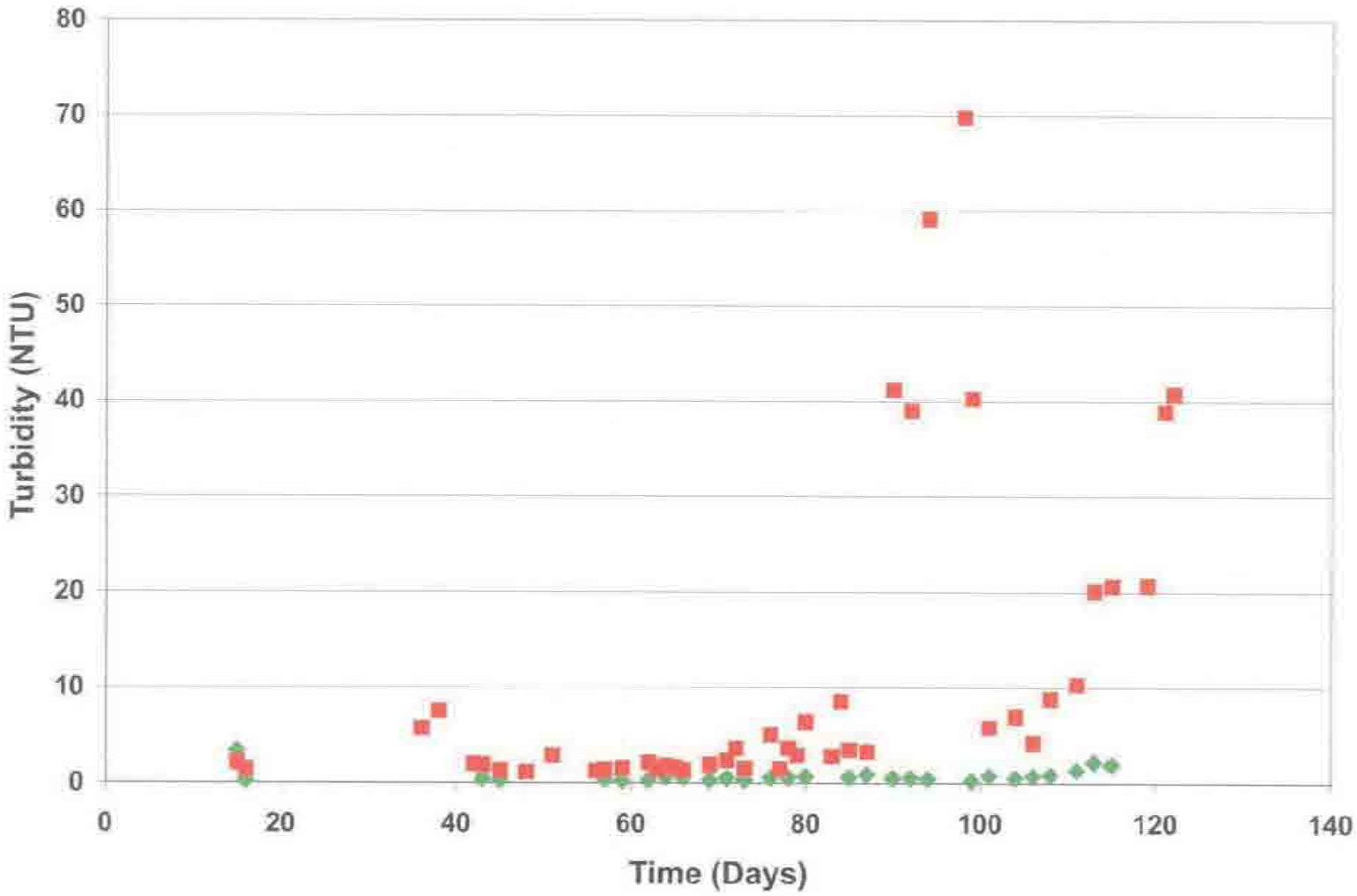

FLUIDIZED-BED TURBIDITY

FIGURE 3.48

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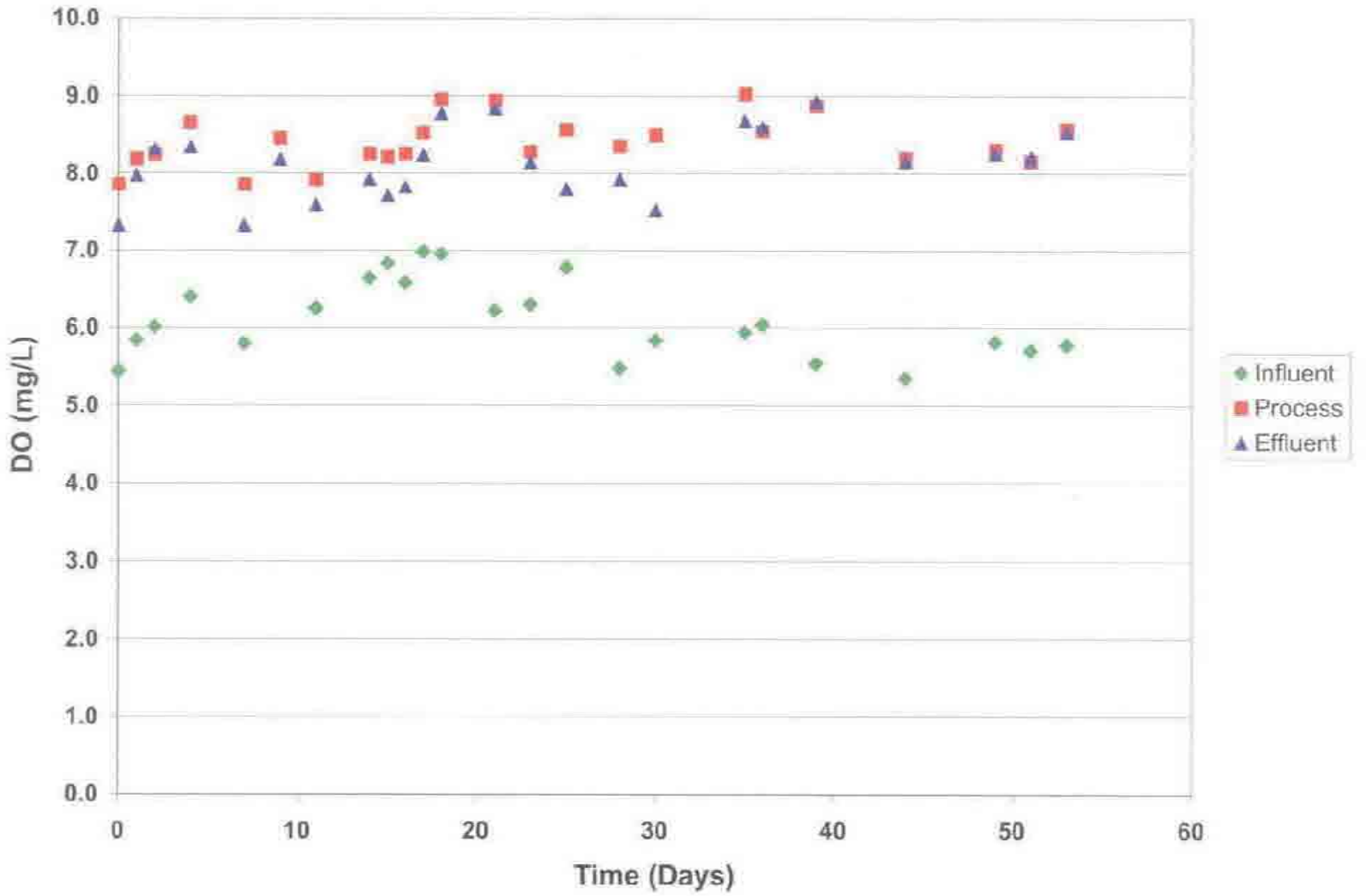

SMBR DISSOLVED OXYGEN

FIGURE 3.49

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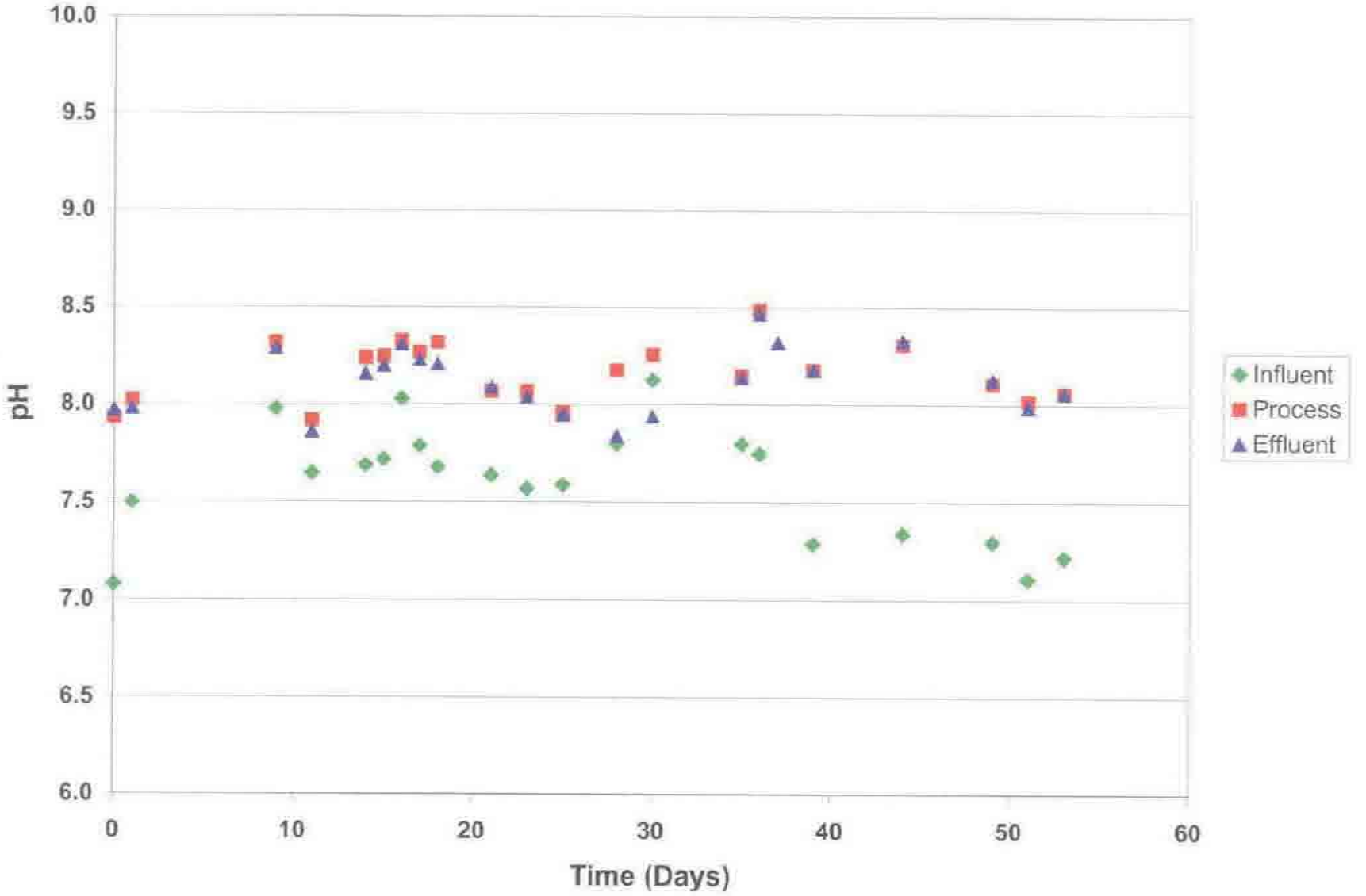

SMBR pH

FIGURE 3.50

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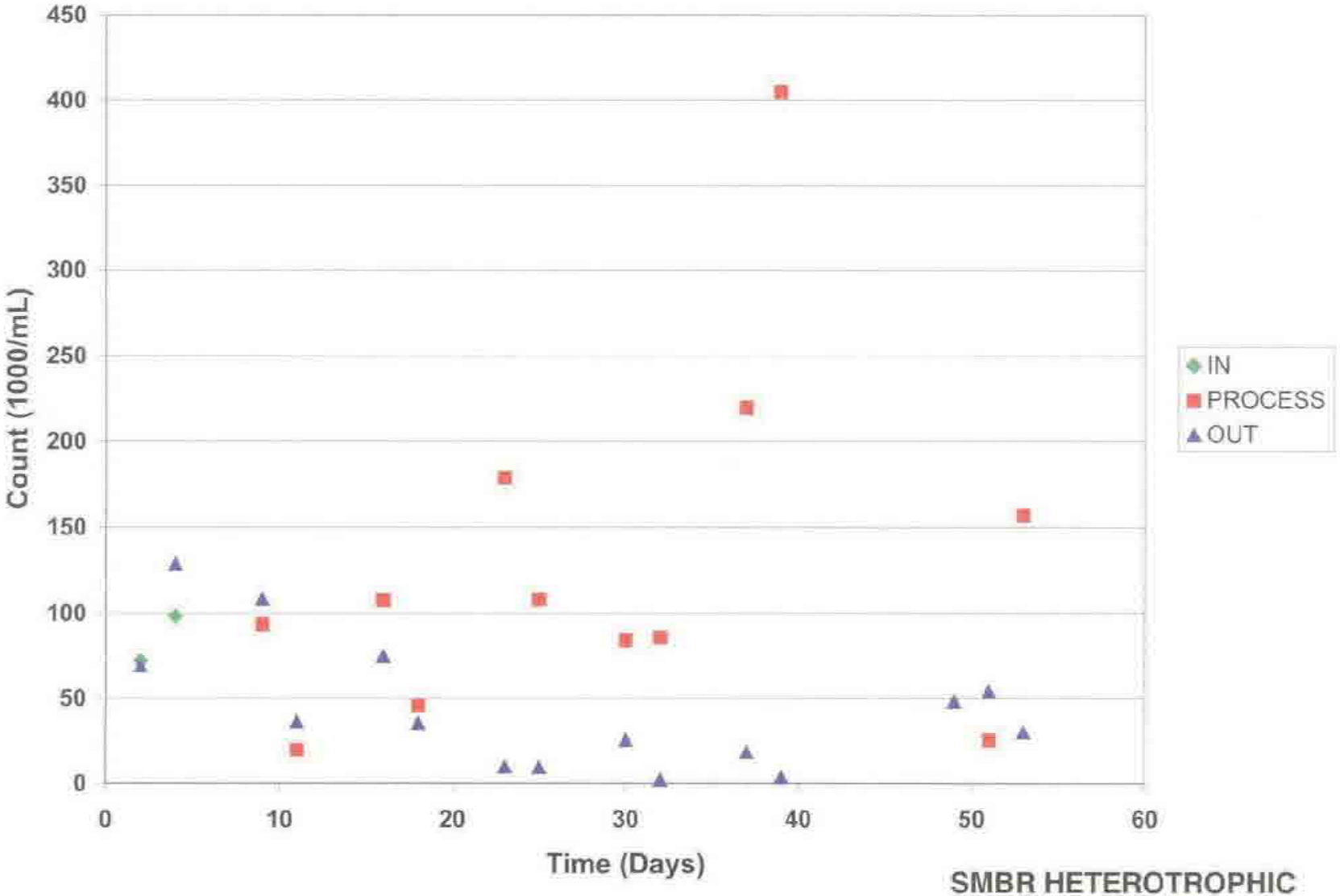

SMBR HETEROTROPHIC PLATE COUNTS

FIGURE 3.51

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7.6.3 Summary

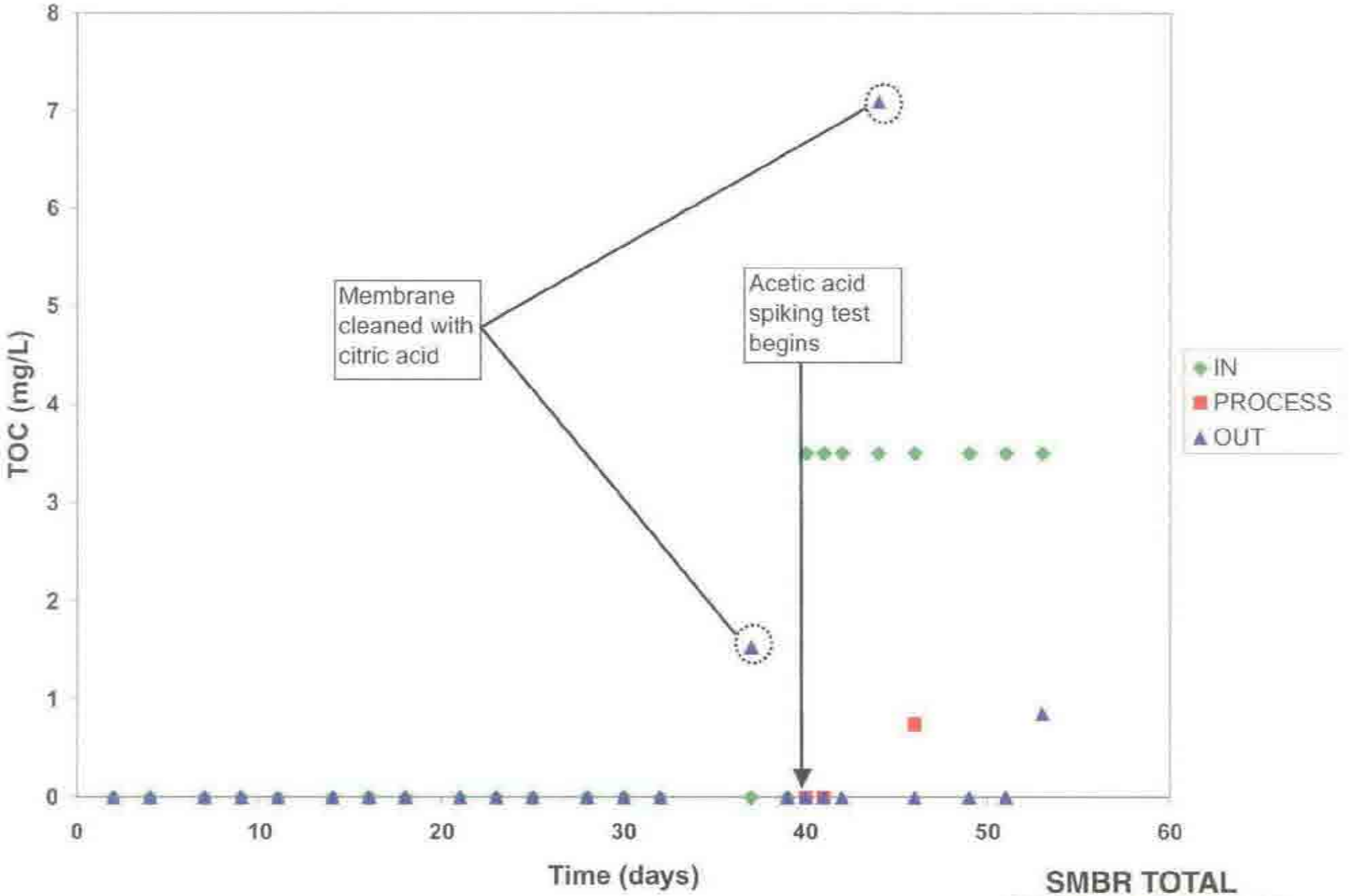
The fluidized-bed reactor did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

7.7 Submerged Membrane Bioreactor (Post-Treatment of FXB Effluent)

The SMBR was set up to provide post-treatment for the FXB effluent, as required by DHS, i.e., aeration, filtration, and biological degradation of excess BDOC. The SMBR was fed with effluent from the FXB biological filter, which was already partially reaerated due to exposure to atmospheric conditions in the backwash tank. As expected, DO concentrations further increased in the SMBR process tank (Figure 3.49). pH also increased during the post-treatment process (Figure 3.50). The water entering the process tank is likely supersaturated with CO_2, produced by the oxidation of acetic acid in the FXB. Aeration within the process tank volatilizes supersaturated CO_2, thus bringing the water into equilibrium with atmospheric conditions and increasing the pH. Figure 3.51 shows that HPCs were being reduced across the ultrafiltration membrane. The effluent HPC concentrations are typically lower than the values observed in the raw well water. (See Figure 3.29.) Additional removal of heterotrophic bacteria can be achieved through disinfection following the SMBR. Batch experiments were performed to assess chlorine demand and HPC reduction using SMBR effluent. The chlorine demand of SMBR effluent was < 1 mg/L in all but one case, and only low doses of chlorine were required to reduce HPCs below 500 counts/mL (Table 3.24).

Table 3.24 Testing Matrix for Bench-Scale Chlorination of SMBR Effluent Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Chlorine Dose (mg/L)	12/1/03		12/3/03		12/5/03	
	Residual (mg/L)	HPCs (counts/mL)	Residual (mg/L)	HPCs (counts/mL)	Residual (mg/L)	HPCs (counts/mL)
0	0	48,450	0	54,150	0	30,400
0.5	0	69,250	0.15	250	0.08	4
1.0	0.17	271	0.31	100	0.60	52
2.0	0.88	10	1.15	450	1.58	2



SMBR TOTAL ORGANIC CARBON

FIGURE 3.52

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Organic carbon concentrations in the effluent of the biological FXB were typically below detection throughout pilot testing. Therefore, 3.5 mg/L of acetic acid carbon was spiked to the SMBR process tank to evaluate the ability of the SMBR system to remove residual organic carbon. Figure 3.52 shows that in all but one instance, TOC concentrations were below detection in the SMBR effluent. Though some of the acetic acid may have volatilized, the lack of acetic acid smell in the vicinity of the process tank suggests that biological oxidation was the dominant mechanism of organic carbon removal in the SMBR.

Hydrogen sulfide odor was rarely detected in the feed to the SMBR and was never detected in the SMBR effluent. Analytical measurements resulted in no detectable sulfide (MRL = 0.1 mg/L). Any observed removal may have been due to volatilization. However, given a $pK_{a,1} = 7.1$ and an average process tank pH of 8.2, approximately 92 percent of the sulfide was in the HS^- form, thus minimizing the contribution of volatilization to sulfide removal. It is also possible that sulfide oxidation was occurring in the reactor, either spontaneously or via microbial catalysis. No effort was made to isolate the sulfide removal mechanism.

7.7.1 Summary

Demonstration testing showed that a submerged membrane bioreactor can meet several post-FXB treatment objectives in a single step: 1) aeration, 2) biomass separation, 3) residual organic carbon removal, and 4) hydrogen sulfide removal.

7.8 In-Line Ion Chromatographic Analysis

In addition to perchlorate analyses performed by CLWA and MWH labs, an in-line perchlorate analyzer was installed to provide real time perchlorate data. A Dionex DX-800 in-line ion chromatograph was used that can sample, analyze, and store data from up to 21 process streams. The system uses a 2 x 250 mm IonPac® AS16 analytical column (Dionex P/N 055378) with a 2 x 50 mm AG16 guard column. The sample volume was 1,000-mL with a flow rate of 0.4 mL/min. The effluent was an EG50-generated 50 mM potassium hydroxide (KOH) solution with a back pressure of approximately 2,500 psi. A 2-mm AMMS III suppressor operated in the chemical suppression mode and a CD20-PA Conductivity Detector was used for detection. The system was controlled by a CC81 controller. Run times for the samples were 30 minutes.

The instrument was initially connected directly to the FBR with samples being continuously drawn into the analyzer every 30 min for analysis. This created a problem due to the high amount of biomass being sloughed from the system. A rough prefilter was installed to complement the 20-µm pre-sample loop filter. This provided some removal of biomass but clogging continued to occur in the instrument, thus causing high excessive pressure build-up in the system. As a result, the system was configured to analyze only occasional grab samples for remainder of the project. This was beneficial in that the results were obtained in 30 minutes rather than 2 or 3 day for the CLWA lab or up to 1 month for MWH labs.

To test the accuracy of the instrument, split samples of raw water, spiked raw water, and effluents from each of the treatment alternatives were analyzed using the instrument. These samples were also sent to the CLWA lab and two different DHS labs. The results from the tests are provided in Table 3.25.

Table 3.25 Comparison of Perchlorate Results (μg/L) (<MRL indicates less than method reporting limit of 4 μg/L) Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency

Sample	CLWA	DHS-LA	DHS-Berkley	In-Line Instrument
Raw water	<MRL	<MRL	<MRL	<MRL
IX-Spike	45.1	54.4	47.5	48.5
IX-C1	<MRL	<MRL	<MRL	<MRL
IX-C2	27.7	32.8	29.1	27.3
IX-C3	<MRL	<MRL	<MRL	<MRL
FXB-Spike	42.1	48.6	44.5	38.9
FXB-Out	<MRL	<MRL	<MRL	<MRL
FBR-Spike	41.8	50.2	43.2	42.4
FBR-Out	<MRL	34.2	26.8	<MRL

The results for the Dionex DX-800 were acceptable in most cases and correlated well with results from the other 3 labs. One sample, FBR out, read 27 and 34 mg/L from the two DHS labs, where the CLWA lab and the in-line monitor read below the reporting limit. This may be due to the lack of sample preservation of samples from the FBR. These samples were not preserved, therefore perchlorate degradation could have been an issue. In general, the Dionex instrument showed good correlation with measurements from other laboratories.

7.9 DBP Formation Potential Testing

7.9.1 Experimental Matrix

7.9.1.1 DBPFP Testing on FXB, FBR, and MBR Effluents

Conditions applied during the DBPFP testing conducted on the FXB effluent, the FBR effluent, and the MBR effluent are presented in Table 3.26. For each experiment, three samples were dosed with a range of free and combined chlorine concentrations in order to reach the target free and combined chlorine residual of 3 to 5 mg/L after an incubation period of 7 days. At the end of the incubation period, the sample with the chlorine residual closest to the target was used for DBP analysis and the other two samples were discarded.

Table 3.26 Conditions Applied during DBPFP testing Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Free Chlorine Testing					
Stream	**Free Cl_2 Dose (mg/L)**	**$[Cl_2]_{Free, 0}$ (mg/L)**	**Initial Demand (mg/L)**	**$[Cl_2]_{Free, 7}$ (mg/L)**	**7-day Demand (mg/L)**
FXB Effluent	10	7.4	2.6	8.6	0
FBR Effluent	24	15.5	8.5	8.0	7.5
MBR Effluent	12	7.4	4.6	7.6	0
Combined Chlorine Testing					
Stream	**Free Cl_2 Dose (mg/L)**	**NH_3-N Dose (mg/L)**	**$[Cl_2]_{Total, 0}$ (mg/L)**	**$[Cl_2]_{Total, 7}$ (mg/L)**	**7-day Demand (mg/L)**
FXB Effluent	8	2.0	6.3	3.0	3.3
FBR Effluent	12	3.0	5.1	3.1	2.0
MBR Effluent	6	1.5	6.4	3.2	3.2

Free chlorine demand was slightly overestimated, resulting in free chlorine residuals ranging from 7.6 to 8.6 mg/L after 7 days of incubation, which was considerably higher than expected. Instantaneous free chlorine demands ranged from 2.6 mg/L in the FXB effluent to 8.5 mg/L in the FBR effluent. This was expected, since the FBR effluent contained higher levels of organic matter relative to the FXB effluent. The free chlorine demand in the FXB effluent and the MBR effluent was satisfied immediately and no decay of free chlorine was measured thereafter. In the case where the initial free chlorine concentration for the fixed bed effluent was lower than after 7-days of incubation, this was most likely due to the error in the measurements. Sample above 5 mg/L free chlorine had to be diluted to fall within the linear range of the method. In contrast to the other systems, free chlorine continued to decay over the 7-day incubation period in the FBR effluent.

As expected, combined chlorine residuals were more stable, measuring at 3 mg/L after 7 days of incubation in all three streams. The initial combined chloramine demand was greater in the FBR effluent relative to the other two streams.

7.9.1.2 DBPFP Testing on Ozonated FXB Effluent

The ozone test was conducted on a blend of 90 percent SPW and 10 percent FXB effluent to simulate the feed of the biological reactor effluent into the Rio Vista WTP. Conditions applied during ozone testing are presented in Table 3.27. Ozone demand ranged from 1.2 to 1.4 mg/L.

Table 3.27 Conditions Applied During Ozonation Testing Perchlorate Treatment from Saugus Aquifer Castaic Lake Water Agency			
Stream	Transferred Ozone Dose (mg/L)	Ozone Residual (mg/L)	HRT (min)
FXB Effluent	1.76	0.37	5.4
FXB Effluent + Acetic Acid (AA)	1.72	0.54	5.3

Ozonated streams were further analyzed for critical parameters and subjected to DBPFP testing with free and combined chlorine. DBPFP conditions applied during ozone testing are presented in Table 3.28. Seven-day free chlorine residuals were higher than the target residual of 5 mg/L. Due to the limited availability of ozonated water, multiple bottles could not be incubated. Therefore, the DBP formation potential results are conservative. The free chlorine residual at time zero was not measured. Combined chlorine residuals ranged from 3.4 to 4.3 mg/L, falling within the target range of 3 to 5 mg/L.

Table 3.28 Conditions Applied During DBPFP Testing of Ozonated Waters Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency					
Free Chlorine Testing					
Stream	Free Cl_2 Dose (mg/L)	$[Cl_2]_{Free, 0}$ (mg/L)	Initial Demand (mg/L)	$[Cl_2]_{Free, 7}$ (mg/L)	7-day Demand (mg/L)
Ozonated FXB Effluent	16	NA	NA	11.4	NA
Ozonated FXB Effluent+ AA	16	NA	NA	10.4	NA
Combined Chlorine Testing					
Stream	Free Cl_2 Dose (mg/L)	NH_3-N Dose (mg/L)	$[Cl_2]_{Total, 0}$ (mg/L)	$[Cl_2]_{Total, 7}$ (mg/L)	7-day Demand (mg/L)
Ozonated FXB Effluent	8	2	NA	4.3	NA
Ozonated FXB Effluent+ AA	8	2	NA	3.4	NA

7.9.2 *Analytical Results*

7.9.2.1 *DBPFP Testing on FXB, FBR, and MBR Effluents*

Control samples of each stream were analyzed for critical parameters (Table 3.28). Prior to chlorination, the FBR effluent contained a DOC concentration of 6 mg/L, whereas the other two streams contained negligible quantities of organic matter. It should be mentioned that DBPFP samples were collected from the FBR at a time before feed acetic acid concentration had been optimized. Since the acetic acid feed concentration was later reduced, the NOM and DBP results are conservative. A BDOC of 1.1 mg/L was measured in the FBR effluent. This BDOC level is higher than the 0.15 to 0.3 mg/L range of acceptable BDOC level for microbial growth in the distribution system. The AOC level in the FBR effluent of 178 μg/L is higher than the suggested 50 μg/L level to control coliform growth in distribution systems. The AOC concentration in the MBR effluent was higher than the AOC concentration in the MBR feed (i.e., FXB effluent), reflecting the fact that the MBR system was still being optimized at the time of the DBPFP tests. As expected, background THM4 and HAA5 levels (prior to chlorination) were non-detect.

Following free chlorine addition with an excess 7-day residual of 7.6 to 8.6 mg/L, THM4 and HAA5 levels were detected in all three streams. TTHM and HAA5 concentrations in the chlorinated FBR stream exceeded Stage 1 and Stage 2 D/DBP maximum contaminant levels of 80 μg/L and 60 μg/L, respectively. HAAs were the dominant DBPs in the biological and MBR effluents. All four TTHM species and all five HAA5 species were detected during the DBPFP testing with FBR effluent.

The reported 7-day TTHM and HAA concentrations are equivalent to formation potential levels since the concentrations on day zero (controls) were non-detect. It should be noted that a detectable level of DOC was measured in the FXB effluent, resulting in a BDOC of 0.23 mg/L. This is unexpected because the DOC in the control FXB effluent sample (i.e., prior to chlorination) was non-detect. THMs and HAAs in the MBR were below the Stage 1 and Stage 2 MCLs.

As expected, chloramination resulted in low levels of TTHMs and lower levels of HAA5 relative to free chlorination.

Table 3.29 DBPFP Testing Results
Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer
Castaic Lake Water Agency

	Prior to Chlorination (Control)				
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**THM4, $_0$ (μg/L)**	**HAA5, $_0$ (μg/L)**
FXB Effluent	<0.5	ND	47	ND	ND
FBR Effluent	6.0	1.1	178	ND	ND
MBR Effluent	<0.5	ND	95	ND	ND

Table 3.29	DBPFP Testing Results Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency				
Following DBPFP with Free Chlorine- Day 7					
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)***	**THM4, 7 (μg/L)**	**HAA5, 7 (μg/L)**
FXB Effluent	NA	NA	NA	20	26
FBR Effluent	NA	NA	NA	110	140
MBR Effluent	NA	NA	NA	24	39
Following DBPFP with Combined Chlorine- Day 7					
Stream	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)***	**THM4, 7 (μg/L)**	**HAA5, 7 (μg/L)**
FXB Effluent	NA	NA	NA	ND	17
FBR Effluent	NA	NA	NA	2.2	24
MBR Effluent	NA	NA	NA	ND	13
Notes: NA: not analyzed					

The DBPFP yields are presented in Table 3.30. The highest DBP formation yields were observed for the tests using FBR effluent. HAA formation yields were higher than THM yields for the same samples. Even though the DOC was non-detect in the MBR effluent, an HAA concentration of 13 μg/L was measured after chloramination, resulting in a yield of > 26 μg/mg DOC.

Table 3.30	DBPFP Yields Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency			
	THM4FP Yield (μg/mg DOC)		**HAA5FP Yield (μg/mg DOC)**	
Stream	**Free Chlorine**	**Combined Chlorine**	**Free Chlorine**	**Combined Chlorine**
FXB Effluent	5.0	0	6.6	4.3
FBR Effluent	32.0	2.1	40.7	7.0
MBR Effluent	0.2	0	0.4	>26(1)
Notes: (1) DOC was ND				

A follow-up 72-hr SDS test was conducted on the FBR effluent. A free chlorine dose of 2.6 mg/L was used, which resulted in a 3-day residual of 0.4 mg/L. The SDS-TTHM4 and SDS-HAA5 concentrations were 40 and 23 μg/L, respectively.

7.9.2.2 DBPFP Testing on Ozonated FXB Effluent

Following ozonation of the FXB effluent and the acetic acid-spiked FXB effluent samples, DBPFP testing was conducted with both free and combined chlorine (Table 3.32).

Bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L. The bromide levels of 200 μg/L for the blended water (i.e., 90 percent SPW and 10 percent FXB effluent) are on the higher side. For comparison, bromate concentrations measured following ozonation at the Rio Vista WTP are less than 5 μg/L.

Aldehydes were formed at moderate levels when the FXB effluent was ozonated. As expected, total aldehydes (acetaldehyde, formaldehyde, glyoxal, pyruvic aldehyde, and pentanal) were slightly higher in the ozonated FXB effluent spiked with acetic acid relative to the unspiked FXB effluent. It should be noted that the filtration process at the Rio Vista WTP downstream of ozonation may further reduce the aldehyde levels in the finished water.

Ozonation increased the concentration of BDOC and AOC, a phenomenon widely reported in the literature. In a full-scale treatment process, the biodegradable organic matter would be reduced through the filters prior to final chlorination by biological oxidation. Chlorination and chloramination of the samples resulted in a decrease in the BDOC concentration, probably as a direct result of NOM oxidation by the disinfectant.

High concentrations of TTHMs and HAAs were measured in the ozonated samples following DBP formation testing with free chlorine. It should be noted that since the measured free chlorine residuals after 7 days of incubation were higher than the target residual range of 3 to 5 mg/L, these DBP results are conservative. In addition, in a full-scale treatment process, the preozonated water would be filtered prior to final chlorination. This filtration process would be expected to remove some of the DBP precursors by biological oxidation, resulting in lower DBP levels than those shown in Table 3.31.

Table 3.31 DBPFP Testing Results-Ozone Test
Treatment of Perchlorate Contaminated Groundwater
from the Saugus Aquifer
Castaic Lake Water Agency

	Raw Samples				
Stream	**TOC (mg/L)**	**DOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**Bromide, low (mg/L)**
FXB Effluent	2.4	2.5	0.53	200	200
FXB Effluent+AA	9.2	8.8	2.5	1266	200

Table 3.31	DBPFP Testing Results-Ozone Test Treatment of Perchlorate Contaminated Groundwater from the Saugus Aquifer Castaic Lake Water Agency								
Ozonated Samples Prior to Chlorination (Control)									
Stream	**DOC (mg/L)**	**TOC (mg/L)**	**BDOC (mg/L)**	**AOC (μg/L)**	**Br (μg/L)**	**BrO_3 (μg/L)**	**Aldehyde (μg/L)**	**THM4, $_0$ (μg/L)**	**HAA5, $_0$ (μg/L)**
FXB Effluent	2.6	2.4	3.7	240	190	8.7	40	ND	ND
FXB Effluent +AA	3.2	8.8	5.6	1,446	200	1.8	54	ND	ND
Following DBPFP with Free Chlorine- Day 7									
Stream		**TOC (mg/L)**		**DOC (mg/L)**		**BDOC (mg/L)**	**THM4, $_7$ (μg/L)**	**HAA5, $_7$ (μg/L)**	
FXB Effluent		2.0		1.9		0.22	200	56	
FXB Effluent+AA		8.6		8.5		1.5	180	65	
Following DBPFP with Combined Chlorine- Day 7									
Stream		**TOC (mg/L)**		**DOC (mg/L)**		**BDOC (mg/L)**	**THM4, $_7$ (μg/L)**	**HAA5, $_7$ (μg/L)**	
FXB Effluent		2.3		2.2		0.38	23	12	
FXB Effluent+AA		8.8		9.0		0.50	25	13	

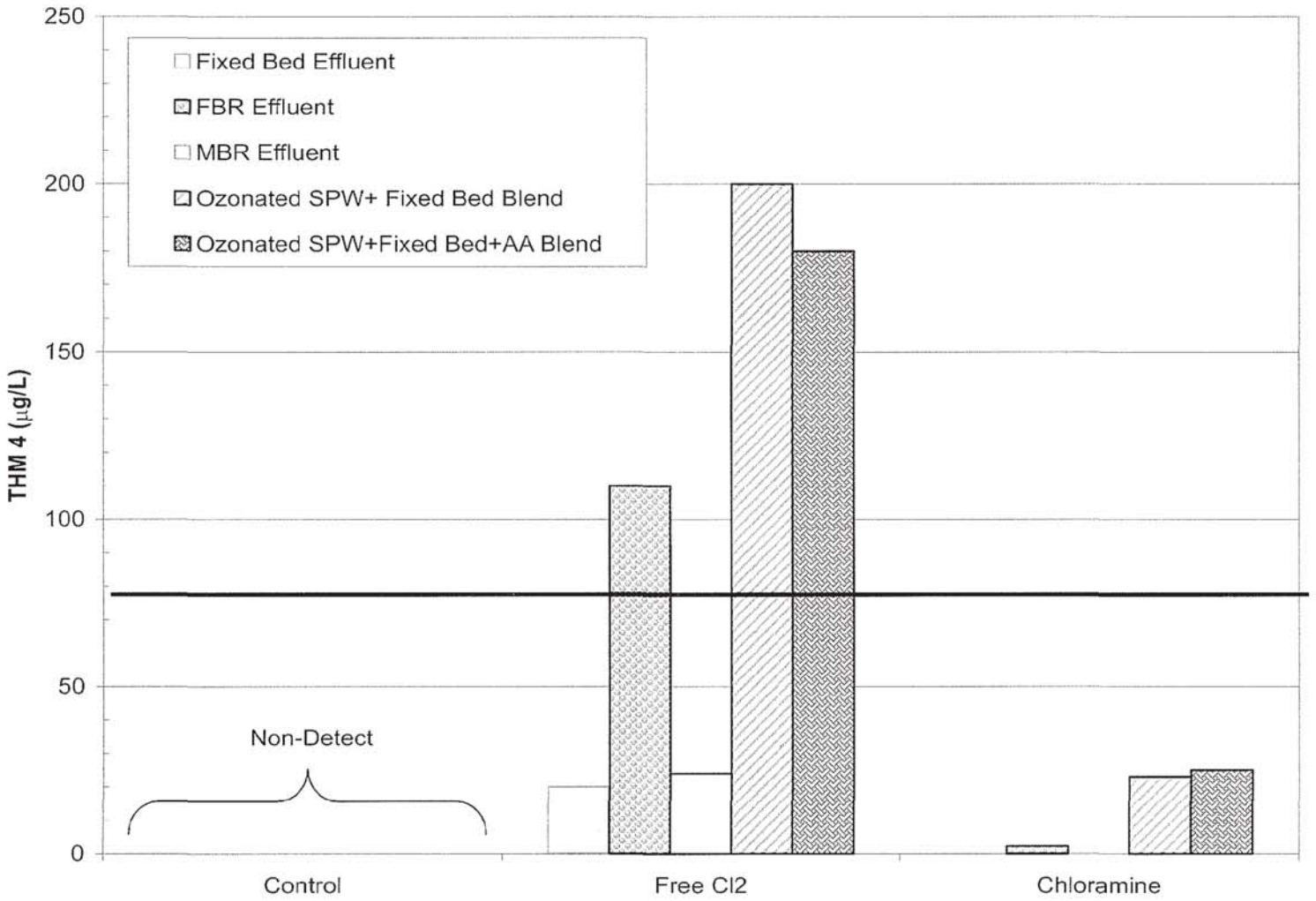
While HAAs were the dominant DBPs in the chlorinated FXB, FBR, and MBR effluents, TTHMs were the dominant DBPs in the blended FXB effluent samples, which is confirmed by typical DBP concentrations measured in the full-scale Rio Vista WTP distribution System (i.e., approximately 65 μg/L for THMs and 15 μg/L for HAAs).

7.9.3 Comparison of DBP Formation Results

THMFP and HAAFP results for all streams are plotted in Figures 3.53 and 3.54. It must be emphasized that the chlorination and ozone results are conservative. The HAA concentrations in the ozonated samples are lower than the TTHM concentrations, suggesting that the SPW water favors the formation of THMs over HAAs. Non-blended water tended to form HAAs over THMs.

In summary THMs and HAAs tend to form in the effluent of the biological systems upon the addition of free chlorine. The THMs and HAAs in the FXB effluent (which was already at steady-state operation) were lower than the current Stage MCLs. Higher DBP concentrations measured in the chlorinated and ozonated FBR effluent are premature since the FBR was not optimized.

20-CLWA204F3.53-6625A10.CDR



COMPARISON OF DBPFP THM4 SAMPLES FROM SEVERAL STREAMS

FIGURE 3.53

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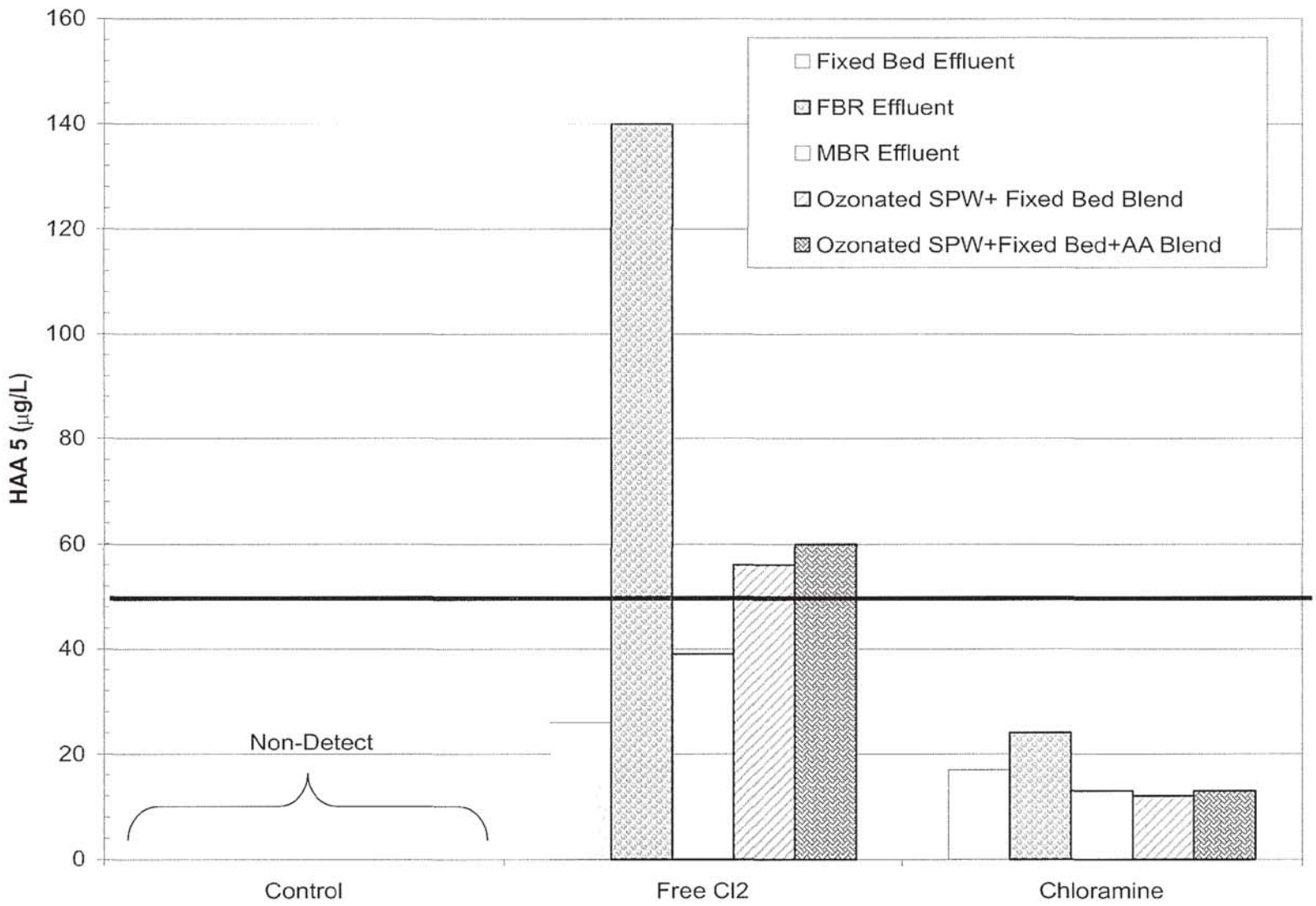

COMPARISON OF DBPFP HAA5 SAMPLES FROM SEVERAL STREAMS

FIGURE 3.54

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As expected, chloramination results in THM and HAA levels significantly lower than the Stage 2 MCLs.

7.10 Summary of DBPFP Results

7.10.1 DBPFP Testing on Fixed Bed, Fluidized Bed, and MBR Effluents

Following free chlorine addition with an excess residual after 7 days of incubation, DBP levels were formed in all streams, with levels in the FBR stream exceeding current MCLs of 80 μg/L and 60 μg/L for THMs and HAAs, respectively. It should be noted that the FBR was not optimized prior to the DBPFP tests. Because the FBR feed acetic acid concentrations were higher than ultimately required, the FBR DBPFP tests are considered conservative. HAAs were the dominant DBPs in the three samples. As expected, chloramination resulted in low levels of THMs and lower levels of HAAs as compared to free chlorination. Higher DBP formation yields were calculated in the FBR effluent relative to the FXB effluent. A follow-up 72-hour SDS test was conducted on the FBR effluent. The SDS-THM4 and SDS-HAA5 concentrations were lower than the D/DBPR Stage 2 MCLs, measured at 40- and 23-μg/L, respectively.

7.10.2 DBPFP Testing on Ozonated Fixed Bed Effluent

To simulate DBP formation potential of FXB effluent that is post-treated at the Rio Vista Water Treatment Plant (WTP), a blend of 90 percent State Project Water (SPW) and 10 percent FXB effluent was ozonated and contacted with free or combined chlorine. Following ozonation, bromate was formed at concentrations ranging from 1.8 to 8.7 μg/L due to high bromide levels of 200 μg/L for the blended water. Aldehydes were formed at moderate levels, even in the effluent spiked with acetic acid. The ozonation of the samples resulted in an increase in the BDOC and AOC concentrations. It should be noted that the filtration process at the Rio Vista WTP downstream of ozonation may further reduce the aldehydes and BDOC levels in the finished water. High levels of THMs and HAAs were measured in the ozonated samples following DBP formation testing with free chlorine. THM4 concentrations were two times the Stage 2 MCL. However, residual chlorine concentrations were excessive during incubation and, more importantly, a large fraction of DBP precursors would likely be removed downstream of ozonation, prior to chlorination at the Rio Vista WTP. The HAA concentrations in the ozonated samples, although relatively high, were lower or equal to the Stage 2 MCL. Seven-day incubation of ozonated water with combined chlorine generated only 23 μg/L TTHM4 and 12 μg/L HAA5.

8.0 CONCLUSION

All three ion-exchange resins removed perchlorate to below detection for run times exceeding model predictions. Preliminary NDMA formation potential tests with pre- and post-disinfection, as well as spent resin characterization tests suggest that the operation and disposal of these resins under the conditions tested should not raise any concern. It

should be noted however that in a full-scale process, the temporal discharge of groundwater following a resin change-out may pose a challenge due to potential restrictions in chloride level imposed by the relative agency (e.g., county sanitation district or regional water quality control board).

Consistent perchlorate removal to below detection was achieved in the FXB filter using only organisms indigenous to the Saugus aquifer. With influent DO and nitrate concentrations of 7 and 15 mg/L, respectively, the lowest EBCT and acetic acid concentration that allowed consistent perchlorate removal to below detection was 15 minutes and 7.8 mg/L as carbon, respectively. Run times ranged from 24 hours to several days. Effluent from the FXB filter was biologically stable and contained no fecal coliforms. Challenge tests demonstrated that the FXB filter was robust with respect to backwashing episodes, changes in feed water quality, system shut-downs, and electron donor addition failures. Large step increases in feed nitrate concentration (e.g., 15 mg/L) required a period of bio-acclimation before perchlorate removal to below detection could be reestablished in the FXB filter. A short-term post-treatment test performed on the FXB system with an SMBR demonstrated that the SMBR would be able to meet regulatory requirements in terms of aeration and filtration in a single step. DBP formation tests for the fixed bed reactor resulted in THM and HAA levels lower than the Stage 2 MCLs.

The fluidized-bed reactor did not achieve perchlorate removal to below detection over a period greater than 8 days, in spite of numerous mechanical and operational adjustments made to the system. However, testing did demonstrate that biological perchlorate removal can be achieved using indigenous microorganisms, a feature that had not yet been demonstrated for the FBR system. Because the FBR was not optimized, challenge testing was not performed.

A number of critical design parameters have been established based on the test results. These will be used during the pre-design of a selected system. Based on the performance of these systems, preliminary budget level costs have been developed, which will be presented in the pre-design report.

9.0 REFERENCES

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MANAGEMENT OF THE
CALIFORNIA STATE WATER PROJECT

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Chapter 9
Water Contracts and Deliveries

San Luis Reservoir

Significant Events in 2003

- On May 5, 2003, the Monterey Settlement Agreement was formally executed and was approved by the court on May 20, 2003. This settlement agreement offered an alternative to further litigation and, with certain conditions, allows the State Water Project to continue to operate pursuant to the Monterey Agreement while the new EIR is being prepared.
- The Department executed 39 long-term water supply contract amendments, 18 water conveyance/exchange agreements, 1 turn-in agreement, 10 turnout agreements, 34 Turnback Water Pool Program agreements, and 16 Article 21 Water Program agreements, with State Water Project contractors.
- The SWP approved delivery of 90 percent of SWP contractors' Table A requests, and conveyed 4,223,255 acre-feet to 27 long-term contractors and 26 other agencies.
- In 2003, 29,770 acre-feet of water were sold and purchased under the Turnback Water Pool Program.
- Implementation of the 2003 Colorado River Quantification Settlement Agreement resulted in a 2003 Exchange Agreement, pending execution, among Coachella Valley Water District, Metropolitan Water District of Southern California, and Desert Water District, which provides for the transfer of 88,100 acre-feet of Metropolitan's Table A amounts to Coachella, and 11,900 acre-feet of Metropolitan's Table A amounts to Desert.

The long-term water supply contracts for water service from the State Water Project between the Department and 29 local agencies are basic to the project's construction and operation. In return for State financing, constructing, operating, and maintaining facilities needed to provide water service, the agencies contractually agreed to repay all associated SWP capital and operating costs.

The Department delivers water to SWP contractors in accordance with their long-term water supply contracts.

These contracts set forth Table A amounts, which determine how much water a contractor may request each year from the Department.

Annual Table A represents the total amount of project water that an SWP contractor may request each year, according to that contractor's long-term water supply contract.

Approved Table A represents the amount of annual Table A requested by the contractors and approved for delivery by the Department, based on hydrologic conditions, current reservoir storage, and total requests by the SWP water contractors. The Department is not always able to deliver the quantity of water requested by the contractors; under certain

Long-Term SWP Water Supply Contracts

The first water supply contract was signed with the Metropolitan Water District of Southern California on November 4, 1960. The contract was negotiated by the Department and Metropolitan according to terms of the contracting principles for water service contracts announced by Governor Edmund G. Brown on January 20, 1960.

The Metropolitan contract became the prototype for all water contracts; by the end of 1967, 31 agencies had contracted for water. In addition, a water supply contract was executed with the City of West Covina in December 1963, but was terminated in August 1965; the city's Table A amount was transferred to Metropolitan through an amendment to the district's long-term contract with the Department. Long-term contracts with Hacienda Water District and Devil's Den Water District were also terminated when those districts transferred their Table A amounts, through contract amendments, to Tulare Lake Basin Water Storage District (1981) and Castaic Lake Water Agency (1992), respectively. Today the SWP has long-term water supply contracts with 29 agencies. Those contracts have been amended periodically to incorporate mutually desired modifications.

All water contracts signed in the 1960s included an estimate of the date water would first be delivered and a schedule of the amount of water the agency could expect to be delivered annually (annual Table A amounts). That amount was designed to increase gradually until the maximum amount of annual Table A was reached. The total combined maximum annual Table A amount for all water contracting agencies was initially 4,230,000 acre-feet, assuming full development of the SWP.

The contracts were initially designed to be valid for 75 years or until all bonds sold as part of the California Water Resources Development Bond Act were repaid, whichever period was longer. As a result of amendments to contracts in the 1990s, the current combined maximum annual Table A amount totals 4,172,786 acre-feet, and the contracts are in effect for the longest of the following periods: (1) the project repayment period, which extends to the year 2035; (2) 75 years from the date of the contract; or (3) the period ending with the latest maturity date of any bond used to finance the construction costs of project facilities.

conditions, a lesser amount, allocated according to the long-term water supply contracts and the process noted above, is made available for delivery.

Approved Table A amounts may also be referred to in this chapter as *approved amounts* or *approved water.*

The long-term water supply contracts are amended as needed. During 2003, 39 amendments were executed, 27 of which were related to the Monterey Settlement Agreement. A number of long-term consolidated contracts, with the amendments integrated into the contract, are available online at www.swpao.water.ca.gov/wsc/index.cfm.

The Department also enters into miscellaneous agreements with SWP contractors and other agencies—which may be amended periodically—to convey SWP and non-SWP water through the California Aqueduct and to approve the construction, operation, and maintenance of turnouts along SWP facilities. During 2003, the Department executed 18 water conveyance/exchange agreements, 1 turn-in agreement, 10 turnout agreements, 34 Turnback Water Pool Program agreements, and 16 Article 21 Water Program agreements with SWP contractors. The Department also delivered water pursuant to 11 miscellaneous agreements executed prior to 2003 with the SWP contractors. Pending execution are 3 water conveyance/exchange agreements (including one unscheduled water program agreement) and 8 storage agreements.

The State Water Project Analysis Office has developed a numbering system for contracts, amendments, and agreements executed by the Department. These numbers, designated as SWPAO #XXXXX, are located in parentheses after each contract, amendment, or agreement.

Detailed information about amendments and agreements follows.

Amendments to Long-Term SWP Water Supply Contracts

All the original contracts signed by the Department and local agencies have been previously amended to incorporate mutually desired changes. Most amendments fall under the following five general categories:

(1) revision of annual Table A amounts in the water supply contracts;
(2) allocation of costs and benefits for the enlargement or extension of the East Branch and extension of the Coastal Branch of the California Aqueduct;
(3) purchase of excess capacity in the California Aqueduct;
(4) provisions to allow contractors, under certain conditions, to carry over undelivered SWP approved Table A water from one year for delivery in the next year; and
(5) implementation of Monterey Agreement principles.

The following long-term SWP Water Supply Contracts were amended during 2003.

Alameda County Flood Control and Water Conservation District-Zone 7. The Department executed Amendment No. 23 to the Water Supply Contract between Alameda-Zone 7 and the Department on August 1, 2003. The Amendment provided for the permanent transfer of 400 acre-feet of SWP Table A amounts from Tulare Lake Basin Water Storage District to Alameda-Zone 7, and set forth conditions for the transfer. The transfer is effective January 1, 2003. (SWPAO #03001)

Alameda County Flood Control and Water Conservation District-Zone 7. The Department executed Amendment No. 24 to the Water Supply Contract between Alameda-Zone 7 and the Department on November 7, 2003. This Amendment set forth the terms and conditions for the financing and repayment of costs attributable to the South Bay Aqueduct Enlargement. (SWPAO #03013)

Alameda County Flood Control and Water Conservation District-Zone 7. The Department executed Amendment No. 25 to the Water Supply Contract between Alameda-Zone 7 and the Department on October 31, 2003. The Amendment provided for the permanent transfer of 2,219 acre-feet of SWP Table A amounts from Kern County Water Agency to Alameda-Zone 7, and set forth conditions for the transfer. The transfer becomes effective January 1, 2004. (SWPAO #04002)

Coachella Valley Water District. The Department executed Amendment No. 18 to the Water Supply Contract between Coachella and the Department on October 10, 2003. The amendment provided for the permanent transfer of 88,100 acre-feet of SWP Table A amounts from Metropolitan Water District of Southern California to Coachella, and set forth conditions for the transfer. This amendment is a result of the 2003 Exchange Agreement pending execution, among Coachella, Metropolitan, and Desert Water Agency, which will provide for the transfer of 88,100 acre-feet of Metropolitan's Table A amounts to Coachella, and 11,900 acre-feet of Metropolitan's Table A amounts to Desert. The transfer is consistent with the implementation of the 2003 Colorado River Quantification Settlement Agreement. The amendment will become effective the later of January 1, 2004, or January 1 of the subsequent year that the 2003 Exchange Agreement becomes effective. The 2003 Exchange Agreement was not executed at the end of 2003. (SWPAO #04009)

County of Kings. The Department executed Amendment No. 16 to the Water Supply Contract between County of Kings and the Department on December 5, 2003. The amendment provided for the permanent transfer of 5,000 acre-feet of SWP Table A amounts from Tulare to County of Kings, and set forth conditions for the transfer. The transfer is effective January 1, 2004. (SWPAO #04004)

Desert Water Agency. The Department executed Amendment No. 18 to the Water Supply Contract between Desert and the Department on November 3, 2003. The amendment provided for the permanent transfer of 11,900 acre-feet of SWP Table A amounts from Metropolitan to Desert, and set forth conditions for the transfer. This amendment is a result of the 2003 Exchange Agreement pending execution, among Coachella, Metropolitan, and Desert Water Agency, which will provide for the transfer of 88,100 acre-feet of Metropolitan's Table A amounts to Coachella, and 11,900 acre-feet of Metropolitan's Table A amounts to Desert. The transfer is consistent with the implementation of the 2003 Colorado River Quantification Settlement Agreement. The amendment will become effective the later of January 1, 2004, or January 1 of the subsequent year that the 2003 Exchange Agreement becomes effective. The 2003 Exchange Agreement was not executed at the end of 2003. (SWPAO #04011)

Kern County Water Agency. The Department executed Amendment No. 36 to the Water Supply Contract between Kern and the Department on October 31, 2003. The amendment provided for the permanent transfer of 2,219 acre-feet of SWP Table A amounts from Kern to Alameda-Zone 7, and set forth conditions for the transfer. The transfer becomes effective January 1, 2004. (SWPAO #04001)

Metropolitan Water District of Southern California. The Department executed Amendment No. 27 to the Water Supply Contract between Metropolitan and the Department on October 24, 2003. The amendment provided for the permanent transfer of 88,100 acre-feet of SWP Table A amounts from Metropolitan to Coachella, and set forth conditions for the transfer. This amendment is a result of the 2003 Exchange Agreement pending execution, among Coachella, Metropolitan, and Desert, which will provide for the transfer of 88,100 acre-feet of Metropolitan's Table A amounts to Coachella, and 11,900 acre-feet of Metropolitan's Table A amounts to Desert. The transfer is consistent with the implementation of the 2003 Colorado River Quantification Settlement Agreement. The amendment will become effective the later of January 1, 2004, or January 1 of the subsequent year that the 2003 Exchange Agreement becomes effective. The

2003 Exchange Agreement was not executed at the end of 2003. (SWPAO #04008)

Metropolitan Water District of Southern California. The Department executed Amendment No. 28 to the Water Supply Contract between Metropolitan and the Department on October 24, 2003. The amendment provided for the permanent transfer of 11,900 acre-feet of SWP Table A amounts from Metropolitan to Desert, and set forth conditions for the transfer. This amendment is a result of the 2003 Exchange Agreement pending execution, among Coachella, Metropolitan, and Desert, which will provide for the transfer of 88,100 acre-feet of Metropolitan's Table A amounts to Coachella, and 11,900 acre-feet of Metropolitan's Table A amounts to Desert. The transfer is consistent with the implementation of the 2003 Colorado River Quantification Settlement Agreement. The amendment will become effective the later of January 1, 2004, or January 1 of the subsequent year that the 2003 Exchange Agreement becomes effective. The 2003 Exchange Agreement was not executed at the end of 2003. (SWPAO #04010)

Solano County Water Agency. The Department executed Amendment No. 19 to the Water Supply Contract between Solano and the Department on November 12, 2003. The amendment provided for the approval for Solano to pay only the prospective charge for the North Bay Aqueduct costs attributable to the 5,756 acre-feet annual Table A increase made effective in Amendment No. 17 to Solano's long term Water Supply Contract. The amendment becomes effective January 1, 2004. (SWPAO #03005)

Tulare Lake Basin Water Storage District. The Department executed Amendment No. 29 to the Water Supply Contract between Tulare and the Department on June 2, 2003. The amendment provided for the permanent transfer of 400 acre-feet of SWP Table A amounts from Tulare to Alameda-Zone 7, and set forth conditions for the transfer. The transfer is effective January 1, 2003. (SWPAO #03002)

Tulare Lake Basin Water Storage District. The Department executed Amendment No. 30 to the Water Supply Contract between Tulare and the Department on December 5, 2003. The amendment provided for the permanent transfer of 5,000 acre-feet of SWP Table A amounts from Tulare to Kings County, and set forth conditions for the transfer. The transfer becomes effective January 1, 2004. (SWPAO #04003)

Monterey Amendments

The Monterey Amendments increase the reliability of existing water supplies; provide stronger financial management for the SWP; and increase water management flexibility, providing more tools for local water agencies to maximize use of existing facilities.

The Monterey Amendments incorporated changes in determination of approved Table A water, the transfer of Table A amounts and land, financial restructuring, and increased operational flexibility. The Monterey Amendments are discussed in detail in Chapter 1, *Summary of Significant Events*, of Bulletin 132-95.

Plumas County Flood Control and Water Conservation District and Empire West Side Irrigation District, the only long-term SWP contractors who have not signed the Monterey Amendment, await completion of the EIR to decide whether to sign.

The Planning and Conservation League filed a lawsuit on December 27, 1995, challenging the California Environmental Quality Act compliance for the Monterey Amendment. A Sacramento County Superior Court judge later dismissed the lawsuit. PCL appealed the decision and on September 15, 2000, the Third District Court of Appeal reversed the Superior Court ruling. On December 13, 2000, the California Supreme Court denied review. The parties commenced mediation on March 26, 2002, and proceedings in Superior Court were stayed pending completion of mediation. On July 18, 2002, the parties reached agreement on principles for settling the lawsuit.

Monterey Settlement Agreement

On May 5, 2003, the Monterey Settlement Agreement was formally executed and was approved by the court on May 20, 2003. This settlement agreement offered an alternative to further litigation and, with certain conditions, allows the State Water Project to continue to operate pursuant to the Monterey Agreement while the new EIR is being prepared. The Department and the contractors agree not to approve any new projects or activity in reliance on the 1995 EIR, which was not approved, initiated or implemented prior to March 26, 2001, and the approval, initiation, or implementation of which would require a separate environmental document under CEQA. Information on the litigation can be found in *Chapter 6, Legislation and Litigation.*

The settlement agreement is a complex agreement with multiple components that balance the interests of the Department, the SWP contractors, Central Coast Water Authority, and Kern Water Bank Authority, with the disparate interests of the three plaintiffs.

All litigation costs will be paid by all SWP contractors, apportioned according to each agency's portion of the total maximum Table A Amounts as of January 1, 2003. Most of the contractors executed an agreement with the Department providing that the litigation costs will be allocated as incurred.

In addition to procedural items including attorney fees, mediation, and disposition of the lawsuit, items concerning the operation and management of the SWP are described below.

New Amendments to the SWP Contracts

The Department and 28 SWP contractors executed new amendments to the SWP long-term water supply contracts to improve and clarify disclosure of information about the delivery capability of the SWP. The amendments deleted the term "entitlement" and replaced that term with "Table A Amount." This does not change the Department's water delivery obligations or any other rights under the SWP contracts.

Language is also added to the bottom of each contractor's Table A to clarify that Table A is not to be interpreted to mean that the Department is able to deliver those amounts in all years. Empire, which has never signed the Monterey Amendment, did not execute the Monterey Settlement Amendment.

The amendment also requires the Department to distribute a biennial report to SWP contractors and all city, county, and regional planning agencies within the SWP project area, providing information as to SWP delivery capabilities, historic deliveries, and estimated deliveries under a range of hydrologic conditions. This report is intended to assist the SWP contractors in the assessment of the adequacy of the SWP component of their overall water supplies. The first edition of this report was issued in 2003 for SWP deliveries through 2002. More information on this report can be found in *Chapter 7, Water Supply Development and Reliability.*

SWP Availability

In addition to the biennial report mentioned above, the settlement agreement requires the Department to develop guidelines to assist the SWP urban contractors in providing information to land use planning agencies regarding local and regional programs to manage or supplement SWP supplies. The Department is also required to assist these contractors in providing complete and accurate information to land use agencies to assure that local land use decisions reflect accurate information on the availability of water from State, local, and other sources. Preparation of this document is underway.

New EIR

Agreement was reached on the content, scope, and process for the new EIR. The project to be analyzed in the new EIR is the Monterey Amendment and certain components of the settlement agreement. The Department will act as lead agency in preparing the new EIR. A Notice of Preparation was issued in January 2003 and scoping meetings were held throughout the State.

Under the agreement, a committee of plaintiffs and SWP contractors advises the Department on developing the EIR. The Department's Director serves as chair of this committee. Preparation of the new EIR is underway. The committee met nine times during 2003.

Public Participation in SWP Contract Negotiations

Future negotiations for SWP-wide contract amendments and for contract amendments to transfer Table A Amounts between SWP contractors will be conducted in public. The Department agrees that public review of significant changes to the water supply contracts is beneficial and in the public interest. The Department notified the contractors of this new process through Notice to State Water Project Contractors No. 03-10, on July 3, 2003, which is available online at swpao.water.ca.gov/notices/index.cfm).

Guidelines for Review and Approval of Permanent Water Transfers

The Department is required to issue guidelines to describe the process for the Department's review of proposed permanent transfers of Table A Amounts. These guidelines are to assist contractors in developing their transfer proposals and obtaining Department review expeditiously, and to assist the public in participating in that review. The Department issued these guidelines on July 3, 2003, through Notice to State Water Project Contractors No. 03-09 and published them in Bulletin 132-02, Chapter 9 (available online at swpao.water.ca.gov/publications/bulletin/02/Bulletin132-02.pdf).

Kern Water Bank

The Kern Water Bank will remain in local ownership and will operate as it has, but will be subject to additional restrictions on use. The Department agrees to prepare an independent study of KWB regarding impacts related to the transfer, development, and operation of KWB in light of the Kern environmental permits, as part of the new EIR.

Permanent Table A Transfers

The following permanent Table A transfers from Kern already completed under the Monterey Amendment are final:

- Kern to Mojave, Table A Amount of 25,000 acre-feet, effective 1998;
- Kern to Palmdale, Table A Amount of 4,000 acre-feet, effective 2000;
- Kern to Alameda-Zone 7, Table A Amount of 7,000 acre-feet, effective 2000;
- Kern to Alameda-Zone 7, Table A Amount of 15,000 acre-feet, effective 2000;
- Kern to Alameda-Zone-7, Table A Amount of 10,000 acre-feet, effective 2001;
- Kern to Solano, Table A Amount of 5,756 acre-feet, effective 2001; and
- Kern to Napa, Table Amount of 4,025 acre-feet, effective 2001.

The parties recognize that the Kern-Castaic Lake Water Agency 41,000 acre-feet Table A transfer is subject to pending litigation and agree that jurisdiction with respect to that litigation remain in the Los Angeles County Superior Court and that nothing in the agreement is intended to predispose the remedies or other actions that may occur in the pending litigation.

The potential environmental effects of these transfers are required to be analyzed in the new EIR.

Plumas County Flood Control and Water Conservation District

Plumas will resume payments pursuant to its SWP water supply contract beginning in 2003. The Department will not collect any Plumas arrearages. Plumas agreed to support the Monterey Amendments and, along with the other contractors, executed the amendment discussed above which deleted the term "entitlement" and replaced that term with "Table A Amounts."

Up to $8 million will be paid over 8 years to Plumas beginning in 2003, primarily for watershed

improvements for the mutual benefit of Plumas and the SWP in the Feather River watershed, and for other district-related purposes, to be disbursed with input from a watershed forum composed of representatives of Plumas, the Department, and SWP contractors. A technical committee composed of the Department, Plumas, SWP contractors, and local resource management groups was formed to assist the forum. To help the forum set priorities for watershed management and restoration action, a consultant was hired during 2003 to help prepare the Feather River Watershed Management Strategy.

In addition, the Department will offer Plumas an amendment to its water supply contract which will include the Department's agreement that water supplied to Plumas be determined based on availability of Lake Davis' water supply and that water deliveries to Plumas will not be reduced during SWP shortages so long as sufficient water is available from Lake Davis.

Miscellaneous Agreements with Long-Term SWP Contractors

2003 Water Conveyance/Exchange Agreements

During 2003, water conveyance/exchange agreements were executed or pending execution with long-term SWP contractors as described below.

Dudley Ridge Water District. A long-term agreement executed June 30, 2003, among the Department, Dudley Ridge, and Tulare, approved a change in point of delivery of a portion of Dudley Ridge's annual approved SWP water and other water supplies to Tulare's turnout at Reach 8D of the California Aqueduct. Two long-term water supply contract amendments with Tulare (Amendment No. 26) and Dudley Ridge (Amendment No. 24), were executed in December 2001 for the permanent transfer of 3,973 acre-feet of Tulare's Table A amounts to Dudley Ridge to accommodate the needs of Sandridge Partners, a landowner who farms in both Tulare and Dudley Ridge service areas. This is a subsequent agreement to provide delivery of water to Sandridge Partners in Dudley Ridge's service area through Tulare's turnout at Reach 8D. No water was delivered in 2003. (SWPAO #02005)

Dudley Ridge Water District. A letter agreement dated October 8, 2003, and executed November 18, 2003, among the Department, Dudley Ridge, and Tulare, approved the delivery of up to 4,000 acre-feet of Dudley Ridge's 2003 Table A amounts to Tulare at Tulare's turnout B in Reach 8D of the California Aqueduct. The agreement facilitated the water transfer from Dudley Ridge to Tulare on behalf of Sandridge Partners, who farms in both Dudley Ridge and Tulare service areas. During 2003, a total of 1,100 acre-feet was delivered to Tulare. (SWPAO #03052)

Dudley Ridge Water District. A letter agreement dated November 19, 2003, and executed November 20, 2003, among the Department, Dudley Ridge, and San Gabriel Valley Municipal Water District, approved the delivery of up to 11,458 acre-feet of Dudley Ridge's 2003 Table A amounts to San Gabriel at Reach 26A of the California Aqueduct. In exchange, San Gabriel will return a like amount of its future Table A amounts to Dudley Ridge by December 31, 2013. During 2003, a total of 8,700 acre-feet of Dudley Ridge's 2003 Table A amounts was delivered to San Gabriel. (SWPAO #03055)

Empire West Side Irrigation District. An agreement, pending execution between the Department and Empire, will provide for the delivery of unscheduled water to Empire in 2003 at times when project water is not needed for fulfilling approved Table A deliveries or for meeting project operational commitments. A total of 175 acre-feet of unscheduled water was delivered to Empire in 2003. (SWPAO #03012)

Kern County Water Agency. A letter agreement dated June 6, 2003, and executed July 3, 2003, between the Department and Kern, approved the delivery of up to 20,000 acre-feet of 2002 CVP water from three CVP contractors

to Kern. In exchange, Kern would return a like amount of its 2003 approved Table A amounts to the CVP contractors by December 31, 2003. The Department petitioned the State Water Resources Control Board on July 25, 2003, and received approval on August 26, 2003, for a temporary change of place of use for delivery of the return water. A total of 18,428 acre-feet was delivered to Kern from O'Neill Forebay and 18,428 acre-feet of water was returned to the CVP contractors at O'Neill Forebay in 2003. (SWPAO #03009)

Kern County Water Agency. A letter agreement dated June 12, 2003, and executed July 3, 2003, between the Department and Kern, approved the delivery of up to 13,000 acre-feet of 2001 CVP water from two CVP contractors to Kern. In exchange, Kern would return a like amount of its 2002 approved Table A amounts to the CVP contractors by December 31, 2002. The Department petitioned SWRCB on June 21, 2002, and received approval on August 16, 2002, for a temporary change of place of use for delivery of the return water. A total of 7,400 acre-feet was delivered to Kern from O'Neill Forebay and a total of 7,400 acre-feet of water was returned to the CVP contractors at O'Neill Forebay in 2002. (SWPAO #02014)

Kern County Water Agency. A letter agreement dated October 2, 2003, and executed December 15, 2003, among the Department, Kern, and Dudley Ridge, approved the delivery of up to 8,000 acre-feet of Kern's 2003 approved Table A amounts to Dudley Ridge at Reach 8D of the California Aqueduct. The agreement facilitated the water transfer from Kern to Dudley Ridge on behalf of the landowner Sandridge Partners who farms in both Kern and Dudley Ridge service areas. During 2003, a total of 8,000 acre-feet was delivered to Dudley Ridge. (SWPAO #03054)

Santa Clara Valley Water District. A letter agreement, pending execution between the Department and Santa Clara, provides for the delivery of up to 3,100 acre-feet of Brown's Valley Irrigation District's water (nonproject) to Santa Clara. This water, which is under Brown's Valley pre-1914 water rights, will be made available at Banks Pumping Plant and conveyed to Santa Clara at Reach 9 of the South Bay Aqueduct. Santa Clara requested this water be delivered pursuant to Article 55 of its long-term Water Supply Contract. During 2003, a total of 2,480 acre-feet of Brown's Valley water (nonproject) was delivered to Santa Clara. (SWPAO #03058)

Solano County Water Agency. A settlement agreement executed May 19, 2003, among the Department, Solano, and the Cities of Fairfield, Vacaville, and Benicia, and a conveyance agreement, executed concurrently between the Department and Solano, approved the delivery of up to 31,260 acre-feet annually of settlement water to Solano for delivery to the Cities of Fairfield, Vacaville, and Benicia. The agreements resulted from negotiations following the cities' petitions to SWRCB to appropriate water from the Sacramento River. The purpose of the agreements was to avoid disputing issues of appropriation before SWRCB. The agreement provides a supplemental water supply to the cities to assist in meeting current and future water demands through the North Bay Aqueduct. Water will be made available during excess conditions in the Delta as defined in the Coordinated Operations Agreement, or during balanced conditions when Water Rights Standard Permit term 91, which relates to availability of water for appropriation, is not in effect. The cities pay a fee per acre-foot of settlement water delivered during balanced conditions at NBA. The agreement remains in effect until December 31, 2035. During 2003, a total of 860 acre-feet of the settlement water was delivered to the Cities of Fairfield, Vacaville, and Benicia through Reaches 1 and 3A of the North Bay Aqueduct. (SWPAO #03017)

Tulare Lake Basin Water Storage District. A letter agreement dated April 14, 2003, and executed April 22, 2003, between the Department and Tulare, approved the transfer of up to 5,000 acre-feet of Tulare's 2003 approved Table A amounts to Westlands Water District at Reaches 5, 6, and 7 of the California Aqueduct on behalf of two landowners, Hansen Ranches

and Newton Farms, who farm in both the Tulare and Westlands service areas. The Department petitioned SWRCB on April 1, 2003, and received approval on May 23, 2003, for a temporary change of place of use. During 2003, a total of 3,900 acre-feet was delivered to Westlands at Reach 5. (SWPAO #03006)

Tulare Lake Basin Water Storage District. A letter agreement dated August 6, 2003, and executed August 25, 2003, between the Department and Tulare, approved the delivery of up to 25,000 acre-feet of Lower Tule River Irrigation District's water (nonproject) to Tulare at Reaches 8C and 8D of the California Aqueduct. Tulare requested this water be delivered pursuant to Article 55 of its long-term water supply contract. No water was delivered in 2003. (SWPAO #03007)

Tulare Lake Basin Water Storage District. A letter agreement dated April 4, 2003, and executed April 10, 2003, between the Department and Tulare, approved the transfer of up to 1,000 acre-feet of Tulare's 2003 Table A amounts to Westlands at Reach 7 of the California Aqueduct on behalf of Westlake Farms Inc., who farms in both Tulare and Westlands service areas. The water was delivered to Westlands for use on lands within the Kings County portion of Westland's service area. During 2003, a total of 1,000 acre-feet was delivered to Westlands at Reach 7. (SWPAO #03011)

Tulare Lake Basin Water Storage District. A letter agreement dated June 5, 2003, and executed August 25, 2003, between the Department and Tulare, approved the delivery of up to 10,000 acre-feet of nonproject water to Tulare at Reaches 8C and 8D (SWPAO #02025). Lower Tule River Irrigation District requested this water be delivered to Tulare and, in exchange, will receive a like amount of Tulare's Tule River water. Tulare requested the water be delivered pursuant to Article 55 of its long-term water supply contract. The water was made available at Banks Pumping Plant and delivered to Tulare in 2002. A subsequent Amendment pending execution between the Department and Tulare, will amend the delivery amounts to 10,596 acre-feet. (SWPAO #04022)

Water Conveyance/Exchange Agreements Prior to 2003

During 2003, water delivered pursuant to agreements with SWP contractors that were executed prior to 2003, is described below.

Alameda County Flood Control and Water Conservation District-Zone 7. A conveyance agreement dated July 28, 1995, between Alameda-Zone 7 and the Department, provides for the transfer of up to 5,000 acre-feet of Byron-Bethany Irrigation District's local water annually to Alameda-Zone 7 through SWP facilities. An amendment to extend the agreement to December 31, 2001, was executed April 26, 2002. Byron-Bethany may only transfer water that has been made available by conservation and crop idling. In 2003, 1,000 acre-feet of Byron Bethany's local water was pumped at Banks Pumping Plant and delivered to Alameda-Zone 7's turnouts in the South Bay Aqueduct. (SWPAO #02325)

Castaic Lake Water Agency. An agreement executed on December 27, 2001, among the Department, Castaic Lake, United Water Conservation District, Newhall Land and Farming Company, Newhall County Water District, and Los Angeles County, provided for the temporary extension through December 31, 2001, to store and release up to 8,786 acre-feet of local flood flows in Castaic Reservoir to Castaic Lake. United, a member unit of Ventura, transferred 4,512 acre-feet of stored local water to Castaic Lake in 2001. In 2003, Castaic Lake released 6,768 acre-feet of its 2003 Table A allocation to the Department (1.5 times the amount transferred by United). The Department in turn released 6,768 acre-feet of local water from Piru Creek to United. (SWPAO #01036)

Kern County Water Agency. An agreement executed on June 8, 2000, among the Department, Kern, and Western Hills Water District, approved delivery of 8,000 acre-feet of pre-1914 Lower Kern River Rights water banked in

Kern's share of the Pioneer Groundwater Banking Project. A portion of Kern's annual Table A amounts will be delivered annually to Western Hills from Reach 2A of the California Aqueduct; in exchange, Kern will take a like amount of banked local water from the Pioneer Groundwater Bank. The Department petitioned SWRCB and by SWRCB Order dated April 21, 2000, Western Hills' service area was included within the authorized SWP place of use. During 2003, a total of 917 acre-feet of Kern's Table A amounts was delivered to Western Hills at Reach 2A. (SWPAO #01001)

Kern County Water Agency. A letter agreement executed October 11, 2002, between the Department and Kern, approved the delivery of up to 30,000 acre-feet of nonproject water from four CVP contractors, members of the San Luis and Delta Mendota Water Authority, to Kern in 2000. In exchange, Kern would return a like amount of its approved Table A amounts to CVP contractors by December 31, 2003. During 2000, a total of 23,941 acre-feet of CVP water was delivered to Kern. During 2003, a total of 1,787 acre-feet was returned to CVP contractors. A balance of 22,154 acre-feet remained to be returned to the CVP contractors at the end of the contract term. (SWPAO #00032)

In a letter dated August 1, 2003, Kern requested an extension on the return period of the CVP water since Kern was unable to return all the water by December 31, 2003. Extension of the return period and other possible alternatives for Kern to return the remaining water to CVP contractors are being discussed among the Department, Kern, and San Luis and Delta Mendota Water Authority.

Mojave Water Agency. An agreement executed November 13, 1997, among AVEK, Mojave, and the Department, approved a change in point of delivery through 2019 of up to 2,250 acre-feet annually of Mojave's approved Table A amount to AVEK's Fairmont Turnout in Reach 19 of the California Aqueduct. Mojave does not have conveyance facilities to provide service to a solar energy generating station located within its service area. AVEK has conveyance capability and has agreed to provide service. During 2003, the Department delivered 816 acre-feet of Mojave's 2003 approved Table A amounts through AVEK's turnout at Reach 19. (SWPAO #97003)

San Bernardino Valley Municipal Water District. San Bernardino and Metropolitan entered into an agreement, Attachment 2, Coordinated Use Agreement for Conveyance Facilities and State Water Project Water Supplies, on May 14, 2001. The Department responded on February 27, 2002, concurring with the agreement and acknowledging the coordinated use of local facilities currently existing within San Bernardino's jurisdictional boundaries. This coordinated use involves delivery of San Bernardino's SWP water to Metropolitan's facilities within San Bernardino's service area. This action is permitted under Article 10 of the long-term water supply contract. During 2003, a total of 5,000 acre-feet of San Bernardino's approved Table A amounts was delivered to Metropolitan at Reach 26A. (SWPAO #02035)

Tulare Lake Basin Water Storage District. A letter agreement, dated June 15, 2001, and executed July 26, 2001, between the Department and Tulare, approved the delivery of up to 50,000 acre-feet of nonproject water from Westlands to Tulare between December 2000 and April 15, 2001, in exchange for a like amount of Tulare's Table A amounts during 2001 through 2003. The delivery of SWP exchange water to Westlands will be from the Delta to Reach 7 of the California Aqueduct, for use within the Kings County portion of Westlands' service area. A combined total of 28,145 acre-feet was delivered to Tulare during 2000 and 2001. During 2001, 1,975 acre-feet were returned to Westlands. During 2002, a total of 12,067 acre-feet was delivered to Westlands, leaving a balance of 14,103 acre-feet to be returned to Westlands. During 2003, a total of 14,103 acre-feet was returned to Westlands, completing this agreement. (SWPAO #01009)

EWA 2:1 Exchange Agreements

During 2002, six SWP contractors had agreements with the Department for the in lieu exchange of a portion of their 2002 Table A amounts for stored Environmental Water Account water. A portion of the EWA water subject to "spilling" in San Luis Reservoir was made available for exchange as of midnight March 29, 2002. For every two units of EWA water delivered to each contractor noted below, the contractor returned one unit of its 2002 approved Table A amounts to EWA by August 31, 2002. The following agreements include provisions concerning the exchanges.

Alameda County Flood Control and Water Conservation District, Zone 7. A letter agreement, dated March 27, 2003, and executed April 4, 2003, between the Department and Alameda-Zone 7, approved an in lieu exchange of a portion of Alameda-Zone 7's 2002 approved Table A amounts for up to 2,000 acre-feet of stored EWA water. During 2002, a total of 803 acre-feet of EWA water was delivered to Semitropic in April in accordance with the *Alameda County Flood Control and Water Conservation District, Zone 7 and Semitropoic Water Storage District Banking Program Agreement*, pursuant to a change in point of delivery agreement among the Department, Alameda-Zone 7, and Kern (SWPAO #02010); a total of 402 acre-feet of Alameda-Zone 7's 2002 Table A amounts was returned to EWA in July and August. (SWPAO #02017)

Alameda County Water District. A letter agreement, dated March 28, 2003, and executed April 8, 2003, between the Department and Alameda County, approved an in lieu exchange of a portion of Alameda County's 2002 approved Table A amounts for up to 2,000 acre-feet of stored EWA water. During 2002, a total of 571 acre-feet of EWA water was delivered to Alameda County in March and April, and a total of 286 acre-feet of Alameda County's 2002 Table A amount was returned to EWA in July and August. (SWPAO #02018)

Dudley Ridge Water District. A letter agreement, dated March 27, 2003, and executed April 9, 2003, between the Department and Dudley Ridge, approved an in lieu exchange of a portion of Dudley Ridge's 2002 approved Table A amount for up to 4,000 acre-feet of stored EWA water. During 2002, the Department delivered a total of 2,140 acre-feet of EWA water to Dudley Ridge, of which 1,597 acre-feet were delivered to Dudley Ridge's turnout and 543 acre-feet were delivered to Tulare's turnout in March and April pursuant to a long-term change in point of delivery agreement among the Department, Dudley Ridge, and Tulare (SWPAO #02005). A total of 1,070 acre-feet of Dudley Ridge's 2002 Table A amounts was returned to EWA in July and August. (SWPAO #02020)

Kern County Water Agency. A letter agreement, dated March 28, 2003, and executed April 15, 2003, between the Department and Kern, approved an in lieu exchange of a portion of Kern's 2002 approved Table A amounts for stored EWA water. During 2002, a total of 6,744 acre-feet of EWA water was delivered to Kern in March and April, and a total of 3,372 acre-feet of Kern's 2002 Table A amounts was returned to EWA in July and August. (SWPAO #02021)

Santa Clara Valley Water District. A letter agreement, dated March 27, 2003, and executed April 15, 2003, between the Department and Santa Clara, approved an in lieu exchange of a portion of Santa Clara's 2002 approved Table A amounts for up to 2,176 acre-feet of stored EWA water. During 2002, a total of 1,448 acre-feet of EWA water was delivered to Santa Clara in March and April, and a total of 724 acre-feet of Santa Clara's 2002 Table A amounts was returned to EWA in July and August. (SWPAO #02019)

Tulare Lake Basin Water Storage District. A letter agreement, dated March 28, 2003, and executed August 25, 2003, between the Department and Tulare, approved an in lieu exchange of a portion of Tulare's 2002 approved Table A amounts for up to 800 acre-feet of stored EWA

water. During 2002, a total of 675 acre-feet of EWA water was delivered to Tulare in March and April, and a total of 337 acre-feet of Tulare's 2002 Table A amounts was returned to EWA in July and August. (SWPAO #02023)

Turn-in Agreements

Antelope Valley-East Kern Water Agency. A turn-in agreement executed April 1, 2003, between the Department and AVEK, approved the introduction of local water into the California Aqueduct during 2001. The local water was introduced from a temporary turn-in structure located at Reach 22B, and AVEK took delivery of local water by exchange with project water delivered upstream in Reach 22A. During 2001, a total of 152 acre-feet of local water was introduced at Reach 22B and 152 acre-feet of SWP water was delivered to AVEK at Reach 22A. (SWPAO #01029)

Kern County Water Agency. During 2003, a total of 20,486 acre-feet of local water was introduced into California Aqueduct through Kern's existing turnouts in Reaches 12E and 13B. Letter agreements to allow the introduction of local water are pending.

Turnout Agreements

Alameda County Flood Control and Water Conservation District, Zone 7. An agreement dated January 23, 2002, between the Department and Alameda-Zone 7, allowed the construction, operation, and maintenance of the Corbett-Ising Turnout at Milepost 14.2, Reach 4 of the South Bay Aqueduct. The turnout has a design capacity of 6.7 cfs. Construction was essentially completed in 2002, but not formally accepted in 2003.

Antelope Valley-East Kern Water Agency. An agreement dated March 28, 2000, between the Department and AVEK, allowed the construction, operation, and maintenance of the Rancho Vista Turnout at Milepost 339.68, Reach 20B of the California Aqueduct. The turnout has a design capacity of 5 cfs. Construction was completed in March 2000, but was not formally accepted in 2003.

Kern County Water Agency and Belridge Water Storage District. An agreement dated October 29, 2001, among the Department, Kern, and Belridge Water Storage District, allowed the modification, operation, and maintenance of the existing Belridge Turnout No. 1A at Milepost 209.71, Reach 10A of the California Aqueduct. The turnout has a design capacity of 100 cfs. Modification work was completed in 2002, and formally accepted on March 27, 2003.

Agreements and Activities Related to the Monterey Amendments

Turnback Water Pool Program. Pursuant to Article 56(d) of the Monterey Amendments, the eighth year of the Turnback Water Pool Program was initiated through Notice to State Water Project Contractors No. 03-02, dated February 3, 2003. All SWP contractors who signed Monterey Amendments were permitted to participate in the program. The program allowed SWP contractors to offer a portion of their approved 2003 Table A water for sale in a turnback pool for use by interested SWP contractors. Based on Table A supply and demand, the turnback water was allocated among the selling and purchasing contractors. In 2003, 29,770 acre-feet of water were purchased under the Turnback Water Pool Program.

Transactions for Pool A and Pool B of the Turnback Water Pool Program occurred in February and March 2003, respectively. Turnback water sold for $11.90 per acre-foot—50 percent of the Delta Water Rate—through Pool A, and for $5.95 per acre-foot—25 percent of the Delta Water Rate—through Pool B. All money collected through the Turnback Water Pool Program was paid to the selling contractors. The 2003 Turnback Water Pool Program closed April 1, 2003. Notices to State Water Project Contractors describing the Turnback Water Pool Program are available online at www.swpao.water.ca.gov/notices/index.cfm.

Table 9-1 lists contractors who participated in Pool A and Pool B of the Turnback Water Pool Program.

Storage of Water Outside Service Area. Pursuant to Article 56 of the Monterey Amendments, six SWP contractors have agreements with the Department to deliver and store SWP water outside their service area for later use within their service area. The following agreements include provisions concerning the points of delivery and method for transporting such water.

Table 9-1. 2003 Turnback Water Pool Program (Acre-feet)

Contractor	Sold	Purchased
	Pool A	
Butte	375	
Mojave	16,900	
Ventura County	6,750	
Yuba City	2,320	
Alameda County		314
Alameda-Zone 7		583
AVEK		250
Coachella		172
Desert		285
Dudley Ridge		428
Kern		7,476
Kings		30
Metropolitan		15,024
Napa		160
Oak Flat		43
Santa Clara		747
Tulare		833
Total	*26,345*	*26,345*
	Pool B	
Butte	175	
Mojave	2,500	
Ventura	750	
Alameda County		40
Alameda-Zone 7		73
Castaic Lake		90
Coachella		22
Desert		36
Dudley Ridge		54
Kern		943
Kings		4
Metropolitan		1,896
Napa		20
Oak Flat		5
Santa Barbara		43
Santa Clara		94
Tulare		105
Total	*3,425*	*3,425*

Alameda County Flood Control and Water Conservation District, Zone 7. A change in point of delivery agreement pending execution, among the Department, Alameda-Zone 7, and Kern, will provide for the delivery of Alameda-Zone 7's approved 2002 carryover water and a portion of Alameda-Zone 7's approved 2003 SWP water supplies for storage in and later recovery from Semitropic, in accordance with the Alameda County Flood Control and Water Conservation District, Zone 7 and Semitropic Water Storage District Banking Program Agreement. Alameda-Zone 7 signed similar delivery agreements annually since 1998. All return water is to be delivered to Alameda-Zone 7 by December 31, 2013. During 2003, the Department delivered a total of 6,500 acre-feet of Alameda-Zone 7's 2002 extended carryover to Reach 10A for storage in Semitropic. (SWPAO #03008)

Alameda County Water District. A change in point of delivery agreement pending execution, among the Department, Alameda County, and Kern, will provide for the delivery of a portion of Alameda County's approved 2003 SWP water supplies for storage and later recovery from Semitropic, in accordance with the Alameda County and Semitropic Banking Program Agreement. Alameda County has signed similar delivery agreements annually since 1996. All return water is to be delivered to Alameda County by December 31, 2013. During 2003, the Department delivered a total of 18,800 acre-feet of Alameda County's approved SWP water to Reach 10A for storage in Semitropic, of which 16,100 acre-feet were 2003 Table A amounts and 2,700 acre-feet were 2002 extended carryover water. (SWPAO #03014)

Castaic Lake Water Agency. A change in point of delivery agreement pending execution, among the Department, Castaic Lake, and Kern, will provide for the delivery of up to 35,000 acre-feet of Castaic Lake's 2003 approved SWP water supplies for storage in and later recovery from Semitropic, in accordance with the Castaic Lake and Semitropic Banking Program Agreement. All return water is to be delivered to Castaic

Lake by March 31, 2014. No water was delivered in 2003. (SWPAO #03060)

Dudley Ridge Water District. A change in point of delivery agreement pending execution, among the Department, Dudley Ridge, and Kern, will provide for the delivery of up to 1,000 acre-feet of Dudley Ridge's approved 2003 Table A amounts for storage in and later recovery from Kern Water Bank. Dudley Ridge has signed similar delivery agreements annually since 1996. All return water is to be delivered to Dudley Ridge by December 31, 2013. During 2003, the Department delivered 350 acre-feet of Dudley Ridge's approved 2003 Table A amounts for storage in KWB. (SWPAO #03018)

Dudley Ridge Water District. A long-term change in point of delivery agreement pending execution, among the Department, Dudley Ridge, and Kern, will approve the delivery of a portion of Dudley Ridge's approved annual SWP water supplies to Kern to be used within Cawelo Water District, a member unit of Kern, the return of a like amount of such water, and the delivery of local Cawelo water supplies to Dudley Ridge by in lieu exchange for a portion of Cawelo's future allocation of Kern's SWP water supplies. This agreement is effective July 1, 2003, and remains in force until December 31, 2035. No water was delivered in 2003. (SWPAO #03053)

Dudley Ridge Water District. A letter agreement, executed November 10, 1997, among the Department, Dudley Ridge, and Kern, approved the delivery of up to 5,000 acre-feet of Dudley Ridge's 1997 Article 21 water and up to 2,000 acre-feet of Dudley Ridge's Table A amounts to KWB for storage and later recovery. A like amount of water is to be returned to Dudley Ridge by December 31, 2007. During 1997, a total of 5,342 acre-feet was delivered to Kern. During 2002, a total of 721 acre-feet was recovered and delivered to Dudley Ridge at Reach 8D. During 2003, a total of 350 acre-feet was recovered and delivered to Dudley Ridge at Reach 8D. (SWPAO #97021)

Metropolitan Water District of Southern California. A long-term change in point of delivery agreement pending execution, among the Department, Metropolitan, and Kern, will provide the delivery of a portion of Metropolitan's approved SWP supplies for storage in and later recovery from the groundwater basin underlying Kern Delta Water District, a member unit of Kern, in accordance with the Metropolitan and Kern Delta Water Management Program Agreement. During 2003, a total of 20,134 acre-feet of Metropolitan's Table A amounts was delivered to Kern Delta at Reaches 12E and 13B. (SWPAO #03019)

Metropolitan Water District of Southern California. A change in point of delivery agreement pending execution, among the Department, Metropolitan, and Mojave Water Agency, will provide for the delivery of up to 75,000 acre-feet of Metropolitan's 2003 and 2004 approved SWP water supplies for storage in and later recovery from Mojave River Basin within Mojave, in accordance with the Metropolitan and Mojave Water Banking Demonstration Program Agreement. The water is to be returned to Metropolitan by January 15, 2010. During 2003, the Department delivered a total of 24,874 acre-feet of Metropolitan's approved SWP water to Mojave at Reaches 22B and 24. (SWPAO #03057)

Metropolitan Water District of Southern California. A long-term agreement (SWPAO #01013), pending execution among the Department, Metropolitan, and Kern, will approve the delivery of a portion of Metropolitan's annual Table A and other water supplies for storage and later recovery from groundwater basins within Arvin-Edison Water Storage District, in accordance with the Metropolitan and Arvin-Edison Water Management Program Agreement. The return water is to be delivered to Metropolitan from Arvin-Edison and /or by exchange of Metropolitan's water for a like amount of Kern's SWP approved Table A amounts or other water delivered from the California Aqueduct. The water is to be returned to Metropolitan by December 31, 2035.

Before this long-term agreement was prepared, three interim agreements dated December 29, 1997 (SWPAO #97025), September 17, 1998 (SWPAO #98018, first amendment to SWPAO #97025), and April 13, 1999 (SWPAO #99009, second amendment to SWPAO #97025), among the Department, Metropolitan, and Kern, provided temporary authorization for Metropolitan to store water in Arvin-Edison. Water was delivered to Arvin-Edison for storage each year from 1997 to 2000 under these agreements. During 2001, water previously stored under SWPAO #97025 was returned to Metropolitan, completing the agreement. During 2003, a total of 7,297 acre-feet previously stored under SWPAO #98018 was recovered and delivered to Metropolitan at Reach 26A, completing this agreement. During 2003, a total of 5,083 acre-feet previously stored under SWPAO #99009 was recovered and delivered to Metropolitan at Reach 26A. During 2003, a total of 40,631 acre-feet of Metropolitan's Table A amounts was delivered to Arvin-Edison for storage at Reaches 12C and 14E. (SWPAO #01013)

Metropolitan Water District of Southern California. A letter agreement executed April 21, 1993, among the Department, Metropolitan, and Kern, approved the delivery of Metropolitan's 1992 carryover water for storage in and later recovery from Semitropic. Water is to be returned by December 31, 2010. A subsequent long-term agreement, executed August 21, 1995, among the Department, Metropolitan, and Kern, approved the annual delivery of a portion of Metropolitan's annual Table A and other water supplies for storage in and later recovery from Semitropic, in accordance with the Metropolitan and Semitropic's Water Banking Program Agreement. This agreement remains in effect until November 4, 2035. Water was delivered to Semitropic for storage in 1993, and each year from 1995 to 1999. During 2001, a total of 31,500 acre-feet was recovered and delivered to Metropolitan at Reach 30. During 2003, a total of 10,000 acre-feet was recovered and delivered to Metropolitan at Reach 26A, and a total of 70,940 acre-feet of Metropolitan's Table A amounts was delivered to Reach 10A for storage in Semitropic. (SWPAO #95010)

Santa Clara Valley Water District. A change in point of delivery agreement pending execution, among the Department, Santa Clara, and Kern, will provide for the delivery of a portion of Santa Clara's approved 2003 SWP water supplies for storage in and later recovery from Semitropic, in accordance with the Santa Clara and Semitropic Banking Program Agreement. Santa Clara has signed similar delivery agreements annually since 1996. All return water is to be delivered to Santa Clara by December 31, 2013. During 2003, the Department delivered 33,000 acre-feet of Santa Clara's 2003 Table A amounts to Reach 10A for storage in Semitropic. (SWPAO #03051)

Article 21 Water Program

Pursuant to Article 21 of the Monterey Amendments, Article 21 water replaces surplus, wet weather, and Article 12(d) water. The Article 21 water program allows a contractor to take delivery of water over the approved and scheduled Table A amounts for the current year. Article 21 water is available for delivery on a short-term basis as determined by the Department when water is still available after operational requirements for project water deliveries, water quality, and other requirements are being met.

The conditions for the Article 21 Water Program for 2003 were described in the March 14, 2003, Notice to State Water Project Contractors No. 03-03, available online at www.swpao.water.ca.gov/notices/index.cfm. Sixteen participants signed the notice, which indicated acceptance of the criteria, procedures, and charges for the program, and collectively received a total of 59,653 acre-feet of Article 21 water (Table 9-2).

During the Article 21 water program period, unscheduled water was also made available to Empire pursuant to its long-term water supply contract. Empire received 175 acre-feet of unscheduled water in 2003 for agricultural purposes.

Table 9-2. 2003 Article 21 Water Deliveries (Acre-feet)

Contractor	Amount
Castaic Lake	991
Coachella	204
Kings	58
Desert	330
Dudley Ridge	1,928
Empire[a]	175
Kern	27,891
Metropolitan	17,622
Napa	376
Oak Flat	19
San Bernardino	200
San Gabriel	200
San Luis Obispo	36
Santa Barbara	339
Santa Clara	936
Solano	2,280
Tulare	6,243
Total	*59,828*

[a]Unscheduled agricultural water

Flexible Storage Program

Pursuant to Article 54 of the Monterey Amendments, the Flexible Storage Program provides SWP contractors participating in the repayment of the capital costs of Castaic Lake and Lake Perris the option to withdraw water in excess of approved deliveries. The objective of this program is to provide additional flexibility and water management benefits to local participating agencies.

Available "flexible storage" is approximately 50 percent of active storage, providing for 160,000 acre-feet at Castaic Lake and 65,000 acre-feet at Lake Perris. Participating contractors of the Castaic Lake program include Metropolitan, Ventura, and Castaic Lake. Each can withdraw a maximum amount of 153,940 acre-feet, 1,377 acre-feet, and 4,683 acre-feet, respectively. At Lake Perris, Metropolitan can withdraw a maximum amount of 65,000 acre-feet. Any participating contractor is given 5 years to replace the water with Table A amounts, purchased water, exchange water, or local water.

One SWP contractor participated in the Flexible Storage Program in 2003. At the end of 2002, Metropolitan had a zero balance in Castaic Lake and Lake Perris. Metropolitan withdrew 77,804 acre-feet from Castaic Lake in 2003, and replaced 77,804 acre-feet in 2003, resulting in a zero water balance at the end of 2003. Metropolitan withdrew 17,993 acre-feet from Lake Perris, and replaced 17,993 acre-feet of Article 21, carryover, and Table A water in 2003, resulting in a zero water balance at the end of 2003. At the end of 2002, Castaic Lake Water Agency had a negative balance of 395 acre-feet from Castaic Lake. There was no action in 2003. Therefore, at the end of 2003, a negative balance of 395 acre-feet remains in Castaic Lake.

Carryover Programs

Pursuant to Article 56 of the Monterey Amendments, contractors can elect to store project water outside of their service area for later use within their service area. Qualified contractors can request carryover Table A amounts for delivery in the following year to the extent that such deliveries do not adversely affect current or future project operations. Factors that influence how much extended carryover water can be delivered include operational constraints of project facilities, filling of SWP conservation storage facilities, flood control releases, and water quality restrictions. If storage requests exceed the available storage capacity, the amount available is allocated among the contractors requesting storage in proportion to their annual Table A amounts for that year. Six SWP contractors took direct delivery of 75,584 acre-feet of 2002 approved Table A amounts carried over into 2003 as extended carryover. One SWP contractor used 45,600 acre-feet of this extended carryover for flexible storage payback. Two SWP contractors had a combined total of 9,200 acre-feet of their extended carryover delivered to storage outside their service areas.

Pursuant to Article 12(e) of the Water Supply Contract, contractors can carry over approved Table A water previously scheduled during October, November, and December that was not delivered due to local outages of wet conditions. One SWP contractor took delivery of 140 acre-feet of 2002 approved Table A amounts carried over into 2003 as Article 12(e) carryover. Addi-

tionally, another SWP contractor took delivery of 187 acre-feet of 2002 approved Table A amounts carried over into 2003 as Article 45(f) carryover.

2002 Summer Allocation Carryover Program

To help contractors prepare for potentially limited water supplies in 2003, the Department provided a 2002 Summer Allocation Carryover Program on October 11, 2002. Under this program, long-term SWP contractors were allowed to carry over up to 5 percent of their 2003 Table A amounts for temporary storage in San Luis Reservoir during 2003. This program is separate from, and in addition to, other carryover programs afforded by Articles 12(e) and 56 of the long-term water supply contracts. Twelve SWP contractors took a total delivery of 89,204 acre-feet of 2002 approved Table A amounts carried over into 2003 (Table 9-3).

Dry Year Water Purchase Program

In 2003, the Department initiated a Dry Year Water Purchase Program to reduce the possibility of adverse economic impacts and hardship associated with water shortages. Two SWP contractors and two Delta farmers participated in the program by signing a Memorandum of Understanding with the Department. The program participants requested a total of 11,355 acre-feet of dry year water. To meet participant demands, the Department obtained water from Butte Water District who made it available through crop idling.

Table 9-3. 2002 Summer Allocation Carryover Program Deliveries (Acre-feet)

Contractor	Amount
AVEK	7,049
Castaic Lake	4,760
Dudley Ridge	1,452
Metropolitan	54,975
Mojave	3,528
Napa	1,055
Palmdale	1,065
San Bernardino	1,844
Santa Barbara	2,274
Santa Clara	5,000
Solano	1,918
Tulare	4,284
Total	*89,204*

The four participants and the amount of water purchased from the 2003 Dry Year Program is detailed below:

- Kern County Water Agency - 8,741 acre-feet
- Dudley Ridge Water District - 2,220 acre-feet
- Phelps Brothers - 300 acre-feet
- Ronald Conn - 94 acre-feet

The participants entered into separate conveyance agreements with the Department to convey the dry year water across the Delta and through SWP facilities. Actual dry year water received by these participants was less than the amount purchased due to the Delta being in excess conditions during all of May and most of June 2003 which prevented the transfer and conveyance of the dry year water. The cumulative amount of dry year water made available to all participants was 7,653 acre-feet.

Environmental Water Account

EWA is a cooperatively managed program intended to provide protection to the fish of the Bay-Delta Estuary through environmentally beneficial changes and increased flexibility in the operations of the SWP and CVP, at no uncompensated water cost to the projects' water users. Responsibility for implementing EWA rests with the National Marine Fisheries Service, U.S. Fish and Wildlife Service, and the Department of Fish and Game (management agencies), as well as with the Bureau of Reclamation and the Department (project agencies).

Under EWA, fish protection is achieved by periodically curtailing project water delivery from the Bay-Delta to project water users south of the Delta and replacing it at a later date within the same calendar year. This necessitates the acquisition of alternative sources of project water, called EWA assets, which are used to replace the project water supply (i.e., the undelivered water). EWA assets consist of *purchase assets*,

which are acquired through purchases from willing water sellers; *variable assets*, which are acquired through changes in operations; and *source shifting*, which involves deferral of scheduled delivery of water allocations by willing participants. EWA is considered operational for any year when these assets are in place and Endangered Species Act commitments are provided by the management agencies.

In 2003, EWA's third operational year, a total of 316,216 acre-feet of curtailments for fish protection was requested by the management agencies between January and May. These exports occurred at Clifton Court Forebay (290,213 acre-feet) and Tracy Pumping Plants (25,799 acre-feet) in the Delta. All purchase asset acquisitions in 2003 were made by the Department as single-year transactions and environmental studies were carried out to ensure that the transactions complied with CEQA.

In fall 2002, the SWP backed approximately 20,000 acre-feet of EWA assets into Lake Oroville, transferring the debt from San Luis Reservoir to Lake Oroville. In spring 2003, heavy rains forced Oroville Reservoir into flood control status which led to the spill of 20,000 acre-feet of stored EWA water. In July, the SWP released 8,474 acre-feet of SWP water from Lake Oroville, using EWA's 500 cfs capacity at Clifton Court Forebay and creating a debt in Lake Oroville, as the likelihood of spilling EWA's debt to the SWP from Oroville Reservoir was deemed to be greater than that in San Luis Reservoir. The SWP also backed 18,922 acre-feet of EWA water (Yuba transfer) into Lake Oroville in July.

The Department and the Bureau acquired 90,591 acre-feet in variable assets and 214,914 acre-feet of purchase assets through contract agreements. A source shift was not implemented because there was no risk of low-point problems at San Luis Reservoir. The initial year of EWA operation ended with an 83,437 acre-foot credit of water for use during 2002 EWA actions. The second year of EWA operation ended with a 31,273 acre-foot credit for use during 2003 EWA actions. The third year of EWA ended with a 252 acre-foot credit for use during 2004 EWA actions.

The following section lists the SWP contractors and non-SWP contractors that participated in the EWA Program in 2003.

Purchase Assets

The purchase asset water amounts below represent the total amounts of water acquired for EWA from various sources. These amounts have not been adjusted to reflect conveyance losses.

Kern County Water Agency. An agreement executed on August 27, 2003, between the Department and Kern approved the purchase of up to 198,240 acre-feet of water stored in Kern Water Bank through the exchange of approved Table A water for support of EWA under the CALFED Program. A total of 125,000 acre-feet of Kern's water was purchased and used to repay SWP debt. (SWPAO #03704)

Yuba County Water Agency. An agreement executed on April 22, 2003, between the Department and Yuba approved the transfer of up to 185,000 acre-feet of water from storage in New Bullards Bar Reservoir and groundwater substitution for support of EWA under the CALFED Program. A total of 65,000 acre-feet of Yuba's water was purchased. Of the total, 6,000 acre-feet was used to repay CVP debt and 59,000 was used to repay SWP debt incurred through Delta fish actions (pumping curtailments at Tracy and Banks pumping plants) (SWPAO #03702).

Santa Clara Valley Water District and Kern County Water Agency. An agreement executed on December 1, 2003, between the Department, Santa Clara, and Kern approved the purchase of up to 30,000 acre-feet of water stored in Santa Clara's portion of Semitropic Groundwater Bank through the exchange of approved Table A water for support of EWA under the CALFED Program. A total of 20,000 acre-feet of Santa Clara's water was purchased and used to repay CVP debt. No water was delivered in 2003. (SWPAO #03703)

Metropolitan Water District of Southern California and Kern County Water Agency. An agreement executed on June 4, 2003, between the Department, Metropolitan, and Kern approved the exchange of up to 36,776 acre-feet of water for support of EWA under the CALFED program. The water was delivered by Kern to the Department, conveyed through the California Aqueduct, and delivered to Metropolitan in exchange for Metropolitan's approved Table A water. A total of 29,596 acre-feet of water was exchanged and Kern provided the remaining 7,180 acre-feet directly to the Department. (SWPAO #03700)

South Feather Water and Power Agency. An agreement executed on February 21, 2003, between the Department and South Feather Water and Power Agency, formerly Oroville-Wyandotte Irrigation District, approved the transfer of up to 10,000 acre-feet of water that would otherwise remain in storage from Little Grass Valley Reservoir and Sly Creek Reservoir for support of EWA under the CALFED Program. A total of 4,914 acre-feet of South Feather's water was transferred. (SWPAO #03701)

Operational Assets

Relaxation of the Export/Import Ratio. The Department has the opportunity to gain water credits if the EWA management agencies decide that the E/I ratio can be relaxed, thus allowing the SWP and CVP to pump any extra water that the fisheries do not need. In 2003, relaxation of the E/I ratio resulted in a total of 65,780 acre-feet of water being credited to EWA. (SWPAO #03730)

EWA Share of State Gain. The Department has the opportunity to pump half the CVPIA (b)(2) releases that reach the Delta on behalf of EWA. A total of 19,208 acre-feet of water was pumped at Banks Pumping Plant in 2003, and credited to EWA. (SWPAO #03740).

For additional information on EWA, see Chapter 7, *Water Supply Development and Reliability.*

Miscellaneous Agreements with Other Agencies

In addition to negotiating agreements with SWP contractors to provide for specified water deliveries, the Department also entered into several agreements with other agencies for water conveyance, or exchange, between January 1, 2003, and December 31, 2003.

Water Conveyance Agreements-CVP Water

The Department regularly enters into agreements to convey CVP water such as agreements with contractors receiving water from the Bureau through the Cross Valley Canal, a water conveyance facility that connects with the Aqueduct near Tupman in Kern County. Other agencies or corporations receive CVP water through agreements between the Department and the Bureau, including the U.S. Department of Veterans Affairs, USFWS, and Musco Family Olive Company. Occasionally, the Department also enters into agreements with the Bureau to convey CVP or SWP water from the Delta to O'Neill Forebay through CVP or SWP facilities. Some of these agreements allow the Bureau to make up for curtailed water exports from Tracy Pumping Plant associated with improving conditions for fish in the Delta. Other agreements allow replacing water exports foregone during maintenance and repair of Tracy and Banks Pumping Plants and CVP and SWP conveyance facilities between the Delta and O'Neill Forebay.

Byron-Bethany Irrigation District. An agreement executed May 28, 2003, between the Department and Byron-Bethany Irrigation District, approved the annual diversion of up to 50,000 acre-feet of Byron-Bethany's water from the Delta for agricultural, municipal and industrial uses. Historically, Byron-Bethany diverted water from the Delta under a pre-1914 water right and the diversions were primarily for agricultural purposes during the irrigation season. Land use within the District is changing from strictly agricultural uses to a mixture of agriculture, urban, and industrial which resulted in a change in the pattern of demand within the District from sea-

sonal to year-round use. This agreement describes the nature and extent of the District's diversion rights between the District and the Department, and is effective until December 31, 2035. No water was delivered in 2003. (SWPAO #02027)

Cross Valley Canal. Eight CVP water contractors use CVC to obtain water from the California Aqueduct either by exchange with other agencies or by direct delivery. The eight water contractors are: County of Fresno, County of Tulare, Hills Valley Irrigation District, Kern-Tulare Water District, Lower Tule River Irrigation District, Pixley Irrigation District, Rag Gulch Water District, and Tri-Valley Water District. These agencies have had water conveyance service by the Department since 1976 through

- long-term 3-party contracts with the Department and the Bureau, executed in 1976, and amendments extending the contracts through February 29, 1996; and
- interim renewal contracts: (1) March 1, 1996, through February 28, 1998; (2) March 1, 1998, through February 28, 2000; (3) March 1, 2000, through November 30, 2000; (4) December 1, 2000, through February 28, 2001; (5) March 1, 2001, through February 28, 2002; (6) March 1, 2002 through February 28, 2003; and (7) April 24, 2003 through February 29, 2004.

Between January 1, 2003, and December 31, 2003, the Department delivered CVP water to the CVC contractors as follows:

In May 2003, the following six CVC contractors received part of their 2003-04 approved CVP water: Kern-Tulare Water District (1,076 acre-feet), Rag Gulch Water District (357 acre-feet), Tri-Valley Water District (82 acre-feet), Hills Valley Irrigation District (242 acre-feet), Fresno County Public Works (216 acre-feet), and County of Tulare (383 acre-feet). The water delivered to the CVC contractors totaled 2,356 acre-feet. (SWPAO #s 03300, 03301, 03304, 03305, 03306, and 03307)

Department of Parks and Recreation. Water is provided for recreation facilities at several SWP lakes and reservoirs under an agreement between the Department and the Department of Parks and Recreation, dated October 28, 1971. The agreement implements the provisions of the Davis-Dolwig Act, and specifies maximum quantities of water that can be allocated to each lake per year. The lakes included in the agreement are Del Valle Reservoir, Lake Perris, Castaic Lake and Lagoon, Bethany Reservoir, and the San Luis Division facilities. Allocations to each lake are based on the percentages of Table A water allocated to SWP contractors in a given year.

Madera Irrigation District. On July 22, 2003, Madera Irrigation District requested that the Department convey 1,237 acre-feet of CVP water from the San Joaquin River Exchange Contractor Authority to Madera through SWP facilities. Under an agreement executed on March 22, 2004, the Department delivered 1,200 (1,237 minus 3 percent conveyance loss) acre-feet of water in October 2003. (SWPAO #03318)

Musco Family Olive Company. An agreement dated September 22, 2003, and executed November 21, 2003, among Musco Family Olive Company, Plain View Water District, the Department, and the Bureau, provides for the conveyance of up to 800 acre-feet of Plain View's CVP water to Reach 2A of the California Aqueduct for use by Musco Family Olive Company. A total of 719 acre-feet—95 acre-feet (SWPAO #02320) and 62 acre-feet (SWPAO #03311)—was delivered in 2003 under this agreement. Construction of a permanent turnout is currently being pursued.

U.S. Department of Veterans Affairs. A letter agreement dated November 6, 2002 and executed January 1, 2003, among the U.S. Department of Veterans Affairs, the Department, and the Bureau, provides for the conveyance of up to 450 acre-feet of CVP-approved water to Reach 2B of the California Aqueduct to the U.S. Department of Veterans Affairs' San

Joaquin Valley National Cemetery. A total of 5 acre-feet was delivered to the National Cemetery in Reach 2B of the California Aqueduct in 2003 under this 2002 agreement (SWPAO #02321), and a total of 80 acre-feet was delivered to the National Cemetery in Reach 2B of the California Aqueduct in 2003 under a pending letter agreement. (SWPAO #03312)

U.S. Fish and Wildlife Service Cooperative Agreement. The Bureau initiated a cooperative agreement with the Department to deliver CVP water to the Kern National Wildlife Refuge for USFWS. Under the terms of this cooperative agreement, dated September 9, 1994, up to 26,530 acre-feet of CVP water would be delivered from Check 21 to the Buena Vista Water Storage District Turnout BV-1B, on Reach 10A of the California Aqueduct, from October 1, 1993, through April 10, 1995. Since the cooperative agreement was signed, 13 modifications to the agreement have been executed. Under Modification No. 001, dated October 31, 1994, additional funding was provided. Similar funding adjustments through modifications were made each year to the agreement. Modification No. 013, executed February 3, 2002, extended the agreement through April 30, 2002, and defined the water delivery rates for 2001 and 2002. A new 5-year agreement with the Bureau for Kern National Wildlife Refuge is currently pending. The Department conveyed 14,936 acre-feet of CVP water to Kern National Wildlife Refuge in 2003.

Other Turnout Agreements. In 2003, there was one new turnout agreement with a non-SWP contractor agency.

Plain View Water District. An agreement executed October 1, 2003, between the Department and Plain View Water District, allowed the construction, operation, and maintenance of a permanent Musco Family Olive Turnout at Milepost 12.47, Reach 2A of the California Aqueduct. Construction is currently unscheduled. The agreement contains provisions for submitting plans and specifications within 1 year of executing the agreement.

Water Deliveries

Approved Table A Deliveries

Each year, by October 1, the SWP long-term water contractors submit initial requests for approved Table A deliveries allocated to contractors for use in the subsequent calendar year. Initial approved Table A amounts for the coming year are made by the Department in December and are based on operations studies that assume 90 percent exceedence of historic water supply (where exceedence refers to the possibility that water supply in the coming year will be exceeded by the historic water supply), current reservoir storage, and total requests by the SWP water contractors. Forecasts for the year are updated as hydrological conditions change. Approved Table A amounts are increased or decreased depending on both actual and projected hydrologic conditions.

On October 1, 2002, SWP long-term contractors submitted initial requests for 2003.

The Department approved deliveries of 825,375 acre-feet on December 3, 2002, resulting in initial approved Table A amounts of 20 percent of most SWP contractor requests. The Department increased the 2003 approved Table A amounts to 1.86 million acre-feet, or 45 percent on January 16, 2003. As water conditions improved, approved Table A amounts were increased to 2.06 million acre-feet (50 percent) on March 28; 2.89 million acre-feet (70 percent) on April 24; and finally to 3.71 million acre-feet (90 percent) on May 16.

Notices to State Water Project Contractors informing them of increases or decreases in approved Table A amounts are online at www.swpao.water.ca.gov/notices/index.cfm.

SWP Deliveries

The SWP delivers water for a variety of beneficial uses. In addition to delivering approved Table A water to long-term water supply contractors, the SWP

- conveys water to, and stores water for, other public agencies through special contracts and agreements;
- provides water for wildlife and recreational uses; and
- stores, releases, and delivers local runoff water from SWP facilities to agencies that hold local water rights.

In 2003, 4,223,255 acre-feet of water were conveyed to 27 long-term contractors and 26 other agencies. That amount includes

- 2,901,041 acre-feet of approved Table A water;
- 59,653 acre-feet of Article 21 water and 175 acre-feet of unscheduled water;
- 2,846 acre-feet of SWP water for recreation, fish and wildlife; and
- 1,037,324 acre-feet of water delivered to satisfy water rights settlement agreements and agreements with SWP contractors for local water supplies.

Figure 9-1, located before the tables at the end of the chapter, shows amounts of water delivered to various locations during 2003.

Specific information about water deliveries made to long-term contractors and other agencies during 2003 and historical deliveries from 1962 through 2003 are presented in the following three sections, each with a corresponding table, located at the end of the chapter:

- Water Delivered to Long-term Water Supply Contractors in 2003, by Service Area (Table 9-4);
- Water Delivered in 2003, by Month (Table 9-5); and
- Total Amounts of Annual Table A Water and Water Conveyed, by Type, 1962-03 (Table 9-6).

Water Deliveries and Credits to Long-Term SWP Contractors

Table 9-4 shows amounts of water delivered in 2003. The following information is arranged by column number.

2003 Approved Table A Water Delivered. Columns 1 through 6 show a detailed breakdown of approved Table A water delivered to long-term water supply contractors in 2003.

Turnback Pool Water. Column 5 shows 29,770 acre-feet of turnback pool water was delivered to long-term water supply contractors in 2003.

2002 Carryover Approved Table A Water Delivered During 2003. For several years, the Department has offered contractors the opportunity to carry over a portion of their approved Table A water for delivery in the current year to be delivered during the next year.

The carryover program was designed to encourage the most effective and beneficial use of water and to avoid obligating the contractors to use or lose the water by December 31 of each year. The SWP contractors' long-term contracts and amendments state the criteria for carrying over approved Table A water from one year to the next. Column 7 shows 219,915 acre-feet of water was carried over from 2002 for delivery in 2003.

Total Table A Water Delivered. Column 8 shows all approved Table A water delivered in 2003—a total of 2,898,144 acre-feet.

2003 Water Bank Recoveries. Column 9 shows 72,812 acre-feet of water bank recoveries in 2003.

2003 Article 21 Water. Column 10 shows 59,828 acre-feet of 2003 Article 21 water delivered to long-term water supply contractors in 2003 (includes 59,653 acre-feet of Article 21 water and 175 acre-feet of unscheduled water). Long-term water supply contractors who have

not signed the Monterey Amendment receive unscheduled water.

Dry Year Water Purchase Program. Column 11 shows 7,388 acre-feet of Dry Year Water Purchase Program water delivered in 2003.

2003 Article 54 Flexible Storage Withdrawal Recoveries. Column 12 shows 95,797 acre-feet of Article 54, Flexible Storage Withdrawal in 2003.

Total SWP Water Delivered. Column 13 shows 3,134,769 acre-feet of total SWP water delivered in 2003. This includes total approved Table A water, water bank recoveries, Dry Year Water Purchase Program, Flexible Storage Withdrawal, and Article 21 and unscheduled water.

Non-SWP Water Deliveries. Column 14 includes deliveries of nonproject water to long-term water contractors. Nonproject water is generally local and permit water that a SWP contractor has a water right to, or water purchased from, exchanged with, or transferred from non-SWP agencies. In 2003, nonproject water deliveries totaled 51,769 acre-feet.

Total Deliveries. Column 15 shows total amounts of water delivered to long-term contractors. In 2003, the SWP delivered 3,186,528 acre-feet to 27 long-term contractors. This amount included 2,901,041 acre-feet of approved Table A water, 59,828 acre-feet of Article 21 and unscheduled water, and 51,139 acre-feet of nonproject water.

Water Delivered in 2003 by Month

During 2003, the SWP provided water service to 53 agencies, including 27 long-term water contractors. Those agencies and the amounts of water delivered to them by month are listed in Table 9-5, and are summarized below as SWP water and nonproject water.

SWP Water. SWP water as defined in the *long-term water supply contracts,* includes Article 21 water; carryover approved Table A water; current year approved Table A amounts; flexible storage water; transfer and exchange of approved Table A water; and turnback pools A and B.

Related water includes operational flood release and recreation and fish and wildlife. There was no operational flood water released in 2003.

Article 21 Water. The Article 21 water program allows a contractor to take delivery of water over the approved and scheduled Table A amounts for the current year. In 2003, 16 contractors participated in the program. A total of 59,828 acre-feet of Article 21 water was delivered to Napa, Solano, Santa Clara, County of Kings, Dudley Ridge, Castaic Lake, Metropolitan, Kern, Oak Flat, Tulare, San Luis Obispo, Santa Barbara, Coachella, Desert, San Bernardino, and San Gabriel. Empire took delivery of 175 acre-feet of unscheduled water.

2002 Carryover Approved Table A Water. In 2003, 174,315 acre-feet of 2002 approved Table A water were delivered that had been stored in SWP storage facilities in 2002.

Approved Table A Water. A total of 2,735,926 acre-feet of 2003 approved Table A water was delivered to 27 long-term contractors. Also, 174,315 acre-feet of carryover water, and 95,797 acre-feet of flexible storage withdrawal water were delivered in 2003.

Exchanges and Transfers of Approved Table A Water. During 2003, a total of 66,677 acre-feet of approved Table A water was exchanged or transferred to SWP long-term contractors and non-SWP water agencies as follows:

- Kern transferred 8,000 acre-feet to Dudley Ridge;
- Tulare transferred 4,900 acre-feet of water to Westlands and exchanged 14,103 acre-feet with Westlands;
- Metropolitan exchanged 24,874 acre-feet with Mojave;
- Dudley Ridge exchanged 8,700 acre-feet with San Gabriel and transferred 1,100 acre-feet to Tulare; and

- San Bernardino transferred 5,000 acre-feet to Metropolitan.

Turnback Pool Water. A total of 29,770 acre-feet of turnback pool water was delivered to long-term water supply contractors.

Water for Recreation and Fish and Wildlife. A total of 2,846 acre-feet of SWP water was conveyed for recreational use and enhancement of fish and wildlife.

Recreational Use. The SWP delivered 563 acre-feet of water for facilities at Lake Oroville, Lake del Valle, O'Neill Forebay, Silverwood Lake, and Lake Perris. In addition, 1,776 acre-feet were delivered to Castaic Lake and Castaic Lagoon, an impoundment downstream from Castaic Lake devoted entirely to recreation.

Wildlife Management. The SWP delivered 507 acre-feet of water to use in managing wildlife in the Pilibos Wildlife Area, located on about 770 acres of land near O'Neill Forebay, 40 miles south of Los Banos.

Water for North Bay Aqueduct Flow Test. A total of 27 acre-feet was conveyed through the North Bay Aqueduct to test the flow capacity downstream of Barker Slough Pumping Plant, following a clean out of a portion of the pipeline.

Non-SWP Water

In 2003, the Department used SWP facilities to convey non-SWP water for various agencies according to the terms of water rights and water transfer and exchange agreements. Detailed information concerning those conveyances is found under the *Miscellaneous Agreements with Other Agencies* section in this chapter.

Floodwater. Occasionally, during wet years, the Department accepts floodwater from the Kern River into the California Aqueduct through the Kern River-California Aqueduct Intertie under an agreement entitled *Agreement among the State of California, Kern County Water Agency, and the Kern River Interests for Diversions of Floodwaters through the Kern River-California Aqueduct Intertie*, dated November 18, 1975. In 2003, the Department did not accept any floodwater into the California Aqueduct.

Water Rights Water. Water in this category is transported through SWP facilities to long-term SWP contractors and other agencies according to terms of various local water rights agreements. Some water simply passes through SWP transportation facilities; a portion is stored in SWP reservoirs for release at a later time. In 2003, 1,037,324 acre-feet of water in this category were delivered to the Feather River, South Bay, North Bay, and Southern California.

Feather River Area. Ten nonproject agencies in the Feather River area received 1,008,093 acre-feet. Those agencies are

- Last Chance Creek Water District, 6,598 acre-feet
- Thermalito Irrigation District, 2,398 acre-feet
- South Feather Water and Power Agency, formerly Oroville-Wyandotte Irrigation District, 4,879 acre-feet
- Western Canal Water District, 282,251 acre-feet
- Joint Water Districts Board, 682,403 acre-feet
- Oswald Water District, 445 acre-feet
- Tudor Mutual Water Company, 3,220 acre-feet
- Garden Highway Mutual Water Company, 16,303 acre-feet
- Plumas Mutual Water Company, 8,498 acre-feet
- Dana Brothers, 1,098 acre-feet

North Bay Area. In the North Bay Area, 4,600 acre-feet of Solano permit and settlement water were delivered.

South Bay Area. In the South Bay area, a total of 17,290 acre-feet of local water was delivered to Alameda-Zone 7 (9,378 acre-feet) and Alameda County (7,912 acre-feet). These two South Bay Aqueduct contractors hold water rights to runoff from Lake Del Valle watershed.

Southern California. In Southern California, 573 acre-feet of local runoff from the Houston Creek watershed were stored and delivered to Crestline under water rights held by the Department on Houston Creek. The authorized place of use is limited to Crestline.

The Department also released 6,768 acre-feet of local water from Piru Creek to United Water Conservation District, a member unit of Ventura.

Annual Table A Water and Water Delivered Since 1962

Information about annual Table A water and water conveyed for the past 40 years is contained in Table 9-6. The following discussion of conveyed Table A water is arranged according to column numbers.

Annual Table A. Columns 1 through 7 of Table 9-6 show the amount of long-term contractor's annual Table A water by area for years 1962 through 2003 as specified in the Table A schedules of the long-term water supply contracts.

In some instances Table A schedules—projections of each contractor's need for water to 2035—have been amended to meet the needs of individual contractors. The amounts of annual Table A water each contractor may request for years 1962 through 2035 can be found in Table B-4 in Appendix B.

Water Delivered. Columns 8 through 16 show water delivered or conveyed, including initial fill water and operational losses and storage changes.

Approved Table A Water. Column 8 shows amounts of approved Table A water delivered each year from 1962 through 2003.

Article 21 and Unscheduled Water. Article 21 and unscheduled water is water in excess of that required to meet all demands for the year's approved Table A water and water to be stored in SWP reservoirs.

Column 9 shows amounts of Article 21 water, as defined under *SWP Deliveries*, and unscheduled water delivered from 1962 through 2003.

Other Water. Column 10 includes amounts of water classified as other water delivered in 2003, including nonproject water conveyed through SWP facilities and regulated delivery of local supply.

In 2003, a total of 251,447 acre-feet of other water was delivered.

Feather River Diversions. Column 11 includes amounts of water from the Feather River delivered according to agreements for water rights water. In 2003, a total of 1,008,093 acre-feet in this category was delivered to agencies in the Feather River area.

Recreation Water. Column 12 shows water conveyed for recreational use or to provide water to improve water quality for fish and wildlife. In 2003, a total of 2,846 acre-feet of SWP water was conveyed for this purpose.

Initial Fill Water. The quantities listed in Column 14 represent the amounts used to initially fill the aqueducts and reservoirs south of the Delta to maximum operating capacities. Initial filling began in 1962 with the filling of the South Bay Aqueduct and was completed in 1979 when Lake Perris reached its maximum operating capacity of 127,000 acre-feet. In 1996 and 1997, the Coastal Aqueduct was initially filled.

Operational Losses. Column 15 includes the total amounts of water lost through evaporation and seepage, net storage changes in reservoirs south of the Delta, and amounts of inflow from local drainage areas, including inflows into San Luis Canal and from the Kern River Intertie.

Negative values are indicated for years when withdrawals and evaporation from reservoirs south of the Delta exceed the amounts of water added to the reservoirs.

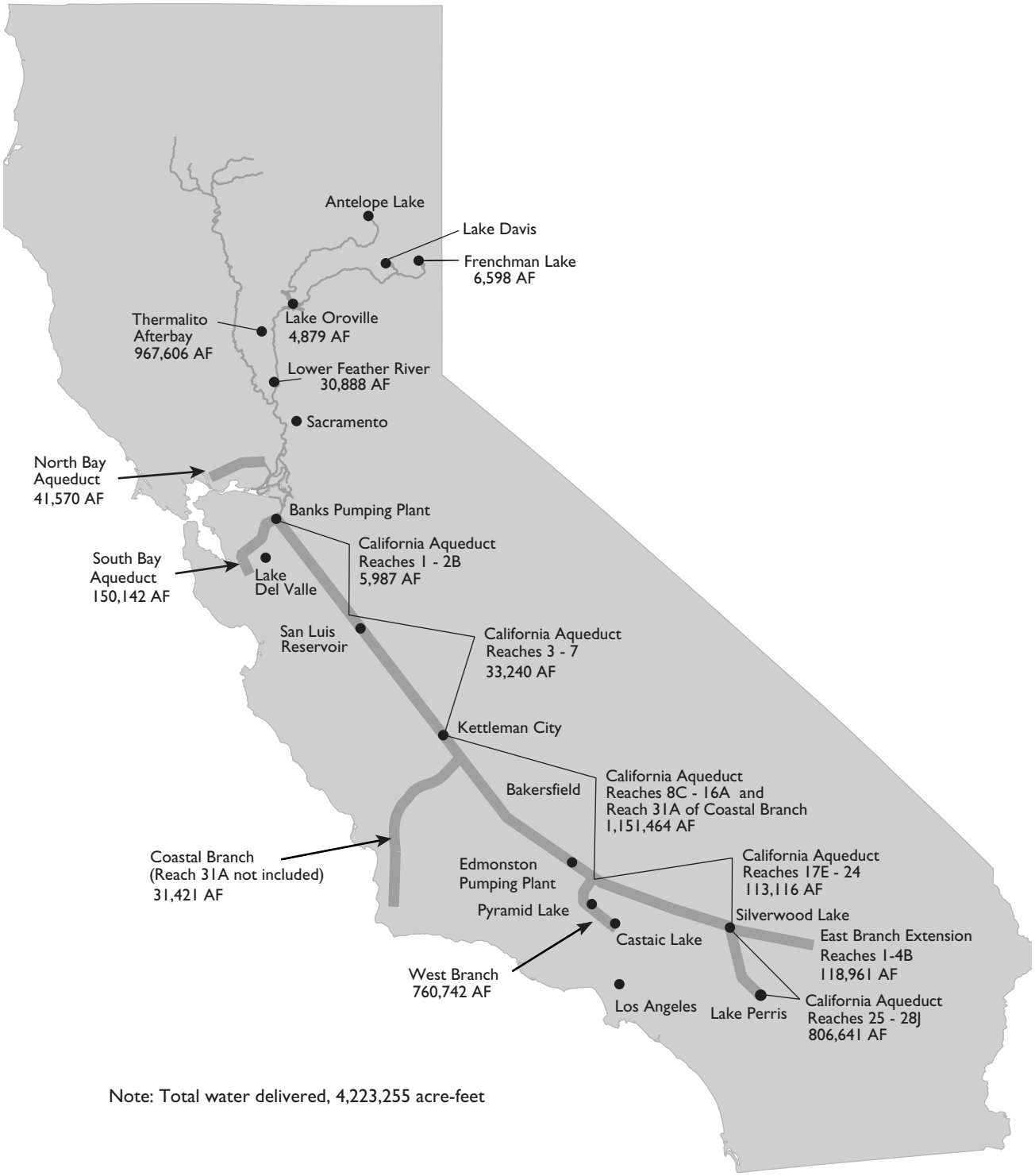

Figure 9-1. Water Delivered in 2003 and Delivery Locations of Long-Term Water Supply Contractors and Feather River Area Districts with Water Right Agreements with the Department

Table 9-4. Water Delivered to Long-Term Contractors through 2003, by Service Area (Acre-Feet)

Water Contractor or Agency	Approved Table A Water Deliveries								Water Bank Recoveries (9)	2003 Article 21 Water (10)	2003 Dry Year Water Purchase (11)	2003 Article 54 Flexible Withdrawal (12)	Total SWP Water Delivered (13)	Non-SWP Water Deliveries (14)	Total Deliveries
	2003 Table A without Transfers, Exchanges, and Storage (1)	2003 Table A Supplied (Not a Delivery) (2)	2003 Table A Delivered through Transfers and Exchanges (3)	2003 Table A Delivered to Storage (4)	Pool Water (5)	Total 2003 Table A Delivered (6)	2002 Carryover Table A Delivered during 2003 (7)	Total Table A Deliveries (8)							
Feather River Area															
County of Butte	551	0	0	0	0	551	0	551	0	0	0	0	551	0	551
Plumas County Flood Control and Water Conservation District	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
City of Yuba City	1,324	0	0	0	0	1,324	0	1,324	0	0	0	0	1,324	0	1,324
North Bay Area															
Napa County Flood Control and Water Conservation District	6,026	0	0	0	180	6,206	1,055	7,261	0	376	0	0	7,637	0	7,637
Solano County Water Agency	25,135	0	0	0	0	25,135	1,918	27,053	0	2,280	0	0	29,333	4,600[p]	33,933
South Bay Area															
Alameda County Flood Control and Water Conservation District-Zone 7	30,695	0	0	6,500[h]	656	31,351	13,099[h]	44,450	0	0	0	0	44,450	10,378[q]	54,828
Alameda County Water District	14,986	0	0	18,800[i]	354	31,440	5,150[i]	36,590	0	0	0	0	36,590	7,912[r]	44,502
Santa Clara Valley Water District	57,000	0	0	33,000[i]	841	90,841	14,104	104,945	0	936	0	0	105,881	3,100[s]	108,981
San Joaquin Valley Area															
Castaic Lake Water Agency	3,506	0	0	0	0	3,506	0	3,506	0	495	0	0	4,001	0	4,001
County of Kings	3,600	0	0	0	34	3,634	0	3,634	0	58	0	0	3,692	0	3,692
Dudley Ridge Water District	39,274	0	9,800[c]	350[k]	482	49,906	1,452	51,358	350	1,928	1,496	0	55,132	0	55,132
Empire West Side Irrigation District	1,074	0	0	0	0	1,074	187	1,261	0	175[m]	0	0	1,436	0	1,436
Kern County Water Agency	697,169	155,565[a]	8,000[d]	0	8,419	713,588	22,380	735,968	0	27,891[n]	5,892	0	790,237	18,428[t]	808,665
Oak Flat Water District	4,059	0	0	0	48	4,107	140	4,247	0	19	0	0	4,266	0	4,266
Tulare Lake Basin Water Storage District	75,373	0	19,003[e]	0	938	95,314	4,284	99,598	0	6,243	0	0	105,841	0	105,841
Central Coastal Area															
San Luis Obispo County Flood Control and Water Conservation District	4,417	0	0	0	0	4,417	0	4,417	0	36	0	0	4,453	0	4,453
Santa Barbara County Flood Control and Water Conservation District	24,312	0	0	0	43	24,355	2,274	26,629	0	339	0	0	26,968	0	26,968
Southern California															
Antelope Valley-East Kern Water Agency	52,730	0	0	0	250	52,980	7,049	60,029	0	0	0	0	60,029	0	60,029
Castaic Lake Water Agency	46,389	0	0	0	90	46,479	4,760	51,239	0	496	0	0	51,735	0	51,735
Coachella Valley Water District	14,045	0	0	0	194	14,239	0	14,239	0	204	0	0	14,443	0	14,443
Crestline-Lake Arrowhead Water Agency	1,563	0	0	0	0	1,563	0	1,563	0	0	0	0	1,563	573[u]	2,136
Desert Water Agency	23,168	0	0	0	321	23,489	0	23,489	0	330	0	0	23,819	0	23,819
Littlerock Creek Irrigation District	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Metropolitan Water District of Southern California	1,261,502	107,771[b]	24,874[f]	131,705[l]	16,920	1,435,001	134,845[w]	1,524,246	51,976	17,622[o]		95,797	1,689,641	0	1,689,641
Mojave Water Agency	10,907	0	0	0	0	10,907	3,528	14,435	0	0	0	0	14,435	0	14,435
Palmdale Water District	9,701	0	0	0	0	9,701	1,846	11,547	0	0	0	0	11,547	0	11,547
San Bernardino Valley Municipal Water District	20,371	0	5,000[g]	0	0	25,371	1,844	27,215	0	200	0	0	27,415	0	27,415
San Gabriel Valley Municipal Water District	13,034	0	0	0	0	13,034	0	13,034	0	200	0	0	13,234	0	13,234
San Gorgonio Pass Water Agency	116	0	0	0	0	116	0	116	0	0	0	0	116	0	116
Ventura County Watershed Protection District	5,000	0	0	0	0	5,000	0	5,000	0	0	0	0	5,000	6,768[v]	11,768
Total	2,447,027	263,336	66,677	190,355	29,770	2,724,629	219,915	2,898,944	72,812	59,828	7,388	95,797	3,134,769	51,769	3,186,528

[a]Kern supplied 125,000 af to EWA; exchanged 350 af of Dudley Ridge for Kern Water Bank water exchanged 10,000 af to Metropolitan for Semitropic Water Bank water; exchanged 6,436 af with Del Puerto Water District; exchanged 4,284 af with Panoche Water District; exchanged 9,495 af to San Luis Water District.

[b]Metropolitan supplied 29,596 af to EWA; used 45,600 af of carryover for flexible storage payback; used 32,575 af for flexible storage payback.

[c]Dudley Ridge exchanged 8,700 af with San Gorgonio; transferred 1,100 af to Tulare.

[d]Kern transferred 8,000 af to Dudley Ridge.

[e]Tulare exchanged 14,103 af with Westlands; transferred 4,900 af to Westlands.

[f]Metropolitan exchanged 24,874 af with Mojave.

[g]San Bernardino transferred 5,000 af to Metropolitan.

[h]6,500 af of 2002 carryover water delivered to Semitropic Water Bank (not shown in Column 6).

[i] 2,700 af of 2002 carryover water delivered to Semitropic Water Bank(not shown in Column 6).

[i]Delivered to Semitropic Water Bank.

[k]350 af delivered to Kern Water Bank.

[l]40,631 af to Arvin-Edison Water Bank, 20,134 af to Kern Delta Water Bank, and 70,940 af to Semitropic Water Bank..

[m]Empire's unscheduled water.

[n]Kern's Article 21 includes 7,180 af delivered to EWA.

[o]Metropolitan's Article 21 was used for flexible storage payback

[p]Santa Clara's permit and settlement water.

[q]Alameda Zone-7's 9,378 af of local water and 1,000 af of Byron-Bethany water.

[r]Alameda County's 7,912 af of local water.

[s]6,000 af of transferred water from Del Puerto WD, transferred 4,000 af from Panoche WD, and transferred 8,418 af from San Luis Water District.

[t]Transferred water from Browns Valley Irrigation District.

[u]Crestline's local water.

[v]Ventura's local water.

[w]Metropolitan used 45,600 af of carryover for flexible storage payback (not a delivery and not shown in Column 8).

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Feather River Area														
City of Yuba City														
Approved Table A water	0	0	0	0	0	0	741	583	0	0	0	0	1,324	9,600
Pool A water sale[a]	2,320	0	0	0	0	0	0	0	0	0	0	0	2,320	
Agency total	0	0	0	0	0	0	741	583	0	0	0	0	1,324	
County of Butte														
Approved Table A water	34	18	107	62	3	95	54	24	71	5	1	77	551	3,500
Pool A water sale[a]	375	0	0	0	0	0	0	0	0	0	0	0	375	
Pool B water sale[a]	175	0	0	0	0	0	0	0	0	0	0	0	175	
Agency total	34	18	107	62	3	95	54	24	71	5	1	77	551	
Plumas County Flood Control and Water Conservation District														
Approved Table A water	0	0	0	0	0	0	0	0	0	0	0	0	0	1,690
Recreation/Fish and Wildlife														
Recreation/fish and wildlife water	0	0	0	0	0	1	1	0	1	0	0	0	3	
Last Chance Creek Water District														
Regulated delivery of local supply	0	0	0	0	1,127	2,493	1,210	990	611	167	0	0	6,598	
Thermalito Irrigation District														
Regulated delivery of local supply	31	50	123	112	193	367	402	336	301	269	112	102	2,398	
South Feather Water and Power Agency														
Regulated delivery of local supply	0	0	0	0	200	893	922	922	893	678	199	172	4,879	
Western Canal Water District														
Regulated delivery of local supply	3,130	0	0	1,110	30,937	49,316	58,530	47,044	15,467	27,994	33,700	15,023	282,251	
Joint Water Districts Board														
Regulated delivery of local supply	31,850	0	0	2,027	62,250	110,610	123,760	106,821	66,885	46,240	71,130	60,830	682,403	
Oswald Water District														
Regulated delivery of local supply	0	0	0	0	13	130	156	93	53	0	0	0	445	
Tudor Mutual Water Company														
Regulated delivery of local supply	0	0	0	0	97	961	1,025	426	553	158	0	0	3,220	
Garden Highway Mutual Water Company														
Regulated delivery of local supply	0	0	0	696	2,205	3,050	3,906	2,801	1,567	2,017	61	0	16,303	
Plumas Mutual Water Company														
Regulated delivery of local supply	0	0	0	0	645	2,123	2,432	929	1,748	621	0	0	8,498	
Dana Brothers														
Regulated delivery of local supply	0	0	0	32	189	439	285	51	25	77	0	0	1,098	
SWP	34	18	107	62	3	96	796	607	72	5	1	77	1,878	
Non-SWP	35,011	50	123	3,977	97,856	170,382	192,628	160,413	88,103	78,221	105,202	76,127	1,008,093	
Feather River Area Total	35,045	68	230	4,039	97,859	170,478	193,424	161,020	88,175	78,226	105,203	76,204	1,009,971	14,790
North Bay Area														
Napa County Flood Control and Water Conservation District														
Approved Table A water	0	42	554	690	286	578	731	681	673	473	438	880	6,026	21,475
Article 21 water	0	0	376	0	0	0	0	0	0	0	0	0	376	
2002 summer allocation carryover	335	720	0	0	0	0	0	0	0	0	0	0	1,055	
Pool A water	0	0	0	0	0	160	0	0	0	0	0	0	160	
Pool B water	0	0	0	0	0	20	0	0	0	0	0	0	20	
Flow capacity test[a]	9	0	0	0	0	0	0	0	0	0	0	0	9	
Agency Total	335	762	930	690	286	758	731	681	673	473	438	880	7,637	
Solano County Water Agency														
Approved Table A water	0	0	100	925	2,365	3,464	5,320	4,126	3,531	1,660	1,546	2,098	25,135	46,756
Article 21 water	0	0	0	0	1,210	1,070	0	0	0	0	0	0	2,280	
2002 summer allocation carryover	279	782	857	0	0	0	0	0	0	0	0	0	1,918	
Solano settlement water	0	0	0	0	0	0	0	0	0	860	0	0	860	
Vallejo permit water	0	0	0	0	0	0	0	0	26	1,338	941	1,435	3,740	
Flow capacity test[a]	18	0	0	0	0	0	0	0	0	0	0	0	18	
Agency Total	279	782	957	925	3,575	4,534	5,320	4,126	3,557	3,858	2,487	3,533	33,933	
Delivery of Dry Year Purchase Water to Non-SWP Agencies														
Dry year purchase water to Ronald Conn	0	0	0	0	0	0	0	0	0	0	63	0	63	
Dry year purchase water to the Phelps Brothers	0	0	0	0	0	0	0	0	0	0	202	0	202	
SWP	614	1,544	1,887	1,615	3,861	5,292	6,051	4,807	4,204	2,133	1,984	2,978	36,970	
Non-SWP	0	0	0	0	0	0	0	0	26	2,198	941	1,435	4,600	
North Bay Area Total	614	1,544	1,887	1,615	3,861	5,292	6,051	4,807	4,230	4,331	2,925	4,413	41,570	68,231
South Bay Area														
Alameda County Flood Control and Water Conservation District, Zone 7														
Approved Table A water	0	0	286	1,136	231	3,778	6,369	5,820	4,629	5,041	1,945	1,460	30,695	78,400
Article 56 extended carryover stored in Semitropic[a]	3,800	2,700	0	0	0	0	0	0	0	0	0	0	6,500	
Article 56(c) extended carryover	1,513	2,304	2,782	0	0	0	0	0	0	0	0	0	6,599	
Local water	283	338	292	2,255	3,904	1,185	65	39	637	34	20	326	9,378	

[a]Excluded water from Agency Total

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Pool A water	0	0	0	0	0	583	0	0	0	0	0	0	583	
Pool B water	0	0	0	0	0	73	0	0	0	0	0	0	73	
Transfer water from Byron-Bethany	0	0	0	0	0	0	0	0	500	500	0	0	1,000	
Agency Total	1,796	2,642	3,360	3,391	4,135	5,619	6,434	5,859	5,766	5,575	1,965	1,786	48,328	
Alameda County Water District														
Approved Table A water	0	0	0	0	0	566	3,116	2,733	3,471	3,608	722	770	14,986	42,000
Approved Table A water stored in Semitropic[a]	0	0	0	0	10,000	6,100	0	0	0	0	0	0	16,100	
Article 56 extended carryover water stored in Semitropic[a]	2,000	700	0	0	0	0	0	0	0	0	0	0	2,700	
Article 56C extended carryover	918	1,169	363	0	0	0	0	0	0	0	0	0	2,450	
Local water	203	0	1,207	1,491	1,841	2,053	65	599	84	34	19	316	7,912	
Pool A water	0	0	0	0	0	314	0	0	0	0	0	0	314	
Pool B water	0	0	0	0	0	40	0	0	0	0	0	0	40	
Agency Total	1,121	1,169	1,570	1,491	1,841	2,973	3,181	3,332	3,555	3,642	741	1,086	25,702	
Santa Clara Valley Water District														
Advanced approved Table A water	0	0	0	0	0	0	0	0	0	0	0	620	620	100,000
Approved Table A water	0	0	3,675	4,842	6,131	6,923	7,295	6,250	9,656	4,187	3,407	4,014	56,380	
Approved Table A water stored in Semitropic[a]	0	0	0	0	0	20,000	0	0	9,500	3,500	0	0	33,000	
Article 21 water	0	0	714	222	0	0	0	0	0	0	0	0	936	
Article 56C extended carryover	24	6,871	2,209	0	0	0	0	0	0	0	0	0	9,104	
2002 Summer Allocation Carryover	5,000	0	0	0	0	0	0	0	0	0	0	0	5,000	
Pool A water	0	0	0	0	0	747	0	0	0	0	0	0	747	
Pool B water	0	0	0	0	0	94	0	0	0	0	0	0	94	
Transfer water from Browns Valley Irrigation District	0	0	0	0	0	0	0	0	0	3,100	0	0	3,100	
Agency Total	5,024	6,871	6,598	5,064	6,131	7,764	7,295	6,250	9,656	7,287	3,407	4,634	75,981	
Recreation/Fish and Wildlife														
Recreation/fish and wildlife water, Lake Del Valle	2	2	4	4	11	19	26	21	20	15	5	2	131	
SWP	7,457	10,346	10,033	6,204	6,373	13,137	16,806	14,824	17,776	12,851	6,079	6,866	128,752	
Non-SWP	486	338	1,499	3,746	5,745	3,238	130	638	1,221	3,668	39	642	21,390	
South Bay Area Total	7,943	10,684	11,532	9,950	12,118	16,375	16,936	15,462	18,997	16,519	6,118	7,508	150,142	220,400
San Joaquin Valley Area														
Castaic Lake Water Agency	0	105	2,197	538	0	0	0	0	0	0	0	666	3,506	12,700
Approved Table A water	0	0	396	99	0	0	0	0	0	0	0	0	495	
Article 21 water	0	105	2,593	637	0	0	0	0	0	0	0	666	4,001	
Agency total														
County of Kings														
Approved Table A water	0	0	0	0	0	500	500	500	500	500	550	550	3,600	4,000
Article 21 water	0	0	50	8	0	0	0	0	0	0	0	0	58	
Pool A water	0	0	0	0	0	0	0	30	0	0	0	0	30	
Pool B water	0	0	0	0	0	0	0	4	0	0	0	0	4	
Agency Total	0	0	50	8	0	500	500	534	500	500	550	550	3,692	
Dudley Ridge Water District														
Approved Table A water	0	2,312	2,540	2,288	5,189	8,296	9,745	8,267	61	399	0	177	39,274	57,343
Approved Table A water in Kern Water Bank[a]	0	0	0	0	0	0	0	0	0	0	0	350	350	
Article 21 water	0	0	1,801	127	0	0	0	0	0	0	0	0	1,928	
Bank water recovery, Kern Water Bank	0	0	350	0	0	0	0	0	0	0	0	0	350	
2002 Summer Allocation Carryover	1,359	93	0	0	0	0	0	0	0	0	0	0	1,452	
Dry Year Water Purchase Program	0	0	0	0	0	0	0	0	0	1,249	247	0	1,496	
Exchange approved Table A water to San Gabriel[a]	0	0	0	0	0	0	0	754	2,555	2,889	2,502	0	8,700	
Pool A water	0	0	0	428	0	0	0	0	0	0	0	0	428	
Pool B water	0	0	0	54	0	0	0	0	0	0	0	0	54	
Transfer of approved water to Tulare[a]	0	0	0	0	0	0	0	0	0	1,100	0	0	1,100	
Transfer of approved from Kern	0	0	0	0	0	0	0	0	5,300	2,700	0	0	8,000	
Agency Total	1,359	2,405	4,691	2,897	5,189	8,296	9,745	8,267	5,361	4,348	247	177	52,982	
Empire West Side Irrigation District														
Approved Table A water	11	395	90	0	200	105	0	0	0	0	0	273	1,074	3,000
Carryover wet	187	0	0	0	0	0	0	0	0	0	0	0	187	
Unscheduled water	0	0	171	4	0	0	0	0	0	0	0	0	175	
Agency Total	198	395	261	4	200	105	0	0	0	0	0	273	1,436	
Kern County Water Agency														
Approved Table A water	1,630	3,446	20,468	12,373	50,130	114,180	190,415	107,059	55,209	49,607	47,967	45,768	696,252	1,000,949
Approved Table A water to EWA[a]	0	0	0	0	0	36,000	36,000	36,000	17,000	0	0	0	125,000	
Approved Table A water to Western Hills	0	0	28	110	114	155	181	104	107	81	29	8	917	
Article 21 water	0	0	18,478	2,233	0	0	0	0	0	0	0	0	20,711	
Article 21 water to EWA	0	0	7,180	0	0	0	0	0	0	0	0	0	7,180	
Article 56C extended carryover	7,031	15,177	172	0	0	0	0	0	0	0	0	0	22,380	

[a]Excluded water from Agency Total

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Dry Year Water Purchase Program	0	0	0	0	0	0	0	0	0	0	5,892	0	5,892	
Exchange approved Table A water for water bank water[a]	0	0	350	0	0	0	0	0	0	0	0	0	350	
Exchange approved Table A water for water bank water[a]	0	0	0	8,867	1,133	0	0	0	0	0	0	0	10,000	
Exchange approved Table A water to Del Puerto[a]	0	0	0	0	0	0	0	0	436	0	0	0	436	
Exchange approved Table A water to Panoche[a]	0	0	0	0	0	0	0	0	284	0	0	0	284	
Exchange approved Table A water to San Luis[a]	0	0	0	0	0	0	0	0	1,067	0	0	0	1,067	
Exchange approved Table A water to Del Puerto[a]	0	0	0	0	0	0	0	0	6,000	0	0	0	6,000	
Exchange approved Table A water to Panoche[a]	0	0	0	0	0	0	0	0	1,129	750	1,168	953	4,000	
Exchange approved Table A water to San Luis[a]	0	0	0	0	0	0	0	0	2,922	4,533	973	0	8,428	
Exchange water from Del Puerto	0	4,942	979	79	0	0	0	0	0	0	0	0	6,000	
Exchange water from Panoche	0	3,070	858	72	0	0	0	0	0	0	0	0	4,000	
Exchange water from San Luis	0	5,000	3,428	0	0	0	0	0	0	0	0	0	8,428	
Pool A water	0	0	0	0	0	0	7,476	0	0	0	0	0	7,476	
Pool B water	0	0	0	0	0	0	943	0	0	0	0	0	943	
Turn-in water recovered by Kern	0	0	678	19,808	0	0	0	0	0	0	0	0	20,486	
Transfer of approved Table A water to Dudley Ridge[a]	0	0	0	0	0	0	0	0	5,300	2,700	0	0	8,000	
Deliveries to water banks in Kern														
Approved Table A water from Alameda County stored in Semitropic	3,800	2,700	0	0	0	0	0	0	0	0	0	0	6,500	
Article 56 extended carryover from Alameda-Zone 7 stored in Semitropic	0	0	0	0	10,000	6,100	0	0	0	0	0	0	16,100	
Article 56 extended carryover from Alameda County stored in Semitropic	2,000	700	0	0	0	0	0	0	0	0	0	0	2,700	
Approved Table A water from Santa Clara stored in Semitropic	0	0	0	0	0	20,000	0	0	9,500	3,500	0	0	33,000	
Approved Table A water from Dudley Ridge stored in Kern Water Bank	0	0	0	0	0	0	0	0	0	0	0	350	350	
Approved Table A water from Metropolitan stored in Semitropic	0	0	0	0	0	16,000	14,940	40,000	0	0	0	0	70,940	
Approved Table A water from Metropolitan stored in Arvin-Edison	0	0	0	0	5,477	13,990	11,799	1,900	1,400	1,520	675	3,870	40,631	
Approved Table A water from Metropolitan stored in Kern Delta	0	0	0	0	0	837	1,491	17,806	0	0	0	0	20,134	
Subtotal (Water Bank Deliveries)	5,800	3,400	0	0	15,477	56,927	28,230	59,706	10,900	5,020	675	4,220	190,355	
Agency Total[a]	14,461	35,035	45,089	34,675	65,721	171,262	227,245	166,869	66,216	54,708	52,563	49,996	983,840	
Oak Flat Water District														
Approved Table A water	0	0	0	194	635	704	926	776	416	400	7	1	4,059	5,700
Article 21 water	0	0	7	12	0	0	0	0	0	0	0	0	19	
Carryover 12(e)	0	18	122	0	0	0	0	0	0	0	0	0	140	
Pool A water	0	0	0	0	0	43	0	0	0	0	0	0	43	
Pool B water	0	0	0	0	0	5	0	0	0	0	0	0	5	
Agency Total	0	18	129	206	635	752	926	776	416	400	7	1	4,266	
Tulare Lake Basin Water Storage District														
Approved Table A water	0	1,288	1,241	2,883	1,077	14,373	12,363	20,616	1,428	3,441	12,275	4,388	75,373	111,127
Article 21 water	0	0	5,993	250	0	0	0	0	0	0	0	0	6,243	
2002 Summer Allocation Carryover	2,413	1,871	0	0	0	0	0	0	0	0	0	0	4,284	
Exchange approved Table A water to Westlands	0	0	0	0	11,103	3,000	0	0	0	0	0	0	14,103	
Pool A water	0	0	0	0	0	0	818	15	0	0	0	0	833	
Pool B water	0	0	0	0	0	0	102	3	0	0	0	0	105	
Transfer approved Table A water to Westlands	0	0	0	0	0	3,200	0	0	0	0	0	700	3,900	
Transfer approved Table A water to Westlands	0	0	0	0	250	250	250	0	0	0	250	0	1,000	
Transfer approved Table A water from Dudley	0	0	0	0	0	0	0	0	0	1,100	0	0	1,100	
Agency Total	2,413	3,159	7,234	3,133	1,077	14,373	13,283	20,634	1,428	4,541	12,275	4,388	87,938	
Westlands Water District														
Exchange approved Table A water from Tulare	0	0	0	0	11,103	3,000	0	0	0	0	0	0	14,103	
Transfer approved Table A water from Tulare	0	0	0	0	0	3,200	0	0	0	0	0	700	3,900	
Transfer approved Table A water from Tulare	0	0	0	0	250	250	250	0	0	0	250	0	1,000	
Agency Total	0	0	0	0	11,353	6,450	250	0	0	0	250	700	19,003	
Recreation/Fish and Wildlife														
Department of Fish and Game, O'Neill Forebay/Lateral 4	23	14	37	3	55	63	93	30	37	37	62	53	507	
Department of Parks and Recreation, O'Neill Forebay/San Luis/Cattle	3	0	2	5	9	10	17	11	9	6	1	1	74	
Total	26	14	39	8	64	73	110	41	46	43	63	54	581	
SWP	18,457	28,119	62,001	41,447	84,239	201,811	252,059	197,121	73,967	63,291	59,816	56,805	1,139,103	
Non-SWP	0	13,012	5,265	151	0	0	0	0	0	1,249	6,139	0	25,816	
San Joaquin Valley Area subtotal	18,457	41,131	67,266	41,568	84,239	201,811	252,059	197,121	73,967	64,540	65,955	56,805	1,164,919	
Other non-SWP Water Conveyed														
Tracy Golf and Country Club	0	0	0	0	0	0	0	0	0	0	0	0	0	
CVP Water Conveyed–Annual Contracts														
Plain View Water District/ Musco Family Olive Company	44	51	0	0	0	0	0	0	0	0	0	0	95	
Plain View Water District/ Musco Family Olive Company	0	0	62	64	63	71	72	72	74	87	56	3	624	
U.S. Department of Veteran Affairs, S.J.V. National Cemetery	1	4	0	0	0	0	0	0	0	0	0	0	5	
U.S. Department of Veteran Affairs, S.J.V. National Cemetery	0	0	3	4	7	9	14	16	15	7	3	2	80	
Subtotal	45	55	65	68	70	80	86	88	89	94	59	5	804	

[a]Excluded water from Agency Total

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Cross Valley Canal Contracts														
CVP water to Tulare	0	0	0	383	0	0	0	0	0	0	0	0	383	
CVP water to Fresno County Public Works	0	0	0	216	0	0	0	0	0	0	0	0	216	
CVP water to Hills Valley Irrigation District	0	0	242	0	0	0	0	0	0	0	0	0	242	
CVP water to Kern-Tulare	0	0	0	1,076	0	0	0	0	0	0	0	0	1,076	
CVP water to Rag Gulch	0	0	0	357	0	0	0	0	0	0	0	0	357	
CVP water to Tri-Valley Irrigation District	0	0	0	82	0	0	0	0	0	0	0	0	82	
Agency Total	0	0	242	2,114	0	0	0	0	0	0	0	0	2,356	
Bureau of Reclamation														
Conveyance of nonproject water to O'Neill Forebay	0	0	0	0	0	0	0	0	6,000	0	0	0	6,000	
Kern National Wildlife Refuge	1,136	2,139	1,291	220	236	145	0	1,008	3,497	0	1,255	4,009	14,936	
Recreation/fish and wildlife water	18	13	34	5	53	60	88	35	38	37	52	43	476	
Transfer of water to Madera Water District	0	0	0	0	0	0	0	0	0	1,200	0	0	1,200	
Agency Total	0	0	0	0	0	0	0	0	6,000	1,200	0	0	7,200	
SWP	0	0	0	0	0	0	0	0	0	0	0	0	0	
Non-SWP	45	55	307	2,182	70	80	86	88	6,089	1,294	59	5	25,772	
San Joaquin Valley Area subtotal	45	55	307	2,182	70	80	86	88	6,089	1,294	59	5	25,772	
SWP (Total)	18,457	28,119	62,001	41,417	84,239	201,811	252,059	197,121	73,967	63,291	59,816	56,805	1,139,103	
Non-SWP (Total)	45	13,067	5,572	2,333	70	80	86	88	6,089	2,543	6,198	5	51,588	
San Joaquin Valley Area Total	18,502	41,186	67,573	43,750	84,309	201,891	252,145	197,209	80,056	65,834	66,014	56,810	1,190,691	1,194,819
Central Coastal Area														
San Luis Obispo County Flood Control and Water Conservation District														
Approved Table A water	180	352	330	325	398	452	476	493	441	423	266	281	4,417	25,000
Article 21 water	0	0	24	12	0	0	0	0	0	0	0	0	36	
Agency Total	180	352	354	337	398	452	476	493	441	423	266	281	4,453	
Santa Barbara County Flood Control and Water Conservation District														
Approved Table A water	0	665	1,887	2,761	3,322	3,193	3,089	2,942	2,686	1,799	717	1,251	24,312	45,486
Article 21 water	0	0	236	103	0	0	0	0	0	0	0	0	339	
Carryover special (2002)	1,414	860	0	0	0	0	0	0	0	0	0	0	2,274	
Pool B water	0	0	0	43	0	0	0	0	0	0	0	0	43	
Agency Total	1,414	1,525	2,123	2,907	3,322	3,193	3,089	2,942	2,686	1,799	717	1,251	26,968	
SWP	1,594	1,877	2,477	3,244	3,720	3,645	3,565	3,435	3,127	2,222	983	1,532	31,421	
Non-SWP	0	0	0	0	0	0	0	0	0	0	0	0	0	
Central Coastal Area Total	1,594	1,877	2,477	3,244	3,720	3,645	3,565	3,435	3,127	2,222	983	1,532	31,421	70,486
Southern California Area														
Antelope Valley-East Kern Water Agency														
Approved Table A water	0	0	187	3,253	5,074	6,972	8,946	8,224	6,797	5,846	3,984	3,447	52,730	141,400
2002 Summer Allocation Carryover	2,274	2,143	2,632	0	0	0	0	0	0	0	0	0	7,049	
Pool A water	0	0	0	0	0	250	0	0	0	0	0	0	250	
Mojave's Approved Table A water delivered through AVEK	0	0	0	84	0	0	162	202	155	108	81	24	816	
Agency Total	2,274	2,143	2,819	3,337	5,074	7,222	9,108	8,426	6,952	5,954	4,065	3,471	60,845	
Castaic Lake Water Agency														
Approved Table A water	0	0	1,964	3,262	3,481	4,122	5,578	5,659	5,216	4,856	3,088	2,395	39,621	82,500
Approved Table A water to the Department	0	0	0	0	768	2,000	2,737	1,263	0	0	0	0	6,768	
Article 21 water	0	0	397	99	0	0	0	0	0	0	0	0	496	
2002 Summer Allocation Carryover	2,609	1,931	220	0	0	0	0	0	0	0	0	0	4,760	
Pool B water	0	0	0	0	0	90	0	0	0	0	0	0	90	
Agency Total	2,609	1,931	2,581	3,361	3,481	4,212	5,578	5,659	5,216	4,856	3,088	2,395	44,967	23,100
Coachella Valley Water District														
Approved Table A water	0	0	0	2,310	2,310	2,310	2,310	3,557	1,248	0	0	0	14,045	(1,748)
Article 21 water	0	0	152	52	0	0	0	0	0	0	0	0	204	
Pool A water	0	0	0	172	0	0	0	0	0	0	0	0	172	
Pool B water	0	0	0	0	0	22	0	0	0	0	0	0	22	
Agency Total	0	0	152	2,534	2,310	2,332	2,310	3,557	1,248	0	0	0	14,443	
Crestline-Lake Arrowhead Water Agency														
Approved Table A water	146	24	0	0	0	166	263	269	250	229	180	36	1,563	5,800
Local water	0	98	122	110	113	28	0	0	0	0	0	102	573	
Agency Total	146	122	122	110	113	194	263	269	250	229	180	36	2,136	
Desert Water Agency														
Approved Table A water	0	0	0	3,810	3,810	3,810	3,810	5,869	2,059	0	0	0	23,168	38,100
Article 21 water	0	0	246	84	0	0	0	0	0	0	0	0	330	
Pool A water	0	0	0	285	0	0	0	0	0	0	0	0	285	
Pool B water	0	0	0	0	0	36	0	0	0	0	0	0	36	
Agency Total	0	0	246	4,179	3,810	3,846	3,810	5,869	2,059	0	0	0	23,819	
Littlerock Creek Irrigation District														
Approved Table A water	0	0	0	0	0	0	0	0	0	0	0	0	0	2,300
Agency Total	0	0	0	0	0	0	0	0	0	0	0	0	0	
Metropolitan Water District of Southern California														
Approved Table A water	0	0	77,525	101,953	134,116	121,735	152,455	154,742	145,886	150,859	115,721	106,510	1,261,502	2,011,500

[a]Excluded water from Agency Total

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Approved Table A water to EWA[a]	0	0	0	0	29,596	0	0	0	0	0	0	0	29,596	
Approved Table A water stored in Semitropic[a]	0	0	0	0	0	16,000	14,940	40,000	0	0	0	0	70,940	
Approved Table A water stored in Arvin-Edison[a]	0	0	0	0	5,477	13,990	11,799	1,900	1,400	1,520	675	3,870	40,631	
Approved Table A water stored in Kern Delta[a]	0	0	0	0	0	837	1,491	17,806	0	0	0	0	20,134	
Article 56(c) extended carryover	0	0	34,270	0	0	0	0	0	0	0	0	0	34,270	
Bank water recovery, Arvin-Edison	5,795	1,502	0	0	0	0	0	0	0	0	0	0	7,297	
Bank water recovery, Arvin-Edison	0	4,186	897	0	0	0	0	0	0	0	0	0	5,083	
Bank water recovery, Semitropic	0	0	0	8,867	1,133	0	0	0	0	0	0	0	10,000	
2002 Summer Allocation Carryover	27,803	23,018	4,154	0	0	0	0	0	0	0	0	0	54,975	
Exchange approved water in behalf of EWA	12,287	15,309	2,000	0	0	0	0	0	0	0	0	0	29,596	
Exchange approved water to Mojave[a]	0	0	0	0	0	0	0	0	0	0	4,683	20,191	24,874	
Flexible storage replacement with Article 21 water (Lake Perris)	0	0	1,139	0	0	0	0	0	0	0	0	0	1,139	
Flexible storage replacement with Article 21 water (Castaic Lake)	0	0	12,000	4,483	0	0	0	0	0	0	0	0	16,483	
Flexible storage replacement with carryover special water (Lake Perris)[a]	0	1,100	0	0	0	0	0	0	0	0	0	0	1,100	
Flexible storage replacement with carryover special water (Castaic Lake)[a]	0	6,000	38,500	0	0	0	0	0	0	0	0	0	44,500	
Flexible storage replacement with Table A water (Lake Perris)[a]	0	0	0	15,754	0	0	0	0	0	0	0	0	15,754	
Flexible storage replacement with Table A water (Castaic Lake)[a]	0	0	0	16,821	0	0	0	0	0	0	0	0	16,821	
Flexible storage withdrawal (Lake Perris)	9,712	8,281	0	0	0	0	0	0	0	0	0	0	17,993	
Flexible storage withdrawal (Castaic Lake)	36,059	41,745	0	0	0	0	0	0	0	0	0	0	77,804	
Pool A water	0	0	0	15,024	0	0	0	0	0	0	0	0	15,024	
Pool B water	0	0	0	0	0	1,896	0	0	0	0	0	0	1,896	
Transfer approved Table A water from Santa Barbara	0	0	0	0	0	0	0	0	0	0	0	5,000	5,000	
Agency Total	91,656	94,041	131,985	130,327	135,249	123,631	152,455	154,742	145,886	150,859	115,721	111,510	1,538,062	
Mojave Water Agency														
Approved Table A water	0	0	395	2,211	1,025	678	1,024	908	1,288	1,871	433	258	10,091	75,800
Mojave's approved Table A water delivered through AVEK	0	0	0	84	0	0	162	202	155	108	81	24	816	
2002 Summer Allocation Carryover	502	671	2,355	0	0	0	0	0	0	0	0	0	3,528	
Exchange approved water from Metropolitan	0	0	0	0	0	0	0	0	0	0	4,683	20,191	24,874	
Pool A water sale[a]	16,900	0	0	0	0	0	0	0	0	0	0	0	16,900	
Pool B water sale[a]	2,500	0	0	0	0	0	0	0	0	0	0	0	2,500	
Agency Total[a]	502	671	2,750	2,211	1,025	678	1,024	908	1,288	1,871	5,116	20,449	38,493	
Palmdale Water District														
Approved Table A water	0	0	148	688	1,021	1,333	1,810	746	1,170	1,566	1,042	177	9,701	21,300
Article 56(c) extended carryover	0	0	781	0	0	0	0	0	0	0	0	0	781	
2002 Summer Allocation Carryover	421	565	79	0	0	0	0	0	0	0	0	0	1,065	
Agency Total	421	565	1,008	688	1,021	1,333	1,810	746	1,170	1,566	1,042	177	11,547	
San Bernardino Valley Municipal Water District														
Approved Table A water	0	0	0	959	865	1,096	1,986	2,384	3,266	3,579	2,541	3,695	20,371	102,600
Article 21 water	0	0	120	80	0	0	0	0	0	0	0	0	200	
2002 Summer Allocation Carryover	1,177	597	70	0	0	0	0	0	0	0	0	0	1,844	
Table A transfer to Metropolitan[a]	0	0	0	0	0	0	0	0	0	0	0	5,000	5,000	
Agency Total	1,177	597	190	1,039	865	1,096	1,986	2,384	3,266	3,579	2,541	3,695	22,415	
San Gabriel Valley Municipal Water District														
Approved Table A water	0	0	0	746	2,713	2,613	2,686	1,936	0	0	0	2,340	13,034	28,800
Article 21 water	0	0	136	64	0	0	0	0	0	0	0	0	200	
Exchange approved water from Dudley	0	0	0	0	0	0	0	754	2,555	2,889	2,502	0	8,700	
Agency Total	0	0	136	810	2,713	2,613	2,686	2,690	2,555	2,889	2,502	2,340	21,934	
San Gorgonio Pass Water Agency														
Approved Table A water	0	0	0	0	0	0	2	14	13	22	26	39	116	4,000
Agency Total	0	0	0	0	0	0	2	14	13	22	26	39	116	
Ventura County Watershed Protection District														
Approved Table A water	154	154	154	154	484	1,186	572	1,501	177	154	154	156	5,000	20,000
Local water from the Department to United Conservation District	0	0	0	0	768	2,000	2,737	1,263	0	0	0	0	6,768	
Pool A water sale[a]	6,750	0	0	0	0	0	0	0	0	0	0	0	6,750	
Pool B water sale[a]	750	0	0	0	0	0	0	0	0	0	0	0	750	
Agency Total	154	154	154	154	1,252	3,186	3,309	2,764	177	154	154	156	11,768	
Recreation/Fish and Wildlife														
Castaic Lake	13	0	16	17	30	34	50	46	50	45	23	32	356	
Castaic Lake to Lagoon	256	0	0	0	0	0	168	182	292	297	0	225	1,420	
Silverwood Lake	2	2	2	2	6	13	18	15	15	14	3	3	95	
Lake Perris	0	0	3	3	2	39	49	47	44	30	18	25	260	
Agency Total	271	2	21	22	38	86	285	290	401	386	44	285	2,131	
Recreation/Fish and Wildlife														
USFWS recreation/fish and wildlife water (Pyramid Lake)	1	1	1	1	1	3	2	2	2	2	0	0	16	
SWP	99,210	100,128	142,042	148,662	156,838	150,401	184,626	188,318	170,481	172,365	134,479	144,553	1,792,103	
Non-SWP	1	99	123	111	882	2,031	2,739	1,265	2	2	0	102	7,357	
Southern California Area Total	99,211	100,227	142,165	148,773	157,720	152,432	187,365	189,583	170,483	172,367	134,479	144,655	1,799,460	2,558,200
SWP Water														
SWP Approved Table A Water														
Agricultural and M&I approved water	2,155	8,801	113,876	148,557	241,225	362,310	453,892	407,954	261,304	245,734	195,795	186,579	2,628,182	

[a]Excluded water from Agency Total

[b]EWA water is not included in the Grand Total to prevent double counting.

Table 9-5. Water Delivered in 2003, by Month (Acre-feet)

Contracting Agency and Type of Service	Jan	Feb	Mar	Apr	May	June	July	Aug	Sep	Oct	Nov	Dec	2003 Total Deliveries	2003 Contract Table A
Agricultural and M&I approved water for EWA[a]	0	0	0	0	29,596	36,000	36,000	36,000	17,000	0	0	0	154,596	
Article 21 water	0	0	29,126	3,445	1,210	1,070	0	0	0	0	0	0	34,851	
Article 21 water for EWA	0	0	7,180	0	0	0	0	0	0	0	0	0	7,180	
Article 56(c) extended carryover	15,286	28,921	40,577	0	0	0	0	0	0	0	0	0	84,784	
2002 Summer Allocation Carryover	45,586	33,251	10,367	0	0	0	0	0	0	0	0	0	89,204	
Carryover 12(e) carryover	0	18	122	0	0	0	0	0	0	0	0	0	140	
Carryover (wet)	187	0	0	0	0	0	0	0	0	0	0	0	187	
Exchange approved water	0	0	0	0	11,103	3,000	0	754	2,555	2,889	7,185	20,191	47,677	
Exchange approved water for banked water[a]	0	0	350	8,867	1,133	0	0	0	0	0	0	0	10,350	
Exchange approved water for nonproject water supplied[a]	0	0	0	0	0	0	0	0	11,838	5,283	2,141	953	20,215	
Exchange banked water in behalf of EWA	12,287	15,309	2,000	0	0	0	0	0	0	0	0	0	29,596	
Flexible storage replacement with Article 21 water (Lake Perris)	0	0	1,139	0	0	0	0	0	0	0	0	0	1,139	
Flexible storage replacement with Article 21 water (Castaic Lake)	0	0	12,000	4,483	0	0	0	0	0	0	0	0	16,483	
Flexible storage replacement with carryover water (Lake Perris)[a]	0	1,100	0	0	0	0	0	0	0	0	0	0	1,100	
Flexible storage replacement with carryover water (Castaic Lake)[a]	0	6,000	38,500	0	0	0	0	0	0	0	0	0	44,500	
Flexible storage replacement (Lake Perris)[a]	0	0	0	15,754	0	0	0	0	0	0	0	0	15,754	
Flexible storage replacement (Castaic Lake)[a]	0	0	0	16,821	0	0	0	0	0	0	0	0	16,821	
Flexible storage withdrawal (Lake Perris)	9,712	8,281	0	0	0	0	0	0	0	0	0	0	17,993	
Flexible storage withdrawal (Castaic Lake)	36,059	41,745	0	0	0	0	0	0	0	0	0	0	77,804	
Flow capacity test[a]	27	0	0	0	0	0	0	0	0	0	0	0	27	
Pool A water	0	0	0	15,909	0	2,097	8,294	45	0	0	0	0	26,345	
Pool B water	0	0	0	97	0	2,276	1,045	7	0	0	0	0	3,425	
Pool A water sale[a]	26,345	0	0	0	0	0	0	0	0	0	0	0	26,345	
Pool B water sale[a]	3,425	0	0	0	0	0	0	0	0	0	0	0	3,425	
Pump-in recoveries	0	0	678	19,808	0	0	0	0	0	0	0	0	20,486	
Transfer approved water	0	0	0	0	250	3,450	250	0	5,300	3,800	250	5,700	19,000	
Unscheduled water	0	0	171	4	0	0	0	0	0	0	0	0	175	
Water Bank water recoveries	5,795	5,688	1,247	8,867	1,133	0	0	0	0	0	0	0	22,730	
Agency Total	127,067	142,014	218,483	201,170	254,921	374,203	463,481	408,760	269,159	252,423	203,230	212,470	3,127,381	
SWP Table A-related water														
Recreation/fish and wildlife water	299	18	64	34	113	179	422	352	468	444	112	341	2,846	
Subtotal (SWP water)	127,366	142,032	218,547	201,204	255,034	374,382	463,903	409,112	269,627	252,867	203,342	212,811	3,130,227	
Non-SWP Water														
Other water														
Dry Year Purchase Program	0	0	0	0	0	0	0	0	0	1,249	6,139	0	7,388	
Conveyance of nonproject water to O'Neill Forebay	0	0	0	0	0	0	0	0	6,000	0	0	0	6,000	
Local	35,497	486	1,744	7,833	104,482	175,648	195,495	162,314	88,824	78,289	105,241	76,871	1,032,724	
Solano settlement water	0	0	0	0	0	0	0	0	0	860	0	0	860	
Vallejo permit water	0	0	0	0	0	0	0	0	26	1,338	941	1,435	3,740	
Subtotal	35,497	486	1,744	7,833	104,482	175,648	195,495	162,314	94,850	81,437	112,321	78,306	1,049,235	
CVP Water														
Conveying water to CVP contractor	0	0	0	242	2,114	0	0	0	0	0	0	0	2,356	
Conveying CVP water annual contract	45	55	65	68	70	80	86	88	89	94	59	5	804	
Conveying CVP water (Kern National Wildlife Refuge–the Bureau)	1,136	2,139	1,291	220	236	145	0	1,008	3,497	0	1,255	4,009	14,936	
Conveying CVP water recreation/fish and wildlife water (San Luis/Pyramid)	19	14	35	6	54	63	90	37	40	39	52	43	492	
Delivery of CVP water from CVP/CVC to SWP contractor	0	13,012	5,265	151	0	0	0	0	0	0	0	0	18,428	
Transfer of CVP water to SWP contractor	0	0	0	0	0	0	0	0	500	3,600	0	0	4,100	
Transfer of CVP/CVC water to CVP contractor	0	0	0	0	0	0	0	0	0	1,200	0	0	1,200	
Subtotal (CVP water)	1,200	15,220	6,656	687	2,474	288	176	1,133	4,126	4,933	1,366	4,057	42,316	
Total (Non-SWP water)	36,697	15,706	8,400	8,520	106,956	175,936	195,671	163,447	98,976	86,669	113,687	82,363	1,093,028	
Grand Total	164,063	157,738	226,947	209,724	361,990	550,318	659,574	572,559	368,603	339,536	317,029	295,174	4,223,255	4,126,926

[a]Excluded water from Agency Total

Table 9-6. Total Amounts of Annual Table A Water and Water Conveyed, by Type, 1962-03 (Acre-feet)

Year	Annual Table A Water According to Long-Term Water Supply Contract							Water Conveyed								
								Deliveries								
	Upper Feather River Area (1)	*North Bay Area (2)*	*South Bay Area (3)*	*San Joaquin Valley Area (4)*	*Central Coastal Area (5)*	*Southern California Area (6)*	*Total (7)*	*Annual Table A Water (8)*	*Article 21 Surplus and Unscheduled Water[a] (9)*	*Other Water[b] (10)*	*Feather River Diversions[c] (11)*	*Wildlife/ Recreation Water (12)*	*Subtotal (13)*	**Initial Fill Water (14)**	**Operational Losses and Storage Changes[d] (15)**	**Total (16)**
1962	0	0	0	0	0	0	0	0	0	18,289	0	0	18,289	9	272	18,570
1963	0	0	0	0	0	0	0	0	0	22,456	0	0	22,456	71	185	22,712
1964	0	0	0	0	0	0	0	0	0	32,507	0	0	32,507	171	152	32,830
1965	0	0	0	0	0	0	0	0	0	44,105	0	0	44,105	93	729	44,927
1966	0	0	0	0	0	0	0	0	0	67,928	0	0	67,928	0	1,746	69,674
1967	0	0	11,538	0	0	0	11,538	11,538	0	53,605	0	0	65,143	8,328	4,212	77,683
1968	550	0	109,900	77,350	0	3,700	191,500	171,709	121,534	14,777	866,926	0	1,174,946	498,926	117,906	1,791,778
1969	620	0	98,700	163,075	0	5,000	267,395	193,020	72,397	18,829	794,374	0	1,078,620	510,614	72,196	1,661,430
1970	700	0	114,200	202,000	0	5,700	322,600	233,993	133,024	38,080	759,759	0	1,164,856	23,947	2,435	1,191,238
1971	890	0	116,200	251,800	0	6,700	375,590	357,340	296,019	44,119	778,362	8	1,475,848	7,853	5,812	1,489,513
1972	970	0	118,300	413,066	0	209,423	741,759	611,801	423,964	66,638	817,398	6,489	1,926,290	100,274	53,062	2,079,626
1973	1,100	0	120,400	383,652	0	481,100	986,252	694,388	296,416	42,511	800,743	1,155	1,835,213	204,638	53,798	2,093,649
1974	1,230	0	122,400	460,650	0	597,920	1,182,200	874,077	417,676	46,224	911,613	2,118	2,251,708	237,554	10,657	2,499,919
1975	1,610	0	124,500	545,809	0	714,950	1,386,869	1,223,990	622,902	63,793	862,218	3,377	2,776,280	103,352	(94,606)	2,785,026
1976	1,990	0	126,500	543,417	0	836,480	1,508,387	1,373,002	580,110	115,217	946,440	1,745	3,016,514	61,122	(681,025)	2,396,611
1977	2,420	0	128,600	581,400	0	954,901	1,667,321	574,155	0	389,065	581,994	1,111	1,546,325	0	(131,151)	1,415,174
1978	1,850	0	130,700	635,900	0	1,049,584	1,818,034	1,452,699	16,914	121,225	786,517	1,691	2,379,046	64,443	717,370	3,160,859
1979	2,130	0	132,700	702,685	0	1,190,573	2,028,088	1,659,896	648,389	187,630	882,549	1,766	3,380,230	12,302	(83,430)	3,309,102
1980	1,810	500	134,800	758,100	1,946	1,317,614	2,214,770	1,529,749	404,557	46,459	875,045	2,131	2,857,941	0	(26,606)	2,831,335
1981	1,940	650	137,000	818,000	2,813	1,432,065	2,392,468	1,909,562	908,428	279,161	838,557	4,688	3,940,396	0	(802,263)	3,138,133
1982	1,970	800	139,200	876,500	5,626	1,550,449	2,574,545	1,750,024	215,873	154,882	776,330	4,646	2,901,755	0	480,752	3,382,507
1983	2,000	950	141,400	867,118	8,439	1,681,257	2,701,164	1,184,869	13,019	181,453	602,905	7,849	1,990,095	0	(90,997)	1,899,098
1984	3,630	1,100	143,600	979,211	12,698	1,744,098	2,884,337	1,588,619	262,917	381,024	832,332	7,040	3,071,932	0	(140,182)	2,931,750
1985	3,760	1,250	145,800	1,019,049	21,138	1,864,849	3,055,846	1,995,453	307,672	404,842	870,008	4,033	3,582,008	0	92,885	3,674,893
1986	4,190	1,400	148,100	1,091,946	28,210	1,983,890	3,257,736	1,995,636	36,620	193,606	791,737	3,865	3,021,464	0	284,380	3,305,844
1987	4,620	1,550	150,300	1,188,500	35,204	2,103,941	3,484,115	2,130,086	114,907	377,592	831,947	7,672	3,462,204	0	(390,413)	3,071,791
1988	5,060	15,471	152,500	1,246,100	43,722	2,225,482	3,688,335	2,385,122	0	507,076	794,834	4,889	3,691,921	0	(92,850)	3,599,071
1989	5,500	24,615	156,700	1,290,400	56,342	2,424,633	3,958,190	2,853,747	0	474,559	830,500	8,135	4,166,941	0	447,917	4,614,858
1990	6,040	28,190	160,900	1,313,450	70,486	2,500,600	4,079,666	2,582,151	90	424,697	875,099	9,262	3,891,299	0	(528,869)	3,362,430
1991	11,880	29,590	166,400	1,338,011	70,486	2,510,200	4,126,567	549,113	3,521	551,051	565,395	4,879	1,673,959	0	167,435	1,841,394
1992	11,920	32,010	171,900	1,342,300	70,486	2,510,200	4,138,816	1,471,454	1,156	144,789	613,978	2,605	2,233,982	0	(63,541)	2,170,441
1993	11,960	34,620	177,400	1,342,300	70,486	2,510,200	4,146,966	2,315,235	0	254,854	822,589	2,609	3,395,287	0	726,123	4,121,410
1994	12,000	37,215	182,000	1,342,300	70,486	2,510,200	4,154,201	1,749,351	112,625	236,739	874,018	8,200	2,980,933	0	(295,405)	2,685,528
1995	12,050	44,030	184,000	1,342,300	70,486	2,510,200	4,163,066	1,967,093	64,330	78,425	860,077	2,575	2,972,500	0	69,536	3,042,036
1996	12,100	48,225	186,000	1,301,630	70,486	2,492,900	4,111,341	2,514,825	28,647	251,391	934,997	3,907	3,733,767	86	491,550	4,225,403
1997	12,150	49,315	188,000	1,297,300	45,201	2,492,900	4,084,866	2,325,775	21,432	322,000	993,211	4,146	3,666,564	527	(11,806)	3,655,285
1998	12,200	50,420	188,000	1,272,300	45,201	2,517,900	4,086,021	1,725,519	20,288	134,682	872,738	2,108	2,755,335	0	(132,491)	2,622,844
1999	12,250	51,500	188,000	1,272,300	70,486	2,519,900	4,114,436	2,738,891	158,070	85,312	1,108,672	4,324	4,095,269	0	(189,525)	3,905,744
2000	14,000	55,945	210,000	1,205,300	70,486	2,565,900	4,121,631	3,200,677	308,785	322,655	1,085,886	4,030	4,932,032	0	(20,103)	4,911,929
2001	14,670	66,561	220,000	1,185,519	70,486	2,566,900	4,124,136	1,690,926	43,435	477,835	1,078,656	2,929	3,293,781	0	159,983	3,453,764
2002	14,730	67,396	220,000	1,195,219	70,486	2,557,200	4,125,031	2,573,030	37,165	307,162	1,132,938	3,694	4,053,989	0	80,709	4,134,698
2003	14,790	68,231	220,400	1,194,819	70,486	2,558,200	4,126,926	2,901,041	59,828	251,447	1,008,093	2,846	4,223,255	0	459,377	4,682,632
Total	**223,280**	**711,534**	**5,567,038**	**33,040,776**	**1,152,372**	**59,707,709**	**100,402,709**	**59,059,556**	**6,752,710**	**8,240,690**	**30,659,435**	**132,522**	**104,844,913**	**1,834,310**	**725,916**	**107,405,139**

[a] Values include amounts of deliveries to short-term contractors (Mustang Water District, 1970-72; Tracy Golf and Country Club, 1974, 1979, and 1980; Green Valley Water District, 1974, 1975, 1978, 1979, 1980, and 1985; Granite Construction Company, 1980).
[b] Includes amounts of SWP non-Table A water and non-SWP water conveyed for SWP and non-SWP water contractors.
[c] Includes amounts of water diverted under various water rights agreements.
[d] Amounts reflect net effect of (1) operational losses from SWP transportation facilities; (2) changes in reservoir storage south of Delta; (3) storable local inflows to SWP reservoirs; (4) side inflow to San Luis Canal; and (5) inflow into California Aqueduct from Kern River Intertie.

Information for this chapter was provided by the State Water Project Analysis Office.

United States District Court, Eastern District of California,
"*Natural Resources Defense Council v. Kempthorne,*
506 F.Supp.2d 322 (E.D. Cal. 2007)" (2007)

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Natural Resources Defense Council v. Kempthorne
E.D.Cal.,2007.
Only the Westlaw citation is currently available.
United States District Court,E.D. California.
NATURAL RESOURCES DEFENSE COUNCIL, et al.,
Plaintiffs,
v.
Dirk KEMPTHORNE, in his official capacity as Secretary of the Interior, et al., Defendants,
California Department of Water Resources, Defendant-Intervenor,
State Water Contractors, Defendant-Intervenor,
San Luis & Delta-Mendota Water Authority, et al.,
Defendant-Intervenors.
No. 1:05-CV-01207 OWW (TAG).

May 25, 2007.

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OLIVER W. WANGER, United States District Judge.

***1** This case concerns the effect on a threatened species of fish, the Delta smelt (*Hypomesus transpacificus*) FN1, of the coordinated operation of the federally-managed Central Valley Project (" CVP") and the State of California's State Water Project (" SWP"), among the world's largest water diversion projects. Both projects divert large volumes of water from the California Bay (Sacramento-San Joaquin) Delta (" Delta") and use the Delta to store water.

For over thirty years, the projects have been operated pursuant to a series of cooperation agreements. In addition, the projects are subject to ever-evolving statutory, regulatory, contractual, and judicially-imposed requirements. The Long-Term Central Valley Project and State Water Project Operations Criteria and Plan (" 2004 OCAP" or " OCAP") surveys how the projects are currently managed in light of these evolving circumstances. At issue in this case is a 2005 FN2 biological opinion (" BiOp"), issued by the United States Fish and Wildlife Service (" FWS" or " Service") pursuant to the Endangered Species Act (" ESA"), which concludes that current project operations described in the OCAP and certain planned future actions will not jeopardize the continued existence of the Delta smelt or adversely modify its critical habitat.

The Delta smelt is a small, slender-bodied fish endemic to the Delta. Historically, Delta smelt could be found throughout the Delta. Although abundance data on the smelt indicates that the population has fluctuated wildly in the past, it is undisputed that, overall, the population has declined significantly in recent years, to its lowest reported volume in fall 2004.

In this case, Plaintiffs, a coalition of environmental and sportfishing organizations, challenge the 2005 BiOp's no jeopardy and no adverse modification findings as arbitrary, capricious, and contrary to law under the Administrative Procedure Act, 5 U.S.C. §§ 702 et seq. Before the court for decision is Plaintiffs' motion for summary judgment. Among other things, Plaintiffs allege that the BiOp fails to consider the best available science, relies upon uncertain (and allegedly inadequate) adaptive management processes to monitor and mitigate the potential impacts of the OCAP, fails to meaningfully analyze whether the 2004 OCAP will jeopardize the continued existence of the Delta smelt, fails to consider the OCAP's impact upon previously designated critical habitat, and fails to address the impacts of the entire project.

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Separate opposition briefs were filed by the Federal Defendants (Doc. 242), the Department of Water Resources (" DWR") (Doc. 246), and the State Water Contractors (" SWC") (Doc. 241), along with a final brief filed collectively by San Luis & Delta-Mendota Water Authority, Westlands Water District, and the California Farm Bureau Federation (" the San Luis Parties") (Doc. 247).

A recent Ninth Circuit opinion in *National Wildlife Federation v. National Marine Fisheries Service*, 481 F.3d 1224 (9th Cir.2007) [hereinafter " *NWF v. NMFS*"], succinctly summarizes the relevant provisions of the ESA:

***2** The ESA requires federal agencies to " insure that any action authorized, funded, or carried out by such agency ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of [designated critical] habitat...." 15 U.S.C. § 1536(a)(2). The ESA imposes a procedural consultation duty whenever a federal action may affect an ESA-listed species.*Thomas v. Peterson*, 753 F.2d 754, 763 (9th Cir.1985). To that end, the agency planning the action, usually known as the " action agency," must consult with the consulting agency. This process is known as a " Section 7" consultation. The process is usually initiated by a formal written request by the action agency to the consulting agency. After consultation, investigation, and analysis, the consulting agency then prepares a biological opinion. *See generally Ariz. Cattle Growers' Ass'n v. U.S. Fish & Wildlife Serv.*, 273 F.3d 1229, 1239 (9th Cir.2001). In this case, the action agencies are the U.S. Army Corps of Engineers and the Bureau of Reclamation, while the consulting agency is NMFS.

The consulting agency evaluates the effects of the proposed action on the survival of species and any potential destruction or adverse modification of critical habitat in a biological opinion, 16 U.S.C. § 1536(b), based on " the best scientific and commercial data available," *id.* § 1536(a)(2). The biological opinion includes a summary of the information upon which the opinion is based, a discussion of the effects of the action on listed species or critical habitat, and the consulting agency's opinion on " whether the action is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical habitat...." 50 C.F.R. § 402.14(h)(3). In making its jeopardy determination, the consulting agency evaluates " the current status of the listed species or critical habitat," the " effects of the action," and " cumulative effects." *Id.* § 402.14(g)(2)-(3). " Effects of the action" include both direct and indirect effects of an action " that will be added to the environmental baseline." *Id.* § 402.02. The environmental baseline includes " the past and present impacts of all Federal, State or private actions and other human activities in the action area" and " the anticipated impacts of all proposed Federal projects in the action area that have already undergone formal or early section 7 consultation." *Id.* If the biological opinion concludes that jeopardy is not likely and that there will not be adverse modification of critical habitat, or that there is a " reasonable and prudent alternative[ ]" to the agency action that avoids jeopardy and adverse modification and that the incidental taking of endangered or threatened species will not violate section 7(a)(2), the consulting agency can issue an " Incidental Take Statement" which, if followed, exempts the action agency from the prohibition on takings found in Section 9 of the ESA. 16 U.S.C. § 1536(b)(4); *ALCOA v. BPA*, 175 F.3d 1156, 1159 (9th Cir.1999).

* * *

***3** The issuance of a biological opinion is considered a final agency action, and therefore subject to judicial review. *Bennett v. Spear*, 520 U.S. 154, 178, 117 S.Ct. 1154, 137 L.Ed.2d 281 (1997); *Ariz. Cattle Growers' Ass'n*, 273 F.3d at 1235.

Id. at *2-*3.

For over thirty years the state and federal agencies charged with management of the CVP and SWP have operated the projects in an increasingly coordinated manner pursuant to a Coordinated Operating Agreement (" COA"). The COA, which dates to 1986, has evolved over time to reflect, among other things, changing facilities, delivery requirements, and regulatory restrictions. The most recent document surveying how the COA is implemented in light of these evolving circumstances is the 2004 Operating Criteria and Plan (" 2004 OCAP" or " OCAP") issued June 30, 2004. (AR 489-728.) [FN3]

A. *Overview of the 2004 OCAP.*

The OCAP begins with a " Purpose of Document" section which states:

This document has been prepared to serve as a baseline description of the facilities and operating environment of the Central Valley Project (CVP) and State Water Project (SWP). The Central Valley Project-Operations and

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Criteria Plan (CVP-OCAP) identifies the many factors influencing the physical and institutional conditions and decision-making process under which the project currently operates. Regulatory and legal instruments are explained, alternative operating models and strategies described.
The immediate objective is to provide operations information for the Endangered Species Act, Section 7, consultation. The long range objective is to integrate CVP-OCAP into the proposed Central Valley document. It is envisioned that CVP-OCAP will be used as a reference by technical specialists and policymakers in and outside the Bureau of Reclamation (Reclamation) in understanding how the CVP is operated. The CVP-OCAP includes numeric and nonnumeric criteria and operating strategies. Emphasis is given to explaining the analyses used to develop typical operating plans for simulated hydrologic conditions.
All divisions of CVP are covered by this document, including the Trinity River Division, Shasta and Sacramento Divisions, American River Division and Friant Division.

(AR 506.) [FN4]

The introductory chapter provides an overview of all of the physical components of the CVP and SWP (AR 507-520), as well as all of the relevant legal authorities affecting CVP operations (508-512).

Chapter 2, explains, among other things, that water needs assessments have been performed for each CVP water contractor, to confirm each contractor's past beneficial use in order to anticipate future demands. (AR 521.) Chapter 2 also reviews the 1986 COA and how it is implemented on a daily basis by Reclamation and DWR. (AR 523-25.) Also provided is a detailed overview of the " changes in [the] operations coordination environment since 1986," which include:
***4** Changes due to temperature control operations on the Sacramento River;
Increases in the minimum release requirements on the Trinity River;
Implementation of CVPIA 3406(b)(2) and Refuge Water Supply contracts;
Commitments made by the CVP and SWP pursuant to the Bay-Delta Accord and the subsequent implementation of State Water Resources Control Board (" SWRCB") Decision-1641;
The Monterey Agreement;
The Operation of the North Bay Aqueduct (which was not included in the 1986 COA).
The SWP's commitment to make up for 195,000 acre-feet of pumping lost to the CVP due to SWRCB Decision 1485;
Implementation of the Environmental Water Account; and Constraints imposed by various endangered species act listings, including that of the Sacramento River Winter-Run Chinook Salmon, the Sacramento River Spring-Run Chinook Salmon, the Steelhead Trout, and the Delta Smelt (which resulted in the issuance of biological opinions in 1993, 1994, and 1995 concerning CVP/SWP operations and the South Delta Temporary Barriers Biological Opinion in 2001)

(AR 525-28.) The OCAP also reviews the regulatory standards imposed by SWRCB D-1641, which include water quality standards based on the geographic position of the 2-parts-per-thousand isohale (otherwise known as " X2"), a Delta export restriction standard known as the export/inflow (E/I) ratio, minimum Delta outflow requirements, and Sacramento River and San Joaquin River flow standards. (AR 530-537.) In addition to imposing requirements, D-1641 granted the Bureau and DWR permission to use each project's capabilities in a coordinated manner. (AR 537-38.)

This is not a complete overview of the projects' operations covered in the OCAP. Numerous regulatory and operational changes have taken place in recent years. As the OCAP's " Purpose of Document" section explains, the immediate objective of the OCAP is to lay out all such regulatory and other operational information so that ESA Section 7 consultation can proceed to evaluate how project operations will effect the Delta smelt under various projected future conditions.

B. ***Applying the ESA to Project Operations.***

Because endangered and/or threatened species, including the Delta smelt, reside in the area affected by the CVP and SWP, the 2004 OCAP, administered on behalf of the federal government by the Bureau of Reclamation (" Bureau"), must comply with various provisions of the ESA. Specifically, prior to authorizing, funding, or carrying out any action, the acting federal agency (in this case, the Bureau) must first consult with FWS and/or NMFS to " insure that [the] action ... is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined ... to be critical...." 16 U.S.C. § 1536(a)(2) [ESA § 7(a)(2)]. This form of consultation is called " formal consultation," and concludes with the issuance of a biological opinion. 50 C.F.R. § 402.02.

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***5** Alternatively, under certain circumstances, a federal agency may pursue " early consultation," on behalf of an agency or private party (referred to as a " prospective applicant") who will require formal approval or authorization to undertake a project. *Id.* Early consultation may be requested when the prospective applicant " has reason to believe that an endangered species or a threatened species may be present in the area affected by this project and that implementation of such action will likely affect such species." 50 C.F.R. § 402.11(b). The result of early consultation is a " preliminary biological opinion," the contents of which are " the same as for a biological opinion issued after formal consultation except that the incidental take statement provided with a preliminary biological opinion does not constitute authority to take listed species." § 402.11(e). Subsequently, the preliminary biological opinion may be " confirmed" after the prospective applicant applies to the federal agency for a permit or licence. Once a request for confirmation is received, the FWS must either confirm that the preliminary biological opinion stands as the final biological opinion or must request that the federal agency initiate formal consultation. § 402.11(f).

In this case, the 2004 OCAP BiOp [FN5] contemplates increases in water diversions and the construction of new facilities in the Delta. (AR 256-271.) The maximum daily diversion rate in Clifton Court Forebay will increase from 6,680 cubic feet per second (CFS) to 8,500 CFS (27% increase in pumping) and eventually to 10,300 CFS (54% increase). Permanent barriers within the south Delta will be constructed and operated. An intertie between the California Aqueduct and the Delta-Mendota Canal will be constructed and operated. Water deliveries from the American River will be doubled. New deliveries of CVP water to the Freeport Regional Water Project will be made. Water transfers resulting in an annual 200,000 to 600,000 acre-feet increase in Delta exports will result. (AR 256, 339-40, 357-59, 371, 382-83, 465.)

The Bureau submitted some of these operational changes for formal consultation with FWS concerning their impact on the Delta smelt, while other changes were subject only to early consultation:

This biological opinion covers formal and early consultation for the operations of the CVP and SWP. The formal consultation effects described in this biological opinion cover the proposed 2020 operations of the CVP including the Trinity River Mainstem ROD (Trinity ROD) flows on the Trinity River, the increased water demands on the American River, the delivery of CVP water to the proposed Freeport Regional Water Project (FRWP), water transfers, the long term Environmental Water Account (EWA), the operation of the Tracy Fish Facility, and the operation of the SWP-CVP intertie. The effects of operations of the SWP are also included in this opinion and include the operations of the North Bay Aqueduct, the Suisun Marsh Salinity Control Gates, the Skinner Fish Facility and water transfers.

***6** Early consultation effects include the effects of operations of components of the South Delta Improvement Program (SDIP). These operations include pumping of 8500 cubic feet per second (cfs) at the SWP and Banks Pumping Plant (hereafter referred to as 8500 Banks), permanent barrier operations in the South Delta, the long term EWA, water transfers, and CVP and SWP operational integration. There are two separate effects sections in this biological opinion, one for Formal Consultation and one for Early Consultation. In addition, there is an incidental take for formal consultation and a preliminary incidental take for early consultation.

(AR 2, 248.) [FN6]

C. *History of This Lawsuit.*

On July 30, 2004, FWS issued a Biological Opinion (the " 2004 OCAP BiOp"), addressing both formal and early consultation for the above-described OCAP actions. (AR 1.) [FN7]

On August 4, 2004, the Ninth Circuit decided *Gifford Pinchot Task Force v. United States Fish & Wildlife Serv.*, 378 F.3d 1059, 1069 (9th Cir.2004), which held that the FWS's definition of " adverse modification" to critical habitat is an impermissible interpretation of the ESA because it focuses on whether critical habitat modifications would impact the *survival* of a species, effectively ignoring the statutorily-mandated goal of " *recovery.*" On November 4, 2004, in response to this ruling, the Bureau requested reinitiation of consultation to address critical habitat issues.

Plaintiffs in this case, a coalition of non-profit conservation organizations, filed suit on February 15, 2005, alleging that the 2004 OCAP BiOp was legally inadequate in light of *Gifford Pinchot* and should be invalidated. (Doc. 1.) Plaintiffs named as defendants the Department of the Interior and the FWS. (*Id.*)

On February 16, 2005, FWS issued an amended BiOp (the " 2005 OCAP BiOp," " OCAP BiOp," or " BiOp"), which superceded the 2004 OCAP BiOp. (AR 247.) The 2005 OCAP BiOp concludes that the coordinated operation of the SWP and CVP, including the proposed future actions, will not jeopardize the Delta smelt's

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continued existence. (AR at 469.) Although the BiOp recognizes that *existing* protective measures may be inadequate, the FWS concluded that certain *proposed* protective measures, including the EWA and a proposed " adaptive management" protocol would provide adequate protection. (*Id.*)

Since the filing of this complaint, Federal Defendants have reinitiated § 7 consultation and contend this case should be dismissed as moot, or stayed for a voluntary remand of the 2005 BiOp without vacatur.

Plaintiffs filed a supplemental complaint on May 20, 2005, challenging the amended BiOp on various grounds. (Doc. 128 pt. 8.)

D. *Delta Smelt Abundance.*

Smelt once were one of the most common pelagic [FN8] fish in the Delta, having previously occupied the waters from " Suisun Bay and Montezuma Slough, upstream to at least Verona on the Sacramento River, and Mossdale on the San Joaquin River." (AR 365.) Smelt abundance has " declined irregularly" for at least the past 20 years. (AR 365-67.) FWS relies primarily upon two indices to monitor Delta smelt abundance, calculated from the Summer Tow Net Survey (" TNS") and the Fall Midwater Trawl (" FMWT"). (AR 366-67, 1022.) The TNS index, which measures the abundance and distribution of juvenile Delta smelt, constitutes " one of the more representative indices because the data have been collected over a wide geographic area (from San Pablo Bay upstream through most of the Delta) for the longest period of time (since 1959)." (AR 370.) Since 1983, except for three years (1986, 1993, and 1994), the TNS has remained consistently lower than ever previously recorded. (*Id.*)

***7** The FMWT index, which measures the abundance and distribution of late juveniles and adult Delta smelt from San Pablo Bay to Rio Vista on the Sacramento River and Stockton on the San Joaquin River, is the second longest running survey (since 1967). The BiOp reviewed the FMWT trends as follows:
Although this index has fluctuated widely (AR 9201-02, 9222), it has " declined irregularly over the past 20 years." (AR 370-71.) Since 1983, the FMWT has registered more low indices for more consecutive years than previously recorded. Until recently, except for 1991, this index has declined irregularly over the past 20 years. Since 1983, the delta smelt population has exhibited more low fall midwater trawl abundance indices, for more consecutive years, than previously recorded. The 1994 FMWT index of 101.7 is a continuation of this trend. This occurred despite the high 1994 summer townet index for reasons unknown. The 1995 summer townet was a low index value of 319 but resulted in a high FMWT index of 898.7 reflecting the benefits of large transport and habitat maintenance flows with the Bay-Delta Accord in place and a wet year. The abundance index of 128.3 for 1996 represented the fourth lowest on record. The abundance index of 305.6 for 1997 demonstrated that the relative abundance of delta smelt almost tripled over last years results, and delta smelt abundance continued to rise, peaking in 1999 to an abundance index of 863, only to fall back down to the low abundance indexes of 139 for 2002 and 213 for 2003.

(AR at 371.)

The 2004 FMWT index, which was not discussed in the BiOp, was calculated to be 74, the lowest ever recorded. (AR 9202.) (This omission forms the basis of one of Plaintiffs' challenges to the BiOp.) The survey was apparently released in December 2004, and was specifically cited to FWS in February 2005.

At the hearing on the summary judgment motions, Federal Defendants in substance argued that despite years of study, the abundance data for the annual Delta smelt population is fraught with uncertainties and " not enough is known about the species" to accurately and finitely measure with certainty the project's effects on Delta smelt. FWS maintains the one to two year life expectancy of the smelt also contribute to this lack of certainty.

E. *Relationship Between Abundance and Project Operations.*

The BiOp cites several reasons for the smelt's decline. First, since the mid 1800s, mining, agricultural use, and levee construction caused the loss of a large portion of smelt habitat. (AR at 365.) Second, recreational boating in the Delta has resulted in the presence and propagation of " predatory non-native fish" and an increase in the rate of smelt erosion resulting from boat wakes.(*Id.*) Third, reduced water quality " from agricultural runoff, effluent discharge and boat effluent has the potential to harm the pelagic larvae and reduce the availability of the planctonic food source." (*Id.* at 366.)Finally, the BiOp acknowledges that " delta smelt have been increasingly subject to entrainment, upstream or reverse flows of waters in the Delta and San Joaquin River, and constriction of low salinity habitat to deep-water river channels of the interior Delta." (*Id.*) The BiOp acknowledges that these final adverse effects are " *primarily a result of the steadily*

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increasing proportion of river flow being diverted from the Delta by the Projects, and occasional droughts." (*Id.* (emphasis added).) The BiOp in no way quantifies the contribution of each of these factors to the smelt's decline. The parties dispute the extent to which project operations jeopardize the smelt.

F. *Relationship Between Smelt and " X2."*

***8** Smelt are euryhaline (tolerant of a wide range of salinities), but generally occur in water with less than 10-12 parts per thousand (ppt) salinity. (AR at 362.) For a large part of its life span, Delta smelt are thought to be associated with the " freshwater edge of the mixing zone," where the salinity is approximately 2 parts per thousand (often referred to as " X2"). (AR at 366.) The summer TNS index increases dramatically whenever X2 is located between Chipps and Roe islands. (*Id.*) Whenever the location of X2 shifts upstream of the confluence of the Sacramento and San Joaquin, either as a result of water diversions or natural conditions, smelt abundance decreases.(*Id.* at 371.)

G. *The Concept of " Salvage."*

The BiOp's " no jeopardy" conclusion relies on the concept of " salvage," which refers generally to the process of using mechanical devices to screen fish that would otherwise be entrained in project facilities (e.g., pumps) into holding tanks for transport to other parts of the Delta. (*See e.g.,* AR 321.) Unlike many other fish species in the Delta, Delta smelt do not survive the salvage process, " either due to stress and injury from handling, trucking and release, or from predation in or near the salvage facilities, the release sites, or in Clifton Court Forebay." (AR at 413.) As a result, for Delta smelt, FWS uses the terms salvage and entrainment essentially interchangeably. (*See id.*(" To simplify predictions of the difference in salvage (and by extension entrainment) between model scenarios....") FN9

Previous BiOps regarding CVP and SWP operations used salvage to set take limits. For example, the 1995 BiOp's incidental take statement set take exceedence levels for Delta smelt based on " [m]onthly average delta smelt salvage at the Federal and State Fish Facilities from 1980 to 1992 by water year type." (AR at 11765.) Essentially, take limits were set according to how much salvage had occurred in the past.

More recently, project managers, fisheries officials, and other experts came to the consensus that the salvage approach was insufficient on its own. For example, one DWR biologist noted that the singular focus on historic salvage had problems:

Higher levels of take are allowed in below normal years merely because this is what the projects " took" historically. However, the population is more condensed in below normal years and possibly more vulnerable to entrainment.

(AR 5532.) Experts advocated (a) further research into the relationship between the position of the Delta smelt and environmental conditions (AR 4881); and (b) the adoption of a flexible management approach, which would allow new information to be " folded back into the operation and conservation strategies." (AR 4870.) The result was a " layered" approach to managing the smelt, made up of more protective take limits than previously imposed along with the implementation of an adaptive management protocol.

I. *Revised Take Exceedence Levels Used In the BiOp.*

***9** The BiOp includes " hard" take limits,[FN10] based on historic " salvage density estimates," adjusted to account for operational constraints under the 2004 OCAP and presumed increased environmental water flows. Separate take limits were established for formal and early consultation purposes.

The revision of the take limits began with historic catch data from periodic samples of salvaged fish. (*See* AR 413.) Data about the volume of water diverted during the collection period is then used to estimate the fish per volume of water diverted. This is referred to as the " salvage density." [FN11](*Id.*) Historically, salvage density varied greatly depending on whether the year was wet (above normal), dry (below normal, dry, or critical) year. Wet and dry year data were analyzed separately. (*Id.*) The estimates were then inputted into a computer modeling system, CALSIM II, to estimate take under varying assumptions about future project operations, including programs designed to improve environmental conditions, such as the Environmental Water Account. (AR 413-14.)

Several different scenarios or " Studies" were run through CALSIM II and included in the BiOp. For example, Study No. 1 reflects the 1995 regulatory base case, without any changes in project operations and without the addition of any environmental water programs. Study No. 4a estimates a take level for flow conditions planned under the operations subject to final consultation (changes to flows in the Trinity River, future development levels, and the operation of the Freeport Regional Water Project and the Intertie). Study 4a

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included flow adjustments required by D-1641 and VAMP, along with projected CVPIA (b)(2) flows, but *did not include* operation of the EWA. Study No. 5a was similar to 4a, except that it added projected EWA flows. Separately, in Study No. 5, CALSIM II simulated flow modifications projected to occur as a result of " those projects subject to early consultation," specifically the increased pumping and permanent barriers called for in the planned South Delta Improvement Project (" SDIP"). (AR 374, 414-19; Sommer Decl. ¶ 5.) Each modeling scenario was run separately for various water year types (Wet, Above Normal, Below Normal, Dry, and Critically Dry) and independently estimated take at CVP and SWP facilities.

The BiOp based its conclusions for formal consultation on the results of the Study No. 5a, and for early consultation on the results of Study No. 5. The results of the modeling scenarios for Study No. 5a are set forth in several tables at pages 414 through 419 of the AR. The following table summarizes the changes in estimated take for Study No. 5a, for each type of water year, relative to the 1995 base case. In other words, the positive figures represent the number of additional smelt that will be taken per month under formal consultation relative to the 1995 base case (Study No. 1) while negative numbers represent how many fewer smelt will be taken per month relative to the 1995 base case.[FN12]

Table 1:

Summary of Results for CVP Salvage Under Study No. 5a

Month	Wet Year	Above Normal Year	Below Normal Year	Dry Year	Critically Dry Year
Adults					
December	-1	-1	-3	-3	-41
January	-13	-13	-12	-10	-98
February	-33	-36	+63	-60	+9
March	+29	-40	-83	-19	+1
Largely Juveniles					
April	0	0	-16	+5	0
May	0	0	-9017	-14469	-11652
June	0	0	0	-2910	0
July	0	+11	+7	-74	0
Net: December-March	-17	-89	-35	+28	-130
Net: April-July	0	+11	-9025	-17448	-1165

Table 2:

Summary of Results for SWP Salvage Under Study No. 5a

Month	Wet Year	Above Normal Year	Below Normal Year	Dry Year	Critically Dry Year
Adults					
December	-6	-6	-16	-15	-11

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January	-76	-87	-82	-87	-104
February	+86	-94	0	0	+51
March	+98	+91	+63	0	+2
Largely Juveniles					
April	-60	-77	-365	-144	0
May	-27188	-25933	-31122	-32083	-7269
June	-1096	-129	-53	1267	0
July	0	+282	+318	+493	+175
Net: December-March	+102	-95	-35	-102	-62
Net: April-July	-28346	-25857	-31213	-33000	-7095

***10** For the CVP, CALSIM II predicts significant reductions in smelt salvage during the months of December through July in below normal and dry years, when compared to the regulatory base case.[FN13] However, under certain scenarios, CVP salvage increases during other months of the year relative to the regulatory base case, because pumping is predicted to increase during these months to make up for water released from storage for fish protection purposes. For the SWP, salvage stays relatively level for the months of December through March. However, salvage decreases for the months of April through July relative to the regulatory base case.

Based on CALSIM II Study 5a, FWS calculated the amount of " combined salvage" (i.e., for both projects) estimated under the formal consultation scenario, for each month, according to water year type. The BiOp rounded the numbers up to the nearest 100 and used those figures to set incidental take limits by water year type. (AR 471-472.)

Table 3: Incidental Take Limits by Water Year Type (For Both CVP and SWP)

	Water Year Type		
	Month	Wet or Above Normal	Below Normal, Dry, or Critical
	October	100	100
	November	100	100
	December	700	400
Monthly	January	3000	1900
Incidental	February	2300	1700
Take	March	1300	1300
	April	1000	1100
	May	37800	30500
	June	45300	31700

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July	3500	2500
August	100	100
September	100	100

Because these incidental take levels are based on predictions produced by CALSIM II Study 5a, they do *not* assume any smelt protection actions under the DSRAM, but do assume continued availability of the EWA water. (AR 374, 471.)

FWS determined that the level of anticipated take " is not likely to result in jeopardy to the smelt because this level of take is at or below historical levels of take." (AR 474.)

However, the BiOp also acknowledges that " the operations of the Projects under formal consultation as described in the Project Description *will result in adverse effects to delta smelt* through entrainment at the CVP and SWP and by drawing delta smelt into poorer quality habitat in the south delta." (AR 422 (emphasis added).) The BiOp concludes that " with the inclusion of [certain] conservation measures described [in the BiOp] *and* the implementation of the [Delta Smelt Risk Assessment Matrix], these adverse effects would be avoided or minimized." (*Id.* (emphasis added).) " [W]ith these conservation measures in place, the re-operation of the Trinity River, the increased level of development on the American River, the Freeport Diversion, the Suisun Marsh Salinity Control Gates, the Barker Slough Diversion, or due to changes to X2 ... are not expected to result in adverse effects to delta smelt." (AR 423.)

FWS' conclusions admit project operations will result in adverse effects to delta smelt, which are unquantified, and can only be avoided by conservation measures and implementation of the DSRAM.

H. *" Conservation Measures."*

***11** The " conservation measures" contemplated are listed in the Summary of Effects section of the BiOp and include: (1) the Environmental Water Account (" EWA"); (2) Central Valley Project Improvement Act (b)(2) water; (3) State Water Resource Control Board's Water Rights Decision 1641; (4) the Vernalis Adaptive Management Plan (" VAMP"); and (5) the DSRAM adaptive management plan. (AR 466-68.)

1. CVPIA (b)(2) Water.

According to the 1992 Central Valley Project Improvement Act, the CVP must " dedicate and manage annually 800,000 acre-feet of Central Valley Project yield for the primary purpose of implementing the fish, wildlife, and habitat restoration purposes and measures authorized by this title; to assist the State of California in its efforts to protect the waters of the San Francisco Bay/Sacramento-San Joaquin Delta Estuary; and to help to meet such obligations as may be legally imposed upon the Central Valley Project under State or Federal law following the date of enactment of this title, including but not limited to additional obligations under the Federal Endangered Species Act." Title XXXXIV of the Reclamation Projects Authorization and Adjustment Act of 1992, Pub.L. 102-575, 106 Stat. 4600, 4706 (1992). (*See* AR 372.)

FWS, in consultation with the Bureau and other agencies, may use this " (b)(2) water" to meet Water Quality Control Plan (WQCP) obligations and any other requirements imposed by law after 1992. " For example, (b)(2) water has been used to maintain flows on Clear Creek to provide adequate spawning and rearing habitat for Chinook salmon. Water exports at the CVP have also been reduced using (b)(2) water to reduce entrainment of salmon or delta smelt at the salvage facilities. This ongoing action provides a benefit to delta smelt in most years." (AR 372.)

The base CVP yield committed to fish restoration is fixed by statute and is mandatory. This fixed supply is subject to reduction up to 25% in critically dry years under CVPIA § 3406(b)(2)(C).

2. Environmental Water Account.

The Environmental Water Account (" EWA") is " an adaptive management tool that aims to protect both fish and water users as it modifies water project operations in the Bay-Delta." (AR 373.)
The EWA provides water for the protection and recovery of fish beyond that which would be available through the existing baseline of regulatory protection related to project operations. The EWA buys water from willing sellers or diverts surplus water when safe for fish, then banks, stores, transfers and releases it as needed to protect fish and compensate water users for deferred diversions.

(*Id.*)

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The EWA has been used to benefit smelt by allowing for the curtailment of project export pumping during critical time periods. (*Id.*) The EWA could also be used to increase in-stream flows or increase outflows in the Delta, both of which would benefit the smelt. (*Id.*) The EWA is not fixed by statute nor is annual funding assured, and the water supply it provides, though reasonably anticipated, is not immutable.

3. Water Rights Decision 1641.

***12** State Water Resource Control Board Decision 1641 (D-1641) imposes certain minimum flow and water quality objectives upon the projects:
D-1641 includes specific outflow requirements throughout the year, specific export restraints in the spring, and export limits based on a percentage of estuary inflow throughout the year. D-1641 obligates the SWP and CVP to comply with the objectives in the 1995 Bay-Delta Plan. The Service issued a biological opinion on the Bay-Delta plan to the Environmental Protection Agency on November 2, 1994. The water quality objectives in the 1995 Bay-Delta Plan and in D-1641 are designed to protect in-Delta agricultural, municipal and industrial, and fishery uses and vary throughout the year and by water year type.... D-1641 will also protect delta smelt by providing transport, habitat and attraction flows.

(AR 373 (citations omitted).)

The D-1641 requirements are mandatory under the projects' operating permits. The water to satisfy D-1641 comes from 3406(b) (2) yield and supplemental sources the Bureau utilizes.

4. Vernalis Adaptive Management Plan (VAMP).

The Vernalis Adaptive Management Plan (VAMP) is an experimental program that had its origin in D-1641. (AR 373.) It provides for flows on the lower San Joaquin River and export curtailments at the projects. (*Id.*) VAMP's purpose is to " provide pulse flows on the San Joaquin River and improve habitat conditions in the Delta by reducing exports at the CVP and SWP" over a 31 day period in April and May for the benefit of Chinook salmon and Delta smelt.(*Id.*) Currently, water used to reduce exports at the CVP under VAMP is accounted for as CVPIA (b)(2) water. (*Id.*) If export reductions are taken, the EWA is used to supply contractors to make up for the transfers. VAMP flows " allow larval and juvenile smelt to avoid becoming entrained at the export facilities and to move downstream to Suisun Bay." (*Id.*)

The VAMP water supply is not irrevocably fixed or assured.

I. *Delta Smelt Risk Assessment Matrix (DSRAM).*

The BiOp's other, primary protection for the smelt is the implementation of a new adaptive management protocol, known as the Delta Smelt Risk Assessment Matrix (" DSRAM"). The DSRAM utilizes a list of trigger criteria to precipitate responses. (AR at 344.) The criteria are:

(1) the previous year's FMWT index;

(2) the risk of smelt entrainment based upon the location of X2;

(3) the estimated duration of the smelt spawning period, based on water temperature;

(4) the presence of spawning female smelt;

(5) the proximity of the smelt to project pumping facilities; and

(6) a salvage trigger for adult and juvenile smelt. (AR 346.)

1. The DSRAM Process.

If any trigger criteria is met or exceeded, a Delta Smelt Working Group (" DSWG") is convened. The DSWG consists of representatives from FWS, the California Department of Fish and Game, DWR, the United States Environmental Protection Agency, the Bureau, and the California Bay-Delta Authority. (*See* AR 344-45.) The DSWG then recommends corrective actions to a Water Operations Management Team (" WOMT").(*Id.*) The OCAP BiOp identifies four specific actions that the DSWG and WOMT must consider taking if one or more trigger criteria occur: (1) export reductions at one or both of the projects; (2) changes in the south Delta barrier operations; (3) changes in San Joaquin River flows; and (4) changes in the operation of the Delta cross channel.[FN14]The DSRAM does not contain defined action criteria, but instead leaves any response wholly to the discretion of the two groups who administer the DSRAM (DSWG and WOMT).

2. DSRAM Implementation.

***13** The BiOp acknowledges although FWS is " confident that use of the DSRAM will reduce the frequency with

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which actual salvage exceeds the median predicted salvage, the exceedence frequency could be as high as 50%." (AR 471.) There is no analysis of the duration or consequences from such exceedence. The DSRAM provides no operating criteria or action schedule, specifying when mitigation actions must be taken. It is not possible to predict what, how and when DSRAM measures will be implemented.

J. *Recent Experience with DSRAM.*

DWR offered post-record evidence regarding the manner in which DSRAM has actually been implemented since its inception. This post-record activity could not have been considered by the agency. A motion to strike the proffered evidence was sustained. The offer of proof includes two " fish actions" that were taken in 2005 in response to " triggers" and a third that was planned but avoided when project water increased in early 2006, a wet year. DWR's offer of proof is to show positive experience in operation of the DSRAM.

K. *Recent Procedural History.*

The Federal Defendants acknowledge that " [s]hortly before the 2005 OCAP BiOP was completed, a fall midwater trawl survey of delta smelt revealed a substantial decline in the population index for the species" to the lowest ever. (Doc. 242-1, at 4.) The Federal Defendants do not concede that the existence of this data renders the BiOp arbitrary and capricious, because " limited analysis of this data existed, and the Service relied on the raw data, and its own professional judgments as the best available scientific and commercial data available." (*Id.*) Nevertheless, " the CALFED agencies have continued to assemble and analyze new data and information." (*Id.*) For example, scientists from CALFED agencies " recently" developed a document based upon the new data: the Interagency Ecological Program Synthesis of 2005 Work to Evaluate the Pelagic Organism Decline (POD) in the Upper San Francisco Estuary (the " IEP POD Synthesis"). This document led the Federal Defendants to conclude that the OCAP for the CVP and SWP may affect Delta smelt in a manner or to an extent not previously considered. (IEP POD Synthesis, Doc. 240, Attachment 1.)

On July 6, 2006, the Bureau requested that the FWS re-initiate consultation concerning the impact of the OCAP on the Delta smelt. (Doc. 240.) In a July 6, 2006 letter to the FWS, the Bureau acknowledged that " emerging data indicates an apparent substantial decline in the Delta smelt population index." (Doc. 240-2.)

1. *No Dismissal or Stay.*

In light of the second re-initiation of consultation, federal defendants sought dismissal on prudential mootness grounds, a voluntarily remand without vacatur, or a stay pending the completion of reconsultation. (*See* Docs. 242-1, 273.) The motion for stay was joined by the DWR (Doc. 277), and various Defendant-Intervenors (Doc. 274). Plaintiffs opposed because Federal Defendants refused to withdraw the challenged BiOp and stated their intent to continue CVP and SWP operations under the disputed BiOp and its incidental take statements during the time period necessary to complete re-consultation, now projected to be July 2008, more than two and one-half water years following the effective date of the disputed BiOp. (*See* Doc. 279.)

***14** Defendants' motion to dismiss on prudential mootness grounds was denied:
Plaintiffs' concerns have not been fully addressed by the reinitation of consultation. Federal Defendants are relying in part on the challenged BiOps in operating the CVP and intend to continue to do so. The controversy over whether the BiOps and OCAP should have continued viability is real and substantial. and this court could provide relief, in the form of a decision invalidating the BiOps followed by hearings on interim remedies. Under these circumstances, it is not appropriate to deem this case prudentially moot.

(Doc. 301 at 18 (footnotes omitted).)

The motion for voluntary remand without vacatur was denied based on the general standard for vacatur set forth in *Natural Resources Defense Council v. U.S. Dept. of the Interior*, 275 F.Supp.2d 1136, 1143 (C.D.Cal.2002), which considers " the seriousness of the order's deficiencies" and " the disruptive consequences of an interim change that may itself be changed." No evidence or argument was presented regarding the nature of the prejudice that might result from invalidating the BiOp (*id.* at 20), and numerous factual and legal disputes exist regarding the seriousness of the order's deficiencies (*see id.* at 27). The court was left to speculate what consequences to the species would result if injunctive relief were ordered against continued implementation of the disputed BiOp.

The stay motion, based on the primary jurisdiction doctrine, was denied on the authority of *Lockyer v. Mirant Corp.*, 398 F.3d 1098, 1109 (9th Cir.2005) (a party seeking a stay " must make out a clear case of hardship or inequity in being required to go forward, if there is even a

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fair possibility that the stay for which he prays will work damage to someone else."). The order held: " Plaintiffs are entitled to have their complaint decided on the merits, particularly given the fact that Defendants continue to rely on the challenged BiOps as if they were lawfully enacted." (Doc. 301 at 33.) The apparent increasing jeopardy to the smelt by and after February of 2005 militates against further delay while FWS continue " to study" the issue of jeopardy, an exercise that has continued for almost a decade.

A. *Objections to Declaration of Ted Sommer.*

DWR offers the post-record declaration of Ted Sommer, Ph.D, to explain (1) the concept of salvage and its relationship to the take exceedence levels in the BiOp; (2) the operation of DSRAM; (3) and the manner in which DSRAM has been implemented since its inception.

Generally, " the focal point for judicial review should be the administrative record already in existence, not some new record made initially in the reviewing court." *Camp v. Pitts*, 411 U.S. 138, 142, 93 S.Ct. 1241, 36 L.Ed.2d 106 (1973). However, the Ninth Circuit recognizes three main exceptions to this rule, allowing courts to consider extra-record evidence:
(1) if necessary to determine " whether the agency has considered all relevant factors and has explained its decision," (2) " when the agency has relied on documents not in the record," or (3) " when supplementing the record is necessary to explain technical terms or complex subject matter."

***15** *Southwest Ctr. for Biological Diversity v. U.S. Forest Service*, 100 F.3d 1443, 1450 (9th Cir.1996). A court may also consider extra-record evidence " when plaintiffs make a showing of agency bad faith." *Nat'l Audubon Soc. v. U.S. Forest Serv.*, 46 F.3d 1437, 1447 n. 9 (9th Cir.1993).

DWR maintains that the Sommer declaration explains " technical or complex subject matters" admissible under the exception for evidence " necessary to explain technical or complex subject matters." (Doc. 246-1 at 5-6 n. 5.) Plaintiffs move to strike the declaration on the ground that subject matters covered by Mr. Sommer are " neither technical nor complex." (Doc. 305 at 4 n. 1.) Rather, Plaintiffs contend that the declaration is offered to explain the agency's post-BiOp experience with DSRAM in an effort to counter the Plaintiffs' argument that the DSRAM is wholly discretionary and contains no defined standards or enforceable requirements.

Generally, " post hoc rationalizations of the agency ... cannot serve as a sufficient predicate for agency action." *Am. Textile Manuf. Inst. v. Donovan*, 452 U.S. 490, 539, 101 S.Ct. 2478, 69 L.Ed.2d 185 (1981); ***see also*** *Sierra Club v. Bosworth*, 199 F.Supp.2d 971, 986 (N.D.Cal.2002) (refusing to consider post hoc explanations that were " neither addressed nor supported by the record"). DWR does not disagree with this general principle, but instead insists that the declaration is offered only to explain complex and technical aspects of the incidental take exceedence levels and the DSRAM.

Paragraphs 11 through 15 of the Sommer Declaration concern the implementation measures taken under the DSRAM after the BiOp issued. There is no basis in the law for the admission of this post-record evidence. DWR does not assert otherwise. Plaintiffs' motion to strike is **GRANTED** as to paragraphs 11 through 15.

The information contained in the remainder of the Sommers declaration is drawn directly from the BiOp itself, explaining in plain language how the incidental take limits were set and how DSRAM operates. Although, much of the same information can be found in the BiOp, the subject matters covered are technical and complex and Dr. Sommer's declaration clarifies or explains them. This exception saves the remaining paragraphs of the Sommers declaration to explain the incidental take limits.

The motion to strike is **DENIED IN PART** as to the past record evidence paragraphs only.[FN15]

B. *Federal Defendants' Renewed Objections to Previously Admitted Extra-Record Documents.*

The May 13, 2006 memorandum decision admitted certain extra-record documents, for limited purposes (Doc. 219), including Document 10 (a Powerpoint presentation by Michael Dettinger given to the Bay-Delta Authority on December 8, 2004 entitled " Uncertainties & CALFED Planning What Are Current Observations and Models Saying?") for two purposes. First, " for the limited purpose[ ] of determining whether [ ]FWS failed to adequately consider the climate change issue and the scientific significance of any such failure....;" but not legal opinions. (Doc. 219 at 25.) Second, to the extent appropriate, all twenty two extra record documents presented by Plaintiffs, including Document 10, may be referenced to aid the court's understanding of various technical concepts under the " technical terms and complex subject matter exception." (*Id.* at 32.)

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***16** In the footnote to their opposition brief, Federal Defendants renew their objection to consideration of any of the documents under the technical terms and complex subject matter exception. (Doc. 242-1 at 22 n. 12.) The May 13, 2006 memorandum decision notes: " Defendants and Defendant Intervenors suggest that Plaintiff has failed to establish that the existing record is inadequate to explain the technical terms, but point to no authority requiring such a showing." (Doc. 219 at 30.) Federal Defendants now assert: " numerous courts, including the Supreme Court and district courts in this Ninth Circuit, have held that a record may not be supplemented for explanatory purposes unless the existing record has been demonstrated inadequate." (Doc. 242-1 at 22 n. 12.), citing an unpublished district court decision, City of *Santa Clarita v. United Stats Dept. Of Interior*, 2005 WL 2972987 at *2 n. 3 (C.D.Cal.2005):
... Plaintiffs bear the burden of making an initial showing that the administrative record is inadequate for effective judicial review and that one of the exceptions to record review applies. Animal Defense Council v. Hodel, 840 F.2d at 1436-38 (affirming district court order limiting review to administrative record and prohibiting discovery because plaintiffs did not show record presented was insufficient for review or that any of the exceptions to record review were applicable)....

(emphasis added).

A district court decision not cited by Defendants, *Karuk Tribe of Cal. v. U.S. Forest Serv.*, 379 F.Supp.2d 1071, 1087 (N.D.Cal.2005), reiterated this holding:
The Ninth Circuit allows a reviewing court to consider extra-record materials in an APA case only under four narrow exceptions: (1) when it needs to determine whether the agency has considered all relevant factors and has explained its decision; (2) when the agency has relied upon documents or materials not included in the record; (3) when it is necessary to explain technical terms or complex matters; and (4) when a plaintiff makes a showing of agency bad faith. *Southwest Center for Biological Diversity v. United States Forest Service*, 100 F.3d 1443, 1450 (9th Cir.1996).*For extra-record material to be considered, a plaintiff must first make a showing that the record is inadequate. Animal Defense Council v. Hodel*, 840 F.2d 1432, 1437 (9th Cir.1988) (" The [plaintiff] makes no showing that the district court needed to go outside the administrative record to determine whether the [agency] ignored information"). At the *1088 same time, " [a] satisfactory explanation of agency action is essential for adequate judicial review, because the focus of judicial review is not on the wisdom of the agency's decision, but on whether the process employed by the agency to reach its decision took into consideration all the relevant facts." *Asarco, Inc. v. U.S. Environmental Protection Agency*, 616 F.2d 1153, 1160 (9th Cir.1980).

(emphasis added).[FN16] *Karuk Tribe*, and *Animal Defense Council v. Hodel*, 840 F.2d 1432, 1437 (9th Cir.1988), on which it relies, do stand for the proposition that, before admitting documents under any exception to the general rule against extra-record evidence, a court should require that a plaintiff make an initial showing that the existing record is insufficient. Here, defendants maintain that those documents plaintiffs have referenced to explain complex or technical matters, are " the cart before the horse," because Plaintiffs have not shown the existing record is inadequate.

***17** First, Federal Defendants objection is arguably untimely. They did not cite cases requiring a preliminary showing of insufficiency when the motion to augment was briefed and heard. Nor did Federal Defendants timely move for reconsideration of the May 13, 2006 ruling on the motion to augment. Striking the challenged documents now, would cause prejudice to Plaintiffs, who relied upon these rulings to prepare their dispositive motions.

Even assuming a timely and specific objection, on the merits, Plaintiffs' extra-record documents were properly admitted. Of these twenty-two documents, Plaintiffs' papers only referenced eight: Docs. 9, 10, 11, 12, 13, 20, 21 & 22. With the exception of Documents 12 and 22, all were admitted on multiple grounds. (Documents 12 and 22 were admitted for the limited purpose of explaining technical materials.) The documents and the bases for their admission are as follows:

Document 9:	Summary of Annual Joint Meeting of California Bay-Delta Authority and Bay-

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	Delta Public Advisory Committee (December 8-9, 2004).	
		Admitted " for the limited purpose of determining whether USFWS failed to adequately consider the EWA/CVPIA(b)(2) issue," " for the limited purposes of determining whether USFWS failed to adequately consider the climate change issue and the scientific significance of any such failure ...," and, as appropriate, to explain complex and technical matters.
Document 10:	Climate Change Uncertainties & CALFED Planning: What Are Current	

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	Observations and Models Saying? Powerpoint presentation by Michael Dettinger, U.S. Geological Survey at the Scripps Institute for Oceanography, et al. to Bay-Delta Authority (December 8, 2004).	
	Admitted " for the limited purposes of determining whether USFWS failed to adequately consider the climate change issue and the scientific significance of any such failure," and as appropriate, to explain complex and technical matters.	
Document 11:	Summary of Annual Joint Meeting of California Bay-Delta Authority	

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	and Bay-Delta Public Advisory Committee (February 9-10, 2005).	
		Admitted for the limited purpose of showing that USFWS failed to consider relevant Delta smelt population data and its scientific significance," and, as appropriate, to explain complex and technical matters.
Document 12:	Letter from H. Candee and K. Poole, NRDC, to S. Thompson re Consultation on OCAP: Significant New Delta Smelt Information, Service (Feb. 14, 2005).	
		Admitted only to explain, as

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	appropriate, complex and technical matters.
Document 13:	Delta smelt abundance trends, Powerpoint presentation by Chuck Armor, DFG, to Bay-Delta Authority Admitted for the limited purpose of showing that USFWS failed to consider relevant Delta smelt population data and its scientific significance," and, as appropriate, to explain complex and technical matters.
Document 20:	Supplemental Biological Opinion on CVP and SWP Operations, April 1, 2004 through March 31, 2006 (Feb. 27, 2004). Admitted "

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	for the limited purpose of determining whether USFWS failed to adequately consider the EWA/CVPIA(b)(2) issue," and, as appropriate, to explain complex and technical matters.
Document 21:	Future Water Availability in the West: Will there be enough? Powerpoint presentation by M. Dettinger to 24th Annual Conference on Water, Climate and Uncertainty: Implications for Western Water Law, Policy, and Management (June 11-13, 2003).
	Admitted " for the limited purposes of determining whether USFWS

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	failed to adequately consider the climate change issue and the scientific significance of any such failure ...," and, as appropriate, to explain complex and technical matters.
Document 22:	Letter from John W. Keys, Bureau, to Hon. George Miller, House of Representatives re Bureau's renewal of CVP water contracts (Dec. 23, 2004).
	Admitted only to explain, as appropriate, complex and technical matters.

***18** With the exception of Documents 12 and 22, Plaintiffs were permitted to reference these documents to show whether FWS adequately considered included subject matter to support the BiOp. Although Plaintiffs did not expressly demonstrate that the record was insufficient, a finding of insufficiency can be implied from the rulings admitting the documents. For example, Document 10, the powerpoint presentation regarding " Climate Change Uncertainties & CALFED Planning" presented to the Bay-Delta Authority on December 8, 2004, references climatological information and issues not otherwise discussed in the administrative record, bearing on whether FWS failed to adequately consider the climate change issue. The same reasoning applies to Documents 9, 10, 11, 13, 20 & 21. As for Documents 12 and 22, were which were only admitted under the complex and technical matters exception, no prior

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showing of insufficiency was made. However, Documents 12 and 22 were only referenced as secondary citations or for context. Even if, any document was admitted in error, no prejudice has resulted.

Summary judgment is appropriate where there are no genuine issues of material fact and the moving party is entitled to judgment as a matter of law. Fed. R. Civ. Pro. 56(c). This is a challenge to the lawfulness of a biological opinion brought under the ESA and the Administrative Procedure Act (" APA"). Agency decisions made under the ESA are governed by the APA, which requires that the agency action be upheld unless it is found to be " arbitrary, capricious, an abuse of discretion, or otherwise not in accordance with law," or " without observance of procedure required by law." 5 U.S.C. § 706(2)(A), (D). The inquiry is designed to " ensure that the agency considered all of the relevant factors and that its decision contained no clear error of judgment." *Pacific Coast Fed'n of Fishermen's Ass'ns v. NMFS*, 265 F.3d 1028, 1034 (9th Cir.2001). Agency action should only be overturned if the agency has " relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Id.* In sum, a court must ask " whether the agency considered the relevant factors and articulated a rational connection between the facts found and the choice made." *Id.*" A biological opinion is arbitrary and capricious and will be set aside when it has failed to articulate a satisfactory explanation for its conclusions or when it has entirely failed to consider an important aspect of the problem." *Greenpeace v. NMFS*, 80 F.Supp.2d 1137, 1147 (W.D.Wash.2000). Alternatively, a biological opinion may also be invalid if it fails to use the best available scientific information as required by 16 U.S.C. § 1536(a)(2).*Id.* at 1150.

***19** As a general rule, a court must defer to the agency on matters within its expertise. *See National Wildlife Federation v. National Marine Fisheries Service*, 422 F.3d 782, 798 (9th Cir.2005). However, " [t]he deference accorded an agency's scientific or technical expertise is not unlimited." *Id.*" Deference is not owed when the agency has completely failed to address some factor consideration of which was essential to [making an] informed decision." *Id.* (internal citations and quotations omitted).

A final BiOp is final agency action for judicial review purposes. *American Rivers, infra*, 126 F.3d at 1124-25.

Plaintiffs move for summary judgment on the following grounds:

(1) First, the BiOp did not utilize the Best Available Science by: (a) failing to reference the " most recent Delta Smelt abundance data," namely the 2004 Fall Midwater Trawl Data; and (b) failing to consider the possible effects that climate change might have on the smelt's habitat.

(2) Second, the BiOp unlawfully relies upon the DSRAM as a mitigation measure because the DSRAM process is " entirely discretionary, uncertain, and unenforceable." In addition, Plaintiffs allege that Federal Defendants acted arbitrarily and capriciously by relying upon the EWA, CVPIA(b)(2), and/or VAMP programs as water sources necessary to implement the DSRAM. Plaintiffs allege that Federal Defendants have (a) failed to demonstrate that EWA, CVPIA and/or VAMP will continue to be available over the 20-year term of the BiOp and (b) failed to demonstrate that DSRAM can reliably operate without water assets from those programs.

(3) Third, there is no rational connection between the evidence in the record and the BiOp's " no jeopardy" conclusion. Specifically, Plaintiffs allege (a) that the BiOp's focus on salvage as the measure of harm to the species underestimates project impacts and results in a meaningless take limit; and (b) that the BiOp fails to explain how its no jeopardy conclusion can be justified in light of the identified adverse effects of the project, along with indirect and cumulative effects.

(4) Fourth, the BiOp failed to adequately analyze whether the OCAP's impacts on the Delta smelt's critical habitat are consistent with the smelt's recovery. In addition, the Federal Defendants failed to adequately take into account smelt habitat areas other than defined by X2.

(5) Finally, the BiOp is unlawfully narrow in its scope because it (a) fails to provide a comprehensive analysis of the effects of constructing facilities required to carry out long term CVP and SWP operations and (b) fails to analyze the impacts of the projects delivering the full amount of water authorized under CVP and SWP water service contracts.

A. *Threshold Issues.*

1. ESA 60-day notice requirement.

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The San Luis Parties argue that Plaintiffs have not complied with the ESA's citizen suit notice requirement, 16 U.S.C. § 1540(g)(2) (A)(I), that written notice be given to " the Secretary, and to any alleged violator" at least sixty days in advance of filing suit. Failure to give this notice is a bar to bringing suit under the ESA. *Southwest Ctr. for Biological Diversity v. U.S. Bureau of Reclamation*, 143 F.3d 515, 520 (9th Cir.1998).

***20** In *American Rivers v. National Marine Fisheries Serv.*, 126 F.3d 1118, 1124-25 (9th Cir.1997), the Ninth Circuit held that issuance of a biological opinion is a final agency action that is properly pled as a challenge under the APA, rather than as a citizen suit claim under the ESA. Failure to comply with the 60-day notice requirement does not deprive the court of jurisdiction. *Id.*

The San Luis Parties advocate an approach that ignores *American Rivers,*[FN17] taken in an unpublished district court opinion, *Pacific Coast Fed' of Fishermen's Ass'ns v. U.S. Bureau of Reclamation*, 2006 WL 1469390 at 27 n. 8 (N.D.Cal.2006).*Pacific Coast Federation* declined to apply *American Rivers'* general rule because the injunctive relief the Plaintiffs sought went beyond simply having the biological opinion invalidated. The *Pacific Coast Federation* Plaintiffs sought to have any new biological opinion first reviewed by the court. This requested *relief,* fell outside the scope of the APA but was " within the scope of the ESA and thus trigger[ed] the notice period requirement." *Id.* Here, the requested relief is invalidation of the BiOp, a remedy undeniably available under the APA. *American Rivers* controls. There was no need to comply with the ESA 60-day notice requirement. The district court has jurisdiction over APA review of the BiOp.

2. Jurisdiction to Review Challenges to Early Consultation and Preliminary Biological Opinion.

Defendants contend the case is not ripe for decision. The BiOp covers not only current operations, but also a variety of future actions, some subject to formal consultation, others to early consultation:

This biological opinion covers formal and early consultation for the operations of the CVP and SWP. The formal consultation effects described in this biological opinion cover the proposed 2020 operations of the CVP including the Trinity River Mainstem ROD (Trinity ROD) flows on the Trinity River, the increased water demands on the American River, the delivery of CVP water to the proposed Freeport Regional Water Project (FRWP), water transfers, the long term Environmental Water Account (EWA), the operation of the Tracy Fish Facility, and the operation of the SWP-CVP intertie. The effects of operations of the SWP are also included in this opinion and include the operations of the North Bay Aqueduct, the Suisun Marsh Salinity Control Gates, the Skinner Fish Facility and water transfers.

Early consultation [issues address] the effects of operations of components of the South Delta Improvement Program (SDIP). These operations include pumping of 8500 cubic feet per second (cfs) at the SWP and Banks Pumping Plant (hereafter referred to as 8500 Banks), permanent barrier operations in the South Delta, the long term EWA, water transfers, and CVP and SWP operational integration. There are two separate effects sections in this biological opinion, one for Formal Consultation and one for Early Consultation. In addition, there is an incidental take for formal consultation and a preliminary incidental take for early consultation.

***21** (AR 2, 248.)

The San Luis Parties object that the early consultation portions of the BiOp are not final agency action and any challenges to the early consultation process are not subject to judicial review. Early consultation, by definition, results in only a " preliminary opinion" and in a preliminary incidental take statement that " does not constitute authority to take listed species." 50 C.F.R. § 402.11(e). Upon request for " confirmation" of a preliminary biological opinion, FWS will review the proposed action to determine if there have been " significant changes in the action as planned or in the information used during early consultation." § 402.11(f). Within 45 days of such request, FWS must either confirm the preliminary biological opinion or request formal consultation. *Id.*

Plaintiffs concede that they " are not challenging the validity of FWS's early consultation or its preliminary biological opinion regarding certain segregated components of the 2004 OCAP." (Doc. 306 at 37.) Rather, Plaintiffs argue that the portion of the BiOp covering formal consultation is flawed because it fails to examine the full impacts of all aspects of the 2004 OCAP. (Doc. 306 at 37.) Plaintiffs maintain the formal consultation should have covered certain planned actions included in the early consultation that are interdependent with other planned actions not included in either consultation. This claim is cognizable, as it challenges the scope of the formal consultation and the completeness of evaluation of overall OCAP operations on jeopardy to the smelt, not the lawfulness of the early consultation on

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future actions.

B. *The Biological Opinion Unlawfully Relies Upon Uncertain, Unenforceable Mitigation Measures.*

The BiOp concludes that the " operations of the Projects under formal consultation ... will result in adverse effects to the delta smelt through entrainment at the CVP and SWP facilities and by drawing delta smelt into poorer quality habitat in the south delta. However with the inclusion of the *conservation measures* described above *and the implementation of the DSRAM,* these adverse effects would be avoided or minimized." (AR 467 (emphasis added).) The " conservation measures" mentioned in the BiOp's conclusion are various regulatory mechanisms already in place to " provide protection to delta smelt and/or their habitats," including D-1641, the EWA, CVPIA (b)(2) water, and VAMP. (AR 421-22, 466-67.)

1. Law Governing Mitigation Measures.

Mitigation measures must be " reasonably specific, certain to occur, and capable of implementation; they must be subject to deadlines or otherwise-enforceable obligations; and most important, they must address the threats to the species in a way that satisfies the jeopardy and adverse modification standards." *Ctr. for Biological Diversity v. Rumsfeld,* 198 F.Supp.2d 1139, 1152 (D.Ariz.2002) (citing *Sierra Club v. Marsh,* 816 F.2d 1376 (9th Cir.1987)); *see also NWF v. NMFS,* 481 F.3d 1224 at *12 & n. 16 (" Although the record does reflect a general desire to install structural improvements [to benefit fish] where feasible, it does not show a clear, definite commitment of resources for future improvements.").

***22** Plaintiffs allege that, in depending on the DSRAM and the other " conservation measures" to support its no jeopardy conclusion, the BiOp unlawfully relies upon uncertain, unenforceable mitigation measures which do not constitute a clear, definite commitment of resources. Specifically, Plaintiffs argue: (a) the DSRAM process is " entirely discretionary, uncertain, and unenforceable and (b) the biological opinion unjustifiably assumes that the other, currently operational " conservation measures" (e.g., the EWA and CVPIA(b) (2) water) will continue to be available for use by DSRAM in the future.

2. The DSRAM is Unlawfully Uncertain and Unenforceable.

All Defendants argue that the DSRAM is an effective adaptive management program that provides the agency the necessary remedial flexibility that makes the BiOp lawful. The BiOp describes the DSRAM as follows:

The delta smelt risk assessment matrix (DSRAM) consists of month by month criteria which, when exceeded will trigger a meeting of the Delta Smelt Working Group (Working Group). The purpose of the DSRAM is to take actions to protect delta smelt in a proactive manner prior to salvage events....The DSRAM is an adaptive management tool which may be further modified by the Working Group/WOMT as new information becomes available, without undergoing formal reconsultation....Data will be updated at least weekly to determine the need for a meeting.

Should a triggering criterion be met or exceeded, Reclamation and/or DWR will inform the members of the Working Group and the Working Group will determine the need to meet. Any member of the Working Group may set up a meeting of the Working Group at any time. A meeting of the Working Group may consist of an in-person meeting, a conference call, or a discussion by email. If needed, the Working Group will meet prior to the weekly meetings of the DAT and the WOMT and information will be shared with these groups.

Should a meeting of the Working Group prove necessary, the group will decide whether to recommend a change in exports, change in south delta barrier operations, San Joaquin River flows, or a change in delta cross channel operations, and the extent and duration of the potential action. These *potential actions* are listed in the DSRAM by the months wherein each of these tools generally become available. *The group will recommend actions which will be shared with the DAT and forwarded to the WOMT for discussion and potential implementation.*This recommendation will include a discussion of the level of concern for delta smelt and will include who participated in the working group discussions. All dissenting opinions and/or discussion points will also be forwarded to the WOMT. The Working Group will meet at least weekly throughout the period in which the triggering criteria are met or exceeded, to determine the need to provide further recommendations to the WOMT.

Notes and findings of Working Group meeting will be submitted to the Service and members of the WOMT for their records. *The WOMT will respond to the Working Group's recommendations and the actions taken by the WOMT will be summarized by Reclamation and/or DWR annually and submitted to all WOMT agencies.*

***23** *If an action is taken, the Working Group will follow up on the action to attempt to ascertain its effectiveness.*An assessment of effectiveness will be attached to the notes from the Working Group's discussion concerning the action.

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(AR 344-45 (emphasis added).)

The trigger criteria, which vary slightly from month to month, are set forth in a table (or matrix) at page 100 of the BiOp. (AR 346.) The criteria include: (1) the previous year's fall midwater trawl recovery index; (2) the risk of smelt entrainment based upon the location of X2; (3) the estimated duration of the smelt spawning period based upon water temperature; (4) the presence of spawning female smelt; (5) the proximity of the smelt to the Project pumping facilities; and, (6) a salvage trigger for adult smelt (calculated as the ratio of adult smelt salvage to the FMWT index) and juvenile smelt (set at zero for May and June, the months of the year during which salvage of smelt is highest). (AR 346-49.)

Plaintiffs argue that the DSRAM is not " reasonably specific, certain to occur, and capable of implementation" because: (1) the DSWG has complete discretion over whether to meet and whether to recommend mitigation measures; (2) even if the DSWG meets and recommends mitigation measures, the WOMT group is free to reject any recommendations; (3) there are no standards to measure the effectiveness of actions taken; (4) reconsultation is not required should mitigation measures prove ineffective; and (5) ultimately, no action is ever required.

DWR responds that implementation of the DSRAM *process* is " mandatory." For example, the incidental take statement requires that the projects shall be implemented " as described" in the BiOp. (AR 475.) Because the BiOp " describes" operation of the DSRAM, DWR asserts that its implementation is made mandatory by the incidental take statement's command that the project shall be implemented " as described;" if a DSRAM triggering criteria is met, the DSWG " *will* determine the need to meet." (AR 344 (emphasis added).) If circumstances warrant action, the DSWG will recommend fish protection actions and forward those recommendations to the WOMT. (*Id.*) The BiOp provides that the DSWG " *will* meet at least weekly throughout the period in which the triggering criteria are met or exceeded, to determine the need to provide further recommendations to the WOMT." (*Id.* at 345 (emphasis added).) The WOMT must then " respond" to DSWG's recommendations. (*Id.*) If actions are taken, the DSWG will monitor the action to determine its effectiveness. (*Id.*)

DWR correctly asserts that the DSRAM *process* must be followed; this does not address Plaintiffs' argument: that the DSRAM process itself does not *require* any mitigation *actions* be taken. Nothing in DSRAM requires the DSWG to make action recommendations, whatever the circumstances, and no criteria prescribe when the WOMT must act to effect DSWG's recommendations.

***24** DWR responds that as adaptive management, " DSRAM is intentionally flexible, taking into consideration the uncertainties surrounding delta smelt population abundance and dynamics ... [D]elta smelt abundance has fluctuated widely, without a clear explanation why. While experts can monitor trends in delta smelt populations, estimating overall population abundance presently is ' not possible,' nor are the sources of year-to-year variability in abundance well understood." (Doc. 246-1 at 12.) DWR suggests that " hard-wiring" the DSRAM to require specific actions be taken when triggering criteria occur would impair the DSRAM's flexibility. For example, the trigger for salvage of juvenile smelt is set at zero. This trigger was designed not to precipitate a meeting every time that standard is exceeded, but to cause heightened awareness of conditions that might require protective action. (Doc. 246-1, at 12, citing AR at 8217-18.)

The conflict between Defendants' choice of a flexible management approach and Plaintiffs' concern to ensure enforceable protective actions are taken when necessary, highlights the extent to which overly flexible adaptive management may be incompatible with the requirements of the ESA. Commentators recognize that adaptive management schemes do not fit neatly within the ESA's existing regulatory structure. *See J.B. Ruhl,*Taking Adaptive Management Seriously: A Case Study of the Endangered Species Act, 52 U. Kan. L.Rev. 1249, 1284 (2004) (" The [ESA] as a whole lacks a cohesive adaptive management architecture...."). H. Doremus, *Adaptive Management, The Endangered Species Act, and the Institutional Challenges of " New Age" Environmental Protection,* 41 Washburn. L.J. 50, 52 (2000) (" Adaptive Management ... runs counter to human nature and the current structure of our management institutions."); (" One key institutional challenge is to combine the flexibility required by adaptive management with the long-term certainty we often seek through our legal and political institutions.") 41 Washburn L.J. at 55.

The case law sheds little light on how to harmonize these competing objectives. The parties cite no cases applying the " reasonably specific, certain to occur, and capable of implementation" concept (or any closely related doctrine) to mitigation measures employed under an adaptive management protocol. Most cases the parties cite are either wholly inapplicable or factually distinguishable.

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For example, mitigation measures have been found unlawfully uncertain because their implementation was not within the control of the relevant federal agencies. *National Wildlife Federation v. NMFS*, 254 F.Supp.2d 1196, 1213 (D.Or.2003), invalidated a 2000 biological opinion addressing the effects of the operation of the Federal Columbia River Power System (" FCRPS") on several listed fish species. A 2000 biological opinion concluded that continued operation of the FCRPS would jeopardize several of the species and adversely modify their critical habitat and adapted mitigation measures to avoid jeopardy. The mitigation measures included a variety of short- and long-term state, regional, tribal, and private off-site mitigation actions. The plaintiffs argued that reliance on such " uncertain and vaguely defined actions of third parties to protect and restore salmon habitat," violated the " reasonably certain to occur" standard. *Id.* at 1209.The district court agreed, concluding that the no jeopardy determination unlawfully relied on " non-federal off-site mitigation actions that are not reasonably certain to occur." *Id.* at 1214.*See also Sierra Club v. Marsh*, 816 F.2d 1376, 1385 (9th Cir.1987) (invalidating biological opinion that relied on mitigation measure involving the transfer of 188 acres of marshland from private ownership to a publicly owned wildlife refuge; land remained under private control and subject to easements that rendered the land valueless for mitigation purposes, and private owners and local government indicated intent to increase use of one of the easements); *Oregon Natural Desert Ass'n v. Lohn*, 485 F.Supp.2d 1190, 2007 WL 1170629 (D.Or.2007) (setting aside biological opinion in part because it overly relied on the actions of private individuals who had a poor past record of compliance with standards); *Florida Key Deer v. Brown*, 364 F.Supp.2d 1345, 1355-56 (S.D.Fla.2005) (setting aside biological opinion that relied on mitigation measures to be implemented by private landowners; nothing compelled the landowners to act and " the record indicate[d] that some landowners entirely disregarded [prior mitigation measures]").

***25** Here, the BiOp's mitigation measures *are* largely under the control of the action agency (the Bureau), which, operating in concert with the DWR, directly regulates water pumping and releases from upstream reservoirs.*Natural Resources Defense Council v. Rodgers*, 381 F.Supp.2d 1212, 1241 (E.D.Cal.2004), does not provide guidance. In that case, plaintiffs contended a BiOp's mitigation measures were not reasonably certain to occur because the action agency had a poor track record of following through on prior commitments. The acknowledging that the agency's track record was " discouraging" district court recognized that the agency had made some progress toward implementing its prior commitments, *id.*, and declined to find that the new commitments were not certain to occur. *Id.* However, the *Rogers* plaintiffs did not attack the efficacy of the mitigation measures themselves, only the likelihood that the agency would not satisfy its commitment to implement them. Here, Plaintiffs challenge the inherent uncertainty and unenforceability of the DSRAM and the other conservation measures.

Plaintiffs cite *American Rivers v. U.S. Army Corps of Engineers*, 271 F.Supp.2d 230, 252 (D.D.C.2003), where, despite the fact that a prior biological opinion required the Corps to implement flow restrictions to mitigate impacts to listed species, the Corps " made it perfectly clear" to the district court " that it ha[d] no intention of ensuring that its future operations will be consistent" with the mitigation requirements. *Id.* at 253.A motion for preliminary injunction was granted: " Plaintiffs will be likely to prove that the 2003 Supplemental BiOp violated the ESA and APA by improperly and unreasonably relying on future actions by the Corps that are *virtually certain not to occur." Id.* at 254 (emphasis added). Here, in contrast, there is no such " smoking gun" evidence of the agency's intent to disregard its mitigation responsibilities, just no definite, certain, or enforceable measures.

Center for Biological Diversity v. Rumsfeld, 198 F.Supp.2d 1139, 1151-53 (D.Ariz.2002) addressed a biological opinion that concluded the Army's continued operations at Fort Huachuca, Arizona would not cause jeopardy to listed species that relied on flows from the Upper San Pedro River, even though rapid development in the area and uncontrolled groundwater pumping at the Fort posed threats to the species. The " no jeopardy" finding was premised on several required mitigation measures.

First, the Army had to develop and implement an on-base plan to protect and maintain populations of listed species and habitats; *id.* at 1148, even though the on-base plan was not designed to address the underlying problem of diminishing flows in the San Pedro River, *see id.* at 1153.Second, the Army had to develop a regional water resources plan, sufficient to maintain flows in the San Pedro River to sustain the protected species and their habitats. *Id.* at 1148.The biological opinion acknowledged, that the Army had no authority over the implementation of the regional plan and was only required to participate along with other stakeholders. *Id.* at 1153.Third, the Army had to monitor progress and

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report on the implementation of the various projects.*Id.* at 1149.Fourth, the biological opinion assumed the operation of a water recharge facility designed to temporarily delay the impact of groundwater overdraft, which the *Rumsfeld* court acknowledged was " subject to substantial uncertainty." *Id.* at 1145.

***26** Leaving it to the Army and other interested parties to develop a regional water management plan " enables the Army to sidestep any direct responsibility for addressing deficit groundwater pumping," and was " an admission that what is currently on the table as far as mitigation measures is inadequate to support the [ ] ' no jeopardy' decision." 198 F.Supp.2d at 1153-54.[FN18]

DWR distinguishes *Rumsfeld,* claiming it is like *NWF v. NMFS,* 254 F.Supp.2d 1196, where mitigation measures were unlawful because they depended upon third parties without any guarantee that those parties would implement the measures. Here, the DSRAM does not depend on actions by outsiders. *Rumsfeld* further found that the Army's on-base mitigation measures were insufficient because they did not require any measurable goals or an implementation schedule:
*There are no requirements in the Final BO to reduce reliance on groundwater pumping by any particular amount or to achieve any measurable goals with respect to water recharge. There is no date certain implementation requirement.*The MOA includes a laundry list of possible mitigation measures related to water conservation and recharge that the Army may implement, but it does not establish which projects have to be undertaken, when, nor what the conservation objectives are for the respective projects. Without such specificity, the mitigation measures in the Final BO are merely suggestions.

Id. at 1153 (emphasis added).*Rumsfeld* stands for the proposition that, at a minimum, a mitigation strategy must have some form of measurable goals, action measures, and a certain implementation schedule; i.e., that mitigation measures must incorporate *some* definite and certain requirements that ensure needed mitigation measures will be implemented.

Here, the agency's BiOp admits that mitigation measures are essential. The no jeopardy finding is conditioned on conservation measures *and the DSRAM.*(*See* AR 422.)

DWR's protestations that hard-wiring the DSRAM would cripple its effectiveness ignore the ESA's requirements of reasonable certainty, timetables, and enforceability standards for mitigation measures. The existing DSRAM process provides *absolutely no* certainty that any needed smelt protection *actions* will be taken at any time by DSWG or WOMT. The DSRAM is in substance an organizational flow chart that prescribes that certain administrative processes (meetings) will be held whenever a trigger criteria is met or exceeded. Although mitigation measures are identified, no defined mitigation goals are required, nor is any time for implementation prescribed. Incorporating *some* ascertainable mitigation standards and enforceable mitigation measures is not inconsistent with avoiding unduly restrictive " hard-wiring" of the DSRAM.

National Wildlife Federation v. Babbit, 128 F.Supp.2d 1274 (E.D.Cal.2000)(*" NWF v. Babbit"*), addresses an adaptive management approach that accommodated uncertainty by allowing regulators to apply new information gathered through monitoring to *adjust and employ well-defined* mitigation measures. There, a Habitat Conservation Plan (" HCP") called for a development fee to be collected on all acreage developed in the Natomas Basin, north of Sacramento, home to a number of endangered species. The HCP also incorporated adaptive management provisions designed to allow the mitigation fee to be modified if new information justified an adjustment:
***27** The [HCP] recognizes that the current state of knowledge as to the conservation needs of protected species is imperfect, and that its assumptions as to the amount, location, and pace of development in the Basin and as to the adequacy of the mitigation fee to accommodate increased expenses may prove inaccurate. The Plan addresses these uncertainties through its " adaptive management" provisions, which permit the Plan's conservation strategy to be adjusted based on new information. The HCP's conservation program can be modified under the adaptive management provisions if: (1) new information results from ongoing research on the GGS or other covered species; (2) recovery strategies under Fish and Wildlife Service recovery plans for the GGS or the Swainson's hawk differ from the measures contemplated by the HCP; (3) certain of the HCP's mitigation measures are shown through monitoring to require modification; or (4) the HCP's required minimum block sizes for reserve lands are shown to require revision. The Plan anticipates that the NBC will make discretionary decisions in future years based upon new information. The NBC will decide, for example, which lands to purchase, depending on a variety of future considerations difficult now to predict, and whether to change the mix of in and out of Basin reserve lands and agricultural as opposed to marsh reserve lands.

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Id. at 1281-82.[FN19]

Here, the adaptive management process has no quantified objectives or required mitigation measures. Although the *process* must be implemented by holding meetings and making recommendations, nothing requires that any *actions* ever be taken.[FN20]The BiOp asks the court to trust the agency to protect the species and its habitat. Notwithstanding any required deference to expertise, the ESA requires more.

All parties agree that adaptive management can be beneficial and that flexibility is a necessary incident of adaptive management. The law requires that a balance be struck between the dual needs of flexibility and certainty. The DSRAM, as currently structured, does not provide the required reasonable certainty to assure appropriate and necessary mitigation measures will be implemented. The DSRAM does not provide reasonable assurance admitted adverse impacts of the 2004 OCAP will be mitigated. This aspect of the BiOp is arbitrary and capricious and contrary to law. Plaintiffs' motion for summary adjudication as to this claim is **GRANTED.**The agency has not provided a reasonable explanation showing the DSRAM will satisfy ESA requirements to assure survival and recovery of the Delta smelt.

The Ninth Circuit's *recent NWF v. NMFS* decision suggests that mitigation measures that are not reasonably certain to occur should be excluded from the agency's no jeopardy analysis. *See*481 F.3d 1224 at *12 n. 16.[FN21]Because mitigation is insufficiently certain to occur under the DSRAM, the DSRAM cannot cure other shortcomings of the BiOp.

3. Plaintiffs' Alternative Argument that the BiOp is Arbitrary and Capricious Because DSRAM Depends Upon EWA, VAMP, CVPIA(b)(2) Water, Programs that are Uncertain in Terms of Funding and Effectiveness.

***28** Plaintiffs maintain that the DSRAM cannot feasibly be implemented without adequate water assets from the EWA, CVPIA(b)(2), and VAMP programs. Plaintiffs allege that Defendants have not demonstrated that adequate assets from these programs will be available during the 20 year term of the BiOp. (*See* Doc. 306 at 17.)

Plaintiffs correctly observe that the BiOp does not assure that adequate water assets from these programs will be available for future use under DSRAM. The BiOp itself acknowledges that " [a]lthough VAMP and [EWA] have helped to ameliorate these threats, it is unclear how effective these will continue to be over time based on available funding and future demands for water." (AR 367-68.) The BiOp recognizes that the " EWA Agencies envision implementation of a long-term EWA as part of the operation of the Project." (AR 335.) However, the BiOp cannot and does not commit to implement the EWA in the long run. (*Id.*)

The record reveals that the loss of EWA assets will " reduce the ability of the EWA agencies to provide [ ] fish protections...." (SAR 20.) Plaintiffs refer to statements made by FWS's D. Harlow during an annual joint meeting of CALFED and the Bay-Delta Public Advisory Committee, that a proposal to change CVPIA(b)(2) policy would " change fish protection envisioned in the Record of Decision (ROD)." (Doc. 9 at 4.) At the same time, Mr. Harlow also noted that this would " not necessarily diminish fish protection." (*Id.*) However, he opined that such a change would " necessitate an increase in the size of the EWA." (*Id.*) National Oceanic and Atmospheric Administration (" NOAA") staff questioned FWS's reliance on the EWA in the BiOp, noting that EWA assets would likely be used up for protective actions during the winter, before the peak months for Delta smelt salvage (May and June). (AR 8574.)

Plaintiffs' claim rests in part on the assumption that the EWA, CVPIA(b)(2), and VAMP programs are the *only* mechanisms by which DSRAM may be implemented. The record does not support this assumption. Under the BiOp, the DSWG is tasked to make recommendations regarding fish protection actions by selecting from a list of " tools for change," which include: (1) " export reduction[s] at one or both facilities" ; (2) " change[s] in barrier operations" ; (3) " change[s] in San Joaquin River flows" ; and (4) " change[s] [in the] position of cross channel gates." (AR 346 and 348 n. 7.) No mention is made of the EWA, CVPIA(b)(2), or VAMP in the DSRAM or its description of the " tools for change." DWR rejoins that, regardless of whether these programs are fully funded and/or remain functional mechanisms to provide water to the Delta, " the burden....falls on the Projects, not the smelt." (Doc. 246 at 10.)

The EWA is simply a means by which the SWP and CVP can obtain water by purchasing it from willing sellers. (AR 373.) EWA water may be used either to protect fish or to compensate project water users for reduced exports at the project pumps. (*Id.*) If money is unavailable to fund the EWA, Defendants are nonetheless required to prevent smelt take from exceeding permissible take limits.

***29** The BiOp sets forth a three-tier process to supply

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water to protect the smelt:
Tier 1 (Regulatory Baseline). Tier 1 is baseline water and consists of currently existing BOs, water right decisions and orders, CVPIA Section 3406(b)(2) water, and other regulatory actions affecting operations of the CVP and SWP. Also included in Tier 1 are other environmental statutory requirements such as Level 2 refuge water supplies.
Tier 2(EWA). Tier 2 is the EWA and provides fish protection actions supplemental to the baseline level of protection (Tier 1). Tier 2 consists of EWA assets, which combined with the benefits of CALFED's ERP, will allow water to be provided for fish actions when needed without reducing deliveries to water users. EWA assets will include purchased (fixed) assets, operational (variable) assets, and other water management tools and agreements to provide for specified level of fish protection. Fixed assets are those water supplies that are purchased by the EWA Agencies. These purchased quantities are approximations and subject to some variability. Operational assets are those water supplies made available through CVP and SWP operational flexibility. Some examples include the flexing of the export-to-inflow ratio standard required [ ] for meeting Delta water quality and flows, and ERP water resulting from upstream releases pumped at the SWP Banks Pumping Plant. Water management tools provide the ability to convey, store, and manage water that has been secured through other means. Examples include dedicated pumping capacity, borrowing, banking, and entering into exchange agreements with water contractors. Chapter 8 of this BA contains a more detailed description of EWA operations, as characterized in the CALSIM II modeling for the CVP OCAP.
Tier 3 (Additional Assets). In the event the EWA Agencies deem Tiers 1 and 2 levels of protection insufficient to protect at-risk fish species in accordance with the Act, Tier 3 would be initiated. Tier 3 sets in motion a process based upon the commitment and ability of the EWA Agencies to make additional water available, should it be needed. *This Tier may consist of additional purchased or operational assets, funding to secure additional assets if needed, or project water if funding or assets are unavailable.*It is unlikely that protection beyond those described in Tiers 1 and 2 will be needed to meet requirements of the Act.

(*Id.* at 336-37.)DWR emphasizes that, if all else fails, Tier 3 assets may be brought to bear, which include " additional purchased or operational assets, funding to secure additional assets if needed, or *project water* if funding or assets are unavailable." (*Id.* (emphasis added).)

There is a difference between the DSRAM's failure to require mitigation actions in response to trigger events, designed to assure the commitment of necessary resources to smelt protection, and the duty to have available or acquire those necessary resources. A court must leave to the agency the application of its expertise and authority to manage the complex hydrologic, legal, financial, physical, and logistical aspects of protecting the delta smelt. Plaintiffs motion for summary adjudication is **DENIED** as to the issue of the insufficiency of the EWA, VAMP, and CVPIA (b)(2) programs.

C. *Best Available Science.*

***30** The § 7 formal consultation process is designed to " insure" that any agency action " is not likely to jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined ... to be critical...." 16 U.S.C. § 1536(a)(2)." In fulfilling the requirements of this paragraph each agency shall use the best scientific and commercial data available." *Id.*

An agency has wide discretion to determine what is " the best scientific and commercial data available." *San Luis v. Badgley*, 136 F.Supp.2d 1136, 1151 (E.D.Cal.2000). Yet, an agency must make its decision about jeopardy based on the best science available at the time of the decision, and may not defer that jeopardy analysis by promising future studies to assess whether jeopardy is occurring. *Rumsfeld*, 198 F.Supp.2d at 1156. While uncertainty is not necessarily fatal to an agency decision, *e.g.*, *Greenpeace Action v. Franklin*, 14 F.3d 1324, 1337 (9th Cir.1992) (" *Greenpeace I*") (upholding agency decision even though there was uncertainty about the effectiveness of management measures because agency premised its decision on a reasonable evaluation of all available data), an agency may not entirely fail to develop appropriate projections where data " was available but [was] simply not analyzed," *Greenpeace v. NMFS*, 80 F.Supp.2d 1137, 1149-50 (W.D.Wash.2000) (" *Greenpeace II*") (where agency totally failed to develop any projections regarding population viability, it could not use as an excuse the fact that relevant data had not been analyzed). Here, EWS maintains the necessary data cannot be obtained.

1. Does a " Benefit of the Doubt to the Species" Presumption Apply?

The parties debate at length whether the best available scientific information principle includes a requirement that the agency " give the benefit of the doubt to the

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species." This language has its origins in the legislative history of the ESA, H.R. Conf. Rep. No. 96-697, 96th Cong., 1st Sess. 12, reprinted in 1979 U.S.C.C.A.N. 2572, 2576:

Section 7(b) of the act requires the fish and wildlife service and the national marine fisheries service to render biological opinions which advise whether or not proposed agency actions would violate section 7(a)(2). Courts have given substantial weight to these biological opinions as evidence of an agency's compliance with section 7(a). The amendment would not alter this state of the law or lessen in any way an agency's obligation under section 7(a)(2).

As currently written, however, the law could be interpreted to force the fish and wildlife service and the national marine fisheries service to issue negative biological opinions whenever the action agency cannot guarantee with certainty that the agency action will not jeopardize the continued existence of the listed species or adversely modify its critical habitat. The amendment will permit the wildlife agencies to frame their section 7(b) opinions on the best evidence that is available or can be developed during consultation. If the biological opinion is rendered on the basis of inadequate information then the federal agency has a continuing obligation to make a reasonable effort to develop that information.

***31** *This language continues to give the benefit of the doubt to the species,* and it would continue to place the burden on the action agency to demonstrate to the consulting agency that its action will not violate section 7(a)(2). Furthermore, the language will not absolve federal agencies from the responsibility of cooperating with the wildlife agencies in developing adequate information upon which to base a biological opinion. If a federal agency proceeds with the action in the face of inadequate knowledge or information, the agency does so with the risk that it has not satisfied the standard of section 7(a)(2) and that new information might reveal that the agency has not satisfied the standard of section 7(a)(2).

(emphasis added).

In *Conner v. Burford,* 848 F.2d 1441, 1454 (9th Cir.1988), the Ninth Circuit applied this " benefit of the doubt" language to hold that FWS violated the ESA by " failing to use the best information available to prepare comprehensive biological opinions considering all stages of the agency action...." At dispute in *Conner* was a biological opinion reviewing the proposed sale of oil and gas leases on National Forest land. The biological opinion analyzed the impact of the " initial lease phase," but failed to address the potential impact of post leasing activities, such as oil and gas development. FWS reasoned that there was " insufficient information available to render a comprehensive biological opinion beyond the initial lease phase," relying instead on " incremental-step consultation." *Id.* at 1452.The Ninth Circuit recognized that " the precise location and extent of future oil and gas activities were unknown at the time," but, " extensive information about the behavior and habitat of the species in the areas covered by the leases was available." *Id.* at 1453.With this information, " FWS could have determined whether post-leasing activities in particular areas were fundamentally incompatible with the continued existence of the species." *Id.* at 1454.

In light of the ESA requirement that the agencies use the best scientific and commercial data available to insure that protected species are not jeopardized, 16 U.S.C. § 1536(a)(2), the FWS cannot ignore available biological information or fail to develop projections of oil and gas activities which may indicate potential conflicts between development and the preservation of protected species. We hold that the FWS violated the ESA by failing to use the best information available to prepare comprehensive biological opinions considering all stages of the agency action, and thus failing to adequately assess whether the agency action was likely to jeopardize the continued existence of any threatened or endangered species, as required by section 7(a)(2).*To hold otherwise would eviscerate Congress' intent to " give the benefit of the doubt to the species."*

Id. (emphasis added).*Conner* does not directly support the broader interpretation urged by Plaintiffs, that the agency should err on the side of the species when evaluating uncertain evidence. *Conner* stands for the proposition that an agency cannot abdicate its responsibility to evaluate the impacts of an action on a species by labeling available information " uncertain," because doing so violates Congress' intent that the agencies " give the benefit of the doubt to the species."

***32** *Center for Biological Diversity v. Lohn,* 296 F.Supp.2d 1223, 1239 (W.D.Wash.2003) (rev'd on other grounds, 483 F.3d 984, 2007 WL 1217738 (9th Cir.)), applied the Conner holding in conformity with Plaintiffs' interpretation. *Lohn* addressed the listing under the ESA of a population of orca whales. Despite considerable record evidence suggesting the Orca whales should be considered a separate species, the Orca population had not yet been identified as a separate *taxon.*NMFS decided not to list the species based on the scientific uncertainty that existed in the field of taxonomy, relying on the fact that the new taxon had not yet been designated. The district court ruled this decision was arbitrary and capricious:

Given the considerable morphological, behavioral, and

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genetic evidence that the global Orcinus orca taxon is inaccurate and that residents and transients do not belong to the same taxon, the decision not to list the Southern Residents cannot be based upon a lack of consensus in the field of taxonomy regarding the precise, formal taxonomic redefinition of killer whales, particularly when that lack of agreement is compounded by the extreme difficulty in gathering evidence to achieve consensus. *The best available science standard gives " the benefit of the doubt to the species."* *Conner v. Burford*, 848 F.2d 1441, 1454 (9th Cir.1988) (observing one of the purposes of the best available science standard in review of whether agency action may result in destruction or adverse modification of listed species' habitat pursuant to 16 U.S.C. § 1536(a)(2)).*To deny listing of a species simply because one scientific field has not caught up with the knowledge in other fields does not give the benefit of the doubt to the species and fails to meet the best available science requirement.*

Id. at 1239 (emphasis added).[FN22]

In response, Defendant Intervenors cite *Oceana, Inc. v. Evans*, 384 F.Supp.2d 203 (D.D.C.2003), a challenge to NMFS's choice between two estimates of how much take a particular type of fishing gear would cause. The agency chose the lower estimate, reasoning that it was the " best estimate possible." The plaintiff argued that this estimate failed to give the " benefit of the doubt" to the species. *Id.* at 228.Although the lower estimate was uncertain, the district court reasoned that " the ESA does not require the agency to reject the ' best estimate possible' in favor of a more ' conservative' estimate that, according to the scientists, would be lacking in support." *Id.*

Lohn and *Oceana* appear irreconcilable, but, they can be harmonized.*Lohn* rejected an agency's decision to follow the taxonomy in the face of significant and compelling scientific evidence favoring a different conclusion. To side with the agency under such circumstances would " not give the benefit of the doubt to the species...." *Id.* at 1239.In contrast, *Oceana*, concerned an agency's choice of the " best estimate possible" over a more " conservative" estimate that lacked scientific support. The *Oceana* court refused to ignore the general rule that an agency must choose the best available science, simply because the ESA commands that the agency give the " benefit of the doubt" to the species. *Both* cases stand for the proposition that the agency must carefully examine the available scientific data and models and rationally choose the most reliable.

2. The BiOp's Failure to Address the 2004 Fall Midwater Trawl Data.

***33** Plaintiffs assert that " one of the most egregious errors in the [BiOp] is its failure to consider available fall 2004 Delta smelt abundance data, which evoked grave concern among agencies involved in smelt management." [FN23](Doc. 232 at 5.) On February 9, 2005, FWS and other CALFED members met to discuss Delta smelt abundance. Among other things, participants discussed data from the 2004 fall midwater trawl (" FMWT") survey, which revealed that " estimates of Delta smelt appear to be their lowest since 1964." (Doc. 11 at 5; AR 9199-9200, 9202; Doc. 12.) The February 16, 2005, BiOp, contained no mention of the 2004 FMWT data.

Plaintiffs assert that FWS acted arbitrarily, capriciously and unlawfully by " ignoring" the 2004 FMWT data and relying instead on the more favorable abundance data from earlier abundance surveys. (AR 366-67 (noting that the 2003 FMWT results were more favorable than those from 2002, while simultaneously acknowledging that the 2003 summer townet index (1.6) was " well below the pre-decline average of 20.4 in (1959).").) Despite the receipt of the new, even less favorable 2004 FMWT data, FWS made no substantive changes to its jeopardy analysis in the biological opinion and did not use or address the new data in any way, not even to explain why the data was not discussed. At oral argument, the agency maintained that ESA analysis cannot go on forever, that there must be a cutoff.

Plaintiffs note that the low population numbers revealed by the FMWT data were " not unexpected," as smelt abundance had been on a downward trend for at least two years prior. (AR 370-71; 9199-9200, 9202.) One prominent smelt biologist warned at a June 2003 OCAP symposium that managers should expect very low smelt abundance data in the near future and that water exports were a key factor in the population decline, noting that the " cumulative proportion of the population lost to exports relative to abundance" could be as high as 30 percent. (AR 5069.)

Federal Defendants suggest that Plaintiffs' entire argument should be rejected as internally inconsistent. (Doc. 242 at 26-27.) Plaintiffs contend that FWS should have revised the BiOp in light of the 2004 FMWT data and that additional evidence of a downward trend was " not unexpected." These contentions are consistent with the central premise of Plaintiffs' position-that the 2004 FMWT data reflected a *record* low abundance (the data showed " estimates of Delta smelt appear to be at their lowest since 1964" (Doc. 11 at 5)); so low that the data

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should have been addressed in the BiOp, even if the agency already knew that smelt abundance was trending downward.

The State Water Contractors suggest that Plaintiffs' acknowledgment that the downward trend was " not unexpected," establishes that the BiOp fully recognizes the dire situation of the smelt. (Doc. 241 at 4.) The BiOp reflects that FWS had knowledge that smelt population levels were at extremely low levels, " [s]ince 1983, the delta smelt population has exhibited more low FMWT abundance indices, for more consecutive years, than previously recorded." (AR 367.)

***34** The results of seven surveys conducted by the Interagency Ecological Program (IEP) corroborate the dramatic decline in delta smelt....According to seven abundance indices designed to record trends in the status of the delta smelt, this species was consistently at low population levels during the last ten years (Stevens et al.1990). These same indices also show a pronounced decline from historical levels of abundance (Stevens et al.1990).

(AR at 370.) The State Water Contractors' argument ignores that the 2004 FMWT data evidences *record* low (the lowest) smelt abundance. Plaintiffs maintain that FWS' acknowledgment of a downward trend is inadequate as it does not address or analyze in survival and recovery terms, that smelt abundance levels had reached the lowest ever recorded.

The State Water Contractors argue that, although the BiOp admits the *fact* of the smelt's declining population, it does not and cannot explain the *cause* of the decline, because there is no scientific consensus as to causation. (Doc. 241 at 5.) " Contributing to [this] uncertainty," " is the fact that SWP and CVP operations have been ongoing for decades-a period during which Delta smelt abundance has increased as well as declined." (*Id.* at 6.) The State Water Contractors assert that the DSRAM was adopted in part to protect the smelt while further monitoring and research is carried out to resolve these uncertainties. They conclude that even if the 2004 FMWT data had been addressed in the BiOp, the ultimate opinion reached would not have differed; i.e., that operation of the projects under the 2004 OCAP BiOp would not jeopardize the smelt because, among other things, take will remain at or below historic levels and the DSRAM will protect smelt from salvage at project facilities.[FN24]But, this is post hoc argument; neither the agency or the biological opinion addressed the 2004 FMWT data and available scientific information opined that Project operations contributed to the decline of the smelt.

The cases the parties cite do not answer whether FWS did not have to analyze most recent data because it would not have altered the ultimate conclusion. Some cases suggest that FWS must use all available information to ensure that a biological opinion analyzes the threats to a species in a comprehensive manner. Plaintiffs refer to *Greenpeace II*, 80 F.Supp.2d at 1149-50, for the proposition that failure to analyze and incorporate available data is fatal to a biological opinion. In that case, NMFS concluded in a biological opinion that the total groundfish catch authorized in the Bering Sea and Gulf of Alaska in a single fishing season (1999) would not jeopardize the endangered Stellar sea lion. NMFS limited the scope of the biological opinion to that single year of fisheries management activities. The district court ruled that the agency should have broadened the scope of the biological opinion to consider the overall fishery management regime, including relevant regulations and specifications. *Id.* at 1146-47.This failure to produce a comprehensive biological opinion permeated all other aspects of the agency's decision. The district court found fault with the BiOp's superficial analysis, emphasizing the agency's failure to address the overall effects of the fisheries upon the sea lion:

***35** As far as the Court can ascertain, the focus of BiOp2 is limited to analyzing whether the fisheries compete with the sea lion for prey. In particular, BiOp2 focuses on the potential for localized depletions of prey caused by the fisheries. BiOp2 at 90, 112. *Even with respect to this limited topic of discussion, meaningful analysis is virtually non-existent. NMFS itself repeatedly concludes in BiOp2 that it simply lacks the information to make any determination one way or the other.*See BiOp2 at 111-118. Thus, NMFS's analysis is admittedly incomplete and its conclusions inconclusive. Although inconclusive data does not necessarily render a particular scientific conclusion invalid, the limited scope and quality of analysis that is contained in BiOp2 serves to highlight its overall inadequacy. For example, NMFS relies substantially on its conclusion that many of the target groundfish species are not important sea lion prey, despite uncertain evidence. BiOp2 at 114. That many of the target species may not individually constitute a major prey source, however, does not mean the cumulative impact of these fisheries is insignificant. *In other words, limited analysis which suggests the fisheries do not jeopardize the sea lion does not obviate the requirement that NMFS address the full scope of the FMPs in order to ascertain their overall effects.*

In sum, BiOp2 is limited in scope, heavy on general background information, and deficient in focused and meaningful discussion and analysis of how these large

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fisheries, and the complex management measures which regulate them, affect endangered Steller sea lions. That NMFS now finds it necessary to undertake yet another " comprehensive consultation" is a final indication to this Court that BiOp2 is not the broad and in-depth consultation it was purported to be by NMFS, much less coextensive in scope with the FMPs as required under the ESA.

A biological opinion which is not coextensive in scope with the identified agency action necessarily fails to consider important aspects of the problem and is, therefore, arbitrary and capricious. Here, BiOp2 not only fails to consider important aspects of the problem, the analysis it does contain is simply not adequate. Although an agency need not rely on conclusive scientific proof in a biological opinion, its conclusions must be based on " the best scientific and commercial data available." 16 U.S.C. § 1536(a)(2). Thus, an agency *" cannot ignore available biological information or fail to develop projections" which may indicate potential conflicts between the proposed action and the preservation of endangered species.*Conner, 848 F.2d at 1454.

Id. at 1149-50 (emphasis added).

In *Greenpeace II,* NMFS admitted that the information it needed to perform a more comprehensive review was available, but argued that it " could not have been analyzed in the time allowed." *Id.* at 1150.The district court rejected this argument:

***36** A federal agency ... is not " excused from [fulfilling the dictates of the ESA] if, in its judgment, there is insufficient information available to complete a comprehensive opinion and it takes upon itself [a more limited analysis]." Conner, 848 F.2d at 1455. This is not a situation where NMFS fully addressed the problem based on uncertain scientific data. *See Greenpeace Action v. Franklin,* 14 F.3d 1324, 1337 (9th Cir.1992).*Rather, NMFS entirely ignored relevant factors and admittedly failed to analyze and develop projections based on information that was available.*

Id. at 1150 (emphasis added); *see also Conner,* 848 F.2d at 1454 (biological opinion invalidated because agency failed to " use best information available to prepare comprehensive biological opinions considering all stages of agency action").

Plaintiffs analogize this case to *Greenpeace II,* because the agency has ignored available biological information. Here, Plaintiffs complain that FWS failed to incorporate into *existing* models and analyses that already reflected concern over an overall declining trend in smelt, the *most recent* survey information, evidencing a more pronounced decline in smelt populations than ever before recorded. In *Greenpeace II,* the agency entirely failed to perform a comprehensive review of threats to the sea lion. The difference in degree is not significant.

Federal Defendants cite *Oceana,* 384 F.Supp.2d 203, where NMFS concluded that an amendment to the Atlantic Sea Scallop Fishery Management Plan would not jeopardize the protected loggerhead sea turtle, based on a population model that involved a degree of uncertainty, but that the agency determined was the " most reliable method." *Id.* at 215.The *Oceana* plaintiffs did not dispute that the model represented the " best available science," instead arguing that the model was " so ill-suited to the purpose for which it was used, and so fraught with uncertainties," that the agency could not rationally reach its no jeopardy conclusion. *Id.* at 218.The district court upheld the agency's use of the model, reasoning " [t]ime and again courts have upheld agency action based on the ' best available' science, recognizing that some degree of speculation and uncertainty is inherent in agency decisionmaking, even in the precautionary context of the ESA." *Id.* at 219.Though the ESA should not be implemented " haphazardly, on the basis of speculation, *id.* at 219, the model " bears a rational relationship to the reality it purports to represent" and no other alternative model was available, *id.* at 221.

The circumstances here are not analogous to those in *Oceana,* where the plaintiffs *admitted* that the challenged model was the best, albeit uncertain, available science. Here, Plaintiffs maintain the agency's failure to analyze the most recent smelt population information prevented consideration of the best available, consequential scientific information.

***37** Federal Defendants also rely on *Greenpeace I,* 14 F.3d at 1337, an earlier challenge to a Stellar sea lion biological opinion. The *Greenpeace I* plaintiffs argued that the agency acted arbitrarily and capriciously by approving certain fishery management measures despite uncertainty about the effects of the measures on the sea lion. The Ninth Circuit concluded that the presence of some uncertainty did not violate the best available science requirement in part because that BiOp analyzed *all* the available data:

We hold that the Service has fulfilled its substantive duties as well. Despite Greenpeace's assertions to the contrary, the Service supported its conclusions with ample data and analysis. The June biological opinion indicates that the Service, the Alaska Fisheries Science Center, and the National Marine Mammal Laboratory " *analyzed all*

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the available data on the pollock fishery and Steller sea lions" in the Gulf of Alaska. The Service also sought the recommendations of the Steller Sea Lion Recovery Team. The opinion demonstrates that the Service evaluated the spatial and temporal distribution of commercial fishing across the Gulf of Alaska. It then addressed not only the total biomass of pollock in the Gulf and the effects of fishery removals on that biomass, but also the spatial and temporal distribution of pollock across the Gulf. And despite Greenpeace's claims to the contrary, the Service did not ignore hydroacoustic surveys of pollock biomass, but considered and compared them to bottom trawl surveys. *Finally, while the Service has repeatedly conceded that it was uncertain about the effectiveness of its management measures, it premised these measures on a reasonable evaluation of available data, not on pure speculation.*
The biological opinions indicate that the Service, an expert agency, consulted with other teams of experts to consider all relevant factors pertaining to the effects of the Gulf fishery on the Steller sea lion. And they indicate that the Service did not ignore data, as Greenpeace suggests. The Service's decision to go ahead with the 1991 fishery under the proposed restrictions, despite some uncertainty about the effects of commercial pollock fishing on the Steller sea lion, was not a clear error of judgment.

(Emphasis added.) *Id.* at 1337.Here, unlike *Greenpeace I*, FWS failed to analyze all of the available data on the Delta smelt, as the 2004 FMWT data is not mentioned in the BiOp. Nor has FWS resolved uncertainties about the identified causes of the serious decline in Delta smelt abundance by adopting unenforceable management measures.

" Although a decision of less than ideal clarity may be upheld if the agency's path may reasonably be discerned, [a court] cannot infer an agency's reasoning from mere silence. Rather, an agency's action must be upheld, if at all, on the basis articulated by the agency itself." *Pacific Coast Fed'n of Fishermen's Ass'ns v. United States Bureau of Reclamation*, 426 F.3d 1082, 1091 (9th Cir.2005) (internal citations and quotations omitted)." [W]hen reviewing a biological opinion, [a court may] rely only ' on what the agency actually said' ...." *Id.*(quoting *Gifford Pinchot Task Force*, 378 F.3d at 1072 & n. 9). Had FWS examined the FMWT 2004 data in the BiOp, the weight it gave to that data would have been entitled to deference. The agency's silence cannot be afforded deference.

a. *The timing of the 2004 FMWT Data relative to the issuance of the BiOp.*

***38** Federal Defendants complain the timing of the release of the 2004 FMWT data did not leave enough time to address the data before issuance of the biological opinion. The record shows at the very latest, the 2004 FMWT data was presented to FWS and other CALFED members on February 9, 2005, less than a week before the February 16, 2005, issuance of the biological opinion. Federal Defendants assert they were not required to rewrite the BiOp at the " eleventh hour." (Doc. 242 at 27).

Although the record shows the 2004 FMWT data was presented at the February 9, 2005 CALFED meeting, it is unclear when FWS *first* saw this data. Plaintiffs' claim that the data was available in December 2004, is not supported.[FN25]However, even assuming FWS was not aware of the 2004 FMWT data until February 9, 2005, the agency was not operating under a deadline. As in *Greenpeace II*, where the agency's statutory duty was not excused because the data could not be " analyzed in the time allowed," 80 F.Supp.2d at 1150, here, FWS could have delayed releasing the biological opinion until it had reviewed and analyzed the new abundance data, which was especially significant as it showed Delta smelt abundance at its nadir.

Defendants and Defendant-Intervenors rejoin that the failure of the BiOp to *directly* address the 2004 FMWT is harmless, because one of the DSRAM's trigger criteria is an index based upon the previous years' FMWT results, calling for any new abundance data to be incorporated into the adaptive management process. However, even if the data were considered later in the DSRAM process, no designated protective actions are required to be taken in response to any of the triggering criteria.[FN26]

Federal Defendants raise a legitimate concern about having to prolong completion of the BiOp on the eve of its release. In theory, new scientific information could arrive on FWS's doorstep on a daily basis. If FWS was required to consider and address every new piece of information it received prior to publication of its decision, it would be effectively impossible for the agency to complete a biological opinion. But, this is not such a case. The FMWT is a credible and reliable Delta smelt population abundance survey, regularly compiled on an annual basis, and relied upon by the agency in the past. There is no rational reason to ignore such important data. The BiOp places great weight on the FMWT as " the second longest running survey." (AR 366, 370). The agency does not suggest the time of receipt of the 2004 FMWT data was unexpected. The agency's failure to

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acknowledge and analyze the record low abundance levels revealed by the 2004 FMWT is unreasonable and violated its duty to use the best available scientific information. 16 U.S.C. § 1536(a)(2).

Plaintiffs' motion for summary adjudication is **GRANTED** as to this claim.

3. Global Climate Change Evidence.

Plaintiffs next argue that the BiOp ignored data about Global Climate Change that will adversely affect the Delta smelt and its habitat. (Doc. 232 at 7.) This is potentially significant because the BiOp's conclusions are based in part on the assumption that the hydrology of the water bodies affected by the OCAP will follow historical patterns for the next 20 years. (AR 375 (explaining that CALSIM II modeling involved making " adjustments to historic water supplies ... by imposing future level land use on historical meteorological and hydrologic conditions").)

***39** In a July 28, 2004 comment letter, Plaintiff NRDC directed FWS's attention to several studies on the potential effects of climate change on water supply reliability, urging that the issue be considered in the BiOp. (AR 8552-56.) The comment letter stated:

The best scientific data available today establishes that global climate change is occurring and will affect western hydrology. At least half a dozen models predict warming in the western United States of several degrees Celsius over the next 100 years (Redmond, 2003). Such sophisticated regional climate models must be considered as part of the FWS' consideration of the best available scientific data.8:43 AM 6/5/2007

Unfortunately, the Biological Assessment provided by the Bureau to FWS entirely ignores global climate change and existing climate change models. Instead, the BA projects future project impacts in explicit reliance on seventy-two years of historical records. In effect, the Biological Assessment assumes that neither climate nor hydrology will change. This assumption is not supportable.

In California, a significant percentage of annual precipitation falls as snow in the high Sierra Nevada mountains. Snowpack acts as a form of water storage by melting to release water later in the spring and early summer months (Minton, 2001). The effects of global climate change are expected to have a profound effect on this dynamic. *Among other things, more precipitation will occur as rain rather than snow, less water will be released slowly from snowpack " storage" during spring and summer months, and flooding is expected to increase* (Wilkinson, 2002; Dettinger, 2003).*These developments will make it more difficult to fill the large reservoirs in most years, reducing reservoir yields and will magnify the effect of CVP operations on downstream fishes* (Roos, 2001). These developments will also dramatically increase the cost of surface storage relative to other water supply options, such as conservation.

While the precise magnitude of these changes remains uncertain, judgments about the likely range of impacts can and have been made. *See e.g.,*U.S. Global Climate Action Report-2002; Third National Communication of the United States Under the United Nations Framework Convention on Climate Change at 82, 101 (2002). [FN3]. The Service can and must evaluate how that range of likely impacts would affect CVP operations and impacts, including the Bureau's ability to provide water to contractors while complying with environmental standards. We therefore request that the Service review and consider the work cited above, as well as the background and Dettinger presentation at a recent climate change conference held in Sacramento, June 9-11, 2004 [citation omitted] and climate change reports [citation omitted].

(AR at 8554-55 (emphasis added).)

A second presentation by Michael Dettinger at a December 8-9, 2004 CALFED meeting, attended by FWS staff, concluded that " warming is already underway ..." ; that this would result in earlier flows, more floods, and drier summers; and that " California water supplies/ecosystems are likely to experience [ ] changes earliest and most intensely." (Doc. 10 at 18.) Following Dettinger's presentation, members of CALFED noted " the need to reevaluate water storage policies and ERP [Ecosystem Recovery Program] recovery strategies, all of which would be affected by projected climate changes." (Doc. 9 at 3.) The record reflects that extreme water temperatures can have dramatic impacts upon smelt abundance. (AR 8979-80.)

***40** In addition to the specific studies and data cited by NRDC, FWS scientists recognized the issue of climate change warranted further consideration. At a June 2003 symposium entitled " Framing the issues for Environmental and Ecological Effects of Proposed Changes in Water Operations: Science Symposium on the State of Knowledge," a number of questions regarding climate change were raised, including: " How does the proposed operations plan account for the potential effects of climate change (e.g., El Nino or La Nina, long term changes in precipitation and runoff patters, or increases in

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water temperature)?" (AR at 4839.)

Plaintiffs argue that, despite this evidence that climate change could seriously impact the smelt by changing Delta hydrology and temperature, the BiOp " did not so much as mention the probable effects of climate change on the delta smelt, its habitat, or the magnitude of impacts that could be expected from the 2004 OCAP operations, much less analyze those effects." (Doc. 232 at 8.) Defendants and Defendant-Intervenors respond by arguing (1) that the evidence before FWS at the time the BiOp was issued was inconclusive about the impacts of climate change; and (2) that, far from ignoring climate change, the issue is built into the BiOp's analysis through the use of X2 as a proxy for the location and distribution of Delta smelt.

a. *Inconclusive Nature of Available Information Regarding the Impacts of Global Climate Change on Precipitation.*

Federal Defendants and the State Water Contractors characterize Mr. Dettinger's presentation, as reflecting " a great deal of uncertainty that climate change will impact future precipitation." The presentation is entitled " Climate Change Uncertainties and CALFED Planning." (Doc. 10 at 1.) Dettinger acknowledges that, although current climate models " yield consistent warming scenarios for California" (*id.* at 6), there is no similar consensus regarding the impact of warming on future precipitation (*id.* at 7). Federal Defendants suggest that FWS " responsibly refused to engage in sheer guesswork, and properly declined to speculate as to how global warming might affect delta smelt." (Doc. 242 at 23.) But, the NRDC letter cited a number of studies in addition to Mr. Dettinger's presentations, all of which predict that anticipated climate change will adversely impact future water availability in the Western United States.

At the very least, these studies suggest that climate change will be an " important aspect of the problem" meriting analysis in the BiOp. *Pacific Coast Fed'n*, 265 F.3d at 1034. However, as with the 2004 FMWT data, the climate change issue was not meaningfully discussed in the biological opinion, making it impossible to determine whether the information was rationally discounted because of its inconclusive nature, or arbitrarily ignored.[FN27]

b. *X2 as a Proxy for Climate Change.*

The State Water Contractors argue that the approaches taken in the DSRAM are " more than adequate to deal with the projected impacts of climate change-assuming they occur." (Doc. 241 at 8.) For example, Plaintiffs' suggestion that climate change will produce earlier flows, more floods, and drier summers is addressed by the DSRAM's X2 trigger. Flow level changes will be reflected in the position of X2. If climate change alters water temperatures, DSRAM also includes a temperature trigger, that monitors the temperature range within which successful Delta smelt spawning occurs.

***41** The DSRAM offers no assurance that any mitigating fish protection actions will be implemented if the X2 criteria is triggered. That X2 indirectly monitors climate change does not assuage Plaintiffs' concerns that the BiOp has not adequately analyzed the potential impact of climate change on the smelt.

The BiOp does not gauge the potential effect of various climate change scenarios on Delta hydrology. Assuming, *arguendo*, a lawful adaptive management approach, there is no discussion when and how climate change impacts will be addressed, whether existing take limits will remain, and the probable impacts on CVP-SWP operations.

FWS acted arbitrarily and capriciously by failing to address the issue of climate change in the BiOp. This absence of *any* discussion in the BiOp of how to deal with any climate change is a failure to analyze a potentially " important aspect of the problem." [FN28]

Plaintiffs' motion for summary adjudication is **GRANTED** as to this claim.

D. *There is No Rational Connection Between the No Jeopardy Finding and the Status of the Species.*

Plaintiffs next allege that there is no rational connection between the record evidence and the BiOp's " no jeopardy" conclusion. Plaintiffs first argue that the BiOp's approach to setting take limits is arbitrary and capricious because FWS failed to consider defined take limits in the context of current smelt abundance. Plaintiffs complain that the BiOp does not explain how its no jeopardy conclusion can be justified in light of the admitted adverse effects of the project, along with indirect and cumulative effects on the species.

In a formal consultation, the ESA requires FWS to " [f]ormulate its biological opinion as to whether the action, taken together with cumulative effects, is likely to jeopardize the continued existence of a listed species or result in the destruction or adverse modification of critical

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habitat." 50 C.F.R. § 402.14; *see also*16 U.S.C. § 1536(a)(2). The phrase " jeopardize the continued existence of" means " to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 C.F.R. § 402.02.

Agency action may be overturned if the agency has " relied on factors which Congress has not intended it to consider, entirely failed to consider an important aspect of the problem, offered an explanation for its decision that runs counter to the evidence before the agency, or is so implausible that it could not be ascribed to a difference in view or the product of agency expertise." *Pacific Coast Fed'n*, 265 F.3d at 1034. A court must ask " whether the agency considered the relevant factors and articulated a rational connection between the facts found and the choice made." *Id.* The agency must " examine the relevant data and articulate a satisfactory explanation for its action including a rational connection between the facts found and the choice made." *Motor Vehicle Mfrs. Ass'n v. State Farm Mutual Ins.*, 463 U.S. 29, 43, 103 S.Ct. 2856, 77 L.Ed.2d 443 (1983).

1. Plaintiffs' Argument that Salvage Underestimates Project Impacts on the Smelt.

***42** Plaintiffs assert that the BiOp's reliance on salvage is arbitrary and capricious because salvage is not a reliable basis for setting Project take limits. Plaintiffs cite record evidence, including statements made by smelt biologists and FWS employees, that salvage does not accurately estimate incidental take of young Delta smelt. (*See* AR 8403, 7578.) The BiOp admits that salvages does not fully account for all smelt losses. (AR 419 (" It should be noted that although salvage is used to index delta smelt take, it does not reliably index delta smelt entrainment. Furthermore, delta smelt salvage is highly variable at all time scales....).") Plaintiffs have not shown that a better measure of smelt take could have been generated from available data. The agency is entitled to rely on this approach as it appears to be the " best estimate possible," no party has suggested an alternative. *See Oceana*, 384 F.Supp.2d at 228.

This objection standing alone is insufficient to justify summary adjudication.

2. The BiOp's Approach to Estimating Future Take Without Considering the Smelt's Current Abundance Is Arbitrary and Capricious.

The take limits are based on historic sampling from " salvage density" (number of fish taken per unit of water), which data is adjusted using CALSIM II modeling to reflect water flows anticipated under the circumstances of the final consultation. FWS's no jeopardy determination is based in part on flow modeling for the final consultation scenario that predicted *lower* than historic salvage levels during critical times. (AR 474 (finding that the level of anticipated take " is not likely to result in jeopardy to the smelt because this level of take is at or below historical levels of take.")

A close examination of the administrative record reveals that this conclusion relies upon an unsupported irrational assumption not justified by the record, i.e., that maintaining salvage at or below historic salvage levels will ensure that the 2004 OCAP is not likely to jeopardize the continued existence of the Delta smelt. First, by focusing only on how proposed operations will either increase or decrease smelt take, FWS effectively limited its analysis to determining whether the magnitude of the OCAP's impact upon the smelt would be different from the Projects' impact under the regulatory historical baseline. FWS did not analyze how the absolute number of smelt taken during any given period of Project operations will impact overall smelt abundance at the time of the 2005 BiOp or in the future. Nor does the finding the smelt " still persists," even at the lowest recorded abundance levels, have any meaning if the smelt's " persistence" is at a level at or near extinction. Evaluating " persistence" instead of smelt population abundance is irrational, arbitrary, and runs counter to the evidence before the agency.

The Ninth Circuit, in *NWF v. NMFS*, 481 F.3d 1224 at *8, invalidated a biological opinion in part because it failed to view the agency action " in the present and future human and natural contexts." Here, the BiOp similarly fails to provide a scientific explanation for why it is appropriate to set incidental take without considering the most current smelt population data. This methodology fails to take most recent available natural conditions (i.e., the smelt's current and/or future population abundance) into consideration. For example, if the smelt's population is currently 600,000, it might be justifiable to permit a monthly take of over 30,000. However, if the smelt's current population is only 60,000, allowing 30,000 to be entrained in the pumps in a single month would represent a 50% reduction in smelt population. Even if the 30,000 figure was significantly lower than historic take, Defendant-Intervenors agree " that salvage impacts cannot be accurately identified without a population

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estimate." (Doc. 247 at 9 n. 13.)

***43** DWR asserts that, in setting the take limits, the BiOp took into consideration concerns expressed by experts that using historic information alone would not create an appropriate take limit. (*See* AR 4880, 5532, 5543). The first of the citations offered by DWR, an email sent by FWS's Wim Kimmerer to several individuals at DWR, EPA and elsewhere, states that there was some discussion at FWS about " getting away from take as the principle criterion governing management and recovery of delta smelt." (AR 4880.) The next page of this email goes on to admit that " determining what level of mortality is acceptable or ' safe' is going to be difficult ...*Ultimately ... this should be done through some sort of population model or viability analysis.*" (AR 4881 (emphasis added).) The other cited communications express similar concerns. (*See* AR 5532, 5543.) It is time to do it, yet FWS continues to profess the smelt population cannot be reliably measured.

DWR argues that, together, the take limits *and* the DSRAM address these concerns by moving the focus of management away from salvage. However, there is no way to know when or what measures will be taken under the DSRAM, which leaves the existing take limits as the only enforceable measures in the BiOp, [FN29] while the species heads toward extinction. Using flawed take limits and refusing to quantify smelt population and recent viability trends create substantial doubt about the reliability of the BiOp.

Defendants and Defendant-Intervenors suggest that sufficient information was simply not available to accurately determine smelt abundance.[FN30] Plaintiffs rejoin by referring to an email sent by Zachary Hymanson to Ryan Olah at FWS, with copies to others at concerned federal and state agencies. Mr. Hymanson opined: " I think we are at the point where we should report and use quantified estimates of the total number of individuals at the various life stages monitories. Quantified population and life stage estimates of fishes around the world are routinely made with A LOT less data than we have for delta smelt." (AR 7542 (emphasis in original).)

The viability of Delta smelt has been under scrutiny for over ten years. No party has shown that producing a reliable population estimate is scientifically unfeasible. Information does not have to be perfect or infallible for the agency to be required to use it to create a population estimate. *See Greenpeace II*, 80 F.Supp.2d at 1149-50 (finding it unlawful for agency to entirely ignore relevant factor and fail to analyze and develop projections regarding that factor based on information that was available); *see also Conner*, 848 F.2d at 1454 (biological opinion invalidated because agency failed to " use best information available to prepare comprehensive biological opinions considering all stages of agency action."). Without population estimates, it is arbitrary for the agency to conclude that project operations will not result in jeopardy simply because the projects will take relatively fewer smelt than they did in the past, in the face of the undisputed fact that the smelt population has been declining steadily in recent years. Failing to incorporate any information about smelt population abundance into the setting of the take limits is a fundamental failure rendering the BiOp arbitrary and capricious.

***44** The San Luis Parties' rationalization of FWS's approach, setting the incidental take limits using a model that does not take current abundance data into consideration, is that historic records reveal " either no, or perhaps a very weak relationship, between juvenile abundance measured by the TNS and adult abundance measured by the FMWT." (Doc. 247 at 5.) This " lack of [a] linear relationship between the two indices, shows that events after the TNS, in late summer and early fall, are probably affecting the number of juveniles that mature into spawners." (Doc. 247 at 6.) From the lack of a linear relationship, San Luis infers that something other than salvage (i.e. entrainment in the pumps) is causing the smelt's decline.[FN31]

The BiOp interprets the data differently:
In a near-annual fish like delta smelt, a strong relationship would be expected between number of spawners present in one year and number of recruits to the population the following year. Instead, the stock-recruit relationship for delta smelt is weak, accounting for about a quarter of the variability in recruitment (Sweetnam and Stevens 1993).*This relationship does indicate, however, that factors affecting numbers of spawning adults* (e.g., *entrainment*, toxics, and predation) *can have an effect on delta smelt numbers the following year.*

(AR at 364 (emphasis added).) [FN32] Plaintiffs refer to other record evidence creating doubt that salvage is not a statistically reliable indicator of smelt abundance, including high entrainment events in the early 1980s and other " extreme events," including the El Niño of 1982-83, which caused significant declines in smelt abundance. (AR 8979.)

The BiOp acknowledges that salvage can have an impact on smelt abundance (although the statistical relationship is non-linear). It is arbitrary and capricious for FWS to

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base take limits on a projection of future salvage calculated without considering the most current or future smelt abundance and without reliable smelt population estimate.

Plaintiffs' motion for summary adjudication is **GRANTED** as to this issue. The BiOp's approach to setting incidental take limits is arbitrary and capricious because it fails to incorporate reliable smelt population data and the most recent information regarding smelt abundance.

3. Plaintiffs' Argument That the Biop Fails to Explain How its No Jeopardy Conclusion Can Be Justified in Light of the Identified Adverse Effects of the Project, along with Indirect and Cumulative Effects.

In formulating a biological opinion, the ESA requires FWS to determine " whether the action, *taken together with cumulative effects,* is likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of critical habitat." 50 C.F.R. § 402.14 (emphasis added). " Jeopardize the continued existence of" means " to engage in an action that reasonably would be expected, *directly or indirectly,* to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 C.F.R. § 402.02 (emphasis added).

***45** The BiOp concludes that the 2004 OCAP will have numerous direct and indirect impacts apart from salvage, including habitat loss, increased vulnerability of Delta smelt to predation, and increased vulnerability to adverse temperature effects. (*See* AR 399, 443-44.) Plaintiffs allege that, although the BiOp lists indirect impacts, it fails to explain how they relate to the potential for jeopardy.

Federal Defendants respond to this allegation with a single paragraph, asserting generally that " the biological opinion considers the effects of dozens of project components, each with a multi-layered analysis," and indicating how many times the topics of predation (18), temperature changes (180 references), life cycle impacts (75 references to the term " juveniles") are discussed in the BiOp. (Doc. 242 at 30.) What Federal Defendants do not do is point to those portions of the BiOp which analyze these issues in *a way that demonstrates why these indirect impacts will not cause jeopardy or how they relate to survival and recovery of the smelt.*A review of the BiOp does not reveal such an analysis.

The State Water Contractors suggest that the DSRAM trigger criteria were designed to address all of the potential impacts identified in the BiOp. (Doc. 241 at 8.) This leaves for future consideration and speculation the impacts events activating DSRAM triggers will have.

a. *Cumulative Impacts.*

Plaintiffs also argue that the BiOp fails to meaningfully address cumulative impacts, " those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur within the action area of the Federal action subject to consultation." 50 C.F.R. § 402.02. The BiOp highlights a number of predicted cumulative effects:

Any continuing or future non-Federal diversions of water that may entrain adult or larval fish would have cumulative effects to the smelt. Water diversions through intakes serving numerous small, private agricultural lands contribute to these cumulative effects. These diversions also include municipal and industrial uses. State or local levee maintenance may also destroy or adversely modify spawning or rearing habitat and interfere with natural long term habitat-maintaining processes.

Additional cumulative effects result from the impacts of point and non-point source chemical contaminant discharges. These contaminants include but are not limited to selenium and numerous pesticides and herbicides as well as oil and gasoline products associated with discharges related to agricultural and urban activities. Implicated as potential sources of mortality for smelt, these contaminants may adversely affect fish reproductive success and survival rates. Spawning habitat may also be affected if submersed aquatic plants, used a[s] substrates for adhesive egg attachment, are lost due to toxic substances.

Other cumulative effects could include: the dumping of domestic and industrial garbage may present hazards to the fish because they could become trapped in the debris, injure themselves, or ingest the debris; golf courses reduce habitat and introduce pesticides and herbicides into the environment; oil and gas development and production remove habitat and may introduce pollutants into the water; agricultural uses on levees reduce riparian and wetland habitats; and grazing activities may degrade or reduce suitable habitat, which could reduce vegetation in or near waterways.

***46** (AR 468.) There is no quantitative and qualitative analysis of the potential impact of these cumulative effects on the smelt and its habitat, except to identify the causes, the BiOp concludes without explanation, " [t]he cumulative effects of the proposed action [are] not

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expected to alter the magnitude of cumulative effects on the above described actions upon the critical habitat's conservation function for the smelt." (*Id.*)

The San Luis Parties argue that FWS's no jeopardy conclusion and impacts analysis is " rationally based on its determination that the proposed future changes will not significantly increase the magnitude of the ongoing Project's potential impacts." (Doc. 247 at 9.) This conclusion is the kind of analysis recently rejected by the Ninth Circuit in *NWF v. NMFS:*

To " jeopardize the continued existence of" means " to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species." 50 CFR § 402.02; 16 U.S.C. § 1536(a)(2). NMFS argues that, under this definition, it may satisfy the ESA by comparing the effects of proposed FCRPS operations on listed species to the risk posed by baseline conditions. Only if those effects are " appreciably" worse than baseline conditions must a full jeopardy analysis be made. Under this approach, a listed species could be gradually destroyed, so long as each step on the path to destruction is sufficiently modest. This type of slow slide into oblivion is one of the very ills the ESA seeks to prevent.

Requiring NMFS to consider the proposed FCRPS operations in their actual context does not, as NMFS argues, effectively expand the " agency action" at issue to include all independent or baseline harms to listed species. Nor does it have the effect of preventing any federal action once background conditions place a species in jeopardy. To " jeopardize" -the action ESA prohibits- means to " expose to loss or injury" or to " imperil." Either of these implies causation, and thus some new risk of harm. Likewise, the suffix " -ize" in " jeopardize" indicates some active change of status: an agency may not " cause [a species] to be or to become" in a state of jeopardy or " subject [a species] to" jeopardy. American Heritage Dictionary of the English Language (4th ed.). Agency action can only " jeopardize" a species' existence if that agency action causes some deterioration in the species' pre-action condition.

Even under the so-called aggregation approach NMFS challenges, then, an agency only " jeopardize[s]" a species if it causes some new jeopardy. An agency may still take action that removes a species from jeopardy entirely, or that lessens the degree of jeopardy. *However, an agency may not take action that will tip a species from a state of precarious survival into a state of likely extinction. Likewise, even where baseline conditions already jeopardize a species, an agency may not take action that deepens the jeopardy by causing additional harm.*

***47** Our approach does not require NMFS to include the entire environmental baseline in the " agency action" subject to review. It simply requires that NMFS appropriately consider the effects of its actions " within the context of other existing human activities that impact the listed species." *ALCOA,* 175 F.3d at 1162 n. 6 (citing 50 C.F.R. § 402.02's definition of the environmental baseline).*This approach is consistent with our instruction (which NMFS does not challenge) that " [t]he proper baseline analysis is not the proportional share of responsibility the federal agency bears for the decline in the species, but what jeopardy might result from the agency's proposed actions in the present and future human and natural contexts."* *Pac. Coast Fed'n,* 426 F.3d at 1093 (emphasis added).

481 F.3d 1224 at *7-8 (emphasis added) (footnote omitted).

Here, the BiOp does not consider the cumulative effects of any future DSRAM actions, which it relies on to avoid jeopardy, nor does it meaningfully relate the most current abundance of the species to future OCAP operations to assess jeopardy. The BiOp unlawfully fails to adequately analyze indirect and cumulative impacts of the 2004 OCAP. Summary adjudication on this issue is appropriate.

E. *Did the BiOp Fail to Adequately Consider Impacts to Critical Habitat?*

Plaintiffs allege that the BiOp fails to adequately consider critical habitat in two respects. First, by failing to analyze the impacts of the 2004 OCAP on the value of critical habitat for *the recovery* as opposed to just the survival of the smelt. Second, failure to consider impacts to all of the Delta smelt's critical habitat because it focuses only on X2.

1. Did the BiOp Fail to Consider Whether 2004 OCAP Would Diminish Value of Critical Habitat for Recovery?

The ESA requires FWS to determine whether the 2004 OCAP will destroy or adversely affect Delta smelt critical habitat. 16 U.S.C. § 1536(a)(2)." Destruction or adverse modification of critical habitat" means " a direct or indirect alteration that appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical

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or biological features that were the basis for determining the habitat to be critical." 50 C.F.R. § 402.02

Initially, the critical habitat analysis was conducted pursuant to agency regulations that defined adverse modification as:
[A] direct or indirect alteration that appreciably diminishes the value of critical habitat for **both survival *and* recovery** of a listed species. Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical.

50 C.F.R. § 402.02 (emphasis added).

Following the issuance of the 2004 BiOp, the Ninth Circuit invalidated the adverse modification regulation, based on its own interpretation of the regulation's language, " alteration that appreciably diminish the value of critical habitat for both the survival *and* recovery of a listed species," " reads the ' recovery' goal out of the adverse modification inquiry." *Gifford Pinchot,* 378 F.3d at 1069-70.

***48** The Bureau requested that FWS reinitiate consultation on the 2004 OCAP to ensure compliance with *Gifford Pinchot.*The result was the disputed 2005 BiOp, which expressly states that it does not rely on the invalidated regulation. (AR 248.) Rather, the BiOp " relied on the statutory provisions of the ESA to complete the analysis with respect to critical habitat." (*Id.*) The ESA defines critical habitat as including " the specific areas ... occupied by the species ... which are ... essential to the *conservation* of the species" and the " specific areas outside the geographical area occupied by the species ... that ... are essential for the *conservation* of the species...." 16 U.S.C. § 1532(5)(A). This statutory reference to " conservation" was the premise for the Ninth Circuit's *Gifford Pinchot* reasoning:
" Conservation" is a much broader concept than mere survival. The ESA's definition of " conservation" speaks to the recovery of a threatened or endangered species. Indeed, in a different section of the ESA, the statute distinguishes between " conservation" and " survival." Requiring consultation only where an action affects the value of critical habitat to both the recovery and survival of a species imposes a higher threshold than the statutory language permits

378 F.3d at 1070 (internal citation omitted).

The 2005 BiOp uses the term " conservation," rather than " survival" and/or " recovery," several times in connection with its critical habitat analysis. In the " Critical Habitat Effects" section, the BiOp states that the " primary constituent elements essential to conservation of the species will not be affected by the proposed project." (AR 423.) In addition, after discussing critical habitat, including those areas essential to spawning, transport, rearing and migration, the BiOp acknowledges impacts, but explains that after the proposed diversions in the OCAP are implemented " the primary constituent elements [of critical habitat] essential to the conservation of the species still function." (*Id.* at 371.)[FN33]What specific effects any DSRAM measures will have on the smelt are not described, nor is there discussion of how the survival and recovery of the smelt will be accomplished.

The Ninth circuit explained in *NWF v. NFMS,* that the agency must conduct a " full analysis" of risks to recovery.
*The question before us is not whether, on the merits, recovery risks in fact require a jeopardy finding here, but whether, as part of the consultation process, NMFS must conduct a**full analysis**of those risks and their impacts on the listed species' continued existence.*Although recovery impacts alone may not often prompt a jeopardy finding, NMFS's analytical omission here may not be dismissed as harmless: the highly precarious status of the listed fishes at issue raises a substantial possibility that considering recovery impacts could change the jeopardy analysis. The only reasonable interpretation of the jeopardy regulation requires NMFS to consider recovery impacts as well as survival.

***49** 481 F.3d 1224 at *9-*10 (emphasis added).[FN34]

Plaintiffs claim that although the BiOp includes generic promises to consider recovery of the smelt, it does not competently analyze nor provide for recovery. Federal Defendants and Defendant Intervenors respond that the BiOp's discussion of critical habitat effects, in conjunction with the BiOp's conclusion that " the smelt's primary constituent elements essential to the conservation of the species [will] still function" (AR 371) under the 2004 OCAP, is a sufficient analysis of the impacts on recovery.

The BiOp's overarching conclusion is that " the smelt's primary constituent elements essential to the conservation of the species [will] still function." In designating critical habitat for a listed species, FWS must " consider those physical and biological features that are essential to the conservation of [the] species and that may require special management considerations or protection." 50 C.F.R. § 424.12. The features that must be considered include, but are not limited to, the following:

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1. Space for individual and population growth, and for normal behavior;
2. Food, water, air, light, minerals, or other nutritional or physiological requirements;
3. Cover or shelter;
4. Sites for breeding, reproduction, rearing of offspring, germination, or seed dispersal; and
5. Habitats that are protected from disturbance or are representative of the historic geographical and ecological distributions of a species.

Id. The BiOp explained that, in designating critical habitat for the Delta smelt, FWS identified the following primary constituent elements " essential to the conservation of the species" :Physical habitat, water, river flow, and salinity concentrations required to maintain delta smelt habitat for spawning, larval and juvenile transport, rearing, and adult migration.

* * *
Specific areas that have been identified as important delta smelt spawning habitat include Barker, Lindsey, Cache, Prospect, Georgiana, Beaver, Hog, and Sycamore sloughs and the Sacramento River in the Delta, and tributaries of northern Suisun Bay.
Larval and juvenile transport. Adequate river flow is necessary to allow larvae from upstream spawning areas to move to rearing habitat in Suisun Bay and to ensure that rearing habitat is maintained in Suisun Bay. To ensure this, X2 must be located westward of the confluence of the Sacramento-San Joaquin Rivers, located near Collinsville (Confluence), during the period when larvae or juveniles are being transported, according to historical salinity conditions. X2 is important because the " entrapment zone" or zone where particles, nutrients, and plankton are " trapped," leading to an area of high productivity, is associated with its location. Habitat conditions suitable for transport of larvae and juveniles may be needed by the species as early as February 1 and as late as August 31, because the spawning season varies from year to year and may start as early as December and extend until July.
***50** Rearing habitat. An area extending eastward from Carquinez Strait, including Suisun, Grizzly, and Honker bays, Montezuma Slough and its tributary sloughs, up the Sacramento River to its confluence with Three Mile Slough, and south along the San Joaquin River including Big Break, defines the specific geographic area critical to the maintenance of suitable rearing habitat. Three Mile Slough represents the approximate location of the most upstream extent of historical tidal incursion. Rearing habitat is vulnerable to impacts of export pumping and salinity intrusion from the beginning of February to the end of August.
Adult migration. Adequate flow and suitable water quality is needed to attract migrating adults in the Sacramento and San Joaquin river channels and their associated tributaries, including Cache and Montezuma sloughs and their tributaries. These areas are vulnerable to physical disturbance and flow disruption during migratory periods.

(AR 368-69.)

The BiOp acknowledges that this Delta smelt critical habitat has been adversely affected by numerous activities, but indicates that the 1994 and 1995 OCAP BiOps " provide a substantial part of the necessary riverine flows and estuarine outflows that allow smelt larvae to move downstream to suitable rearing habitat ... outside the influence of marinas, agricultural diversions, and Federal and State pumping plant." (AR 371.) The BiOp also explains that increasing demands for surface water " would likely result in lower delta outflows and increased entrainment," but that the impacts of these demands " have not altered critical habitat's conservation function for the delta smelt, and *the smelt's primary constituent elements essential to the conservation of the species still function."* (*Id.*) Finally, the BiOp concludes:
In evaluating the Status of the Species for critical habitat and the Environmental Baseline, while there are current actions that result in adverse effects to delta smelt critical habitat, the primary constituent elements continue to remain functional for the smelt. In the effects section, the Service determined that the primary constituent elements of delta smelt critical habitat would not be affected by the proposed project since there will not be a loss of physical habitat in the delta, river flows will continue to provide habitat, salinity will not be affected by the proposed project, and no breeding habitat will be affected and the sustainability of the food base will not be affected. In the cumulative effects section, we determined that the cumulative effects of the proposed action are not expected to alter the magnitude of future actions' effects on critical habitat's conservation function for the smelt. Based on the analysis in these four areas, it is our conclusion that Critical habitat is not likely to be adversely modified or destroyed as a result of implementing the proposed project.

(AR 469 (emphasis added).)

These conclusions are not supported by most recent smelt data to corroborate that the primary constituent elements of Delta smelt habitat will still function in a manner consistent with conservation (i.e.recovery). The functions and their locations are identified, but impacts upon

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breeding habitat are not analyzed. Second, although " there will still be water in the Delta....whether the water will be of adequate quality and quantity to allow the delta smelt to recover is an entirely different question." (Doc. 306 at 25.) The BiOp does not *analyze* the water supply, temperature, and quality under variable conditions with results that demonstrate the impact on smelt, nor is such an analysis found elsewhere in the administrative record.[FN35]

***51** The analysis of the predicted movement of X2 is more specific. When X2 is located upstream of Chipps Island, smelt are vulnerable to entrainment and are located in an area that is not ideal for feeding or protection. (*See* AR 424.) FWS opines that smelt reproduce better when X2 remains in a specific area, west of the confluence of the Sacramento and San Joaquin Rivers. That smelt reproduction is increased and the fish may be located where there are better sources of food does not assure that the smelt are on a path to *recovery*.The DSRAM is to provide the means by which FWS will maintain X2 in the most beneficial location. As the DSRAM is uncertain, speculative, and lacking enforceable action measures, there is no reasonable assurance that X2 will be maintained in the necessary protective location.

DSRAM utilizes other trigger criteria, arguably aimed at the recovery of the smelt. (Doc. 241 at 13-14.) One criteria is the " recovery index trigger," derived from the September and October FMWT sampling. (AR 347; Sommer Decl. at ¶ 9a.) The number used to trigger the DSWG is 74, the median value of the recovery index for the 1980-2002 period. Whenever the recovery index falls below this median, the DSWG convenes to decide whether to recommend actions. (AR 346-47.) Use of the term " recovery" in the title of the trigger index, suggests that this index will serve to monitor the potential for the smelt population to recover. This title is inaccurate. All that this trigger criteria monitors is whether the abundance of smelt drops below the 1980-2002 median abundance. As smelt have been in decline throughout the period to February 2005, the opinion that maintaining abundance slightly above this median leads to recovery of the smelt is unjustified.

The temperature trigger criterion of 12-18°C, the range within which the *most* smelt spawning occurs, is more arguably focused on recovery. (AR 347.) If the number of days falling within the temperature range is 39 days or less by April 15, or 50 days or less by May 1, DSWG is triggered. This trigger is arguably related to the recovery of smelt, because it focuses on spawning. However, no action except a group meeting is required in response to the trigger. Moreover, maximizing the potential for smelt to spawn is only one aspect of recovery. If Project operations and/or other impacts kill more smelt than are produced during spawning, recovery does not occur. The existence of this trigger, alone, does not establish that recovery of smelt was adequately considered or addressed.[FN36]

2. *The Biop Does Not Adequately Assess Impacts to All Areas of Critical Habitat.*

Plaintiffs also allege that the BiOp arbitrarily ignores impacts to certain areas of critical habitat because it focuses on X2 as a proxy for Delta smelt habitat. Plaintiffs argue that the focus on X2 ignores other areas of designated critical habitat.

The BiOp focuses on the impact project operations have had and will have on the position of X2. Defendants and Defendant-Intervenors argue that critical habitat will be protected, because any impacts to the position of X2 will be addressed by the DSRAM. The State Water Contractors contend that protecting critical habitat outside X2 " makes no sense if they are not the areas in which the fish resides." (Doc. 241 at 17.)

***52** Plaintiffs do not dispute the notion that X2 directly relates to where most smelt are located. Rather, Plaintiffs maintain that critical habitat is not coextensive with X2. The BiOp identifies numerous areas in which smelt occur (AR 362) and acknowledges that X2 " does not necessarily regulate smelt distribution in all years." (*Id.*) Delta smelt critical habitat is defined by physical boundaries:

California-Areas of all water and all submerged lands below ordinary high water and the entire water column bounded by and contained in Suisun Bay (including the contiguous Grizzly and Honker Bays); the length of Montezuma Slough; and the existing contiguous waters contained within the Delta, as defined by section 12220, of the State of California's Water Code of 1969 (a complex of bays, dead-end sloughs, channels typically less than 4 meters deep, marshlands, etc.) as follows:

Bounded by a line beginning at the Carquinez Bridge which crosses the Carquinez Strait; thence, northeasterly along the western and northern shoreline of Suisun Bay, including Goodyear, Suisun, Cutoff, First Mallard (Spring Branch), and Montezuma Sloughs; thence, upstream to the intersection of Montezuma Slough with the western boundary of the Delta as delineated in section 12220 of the State of California's Water Code of 1969; thence, following the boundary and including all contiguous

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water bodies contained within the statutory definition of the Delta, to its intersection with the San Joaquin River at its confluence with Suisun Bay; thence, westerly along the south shore of Suisun Bay to the Carquinez Bridge.

59 Fed.Reg. 65,256, 65,277 (Dec. 19, 1994).

Federal Defendants respond that " the agencies have developed an operating and adaptive management system that adequately protects the existing critical habitat, that reasonably uses X2 as an evaluation tool, and that also ensures that ' additional measures' will be taken in accordance with the DSRAM to affirmatively and proactively manage habitat, as needed." (Doc. 242 at 26.) But, apart from the X2 analyses, Federal Defendants identify no other record evidence that reflects the agency *analyzed* impacts to critical habitat or that any " additional measures" will be required under DSRAM, as the DSRAM does not require any measure be implemented.

Defendant Intervenors assert that it is unnecessarily costly to accommodate impacts to all of the geographically designated critical habitats because the smelt are not located in the entirety of their critical habitat range all of the time. They argue the focus must be on protecting the habitat occupied by the smelt. Even if more sensible, the law requires that the agency analyze whether project operations will directly or indirectly alter critical habitat in a way that " appreciably diminishes the value of critical habitat for both the survival and recovery of a listed species." 50 C.F.R. § 402.02. " Such alterations include, but are not limited to, alterations adversely modifying any of those physical or biological features that were the basis for determining the habitat to be critical." *Id.* The statute defines critical habitat to include both " the specific areas within the geographical area occupied by the species ... on which are found those physical or biological features ... essential to the conservation of the species" *and*" specific areas outside the geographical area occupied by the species ... upon a determination by the Secretary that such areas are essential for the conservation of the species." 16 U.S.C. § 1532(5)(A). The definition of critical habitat is broader than the specific areas of occupation.

***53** Here, the agency defined critical habitat to have a geographic scope. Absent any alterations to the critical habitat designation, the agency must address in the BiOp the full extent of impacts to the currently designated critical habitat,[FN37] which excluded " already degraded areas." Alternatively, the Delta smelt's critical habitat should be redefined to reflect the actual location of the smelt, if such redesignation would be consistent with law.

This has not been done. Plaintiffs motion for summary adjudication is **GRANTED** as to this issue.

F. *Did the BiOp Fail to Address the Impacts of the Whole Project?*

1. Plaintiffs' Argument That the Biop Should Have Analyzed the Effects of Constructing the SDIP, Intertie, and FRWP.

Plaintiffs complain that the BiOp's scope is unlawfully narrow because it fails to consider all planned actions. The BiOp includes within its formal consultation, " delivery of CVP water to the proposed Freeport Regional Water Project (FRWP)" as well as the " operation of the SWP-CVP intertie." The BiOp designates as an early consultation issue " operations of components of the South Delta Improvement Program (SDIP)," which include " permanent barrier operations in the South Delta." (AR 248.) The effects of constructing the FRWP, the Intertie, and the permanent barriers are to be covered in separate formal consultations. (AR 256, 339, 341, 421.)

The ESA requires FWS to address impacts associated with the entire agency action. *See* *Conner*, 848 F.2d at 1453-54 (holding that agency violated ESA by choosing not to analyze the effects of all stages of oil and gas activity on federal lands). According to ESA regulations, the effects of an agency action include " direct and indirect effects of an action on the species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action, that will be added to the environmental baseline." 50 C.F.R. § 402.02. " The meaning of ' agency action' is determined as a matter of law by the Court, not by the agency." *Greenpeace II*, 80 F.Supp.2d at 1146 (citing *Pacific Rivers Council v. Thomas*, 30 F.3d 1050, 1054 (9th Cir.1994).)

The BiOp explains its approach to scope as follows:
The proposed action is to continue to operate the CVP and SWP in a coordinated manner. In addition to current day operations, several future actions are to be included in this consultation. These actions are: (1) increased flows in the Trinity River, (2) 8500 Banks, (3) permanent barriers operated in the South Delta, (4) an intertie between the California Aqueduct (CA) and the Delta-Mendota Canal (DMC), (5) a long-term EWA, (6) delivery of CVP water to the FRWP, and (7) various operational changes that are identified in this project description. Some of these items will be part of early consultation including 8500 Banks,

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permanent barriers and the long-term EWA. These proposed actions will come online at various times in the future. Thus, the proposed action is continued operation of the Project without these actions, and operations as they come online.
***54** The actions listed in the preceding paragraph are not being implemented at present; however, they are part of the future proposed action on which Reclamation is consulting. Only the operations associated with the proposed activities are addressed in this consultation; i.e., the activities do not include construction of any facilities *to implement* the actions. All site specific/localized activities of the actions such as construction/screening and any other site specific effects will be addressed in separate action specific section 7 consultations.

(AR at 256 (emphasis added).) In sum, only those aspects of the 2004 OCAP that will be implemented without further approval were the subject of formal consultation. However, certain other changes that will be effectuated in the future were the subject of early consultation. With respect to future operational changes, including some subject to formal consultation, full implementation will require the construction of specified facilities. The impact of the construction activities themselves will be the subject of separate § 7 consultation.

Plaintiffs argue that the BiOp should have addressed the full impacts of construction of the Intertie, Freport diversion, and the SDIP because those projects are within the scope of the agency action as a whole and are " interrelated and interdependent" with the 2004 OCAP.FN38

In response, Federal Defendants cite the Endangered Species Consultation Handbook, which explains, in a hypothetical example, that operation of an existing dam project need not be considered an interrelated or interdependent activity, where the agency action being evaluated in a biological opinion was the addition of a new turbine to an existing dam.FN39(Handbook at 4-25 to 4-29.) Although not cited by the Federal Defendants for this purpose, the Handbook also describes a general approach FWS should use when determining whether certain actions are " interrelated or interdependent," so as to be considered part of the action:
Interrelated and interdependent actions: Effects of the action under consultation are analyzed together with the effects of other activities that are interrelated to, or interdependent with, that action. An interrelated activity is an activity that is part of the proposed action and depends on the proposed action for its justification. An interdependent activity is an activity that has no independent utility apart from the action under consultation. (Note: the regulations refer to the action under consultation as the " larger action" [50 CFR § 402.02]) ....
As a practical matter, the analysis of whether other activities are interrelated to, or interdependent with, the proposed action under consultation should be conducted by applying a " but for" test. *The biologist should ask whether another activity in question would occur " but for" the proposed action under consultation.*If the answer is " no," that the activity in question would not occur but for the proposed action, then the activity is interrelated or interdependent and should be analyzed with the effects of the action. If the answer is " yes," that the activity in question would occur regardless of the proposed action under consultation, then the activity is not interdependent or interrelated and would not be analyzed with the effects of the action under consultation. There will be times when the answer to this question will not be apparent on its face. The biologist should ask follow-up questions to the relevant parties to determine the relationship of the activity to the proposed action under consultation. It is important to remember that interrelated or interdependent activities are measured against the proposed action. That is, the relevant inquiry is whether the activity in question should be analyzed with the effects of the action under consultation because it is interrelated to, or interdependent with, the proposed action. Be careful not to reverse the analysis by analyzing the relationship of the proposed action against the other activity. For example, as cited below, if the proposed action is the addition of a second turbine to an existing dam, the question is whether the dam (the other activity) is interrelated to or interdependent with the proposed action (the addition of the turbine), not the reverse.

***55** Section 7 Handbook at 4-26.

Here, applying the Handbook test, the question is whether the other activities (construction and operation of SDIP, Freeport, and the Intertie) are interrelated to or interdependent with the proposed actions subject to formal consultation? The formal consultation, as described in the BiOp, covers
... the proposed 2020 operations of the CVP including the Trinity River Mainstem ROD (Trinity ROD) flows on the Trinity River, the increased water demands on the American River, the *delivery of CVP water to the proposed Freeport Regional Water Project (FRWP),* water transfers, the long term Environmental Water Account (EWA), the operation of the Tracy Fish Facility, and *the operation of the SWP-CVP intertie.*The effects of operations of the SWP are also included in this opinion

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and include the operations of the North Bay Aqueduct, the Suisun Marsh Salinity Control Gates, the Skinner Fish Facility and water transfers.

(AR 248 (emphasis added).) The formal consultation admittedly covers *delivery* of CVP water to the proposed FRWP and operation of the Intertie. But, the BiOp expressly excludes the impacts of construction associated with FRWP or the Intertie:The actions listed in the preceding paragraph [including permanent barriers in the South Delta, an intertie, and the FRWP] are not being implemented at present; however, they are part of the future proposed action on which Reclamation is consulting. *Only the operations associated with the proposed activities are addressed in this consultation; i.e., the activities do not include construction of any facilities to implement the actions.*All site specific/localized activities of the actions such as construction/screening and any other site specific effects will be addressed in separate action specific section 7 consultations.

(AR 256 (emphasis added).)

Is there a " but-for" relationship between the 2004 OCAP and the new projects? The FRWP and the Intertie are designed to more effectively distribute CVP and SWP waters. There is no evidence in the record indicating that construction of either project is tied in any way to the pre-approval of delivery of water to the projects. Flow operations could be approved *after* or simultaneously with the approval of new construction. Under the Handbook test, the construction projects are not considered interdependent and interrelated. These projects may be consulted upon separately. By approving a flow regime before the construction, the Bureau may plann for the *possibility* that the FRWP will be constructed in the future. The entire OCAP BiOp would not need to be revised should the projects be constructed. This is a reasonable approach.

With respect to the SDIP, the BiOp currently excludes *both* its operation and related construction coverage under the formal consultation. Plaintiffs allege that *both* should have been covered by the BiOp because they are interrelated with or interdependent on the agency action. Applying the Handbook analysis, the operation and construction of the SDIP (which includes increased pumping at Banks and operation of permanent barriers) will not occur " but for" the approval of the 2004 OCAP for CVP-SWP operations? Each action is independent of the 2004 OCAP. The SDIP is a separate addition that may or may not be constructed. Project operations under the 2004 OCAP in no way depend upon the SDIP. There is no prohibition to addressing the future operation, if and when the construction of the SDIP will occur, in a separate consultation.

***56** Plaintiffs' motion for summary adjudication is **DENIED** as to the future projects issue.

2. Plaintiffs' Argument that the BiOp Failed to Analyze the Impact of Full Contract Deliveries.

A biological opinion must consider the effects of the entire agency action, meaning " all activities or programs of any kind authorized, funded, or carried out," including " the granting of ... contracts." 50 C.F.R. § 402.02. One of the primary purposes of the 2004 OCAP is to " deliver water supplies to affected water rights holders as well as project contractors." (AR 259.) The Bureau delivers water to numerous parties pursuant to long-term contracts (" CVP Contracts"), some of which were renewed shortly after the BiOp was issued. (AR 4732, 4796, 4855.)

The CALSIM II model incorporated water deliveries into its various flow scenarios, but only performed its analysis based on the effects of delivering between 11 and 89 percent of the full CVP Contract allocations. (*See* AR 1067; see also Doc. 242 at 31 (acknowledging that the agency " did not evaluate the impacts of 100% percent delivery of all contracted waters").) This range of delivery scenarios is based on historic average water deliveries.

Plaintiffs allege that, by failing to evaluate the impact of delivering full amount (100%) of contracted water, the BiOp violates the requirement that the it evaluate the entire agency action. Plaintiffs cite *Rodgers*, 381 F.Supp.2d at 1237-40, which examined a biological opinion approving long term water contracts in the Friant, Buchanan, and Hidden water units of the CVP. The BiOp only examined the impacts of the amount of historical water deliveries, which amounted to less than half of the water deliveries authorized under the long term water service contracts. *Id.* at 1237-28.
The Friant long-term contracts cumulatively authorized the Bureau to deliver more than 2.1 million acre-feet of water per year, for twenty-five years. Rather than analyzing the effects of 2.1 million acre-feet of water delivery, FWS explained that its " effects analysis is conducted under the expectation that water will be delivered to CVP service contractors in quantities that approximate historic deliveries (1988 through 1997), as given in Appendix D of the November 21, 2000 programmatic long-term CVP contracts consultation."

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This assumption was made, the BiOp explained, because " delivery of full contract quantities is unrealistic."

Id. at 1238. *Rodgers* rejected FWS's approach, reasoning that the " ESA requires that all impacts of agency action-both present and future effects-be addressed in the consultation's jeopardy analysis." The fact that it was thought by FWS that " delivery of full contract quantities is unrealistic" and that " deliveries continue to be impacted by existing climate, hydrology, actions and statutes, ... socio-economic factors" does not excuse consulting on the " entire agency action," which was the authorized delivery of over 2.1 million acre-feet of water, and nothing less than that.

***57** *Id.* at 1239.

Federal defendants assert that the *Rodgers* decision was wrong, arguing that " [a]bsent alternative information that the agency failed to consider, and given the fact that the agency did use the best available information, the *Rodgers* court should have deferred to the agency." (Doc. 242 at 32.) It is not the province of another district court to decide whether *Rodgers* is " wrong." *Rodgers* is distinguishable as it specifically addressed the government authorization of CVP water users' long-term water service contracts. Those contracts authorized 2.1 MAF of water deliveries in total. *Rodgers* found unlawful the biological opinion's limitation in its scope to approximate historic deliveries, instead of the full contract allocations. Here, however, the agency action subject to consultation is not the authorization or merits of the water service contracts, rather, it is the *operation* of the CVP and SWP under the OCAP and whether those projected operations will cause jeopardy to the survival and recovery of smelt or smelt habitat. The government is entitled to make *reasonable* assumptions about the operational volume of water flows, water levels, temperature, and quality based on the historical and projected data in the administrative record. The BiOp explains that the delivery of full water service contract entitlements is expected only when excess water conditions exist, i.e., in a wet water year when sufficient water is available to meet all beneficial needs. (AR 259.) Plaintiffs do not suggest that this assumption is factually impossible. (Nor would it be unreasonable for FWS to model a full (100%) water contract delivery scenario, even if it has not happened in the past fifteen years.) The agency model for the worst case scenario is indispensable. Analysis of a " best of the best" case in a wet water year is not indispensable, as such " wet" water year conditions do not present any reasonable likelihood of jeopardy, absent an additional showing. However, because such a scenario could eventuate, it is not unlawful for the agency to analyze the effects on the smelt of 100% water contract deliveries. However, the 100% delivery analysis is not required. This is a matter committed to the agency's expertise and discretion.

Plaintiffs motion for summary adjudication is **DENIED** as to this issue.

As the history of the many CVP water cases decided in this court evidences, the duty to defer to the agency's expertise is well recognized and honored, when the agency has acted reasonably and lawfully to discharge its statutory responsibilities. The disputed BiOp depends in material measure for its no jeopardy finding on the DSRAM, which is legally insufficient. The agency's recognition the Delta smelt is increasingly in jeopardy; that its operative BiOp is inadequate, as evidenced by its second initiation of reconsultation for the 2004 OCAP, now pending, and its insistence that it will nonetheless operate the Projects under the challenged BiOp is unreasonable. The agency could have, but did not, offer a viable protective alternative. Adaptive management is within the agency's discretion to choose and employ, however, the absence of any definite, certain, or enforceable criteria or standards make its use arbitrary and capricious under the totality of the circumstances.

***58** The agency's failure to reasonably estimate the Delta smelt population and to analyze most recent smelt abundance data make the take limits based on historical data unreliable and unreasonable. The Delta smelt is undisputedly in jeopardy as to its survival and recovery. The 2005 BiOp's no jeopardy finding is arbitrary, capricious, and contrary to law.

For all the reasons set forth above, the 2005 OCAP BiOp is unlawful and inadequate on the following grounds:
(1) The DSRAM, as currently structured, does not provide a reasonable degree of certainty that mitigation actions will take place, even if the agency retains the discretion to draw upon numerous sources of water, not just the EWA, CVPIA(b)(2), and VAMP programs, to support fish protection.
(2) The agency failed to utilize the best available scientific information by not addressing the 2004 FMWT data and the issue of climate change.
(3) The BiOp's historical approach to setting take limits fails to consider take in the context of most recent overall species abundance and jeopardy.
(4) The BiOp did not adequately consider impacts to critical habitat by (a) failing to analyze how project

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operations will impact the value of critical habitat for the recovery of the smelt and (b) failing to consider impacts upon the entire extent of known smelt critical habitat.

The Plaintiffs' motions for summary judgment are GRANTED IN PART AND DENIED IN PART, as delineated above.

Based on the legally flawed BiOp, an appropriate interim remedy must be implemented. All parties agree that it is not prudent to impose a remedy without further input from the parties. A separate remedies hearing will be scheduled within thirty days at the parties' mutual convenience.[FN40] During oral argument, Federal Defendants and Defendant-Intervenors jointly requested a stay of any order finding the BiOp unlawful to avoid the draconian consequences of operating the CVP-SWP without a lawful take limit. Affording all parties the opportunity to participate in a remedies hearing will not jeopardize the species or the public interest during interim operation of the projects. Plaintiffs did not object to such an approach.

A Scheduling Conference is set for May 30, 2007, at 8:45 a.m. in Courtroom 3 to afford the parties time for discussions to set a remedies hearing, and to consider the entry of a stay, if necessary.

Plaintiffs shall submit a form of order on the motions for summary judgment consistent with this decision within five (5) days following service of this decision.

IT IS SO ORDERED.

FN1. The Delta smelt was listed as a threatened species under the ESA, March 5, 1992, 58 Fed.Reg. 12863.

FN2. The biological opinion was first issued in July 2004. Then, after reconsultation, was reissued in February 2005.

FN3. All " AR" references are to the administrative record provided by the U.S. Fish and Wildlife Service..

FN4. Whether the 2004 OCAP is a " final agency action" for the purposes of the National Environmental Policy Act is at issue in a related lawsuit, *Pacific Coast Federation of Fishermen's Associations v. Gutierrez*, 1:06-cv-00245 OWW (TAG) (" *PCFFA*"). This overview of the OCAP does not prejudge the merits of the pending motion to dismiss in *PCFFA.*

FN5. The OCAP itself does not plan for increased pumping or the construction or operation of any new facilities, nor does it describe or model flow regimes under any of these future plans. These planned operational changes are set forth in the BA and the BiOp. (*See* AR 381-423 (describing the effects of those actions included in formal consultation, including re-operation of the Trinity River, increased demands on the American River, operation of the Freeport Regional Water Project (" FRWP"), and operation of an intertie between the Delta-Mendota Canal and the California Aqueduct); AR 357-61 (describing the " items for early consultation," including operation of components of the South Delta Improvement Project, which calls for pumping at Banks to increase to 8500 cfs, operation of permanent barriers in various places within the Delta, the operation of a long term EWA, the use of CVP/SWP capacity to facilitate expanded water transfers, and further integration of CVP/SWP operations.)

FN6. The first step in the consultation process is usually the preparation of a Biological Assessment (" BA") by the action agency (in this case, the Bureau), the purpose of which is to " evaluate the potential effects of the action on listed [ ] species and designated [ ] critical habitat and determine whether any such species or habitat are likely to be adversely affected by the action...." 50 C.F.R. § 402.12(a). In this case, the Bureau issued its BA regarding the " Long-Term Central Valley Project and State Water Project Operations and Criteria Plan" on June 30, 2004. (AR 729.) The BA describes the project on which consultation is being held, both early and formal, in much the same terms as are used in the BiOp.

FN7. Prior to 2004, the OCAP operated under Biological Opinions issued in 1993 and 1995.

FN8. Pelagic fish live in open water, generally away from vegetation or the bottom. (AR 365.) A significant amount of the smelt's habitat are the Delta waters and waters of surrounding areas.

FN9. The BiOp contradictorily acknowledges that " although salvage is used to index delta

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smelt take, it does not reliably index delta smelt entrainment." (AR 419.)

FN10. These " hard" take limits, as the Defendants and Defendant Intervenors referred to them during oral argument are different from a separate take trigger that is part of the DSRAM process described below.

FN11. DWR insisted during oral argument that the data used to run the CALSIM II models was not " salvage" data but was rather " density data." The BiOp is explicit that the models were run using a " salvage density" estimate generated from periodic samplings of salvaged fish.

FN12. The information contained in these tables was derived by the court from the BiOp but was not presented in this form in the BiOp.

FN13. The tables at pages 414 and 419 of the AR do not list the absolute number of smelt estimated to be taken in any given month under the 1995 regulatory base case (Study No. 1). However, the incidental take limits (set forth in the Table 3 below) were based on the absolute numbers of smelt that are projected to be taken under Study No. 5a. For example, the take limit for the month of May in a Critically Dry year, set at 30,500, under the CALSIM II results in a reduction of the 30,500 to 18,921 (representing 11,652 reduction in CVP salvage plus 7,269 reduction in SWP salvage) *lower* than the 1995 regulatory base case.

FN14. The DSRAM also includes a chart illustrating when during the year each of these actions will be available. (AR 346.)

FN15. In a footnote at the end of Plaintiffs' motion to strike the Sommer Declaration, Plaintiffs also challenge Federal Defendants' reliance on the declaration of Ann Lubas-Williams, which Federal Defendants filed with their response to Plaintiffs' motion for summary judgment/cross motion to dismiss. (*See* Doc. 242-4.) The Lubas-Williams declaration concerns the implementation of DSRAM and the sources from which DWR plans to obtain water to protect Delta smelt in the near future. Federal defendants relied on her declaration primarily to support their motion to dismiss or for voluntary remand. No party has relied upon this declaration in the context of the pending motions; it was not considered by the court. It is unnecessary to rule on this motion to strike.

FN16. Federal Defendants also cite *Pension Benefit Guar. Corp. v. LTV Corp.*, 496 U.S. 633, 654-655, 110 S.Ct. 2668, 110 L.Ed.2d 579 (1990), in which the Supreme Court reasoned: " Here, unlike in *Overton Park*, the Court of Appeals did not suggest that the administrative record was inadequate to enable the court to fulfill its duties under § 706."
Federal Defendants quote *Pension Benefit* entirely out of context. The quoted language is drawn from a part of the opinion addressing the Second Circuit's ruling about the adequacy of *procedures* used by the defendant agency. Specifically, that court ruled that the agency acted arbitrarily and capriciously because it failed to apprise the plaintiff of the material on which it was to base its decision, never gave plaintiff an adequate opportunity to offer contrary evidence, failed to proceed according to ascertainable standards, and failed to provide plaintiff a statement showing its reasoning. *Id.* at 653.One party claimed that *Overton Park* validated a court's order that an agency undertakes additional procedures.*Id.* The Supreme Court rejected this argument, reasoning that, at most, *Overton Park*" imposes a general ' procedural' requirement of sorts by mandating that an agency take whatever steps it needs to provide an explanation that will enable the court to evaluate the agency's rationale at the time of decision." *Id.* at 654.The Supreme Court then distinguished *Overton Park*, reasoning that " [h]ere, unlike in *Overton Park*, the Court of Appeals did not suggest that the administrative record was inadequate to enable the court to fulfill its duties under § 706." *Id.* at 655.This was a specific reference to language in *Overton Park* which criticized the lower courts for relying only on the litigation affidavits, rather than the whole administrative record. *Pension Benefit* sheds absolutely no light on the admissibility of extra-record evidence.

FN17. At least one district court has followed the holding in *American Rivers.See NRDC v. Rodgers*, 381 F.Supp.2d 1212, 1230 (E.D.Cal.2005).

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FN18.*Rumsfeld* also found fault with the biological opinion's monitoring plan, characterizing it as a means of delaying the implementation of necessary mitigation measures:
The Army may not delay identifying the measures necessary to mitigate the effects of its ten-year plan based on the monitoring provisions in the Final BO....
The Final BO's monitoring requirements do not measure the success or failure of the on-base and/or regional mitigation measures to reduce the groundwater deficit. It only requires the Army to develop " a monitoring program designed to assess progress," and requires an annual review of the AWRMP, as to which projects have been implemented the past year and which are to be implemented in the coming year. Especially since the Final BO and the AWRMP fail to quantify the remedial value of the proposed projects, simply reporting project implementation is not a meaningful assessment of the success or failure of the mitigation measures in protecting the water umbel, willow flycatcher, and critical habitat from adverse impact. Such an assessment would require systematic monitoring of either San Pedro baseflows or the groundwater aquifer.
198 F.Supp.2d at 1154 (internal record citations omitted). No such failure is alleged here. Plaintiffs do not suggest that the monitoring called for by the DSRAM is flawed.

FN19. In *NWF v. Babbit,* the district court expressly approved the design of the HCP as a whole, but invalidated the permit issued in connection with the plan on grounds wholly independent from the design of the HCP and/or the adaptive management plan. *See 128 F.Supp.2d* at 1298-99.

FN20. The only clearly enforceable standard or benchmark in the BiOp is compliance with the BiOp's " hard" take exceedence limits. But, the existence of enforceable take limits does not shield the DSRAM from scrutiny. There is no provision to allow the " hard" take exceedence limits to be adjusted to reflect new information about the species. Moreover, the BiOp expressly recognizes that the take limits alone are not enough to prevent jeopardy, requiring, among other things, implementation of the DSRAM as a reasonable and prudent measure. (*See* AR 475 (" The Project shall be implemented as described.") This is exactly the reason why the DSRAM must be made more certain and enforceable.

FN21. As of the date of oral argument, the mandate has not yet issued in *NWF v. NMFS.*

FN22. Plaintiffs cite another district court decision that applied the benefit of the doubt language: " To the extent that there is any uncertainty as to what constitutes the best scientific information, Congress intended for the agency to ' give the benefit of the doubt to the species.' " *Ctr. for Biological Diversity v. Bureau of Land Mgmt.,* 422 F.Supp.2d 1115, 1127 (N.D.Cal.2006) (citing *Conner,* 848 F.2d at 1454). However, that district court did not apply the " benefit of the doubt" concept in its analysis in any way, let alone as a presumption governing the agency's analysis of scientific information.
Another case Plaintiffs cite, *Rock Creek Alliance v. U.S. Fish & Wildlife Service,* 390 F.Supp.2d 993, 1003 (D.Mont.2005), does not support imposing a " benefit of the doubt" presumption to uncertain scientific evidence:
Though the agency has discretion to make decisions based in its expertise, the ESA expresses a legislative mandate " to require agencies to afford first priority to the declared national policy of saving endangered species.... Congress has spoken in the plainest of words, making it abundantly clear that the balance has been struck in favor of affording endangered species the highest of priorities, thereby adopting a policy which it described as ' institutionalized caution.' "
Id. (quoting *Tennessee Valley Authority v. Hill,* 437 U.S. 153, 185, 98 S.Ct. 2279, 57 L.Ed.2d 117 (1978)). However, as in *Center for Biological Diversity,* this language was part of a general discussion of the legal framework; the *Rock Creek* court never applied a benefit of the doubt presumption in the manner Plaintiffs suggest it should be applied here.

FN23. Defendants and Defendant-Intervenors dispute whether the data " evoked grave concern." The degree of concern is irrelevant to the inquiry, as it is undisputed that the 2004 FMWT data showed the lowest smelt abundance on record.

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FN24. The State Water Contractors maintain that CVP/SWP operations have been on-going for decades, during which time Delta smelt abundance has fluctuated greatly.

FN25. Plaintiffs' record citations, AR 9199-9202, are print-outs of the FMWT data which post date the issuance of the BiOp.

FN26. Abundance data is relevant to aspects of the BiOp that are independent of the DSRAM process. For example, the agency's conclusion that the level of anticipated take " is not likely to result in jeopardy to the smelt because this level of take is at or below historical levels of take" (AR 474), is irrational because no consideration is given to the current decline in smelt abundance nor any explanation provided how the further decline of the smelt does not exacerbate jeopardy to the species' survival and recovery.

FN27. Plaintiffs argue that " [r]egardless of the uncertainty involved in predicting the consequences of climate change, FWS had an obligation under the ESA to address the probable effects on Delta smelt." (Doc. 232 at 7.) In response, the State Water Contractors quote the following passage from *Bennett v. Spear*, 520 U.S. 154, 176-177, 117 S.Ct. 1154, 137 L.Ed.2d 281 (1997), in support of the proposition that the ESA intended to preclude exactly this kind of argument:

The obvious purpose of the requirement that each agency " use the best scientific and commercial data available" is to ensure that the ESA not be implemented haphazardly, on the basis of speculation or surmise. While this no doubt serves to advance the ESA's overall goal of species preservation, we think it readily apparent that another objective (if not indeed the primary one) is to avoid needless economic dislocation produced by agency officials zealously but unintelligently pursuing their environmental objectives.

But, this passage from *Bennet* was part of a broader discussion holding that persons who are economically burdened by a decision made under the ESA fall within the zone of interests the statute protects for the purposes of standing. *Bennet* sheds little light on the current inquiry-whether and to what extent the data that was before the FWS regarding climate change should have been considered and addressed in the BiOp.

FN28. There is no basis to determine what weight FWS should ultimately give the climate change issue in its analysis.

FN29. There is no recognized mechanism for introducing any population viability data, collected through the adaptive management process, into the setting of the take limits.

FN30. The San Luis Parties mischaracterize Plaintiffs argument as a request for FWS to undertake additional research projects. (Doc. 247.) Defendant Intervenors are correct that FWS is not required to undertake new research, *Greenpeace Action v. Franklin*, 14 F.3d 1324, 1335 (9th Cir.1992) (agency may proceed despite uncertainty about accuracy of modeling effort); Southwest Ctr for Biological Diversity, 215 F.3d 58, 60 (D.C.Cir.2000) (agency could rely on inconclusive data to make decision; not obligated to conduct new independent studies). Plaintiffs do point out that FWS acknowledges in the AR that an accurate determination of non-jeopardy would require knowledge of how many smelt existed, what proportion would be lost due to the projects, and what level of loss would be sustainable. (Doc. 232 at 23 (citing AR 8221).) However, the crux of Plaintiffs' concern is that FWS has not developed such population data and ignored important existing data on abundance in setting the take limits.

FN31. The Administrative Record reflects various explanations for the lack of a linear relationship between the TNS and the FMWT. (AR 1025-26.) One possible explanation for why the number of spawning age smelt (indexed by the FMWT) seems to be a poor predictor of subsequent offspring (indexed by the TNS) is that there is some environmental factor (not directly related to entrainment at the projects) limiting survivability, inferring that there is a carrying capacity for the population. (*Id.*) Alternatively, some scientists question whether it is proper to try to draw statistical conclusions from the entire 1969-2002 data pool, given that the smelt experienced a precipitous decline in 1981. These scientists have postulated that the data " may reflect two different relationships from two time periods with different delta smelt carrying capacities." (*Id.* at 1026.)One study cited in the AR indicates that food supply may

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be the limiting factor during this time period. (AR 8976.)

FN32. The San Luis Parties raise numerous questions regarding FWS's conclusion that there is a statistical relationship between the numbers of spawning adults and Delta smelt abundance the following year, criticizing the statistical analyses referenced in the BiOp. (Doc. 247 at 5.) It is unnecessary to adjudicate these issues, as the San Luis Parties have not separately challenged the conclusions reached in the BiOp on this ground nor have they moved for summary judgment on any issue in this case.

FN33. Defendant-Intervenors argue that, because of these mentions of " conservation," FWS is entitled to a " presumption of regularity," and the court must *assume* that agency considered recovery. (Doc. 247 at 12.) In *Gifford Pinchot,* after invalidating the destruction and adverse modification regulation, the Ninth Circuit considered whether it should presume that the agency followed its own regulation that was valid at the time the biological opinion was issued. The Ninth Circuit concluded that, because the agencies must be afforded a " presumption of regularity," a court must assume that the agency followed the then applicable regulation.*Id.* at 1072.Applying this presumption here, given that the agency specifically applied the statute, not the invalid regulation, there is no evidence the agency applied an invalid regulation. However, Defendant-Intervenors' suggestion that the presumption should be applied to validate the BiOp's *analysis* of recovery is misplaced. The agency still has an obligation to thoroughly consider the issue of recovery and to reach a reasoned conclusion based on the evidence in the administrative record.

FN34. Although this portion of *NWF v. NMFS* concerned analysis of recovery in the context of the " no jeopardy" determination, as opposed to the " destruction or adverse modification of critical habitat" analysis, the holding is equally applicable to habitat jeopardy.

FN35. There is also merit to Plaintiffs' argument that " [g]iven that the very same sorts of impacts to critical habitat have contributed to the species decline, one might expect FWS to examine carefully how the continuance and magnification of these kinds of impacts could allow for the survival of the species, much less its recovery." (Doc. 306 at 5.)

FN36. The San Luis Parties correctly note that the CALSIM II models indicate that increased pumping capacity and operational flexibility may actually *increase* the smelt's prospects vis-a-vis the regulatory baseline. However, that the species will fare better than in the past does not assure that the totality of OCAP operations are consistent with the smelt's recovery.

FN37. Plaintiffs raise an additional contention why the critical habitat analysis is insufficient; i.e., that the BiOp unlawfully " writes off" areas of critical habitat because they have already been degraded. For example, the BiOp concludes that " [a]n upstream movement of X2 of 0.5 km would not be significant when [X2] is located upstream of the [Sacramento-San Joaquin River] confluence because *smelt habitat is already poor* and the upstream movement does not result in any substantial additional loss of habitat or increase in adverse effects." (AR 443.) This issue need not be reached, as the critical habitat analysis is insufficient on other grounds. Federal Defendants are already revising the BiOp to reflect new information and new law.

FN38. The San Luis Parties cite *Gifford Pinchot* in support of the proposition that this is a properly " tiered" biological opinion. *In Gifford Pinchot,* the Ninth Circuit approved for the the tiering of a biological opinion for timber harvests in specified forest areas. The no jeopardy conclusion contained in that biological opinion relied on compliance with a very thorough, overarching forest management plan that was previously approved by the court. 378 F.3d at 1067-68. *Gifford Pinchot* allowed the agency to tier its BiOp of a timber harvest with a programmatic forest management plan that provided guidelines regarding the harvesting of timber. *Rodgers,* 381 F.Supp.2d at 1228 n. 27, interpreted the holding narrowly to apply tiering only to cases in which the programmatic opinion was particularly thorough. Tiering of future construction projects is not appropriate here, because the BiOp provides no programmatic guidelines regarding construction activities. However, just because the later projects cannot

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be " tiered" off the current BiOp does not mean they must be included in the current BiOp. The relevant inquiry is whether the construction projects are interrelated to and/or interdependent upon the BiOp and the 2004 OCAP.

FN39. Federal Defendants correctly point out that the FWS uses as a guidance document the ESA Section 7 Consultation Handbook (March 1998), available at " http:/ / www.fws.gov/endangered/consultations/s7hndbk /s7hndbk.htm" (last visited Apr. 27, 2006).*See e.g.*, *Oregon Natural Res. Council v. Allen,* 476 F.3d 1031, 1039 n. 7 (9th Cir.2007); *Ariz. Cattle Growers' Ass'n v. U.S. Fish & Wildlife Serv.*, 273 F.3d 1229 (9th Cir.2001).

FN40. The parties stated that they may be able to reach an agreement as to interim remedies, avoiding the need for a remedies hearing.

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Santa Barbara Superior Court Decision on West Creek

SUPERIOR COURT OF CALIFORNIA, COUNTY OF SANTA BARBARA			FILED
STREET ADDRESS: 1100 Anacapa St MAILING ADDRESS: CITY AND ZIP CODE: Santa Barbara, CA, 93101 BRANCH NAME:		RECEIVED	SUPERIOR COURT of CALIFORNIA COUNTY of SANTA BARBARA JAN 0 6 2006
PLAINTIFF: Santa Clarita Organization DEFENDANT: County of Los Angeles		JAN 11 2006 PAUL HASTINGS	GARY M. BLAIR, Executive Officer BY Leanna M. Pearson LEANNA M PEARSON, Deputy Clerk
ORDER AFTER HEARING			CASE NUMBER: 1043805

On October 5, 2005 a Civil Law and Motion Hearing was set before Judge James Brown on the following matter(s):

Matter(s):

(1) 08-24-05 Notice of Motion and Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction/Opposition to Return on Writ; P's and A's -- Hrg: 10/05/2005 at 9:30 am in Dept 5, Filed by Petitioner

(2) 08-04-05 Notice of Hearing Return to Peremptory Writ of Mandate Filed by Respondent and Real Parties in Interest Hrg 10/05/05 9:30am Dept 4, Filed by Respondent

Issues Presented:

Return to Peremptory Writ of Mandate; Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction

Findings:

Background

This is an administrative mandamus action. Respondent County (County of Los Angeles) certified a final EIR and passed resolutions approving the West Creek development. The West Creek project is a proposed mixed residential and commercial development in the Santa Clarita Valley, which is to include 2,545 homes among other things. Petitioner SCOPE (Santa Clarita Organization for Planning the Environment and the Friends of Santa Clarita River, collectively) challenged the certification of the EIR and related resolutions. The developer of the Project is real party in interest, The Newhall Land and Farming Company, a California Limited Partnership, and Valencia Corporation, a California corporation (collectively "Newhall").

On 1/10/02 Dept 3 of this court denied the petition for writ of mandate. SCOPE appealed. In a published decision, the Court of Appeal reversed.

The Court of Appeal concluded that the water service portion of the EIR was inadequate. "An [EIR] for a housing development must contain a thorough analysis that reasonably informs the reader of the amount of water available. The dream of water entitlements from the incomplete State Water Project (SWP) is no substitute for the reality of actual water the SWP can deliver." *Santa Clarita Organization for Planning the Environment v. Los Angeles County (Newhall Land and Farming Co.)* (2003) 106 Cal.App.4th 715, 717-718.

Upon reversal, the Court of Appeal ordered:

"Because the water services portion of the EIR is inadequate, the judgment is reversed. The trial court shall issue a writ of mandate vacating the certification of the EIR, shall **retain jurisdiction until the County certifies the EIR complying with CEQA** consistent with the view expressed in this opinion, and shall consider such orders it deems appropriate. (See section 21168.9 on trial court's power over EIR.)"

(*Santa Clarita v. Los Angeles County* (2003) 106 Cal.App.4th 715. Emphasis supplied.)

Upon Remittitur, SCOPE exercised a 170.6 challenge, and on 5/13/03 the matter was reassigned to this department.

On 6/27/03 this Court issued a Writ of Mandate ordering the County to vacate certification of the EIR, to revise the EIR to include the issues raised in the Court of Appeals decision, and to re-circulate for public comment.

On 6/30/05 this Court issued a decision clarifying the injunction contained in the Writ of Mandate.

On 8/4/05 RPI Newhall filed its Return to the Writ of Mandate.

On 8/24/05 SCOPE filed an Opposition to the Return and "Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction"

The Return and Petitioner's Motion present overlapping issues and are considered here together.

The Court has considered on the merits all new developments impacting the adequacy of the EIR, having retained jurisdiction until an EIR in compliance with CEQA is certified. The Court of Appeal directed this court to "retain jurisdiction until the County certifies the EIR complying with CEQA..." (*Santa Clarita v. Los Angeles County* (2003) 106 Cal.App.4th 715. Public Resources Code §21168.9(b) provides that, "...The trial court shall retain jurisdiction over the public agency's proceedings by way of a return to the peremptory writ until the court has determined that the public agency has complied with this division." County and Newhall cite no authority that would prevent this court from considering new developments that occurred after issuance of the Writ and before certification of the revised EIR.

The certified "Revised EIR" consists of the initial EIR, an Additional Analysis concerning water services that was circulated in response to the Writ and revised in response to public comment, and a Supplement concerning perchlorate contamination, also circulated for public comment, discussed below.

The Writ of Mandate provided that "This Court will retain jurisdiction over this matter ...until such time as the Court has determined that the County has certified a revised EIR for the West Creek project that complies with the provisions of the California Environmental Quality Act..." The Writ of Mandate directed the County to take specific action regarding revision of the water supply analysis, and all water supply and demand analysis, within the EIR:

> "The water supply analysis in the EIR shall be revised to include the issues in the Court of Appeal decision, including, at a minimum, **accurate availability, reliability and supply estimates for State Water Project water** in wet, average and dry years, which estimates must be obtained from the Department of Water Resources. The County must also revise and re-assess the EIR's cumulative impacts analysis for water supply and demand, and must revise and re-assess any and all analysis contained in the EIR related to water supply and demand. The revised EIR shall then be re-circulated for public review and comment. If there are comments on the revised IER, then **adequate and detailed responses must be prepared for such comments**, as required under Public Resources Code §21092.5 and consistent with the Court of Appeal decision in this case. The County must make clear in the revised analysis that State Water Project entitlements are not equivalent to actual deliveries of water." (Emphasis supplied)

This court finds the Revised EIR does comply with CEQA, and includes accurate availability, reliability supply estimates for State Water Project Water in wet, average and dry years based upon estimates from the DWR, contains revised and re-assessed analysis for water supply and demand, makes clear that SWP entitlements are not equivalent to actual deliveries of water. The court finds that adequate detailed response has been prepared for public comments on the revised EIR. Petitioner's Request to expand the injunction will be denied.

Standard of Review

An agency's certification of an EIR is subject to judicial review, but a court's inquiry "shall extend only to whether there was a **prejudicial abuse of discretion**. Abuse of discretion is established if the agency has **not proceeded in a manner required** by law or if the determination or decision is **not supported by substantial evidence**." (Public Resources Code section 21168.5) (Emphasis supplied)

"**When the informational requirements of CEQA are not complied with, an agency has failed to proceed in 'a manner required by law'** and has therefore abused its discretion." *Save Our Peninsula Committee v Monterey County Bd. Of Supervisors* (2001) 87 Cal.App.4th 99, 118. (Emphasis supplied)

The court "does not pass upon the correctness of the EIR's environmental conclusions, but **only upon its sufficiency as an informative document**.'" *Laurel Heights Improvement Ass'n v Regents* (1998) 47 Cal.3d 376, 392. (Emphasis supplied)

An EIR must include analysis of the water supplies necessary to serve the project, including impacts related to infrastructure necessary to develop and deliver the water to the project. *Santiago County Water District v. County of Orange* (1981) 118 Cal.App.3d 818, Guidelines App G, ¶XVI(d) ("sufficient water supplies available to serve the project from existing entitlements and resources.")

An EIR "cannot simply label the possibility that [water resources] will not materialize as 'speculative,' and decline to address it." *Napa Citizens for Hones Government v Napa County Board of Supervisors,* (2001) 91 Cal.App.4th 342, 373 in which an EIR failed to provide sufficient information as to the effects the project might be expected to have on the region's water supply and the need for treatment of wastewater, so that the governing body's conclusion that project was consistent with general plan was invalid. "The County should be informed if other sources exist, and be informed, in at least general terms, of the environmental consequences of tapping such resource. Without either such information or a guarantee that the resources now identified in the FSEIR will be available, the County simply cannot make a meaningful assessment of the potentially significant environmental impacts of the Project"" *Id.* at 373-374.

The court "may not set aside an agency's approval of an EIR on the ground that an opposite conclusion would have been equally or more reasonable" and "may not...substitute [its] judgment for that of the people and their local representatives" but "can and must, however, scrupulously enforce all legislatively mandated CEQA requirements." *Citizens of Goleta Valley v. Board of Supervisors*, (1990) 52 Cal. 3d 553, 564.

"Under CEQA, an EIR is presumed adequate (Pub. Res. Code §21167.3), and the plaintiff in a CEQA action has the burden of proving otherwise." *State of California v. Superior Court*, (1990) 222 Cal. App. 3d 1416, 1419.

Return to Peremptory Writ of Mandate; Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction

The County has complied with the directions set forth in the Peremptory Writ of Mandate issued 6/27/03 and the Writ should be discharged. The County has certified an EIR in compliance with CEQA.

The Revised EIR contains an extensive Additional Analysis concerning water supply, based on DWR estimates for actual delivery, and makes clear that water entitlements are not equal to actual delivery.

Petitioner's challenge to the Revised EIR focuses on two issues: (1) Disclosure and Reliability Conclusions concerning the Kern-Castaic Transfer of 14,000 acre foot of water per year (afy), a source of water relied on for planning purposes; and (2) Disclosure and analysis concerning Spread of Perchlorate Contamination in the aquifer, a source of water relied on for planning purposes. The two issues are discussed in turn.

(1) Kern-Castaic Transfer of 14,000 afy

The EIR relies for planning purposes on availability of a 41,000 afy transfer of State Water Project water from Kern County Water Agency to Castaic Lake Water Agency.

The County's decision that the 41,000 afy transfer from Kern to Castaic would be available for planning purposes, despite some uncertainty arising from ongoing litigation, was supported by substantial evidence and was fully disclosed such that there was no abuse of discretion by way of failure to comply with CEQA's informational requirements.

Petitioner contends there is inadequate disclosure on the reliability of a 41,000 afy transfer from Kern to Castaic, because the Revised EIR does not refer to an Exhibit E to a Settlement Agreement reached in other litigation between Castaic, the Department of Water Resources, and other parties. (The "PCL" Litigation)

A brief historical background of the 41,000 afy SWP transfer is as follows. In 1951, California's Legislature authorized construction of a State Water Project (SWP), for which voters approved a bond issued approximately eight years later. The Department of Water Resources (DWR) is operator of the State Water Project. The DWR entered into agreements with various water districts to supply water (SWP Contracts). Castaic Lake Water Agency is such one such Contractor. In the early 1990's water shortages resulted in disputes between DWP and Contractors, which were resolved by the "Monterey Agreement" and execution of the "Monterey Amendments." The Monterey Agreement allowed SWP contractors (such as Castaic and Kern) to transfer unused Table A Amounts to other SWP contractors on a permanent basis.

In a 1999 Monterey Amendment, the DWR approved a transfer of 41,000 afy from Kern County Water Agency to Castaic Lake Water Agency. The West Creek EIR presently before the court relies heavily on availability of this transfer for planning purposes.

In 1995 an EIR for the Monterey Amendments was certified. However, it was decertified following a 2000 appellate decision in *Planning and Conservation League [PCL] v. Department of Water Resources,* (2000) 83 Cal.App.4th 892. The Third District found there that the EIR for the Monterey Agreements was inadequate, and should have been prepared by DWR as the lead agency who was in the best position to assess statewide impacts of the Monterey Amendments. This decertification of the Monterey EIR is disclosed in the EIR's Additional Analysis. (Vol 59, p. 27743, §4.2.4 *Imported Water Supplies*, (c) *Monterey Agreement Environmental Review and Litigation*) This Monterey Amendment EIR litigation is generally referred to as the "PCL Litigation."

On May 5, 2003, (after the Second District's 2/27/03 decision in this West Creek case) the PCL parties reached a Settlement Agreement concerning preparation of the required new EIR for the Monterey Amendments. That Monterey Agreement EIR is not complete. The Department of Water Resources is the lead agency for the PCL Monterey Agreement EIR, and has not yet made its final decision. This fact is also disclosed in the West Creek Revised EIR.

The EIR's Revised Additional Analysis discloses that the PCL Monterey Agreement EIR has been decertified and that the court has retained jurisdiction "until DWR certifies an EIR in accordance with CEQA." (Vol. 59, p 27743, §4.2.4(c) *Monterey Agreement Environmental Review and Litigation*) The EIR's Additional Analysis also states, "The appellate court decision invalidated certification of the EIR, but did not set aside, invalidate or otherwise vacate the Monterey Agreement. In addition, no court orders have been issued to 'stay' further implementation of the Monterey Agreement." (*Ibid.*) The statement is accurate, although it is also true no court has determined whether or not agencies may rely upon the 41,000 afy transfer for planning purposes pending recertification of the Monterey Agreement EIR.

The May 5, 2003 PCL Settlement Agreement is disclosed and summarized in the EIR's Revised Additional Analysis at section 4.2.4(c) (Vol. 59, p. 27743-27744). The PCL Settlement is attached to the Revised EIR as Appendix O. (This court recognizes that disclosure in the appendixes would not, alone, be sufficient for CEQA compliance. The Court of Appeal has previously criticized Respondent herein for relying on disclosures in appendices. "It is not enough for the EIR simply to contain information submitted by the public and experts. Problems raised by the public and responsible experts require a good faith reasoned analysis in response." 106 Cal.App.4th 715, 723.)

In the May 5, 2003 PCL Settlement Agreement, the parties including DWP and Castaic Lake Water Agency agreed that certain transfers were "final" and agreed not to "hereafter challenge the effectiveness or validity of such water transfers" (Vol. 55, p.22513, Settlement Agreement §III, D)

The 41,000 afy Kern-Castaic transfer was not among those agreed "final" transfers immune from challenge. It was treated separately in section III, E of the Agreement, because parallel litigation remained pending in Los Angeles Superior Court ("*Friends*") challenging Castaic's own certification of an EIR for the 41,000 afy purchase. The PCL parties expressly deferred to *Friends* court's jurisdiction. The PCL parties expressly acknowledged in section III, E of the PCL Agreement that the Kern-Castaic transfer was subject to separate pending litigation (*Friends of the Santa Clara River v. Castaic Lake Water Agency,* LASC BS05954, "*Friends*" in which Castaic's own EIR for the 41,000 afy transfer had been challenged, and the Court of Appeal ordered the EIR decertified. The Revised EIR discloses this information. (Vol 59, 27745-27746) The *Friends* litigation has subsequently been voluntarily dismissed. On 12/22/04 Castaic certified a revised EIR for the 41,000 transfer. A new challenge to the revised EIR is pending in Los Angeles. The PCL parties agreed, "that nothing in this Settlement Agreement is intended to predispose the remedies or other action that may occur in that pending [*Friends*] litigation."

Exhibit E to the PCL Settlement Agreement is entitled "Final Permanent Table A Amount Transfers from Kern County Water Agency Subsequent to Monterey Amendments (January 1, 2003)." It lists the seven "final" transfers. The transfer from Kern to Castaic Lake Water Agency is not included. (Vol. 55, p. 22561). The Agreement is signed by the Castaic Lake Water Agency, as well as DWR. (Vol. 55, p. 22545)

The West Creek EIR and its Additional Analysis do not refer to Exhibit E of the PCL Settlement Agreement, or to the separate treatment of that transfer by the PCL parties due to the pending *Friends* litigation. Petitioner contends this is a fatal deficiency.

In the PCL Settlement Agreement, the parties including DWP and Castaic Lake Water Agency also agreed that "they will not approve any new project or activity in reliance on the 1995 EIR, that was not approved, initiated or implemented prior to March 26, 2001, and the approval, initiation or implementation of which would require a separate environmental impact report or negative declaration under CEQA (other than, or in addition to, the 1995 EIR)." (22529, §VII (A))

On the other hand, nowhere in the PCL Agreement or anywhere else in the record does DWR disavow its prior approval of the 41,000 afy transfer and its subsequently published delivery estimates continue to list the 41,000 afy transfer.

Petitioner argues that the 41,000 afy transfer is not reliable for long-term planning purposes because, before determining whether to authorize the transfer as final and permanent, the DWR must prepare an EIR analyzing state-wide impacts of such a long-term transfer. Petitioner points out that DWR is allowing Castaic to avail itself of the 41,000 afy on an interim basis, and that the DWR may ultimately determine that state wide impact of the Monterey Amendments is too great and may disapprove all or part of the 41,000 afy transfer, which is the only transfer not immune from challenge pursuant to Exhibit E.

Petitioner contends that it is speculative to consider any transfer outside the Monterey Agreements, because DWR must agree to any transfer, even if made outside the Monterey Agreement (*PCL v DWR,* (2000) 83 Cal.App.4th 892), and DWR has not done so.

This court finds that the Revised EIR adequately discloses the uncertainties arising from the pending DWR recertification process, and substantial evidence supports the County's conclusion that the transfer is reliable notwithstanding the uncertainty created by litigation and pending DWR environmental review.

The Court of Appeal directed that the Revised EIR must disclose that State Water Project entitlements cannot be taken at face value:

> "Here the draft EIR gives no hint that SWP entitlements cannot be taken at face value. It is only in response to comments and submissions by project opponents such as SCOPE that the EIR obliquely acknowledges that the entitlements may not be all they seem. Instead of undertaking a serious and detailed analysis of SWP supplies, the EIR does little more than dismiss project opponents' concerns about water supply. Water is too important to receive such cursory treatment.
>
> "The final EIR's acknowledgement that there 'could be a deficit of supply' does not cure the defect. Without some reasonably accurate estimate of SWP's ability to deliver water, it is impossible to judge how likely or how deep the deficit might be."

Santa Clarita Organization for Planning the Environment v County of Los Angeles, supra, 106 Cal.App.4th 715, 723.

The revised EIR does disclose that the 41,000 transfer is subject to DWR's assessment of the statewide environmental impacts of the Monterey Amendments. It discloses that the PCL Monterey Agreement EIR has been decertified and that the court has retained jurisdiction until DWR certifies an EIR in accordance with CEQA, as noted above.

The West Creek revised EIR discloses that the 41,000 afy transfer is subject to "**many factors** including ...**the environmental requirements associated with the Sacramento-San Joaquin Delta** (Delta), where the water supplied by the SWP is pumped into the California Aquaduct...." (Vol. 53, 19091-19097) * (Emphasis supplied)

The West Creek revised EIR discloses that, "**an adverse final judgment invalidating the Monterey agreement could affect Castaic's completed acquisition of the 41,000 AF**, which could in turn impair CLWA's supply of SWP water contracts with DWR and other SWP contractors." (Revised Additional Analysis, Vol. 59, 27747; Vol 53, 19142) It continues, "Nevertheless, CWLA believes that an adverse outcome in the Monterey Agreement litigation is not likely to adversely affect CLWA's water supplies over the long-term because (a) CWLA believes that such a result is unlikely to 'unwind' executed and completed agreements with respect to the permanent transfer of SWP water amounts; (b) existing SWP water supply contract provisions allow such transfers (without the need for the Monterey Agreement); and (c) existing law enables the CWLA to enter into contract outside the context of the Monterey Agreement. " (*Ibid.*) (Emphasis supplied)

There is further information in the Revised EIR concerning the status and reliability of the 41,000 afy transfer. Responses 1 and 3 to Letter 4 from Rossman and Moore LLP, it is disclosed that Castaic Lake Water Agency's water supply contract with the State Water Project reflect only an expectation and that under some conditions only a lesser amount will be available, relies upon the 41,000 as an amount reported in the DWR's State Water Project Delivery Reliability Report, and **acknowledges that the Monterey Settlement Agreement does not list the 41,000 afy transfer as final.**

There is substantial evidence in the record to support the decision to rely upon the 41,000 afy transfer for planning purposes. The EIR's Revised Additional Analysis, section 4.2.4 Imported SWP Water Supplies, provides a brief history of the SWP, and describes the Table A Amount as the "maximum annual allocation of SWP water." (Vol. 59, p. 27740) It describes the SWP contract for 41,000 afy, and discloses that "Because the SWP system was not fully constructed, and its capacity has been constrained due to environmental considerations and evolving policies for the Sacramento=San Joaquin Delta (Delta) not contemplated in the 1960s, **the SWP cannot reliably deliver the full amounts of supplies anticipated in the contracts in any given year.** However, in ten percent of the years, (i.e. during wet periods), DWR estimates the annual water delivery of the SWP, utilizing existing facilities, to be at or above 4.10 million AF per year (98 percent of the full Table A Amount of 4.13 million AF.) The most SWP Table A water delivered to date (2003) in any year was about 3.5 million AF in 2000, and 2003 may result in a new high for annual deliveries. The demands for SWP water are expected to increase as the population of California continues to increase." (Vol 59, pp 27740-27741)

There is further disclosure in EIR's Revised Additional Analysis, section 4.2.4, subdivision (g) SWP Supplies: "DWR water supply contracts require the SWP to deliver 4.2 million AFY to 29 SWP contractors. Although the SWP is not fully constructed and cannot yet deliver the full 4.2 million AFY, **since the end of the six year drought in 1992, the SWP has fully met SWP contractor's water needs every year, except the dry years of 1994 and 2001.** Of SWP water deliveries, about 70 percent is delivered to SWP urban contractors and about 30 percent is delivered to SWP agricultural contractors. In 2003 DWR indicates that it can deliver 90 percent (or 3.71 million AF) of SWP Table A Amount to its contractors. Ninety percent of CLWA's SWP maximum table amount of 95,200 AFY equates to 85,680 AF of water. However, as discussed more fully below, **the maximum Table A amount contractually allocated does not necessarily result in equivalent deliveries of SWP water in any given year.**" (Vol 59, p. 27754) (Emphasis supplied)

Section 4.2.4 of the Revised Additional Analysis continues at subdivision (h), *SWP Reliability*, and discloses, "SWP supplies are **subject to reduction**, especially in drought periods." (Vol 59, p. 27756). It provides that Table A Amounts, "**should not be read as a guarantee of that amount**, but rather as the tool in an allocation process that defines an individual contractor's 'slice of the pie.' The size of the 'pie' itself is determined by **many factors** including local weather conditions, the amount of winter rains and snow pack in on northern California watersheds and **the environmental requirements associated with the Sacramento-San Joaquin Delta** (Delta), where the water supplied by the SWP is pumped into the California Aquaduct....**As a result of various factors, the SWPs annual deliveries of both Table A Amount water and non-Table A Amount Water have ranged from approximately 550,000 AF to 3.52 million AF** (DWR 2003)." [Vol. 53, 19091-19097] (Emphasis supplied). The total of all contractor's maximum Table A Amounts is 4.173 million.

The EIR's Revised Additional Analysis provides a thorough discussion of reliability of water supplies from the SWP using DWR's published reliability projections. (Additional Analysis, Volume VIII, AR Vol 59 pp27630-27826)

The court does recognize that the EIR and its Additional Analysis do not provide water supply figures assuming the DWR does *not* approve the 41,000 transfer after completion of the Monterey Amendments revised EIR. The 41,000 afy transfer constitutes about 43% of the Castaic SWP water relied on by the West Creek revised EIR.

The EIR's Revised Additional Analysis concludes that, "because cumulative water supplies exceed demand, cumulative development (including the proposed West Creek project) would not result in unavoidable significant impacts on Santa Clarita Valley water resources." (Vol 59, p 27794.)

The EIRs Additional Analysis disclosed that the Castaic EIR for the transfer was decertified in the *Friends* litigation, and that preparation of a new EIR is in process. The EIRs Additional Analysis states that, "the trial court did not order CLWA to vacate its approval of the water transfer itself. Rather, the court ruled that CWLA may utilize and rely on the 41,000 AFY. The trial court allowed that the petitioner may renew its application for a prohibition on CLWA's use of the 41,000 AFY if the petitioner could provide evidence that CWLA is actually using the additional entitlement for purposes petitioner considers improper." (Vol. 59, p 27701)

Petitioner contends this summary is misleading, because it suggests that the *Friends* court allowed CWLA to "rely" on the transfer *for planning purposes,* when it did not. The court's order does not in fact approve or disapprove reliance for planning purposes:

> "Petitioner requests that the Court also prohibit respondent from using any of the 41,000 acre feet of additional water allotted to it from the subject State Water Project. **Petitioner contends that the said water will be used**

to approve new development that will not be able to be reversed if a Final Environmental Impact Report is not certified. Respondent contends that such a prohibition would prevent it from meeting the existing water needs in the area it services. Both **contentions appear to be speculative** at this time. Respondent will not be prohibited from using the water to which it is entitled, but **petitioner may renew its application for such prohibition based upon evidence of actual use** of such additional water for purposes it considers improper."

(Judgment of Los Angeles Superior Court in *Friends,* BS056954, decertifying Castaic EIR on remand, included in Appendix O to the Draft Additional Analysis, AR at Vol 54, p20658.) (Emphasis supplied)

Before this court presently County and Newhall are using the water to approve new development. Whether such reliance is appropriate, *if the uncertainties are disclosed*, appears to be a question of first impression.

On appeal in this case, Petitioner argued that the transfer was not final and could not be relied upon because the 5th Circuit Court of Appeal in *Planning and Conservation League v Dept of Water Resources* (2000) 83 Cal.App.4th 892, found the Monterey Agreement EIR defective, and the Second District in *Friends of the Santa Clara River v Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373, found CLWA's EIR for the 41,000 afy transfer to be defective, having tiered off the Monterey Agreement EIR. (Petitioner's Reply Brief on appeal, Ex 5 to Appendix filed 9/8/05 herein, p. 11.) This court does not read the Opinion of the Court of Appeal herein as rejecting or accept the argument. (*SCOPE,* 106 Cal.App.4th 720, 721-724) In the Opinion, the Court notes that Petitioner cites the *Friends* decision (decided after certification of the initial West Creek EIR) only to show that entitlements cannot be taken at face value, and goes on to conclude that because actual delivery is not adequately analyzed, the decision to approve the West Creek EIR is not supported by substantial evidence. The Court did not reach the merits of the question whether an agency may rely on the 41,000 afy transfer for planning purposes pending the DWR's environmental review of statewide impacts of the Monterey Agreements.

Reliance on the 41,000 afy transfer for planning purposes was recently addressed by Division 8 of the Second Circuit, but there the EIR failed to disclose the uncertainties surrounding the transfer. In *California Oak Foundation v City of Santa Clarita* (Nov. 2, 2005) 133 Cal.App.4th 1219, decided after this court hear oral argument in this case, the trial court erred in approving an EIR certified by the City of Santa Clarita 6/24/03 concerning the Gate King industrial business park development project, because the section discussing water supplies "did not adequately inform the public about [] uncertainties in the water supply" with regard to the 41,000 afy entitlement. (The court also rejected SCOPE's contention that the "EIR's treatment of perchlorate contamination was insufficient" *Id.* at 1226.) The EIR for the Gate King development in *California Oak Foundation,* contained "inadequate discussion –in fact, no discussion at all- of the uncertainty surrounding the transfer of the 41,000 AFY entitlement. The text of the [Gate King] EIR does not mention the decertification of the EIR for the Castaic purchase, and does not discuss the fact that entitlements are not really entitlements, but only 'paper' water...The EIR merely states, in an analysis unchanged from the draft [after public comment on the decertification issue] that Castaic's entitlement 'can fluctuate from year to year based on a number of factors...'"

The West Creek Revised EIR here contains similar language about fluctuation based on factors such as "(including "environmental requirements," and "evolving policies for the Bay-Delta") but also includes the Additional Analysis circulated for public comment with specific discussion of the *Friends* and *PCL* litigation and disclosure of the EIR decertification. In *California Oak Foundation,* by contrast, "the only discussion in the EIR of the uncertainty created by the decertification of the EIR for the Castaic purchase appears in an appendix added to the final EIR, shortly before certification...at a minimum, the text of the EIR should refer to the appendices that contain the relevant discussion." (*Id.* , at 1239) Here, disclosure was more complete.

Castaic has now certified a revised EIR, and that EIR is presumed adequate pending challenge. (*State of California v. Superior Court*, (1990) 222 Cal. App. 3d 1416, 1419.) The court does recognize that the DWR has not certified a Revised EIR for the statewide impact of the Monterey Amendments and that it does not appear the DWR would be bound by the decisions of Castaic if the DWR were ultimately to decide against all or part of the 41,000 afy.

The court in *California Oak Foundation* acknowledged that the decision whether to rely on the 41,000 afy transfer is to be made by the agency, but emphasized the importance of clear disclosure. "[T]he question is whether the entitlement should be used for purposes of planning future development, since its prospective availability is legally uncertain. Although this decision must be made by the City, the EIR is intended to serve as an informative document to make

government action transparent. Transparency is almost impossible without a clear and complete explanation of the circumstances surrounding the reliability of the water supply." (*Oak Creek, supra,* at 1237-1238.)

This court finds the issue to be a close call, but on balance finds that the uncertainties surrounding the 41,000 afy transfer are adequately disclosed and that there is substantial evidence supporting the County's decision to rely upon the 41,000 afy transfer. The court "may not set aside an agency's approval of an EIR on the ground that an opposite conclusion would have been equally or more reasonable" and "may not...substitute [its] judgment for that of the people and their local representatives..." *Citizens of Goleta Valley v. Board of Supervisors*, (1990) 52 Cal. 3d 553, 564.

"CEQA requires an EIR to reflect a good faith effort at full disclosure; it does not mandate perfection, nor does it require an analysis to be exhaustive. . . . The absence of information in an EIR, or the failure to reflect disagreement among the experts, does not per se constitute a prejudicial abuse of discretion. [Citation.] A prejudicial abuse of discretion occurs if the failure to include relevant information precludes informed decisionmaking and informed public participation, thereby thwarting the statutory goals of the EIR process. [Citation.]" *Kings County Farm Bureau v. City of Hanford* (1990) 221 Cal.App.3d 692, 712.

Here, the omission of specific reference to Exhibit E did not preclude informed decisionmaking and informed public participation or thwart the goals of the EIR process.

Petitioner also contends the Revised EIR contains inadequate response to two written public comments concerning the transfer.

Two written comments were submitted on behalf of Petitioner raising the issues of finality of the Kern-Castiac Transfer, and its exclusion from Exhibit E to the PCL Agreement listing final transfers.

Comment 1 was submitted by Petitioner, transmitting correspondence on the subject between Petitioner's Counsel and the Director of the DWR regarding the outstanding EIR on the Monterey Amendments consistent with the PCL Agreement. Petitioner wrote to County:

"Please include the following correspondence between our attorney and the Department of Water resources and their response regarding the timeline for the completion of the Monterey Agreement Environmental Impact Report. **We continue to protest that you may not approve projects based on this water transfer were [sic] two environmental impact reports have been decertified.** This would mean that the **water transfer project is proceeding without any CEQA documentation**. Such action is precluded by law...." (Vol. 56, p. 24329.) (Emphasis supplied)

Enclosed was a letter from Petitioner's counsel to the Director of the Department of Water resources inquiring about the process and timeline for approval of the water transfer. Also enclosed was the DWR Director's letter in response acknowledging that the Department of Water was undergoing, and had not completed, environmental review of the impact of the 41,000 afy transfer.[1] The Director of DWR wrote, "...**DWR has not completed any draft or final analysis regarding these transfers**. Attached is an estimated schedule for completion of the EIR...." (Emphasis supplied)

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[1] Counsel wrote, "Pursuant to the Court decision in *Planning & Conservation League v. Department of Water Resources*..., the Department of Water Resources is required to prepare a new Environmental Impact Report regarding all aspects of the Monterey Amendments. I understand you will be overseeing this process. ¶ The Settlement Agreement that was entered into between all of the parties to the *PCL* case on May 5, 2003 set forth various requirements for the EIR. According to Attachment B-1 of this Settlement Agreement, the parties specifically excluded the 41,000 afy entitlements purchased by Castaic Lake Water Agency ("CLWA") emanating from the Monterey Amendments from the list of final transfers. It is therefore my understanding that your office will be evaluating the environmental impacts of the 41,000 afy transfer as part of the Environmental Impact Report for your project (the Monterey Amendments Project.) ¶ As you may also be aware, the EIR prepared by the CLWA for the 41,000 afy transfer was decertified by the Los Angeles Superior Court on November 1, 2002 in *Friends of the Santa Clara River Valley v. Castaic Lake Water Agency*...¶...please advise me of the procedural steps that DWR will take before making a determination whether or not to approve the Kern-Castaic transfer as a 'final' transfer and criteria that will be utilized for making this determination..." (Vol 56, p. 24330-24331, 5/18/04 Letter from counsel for Petitioner to Lester Snow, Director Department of Water Resources)

The DWP Director responded, "...the Department of Water Resources (DWR) is preparing an Environmental Impact Report (EIR) on the Monterey Amendments and the Settlement Agreement resulting from the court of appeal decision in Planning & Conservation League v Department of Water Resources...¶ ...the EIR will include an 'analysis of

Comment 2 is a 4/13/04 letter written on behalf of Petitioner by its counsel, objecting that the water supply analysis overstates the reliable amount of State Water Project entitlements, because "**Depending upon the outcome of DWR's analysis of the environmental impacts of Castaic's 41,000 afy project on the State Water Project's current users ...DWR may ultimately decide to deny approval of the transfer of the 41,000 acre feet yearly to Castaic as part of the Monterey Amendment program.**"[2] (Emphasis supplied)

Failure to respond to any significant public comment is an abuse of discretion. *Cleary v County of Stanislaus* (1981) 118 Cal.App.3d 348. The agency must respond in writing to written comments. 14 CCR 15088(a); *Browning-Ferris Industries City Council* (1986) 181 Cal.App.3d 852. The Revised EIR contains both topical response concerning perchlorate contamination ((Vol 54, pp 21361-21374 and 21386-21396) and specific responses to particular comment.

A specific Response to the 4/13/04 comment letter mentions decertification of the Monterey Program EIR, but does not mention the DWR's pending environmental impact analysis of the 41,000 afy transfer. The Additional Analysis does disclose the pending review, as discussed above. The Response concludes, "**Because the 41,000 AFY was a permanent water transfer, because DWR includes the 41,000 AFY in calculating CLWA's share of SWP Table A Amount, and because the courts have not prohibited CLWA from using or relying on those additional SWP supplies, the County has determined that it remains appropriate for the West Creek project to include those water supplies in its water supply and demand analysis, while acknowledging and disclosing the potential uncertainty created by litigation.**"[3] The Response also incorporates Topical Response 4 and Responses 1 and 3 to a letter from

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the potential environmental impacts relating to (a) the Attachment E transfers, and (b) the Kern-Castaic [41,000 afy] Transfer, in each case as actions that relate to the potential environmental impacts of approving the Monterey Amendments.' ...DWR has not completed any draft or final analysis regarding these transfers. Attached is an estimated schedule for completion of the EIR...." (Vol. 56, p 24332, Letter from Director Snow to counsel for Petitioner) (Emphasis supplied)

[2] Petitioner's counsel wrote, "...I. The Water Supply Analysis Overstates the Reliable Amount of State Water Project Water Entitlements Available on a Long-Term Basis from Castaic Lake Water Agency by 41,000 acre feet per year. ... ¶ Throughout he DAAEIR, the estimate of SWP water supply available for the project is improperly premised upon Castaic's claimed entitlements/allocation of 95,200 acre feet per year. .. The DAAEIR fails to disclose that of this amount of allocation (described by the Court in the SCOPE decision as 'paper water'), the transfer of 41,000 acre feet annually ('afy') has been specifically recognized by DWR to be a 'non-final' transfer of agricultural water to urban use (See the DWR/PCL Settlement Agreement Attachment E-1 [FN omitted]) ...¶The DWR/PCL settlement agreement specifically requires DWR to analyze 'the potential environmental effects' relating to the Castaic project...and to make new determinations regarding all non-final aspects of the Monterey Agreement upon completion of a new EIR...¶ Depending upon the outcome of DWR's analysis of the environmental impacts of Castaic's 41,000 afy project on the State Water Project's current users ...DWR may ultimately decide to deny approval of the transfer of the 41,000 acre feet yearly to Castaic as part of the Monterey Amendment program. ¶ Because a decision has not yet been made by DWR as to whether or not to approve the permanent transfer of the 41,000 afy allotment to Castaic, it would be speculative and without factual foundation for Los Angeles County to factor in any of the 41,000 afy in its calculations of the future water supply that will be available for West Creek's use." (Vol. 54, p. 21328-21330)

[3] More fully quoted, the response states, "...Evidence in the record supports CLWA's reliance on the 41,000 acre-feet of SWP supplies as part CLWA's SWP Table A Amount. [FN 1] Please see the West Creek Draft Additional Analysis, Section 4.2.4, at pages 4.0-5.9 through 4.0-65.

"The transfer of the 41,000 acre-feet ...was the subject of a completed contract between the parties in 1999,and imported water supply associated with that transfer became available for use by CLWA starting January 2000. The 41,000 acre-feet Transfer Agreement and the Point of Delivery Agreement ...are included in Appendix L of the Final Additional Analysis. ...

"The 41,000 acre-foot water transfer ... was evaluated previously in a Final EIR prepared by CLWA in 1999. The Second Appellate Court, Fourth Division, ordered that the EIR be decertified in January 2002 ...(Friends decision) in Appendix N of this FAA. The appellate court decertified the 1999 EIR because it tiered from the Monterey Agreement Program EIR, which itself was decertified as a result of a separate appellate court decision issued while the Friends decision was on appeal. (See Planning & Conservation League v. Department of Water Resources (2000) 83 Cal.App.4th 892 [PCL decision, Appendix P of this FAA] [FN: "For copies of the referenced opinions, decisions and other related documents, please see Appendices M, N, P and Q of the Final Additional Analysis."]

"In the Friends decision, the appellate court found that 'all other contentions ' concerning the legal adequacy of the EIR

Rossman and Moore, LLP. The referenced Responses 1 and 3 to Letter 4 from Rossman and Moore LLP disclose that Castaic Lake Water Agency's water supply contract with the State Water Project reflect only an expectation and that under some conditions only a lesser amount will be available, relies upon the 41,000 as an amount reported in the DWR's State Water Project Delivery Reliability Report, and **acknowledges that the Monterey Settlement Agreement does not list the 41,000 afy transfer as final**, but concludes that it is appropriate to include the 41,000 afy because the transfer was permanent, DWR has consistently included it in CLWA's share of the Table A Amount, and "courts have not prohibited CLWA from using and relying on" it. The Response also notes that CLWA is currently preparing a new EIR concerning the 41,000 afy transfer, and that "Nothing precludes CWLA from relying on this portion of its SWP supplies, pending completion of the new EIR."[4] (Emphasis supplied)

"The written response shall describe the disposition of significant environmental issues raised (e.g., revisions to the proposed project to mitigate anticipated impacts or objections). In particular, the **major environmental issues raised** when the lead agency's position is at variance with recommendations and objections raised in the comments **must be addressed in detail** giving reasons why specific comments and suggestions were not accepted. There must be **good faith, reasoned analysis in response**. Conclusory statements unsupported by factual information will not suffice." 14 CCR 15088(c) (Emphasis supplied)

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were 'without merit.' ...CWLA's Board of Directors decertified the 1999 EIR in the fall of 2002.

"In September 2002, the trial court was requested to prohibit CLWA from using the 41,000 acre-feet in any manner. The trial court refused to enjoin performance of the completed 41,000 acre-feet Transfer Agreement, maintained its jurisdiction over the matter, and authorized CWLA to utilize "any of the 41,000 AFY,' subject to the following order: 'Respondent [CWLA] will not be prohibited from using the water to which it is entitled, but Petitioner may renew its application for such prohibition based upon evidence of the actual use of such additional water for purposes it considers improper' [FN]

"...the Court of Appeal affirmed the trial court's judgment that CWLA use of the 41,000 AFY is not prohibited.[FN]"

"Because the 41,000 AFY was a permanent water transfer, because DWR includes the 41,000 AFY in calculating CLWA's share of SWP Table A Amount, and because the courts have not prohibited CLWA from using or relying on those additional SWP supplies, the County has determined that it remains appropriate for the West Creek project to include those water supplies in its water supply and demand analysis, while acknowledging and disclosing the potential uncertainty created by litigation."

"In the meantime, CLWA has reported to the County that it continues to prepare the new EIR for the 41,000 AFY water transfer...

"In light of the information presented in the Draft Additional Analysis and the entire record, the County believes that CLWA was entitled to use, and may continue to use, the additional SWP water supplies from the 41,000 AFY water transfer pending completion of the new EIR pursuant to CEQA, absent a subsequent order to the contrary from the Los Angeles Super Court..."

"For further responsive information, please see Topical Response 4: SWP Supplies – Reliance on the 41,000 AFY Water Transfer, and Responses 1 and 3 to Letter 4 from Rossman and Moore, LLP (Roger B. Moore), dated February 3, 2004."(Vol. 55, pp. 21458-21460, Responses to Comment Letters)

[4] More specifically, Response 1 discloses that the water supply contract with SWP contractors including CLWA to state that the Table A Amount (here 41,000 AFY) "shall not be interpreted to mean that in each year the State will be able to make that quantity of project water available to the Agency" and that the Table A Amounts "reflect an expectation that under certain conditions the Agency will receive its full Annual Table A Amount; but that under other conditions only a lesser amount, allocated in accordance with this contract, may be made available to the Agency."

Response 1 also refers to, and relies upon, amounts from the DWR's State Water Project Delivery Reliability Report, 2002, (Appendix L), which states "[t]his report provides local officials with a single source of the most current data available on SWP delivery reliability for use in local planning decisions."

Response 3 acknowledges that "Attachment E to the Monterey Settlement Agreement does not list CLWA's 41,000 AFY transfer as 'final'" but states that, "neither the appellate court nor the trial court (on remand) invalidated CLWA's permanent water transfer...," restates that it is appropriate to include the 41,000 afy because the transfer was permanent, DWR has consistently included it in CLWA's share of the Table A Amount, and "courts have not prohibited CLWA from using and relying on" it. The Response also notes that CLWA is currently preparing a new EIR concerning the 41,000 afy transfer, and that "Nothing precludes CWLA from relying on this portion of its SWP supplies, pending completion of the new EIR." (Vol 55, p. 21414-21418, FAA, Response to Comment Letters)

This court finds the Revised EIR contains adequate written response to significant public comment.

"[T]he court shall not exercise its independent judgment on the evidence but shall only determine whether the act or decision is supported by substantial evidence in the light of the whole record." *Public Resources Code* §21168)

Substantial evidence appears in record to support the decision to rely upon the 41,000 transfer based upon the fact that the Dept. of Water Resources continues to allocates and deliver the water in accordance with the 41,000 afy transfer, neither the PCL litigation not Monterey Settlement Agreement set aside any of the water transfers made under the Monterey agreement including the 41,000 transfer, the courts have not enjoined CLWAs use of the transfer, and CLWA has prepared and certified an EIR and its is presumed to be adequate despite pending legal challenges.

This court finds that the uncertainties involving the 41,000 afy transfer were adequately disclosed in the revised EIR, and substantial evidence supports the County's conclusion that it could be relied upon for planning purposes, notwithstanding the pending DWR environmental review and the fact that it is not among those transfers listed as immune from challenge in the PCL Settlement Agreement.

(2) Spread of Perchlorate Contamination Aquifer

The revised EIR also relies for planning purposes on 35,000 afy from the Alluvial Aquifer and 11,000 afy from the Saugus Formation in average years. (Vol 59, p27642)

The County's decision that these amounts would be available for planning purposes was supported by substantial evidence and was fully disclosed such that there was no abuse of discretion by way of failure to comply with CEQA's informational requirements

Petitioner has waived its challenge based on disclosure, analysis and conclusions concerning perchlorate contamination to the extent those issues were raised previously before Judge Anderle, decided, and not appealed. To the extent new information is involved (detection of contamination in two additional wells in 2002 and 2005), the Supplement of the Revised EIR adequately discloses the information and contains a reasoned (even if optimistic) analysis supported by substantial evidence concerning impact on the water supply. (Vol 53, p 19115, 19121-19132, Draft Additional Analysis, Ammonium Perchlorate discussions)

Due to perchlorate contamination, 4 wells were closed in the Saugus Formation at the time the Petition was presented to Judge Anderle, and 2 additional wells were closed in the Alluvial Aquifer. The four Alluvial wells were closed in 1997. The first Saugus well was closed in 2002 and the second in April 2005.

In its challenge to the initial EIR, Petitioner raised the perchlorate contamination issue. ("Until clean-up of the perchlorate contamination is competed – perhaps years from now—pumping form the Saugus Aquifer can not be increased without jeopardizing the health and safety of the communities relying upon that water. Petitioner's Trial Brief, 9/10/01, p. 22)

In January 2002 Judge Anderle rejected Petitioner's concerns that perchlorate contamination rendered the aquifer supply unreliable. Petitioner did not appeal that issue. Judge Anderle observed in his Statement of Decision (January 2002) that an expert hydrologist testified, "there is no evidence of widespread perchlorate contamination of the groundwater and that the groundwater that is contaminated is generally limited to that in the vicinity of the Whittaker-Bermite site..." and that "...Testimony of other experts noted that technology for effective treatment of perchlorate contamination is currently available and is not contingent on further characterization of the contamination..." (Statement of Decision, pp 15-16)

The EIR's Additional Analysis discussed the perchlorate contamination found in four Saugus wells and (at that time) one Alluvial well, and its potential impact on groundwater supply. (Vol 59, p27719-27736) Included were discussions of detected contamination, and programs to test all wells. It was reported that treatment technology was expected to return contaminated water to drinking water quality 'soon.'

The EIR states that, "technology to clean up the contamination exists and will soon be brought online, thus returning the wells to production." (Final Additional Analysis, Topical Responses, Vol 54, 21390)

The Supplement does not provide an analysis of the environmental impacts to the aquifers if the location and patterns of pumping were changed in response to contamination, and does not identify specific funding for perchlorate treatment. This issue was raised by public comment. (Vol 59, 27941)

Public disclosure concerning the contamination proceeded as follows.

In response to the Writ, the EIR's Additional Analysis was prepared and circulated. It acknowledged that four municipal supply wells in the Saugus Formation and one in the Alluvial had been taken out of service due to perchlorate contamination. (Vol 53, p19122, figures 4.0-17) It anticipated further spread of the plume, and a need to contain it. ("Slade has reported that the Saugus Aquifer is and will continue to be a viable source of water supply for the water purveyors in the Santa Clarita Valley as long as efforts remain in place to treat impacted wells on an interim basis to contain the plume." Vol. 53, p. 19123)

On March 22, 2005, the County certified the EIR and Final Additional Analysis.

Subsequently, in April 2005 the perchlorate contamination was detected in the second Alluvial Aquifer well, Well Q2. (Supplement May 2005, Vol 59, p 27853-27854, 28522)

In response, the County provided a Supplement to the Additional Analysis. (Vol 59, 27827-27909 and 27912-28160) The Supplement was circulated for 45 day review and comment, the County prepared written responses to public comment, held a public hearing, and the County then recertified the EIR, including the Additional Analysis and the Supplement.

The Supplement reports that as a result of the detection, Well Q2 had been removed from service and that the retailer, Valencia, "is pursuing rapid permitting and installation of wellhead treatment in order to return the well to water supply service." (Vol 59, 27831)

The County concluded that the development did not constitute significant new information and did not require recirculation of the Revised EIR. Also, the County concluded that after the detection there are sufficient water supplies to serve both West Creek and cumulative development. [59 27829-27830, 27834-27835, 27846]

"[B]ecause CWLA and the other retail water purveyors have found that perchlorate detected in the designated wells, including Well Q2, does not significantly effect water supplies in the Santa Clarita Valley, and that such supplies are treatable given the current remediation schedule, the County believes that perchlorate detected at Well Q2 does not constitute new or more severe impacts, particularly where Valencia Water Company has planned for some time to initiate wellhead treatment should other Alluvial wells be impacted, and Valencia already has sought permitting, and obtained funding, for wellhead treatment at Well Q2." (Vol 59, 27835)

The County did circulate the Supplement for a 45-day review and comment period, prepared written responses to public comments, and held a public hearing, after which the Board recertified the revised EIR, including the Additional Analysis and the Supplement.

Although contamination was somewhat contained at the time the initial EIR was certified, the spread of contamination was not unforeseen. Spread beyond the Whittaker-Bermite was anticipated by the prior analysis, as can be seen by its discussion of groundwater flows and testing to detect new contamination. (Vol. 59, 27718-719, 721, 724; Vol 59, 27829-830, 27846.)

Petitioner argues essentially that the conclusion is wrong. Petitioner argues that County relied upon "speculation that these wells will 'soon' reopen despite present absence of needed funding and statewide agency approvals, and despite the strong prospect that the contamination may never be cleaned up." (Motion p5) "Substantial evidence is not argument, speculation, unsubstantiated opinion or narrative, evidence that is clearly inaccurate or erroneous, or evidence of social or economic impacts that do not contribute to, or are not caused by, physical impacts on the environment." *Pulic Resource Code* §21080(e)(2)) In certifying an EIR, the agency may not rely on speculation. "[S]ubstantial evidence includes fact, a reasonable assumption predicated upon fact, or expert opinion supported by fact." *Public Resource Code* §21080(e)(1)) The conclusions are based on the findings that treatment is already underway, including installation of wellhead treatment (DHS 'best available technology') and that treatment was expected to be on line by the end of 2005. Petitioner points out that five years after certification of the initial EIR, the four originally contaminated wells have not been treated. This fact is self-evident from the information contained in the Revised EIR. The record contained substantial evidence including expert opinion based on fact to support the conclusions reached by the County concerning perchlorate contamination.

The court has received and considered:

08-04-05 Notice of Hearing Return to Peremptory Writ of Mandate Filed by Respondent and Real Parties in Interest Hrg 10/05/05 9:30am Dept 4, Filed by Respondent

08-04-05 Memorandum of Points & Authorities Joint Filed by Respondent and Real Parties in Interest in Support of Return on Peremptory Writ of Mandate, Filed by Respondent

08-04-05 Request for Judicial Notice Joint Filed in Support of Joint Memorandum of Points and Authorities of Respondent and Real Parties in Interest in Support of Return to Peremptory Writ of Mandate Declaration of Robert I McMurry in Support Thereof, Filed by Respondent

08-04-05 Certificate Certification of Additional Administrative Record as Part of the Entire West Creek Administrative Record Additional Administrative Record Vol 53-59, Filed by Respondent

08-04-05 Appendix Joint of Excerpts From Administrative Record and Additional Administrative Record Cited in Joint Memorandum of Ps and As Filed Respondent and Real Parties in Interest in Support of Return to Peremptory Writ of Mandate Declaration of Robert I McMurry Vol II, Filed by Respondent

08-04-05 Appendix Joint of Excerpts from Administrative Record and Additional Administrative Record Cited in Joint Memorandum of Ps and As Filed Respondent and Real Parties in Interest in Support of Return to Peremptory Writ of Mandate Declaration of Robert I McMurry Vol I, Filed by Respondent

08-08-05 Notice of Completion Certification and Service of West Creek Additional Administrative Record, Filed by Respondent

08-24-05 Notice of Motion and Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction/Opposition to Return on Writ; P's and A's -- Hrg: 10/05/2005 at 9:30 am in Dept 5, Filed by Petitioner

09-08-05 Reject Letter joint appendix etc 1) The Joint Appendix's appear to be Administrative Records and must be lodged with the court, not filed. Lodged Documents must be submitted with an envelope large enough and bearing sufficient postage to

09-08-05 Document: Supplement to Certification of Additional Administrative Record as Part of the Entire West Creek Administrative Record, Filed by Respondent

09-08-05 Points & Authorities Joint Memorandum of Points and Authorities Filed by Respondent and Real Parties in Interest in Support of Return on Peremptory Writ of Mandate, Filed by Respondent

09-08-05 Proof of Service by Mail, Filed by Respondent

09-08-05 Proof of Service via Personal Service, Filed by Respondent

09-08-05 Document: Joint Appendix on Reply Filed by Respondent and Real Parties in Interest in Support of Return to Peremptory Writ of Mandate; Declaration of Robert I McMurry in Support, Filed by Plaintiff

09-08-05 Document: Joint Appendix on Reply Filed by Respondent and Real Parties in Interest in Support of Return to Peremptory Writ of Mandate, Filed by Party in Real Interest

09-21-05 Document Lodged Administrative Record-Volume 53, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 54, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 55, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 56, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 57, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 58, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 59, Lodged by Respondent

09-21-05 Document Lodged Administrative Record-Volume 60, Lodged by Respondent

09-21-05 Document Lodged various CDs, Lodged by Respondent

09-27-05 Reply to Respondents Response to Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction/Surreply to Return on Writ; Points and Authorities, Received by Petitioner, Doc Sent To: sb4

09-29-05 Ex Parte Application to File Longer Memorandum; Order, Filed by Petitioner

09-29-05 Opposition (Joint) to Ex Parte Application to File Longer Memorandum;Joint Objection to, and Motion to Strike Improper Sur-Reply Brief and Request for an Award of Sanctions Against Petitioners and Their Counsel, Alyse M Lazar; Declaration of Edgar Khalatian, Filed by Party in Real Interest

09-29-05 Reply to Objection to Ex Parte Application to File Longer Memorandum and Notice of Erratum, Filed by Petitioner

09-29-05 Order, Denied [D], Filed by Petitioner

10-05-05 Minute Order Hearing: Re Compliance, Submitted with argument, Filed

11-03-05 Notice of November 2 2005 Published Court of Appeal Opinion, Filed by Petitioner

11-07-05 Objection to and Motion to Strike, Petitioners' Notice of Court of Appeal Decision, and Response to Notice/Joint, Filed by Respondent

11-09-05 Objection Petitioners and Motion to Strike Respondents Post Submittal Extra Record Evidence and Brief, Filed by Petitioner

Ruling:

Return to Peremptory Writ of Mandate; Motion for Order Decertifying Environmental Impact Report and Expanding the Current Injunction

The Request to expand the Injunction is DENIED.

The Writ is DISCHARGED

Petitioner's Motion for Order Decertifying EIR is DENIED

Respondent's Objection to, and Motion to Strike, Petitioners' Notice of Court of Appeal Decision is OVERRULED and DENIED. The court has considered the published decision reported after hearing on this matter, *California Oak Foundation v City of Santa Clarita* (Nov. 2, 2005) 133 Cal.App.4th 1219, and the parties' supplemental briefs with respect to it.

Petitioner's Objection to, and Motion to Strike, Respondents Post Submittal Extra Record Evidence and Brief is OVERRULED and DENIED except with respect to the excerpts of the unauthenticated draft EIR for the Gate-King Industrial Park project (Ex A to Respondent's 11/7/05 filing), to which the objection is SUSTAINED. The court has not considered these excerpts of the Gate-King DEIR, which were submitted after hearing, are not authenticated, and are not the proper subject of judicial notice.

SO ORDERED

Dated: January 6, 2006

JAMES W. BROWN

James W. Brown
JUDGE OF THE SUPERIOR COURT

SUPERIOR COURT OF CALIFORNIA, COUNTY OF SANTA BARBARA	FILED SUPERIOR COURT of CALIFORNIA COUNTY of SANTA BARBARA
STREET ADDRESS: 1100 Anacapa Street MAILING ADDRESS: CITY AND ZIP CODE: Santa Barbara, California 93101 BRANCH NAME: Santa Barbara-Anacapa Division	JAN 10 2006 GARY M. BLAIR, Executive Officer BY Leanna M. Pearson LEANNA M PEARSON, Deputy Clerk
Caption: **Santa Clarita Organization vs County of Los Angeles**	
CLERK'S CERTIFICATE OF MAILING	CASE NUMBER: **1043805**

I certify that I am not a party of this action and that a true copy of the foregoing was mailed first class, postage prepaid in a sealed envelope addressed as shown, and that the mailing of the foregoing and execution of this certificate occurred at Santa Barbara, California, on (date) 01/10/2006 Re: Order After Hearing.

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Santa Clarita Organization for **Planning** the **Environment** v. **County** of **Los Angeles**
Cal.App. 2 Dist.,2007.

Court of Appeal, Second District, Division 6, California.
SANTA CLARITA ORGANIZATION FOR **PLANNING** THE **ENVIRONMENT** et al., Plaintiffs and Appellants,
v.
COUNTY OF **LOS ANGELES**, Defendant and Respondent;
Newhall Land and Farming Company et al., Real Parties in Interest and Respondents.
No. B189116.

Nov. 26, 2007.

Background: **Environmental organizations** petitioned for writ of mandate, requesting that court order **county** to vacate resolution certifying final **environmental** impact report (EIR) which approved development project. The trial court denied the petition, **organizations** appealed, and the Court of Appeal, 106 Cal.App.4th 715, 131 Cal.Rptr.2d 186, reversed. On remand after **county** revised and recertified EIR, the Superior Court, **Santa** Barbara **County**, No. 1043805,James W. Brown, J., again denied petition. **Organizations** appealed. The Court of Appeal, 66 Cal.Rptr.3d 559, affirmed, but granted rehearing, vacating its opinion.

Holdings: The Court of Appeal, Gilbert, P.J., held that:
(1) law of the case did not bar **organizations**' challenge to water transfer in revised EIR;
(2) EIR was not inadequate as it related to water transfer involved in pending litigation; and
(3) EIR was not required to discuss funding to remediate perchlorate contamination of local water wells.

Affirmed.

West Headnotes

[1] Environmental Law 149E 695

149E Environmental Law
149EXIII Judicial Review or Intervention
149Ek694 Determination, Judgment, and Relief
149Ek695 k. In General. Most Cited Cases
Court of Appeal's finding that water service portion of environmental impact report (EIR) for residential subdivision did not comply with California Environmental Quality Act (CEQA) did not bar, under doctrine of law of the case, environmental organizations' subsequent challenge to specific water transfer in revised EIR; Court of Appeal had stated no principle or rule of law bearing on the adequacy of the EIR's discussion of this water transfer, and silence on issue did not transform issue into law of the case. West's Ann.Cal.Pub.Res.Code § 21005(c).

[2] Appeal and Error 30 1097(1)

30 Appeal and Error
30XVI Review
30XVI(M) Subsequent Appeals
30k1097 Former Decision as Law of the Case in General
30k1097(1) k. In General. Most Cited Cases

Appeal and Error 30 1195(1)

30 Appeal and Error
30XVII Determination and Disposition of Cause
30XVII(F) Mandate and Proceedings in Lower Court
30k1193 Effect in Lower Court of Decision of Appellate Court
30k1195 As Law of the Case
30k1195(1) k. In General. Most Cited Cases
Where an appellate court states in its opinion a principle or rule of law necessary to its decision, that principle or rule becomes the "law of the case," which must be adhered to both in the lower court and upon subsequent appeal, even if the court that issued the opinion becomes convinced in a subsequent consideration that the former opinion is erroneous.

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[3] Environmental Law 149E 614

149E Environmental Law
149EXII Assessments and Impact Statements
149Ek612 Evidence
149Ek614 k. Presumptions, Inferences, and Burden of Proof. Most Cited Cases
Under California Environmental Quality Act (CEQA), an environmental impact report (EIR) approved by the appropriate governmental agency is presumed adequate, and the party challenging the EIR has the burden of showing otherwise. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[4] Environmental Law 149E 689

149E Environmental Law
149EXIII Judicial Review or Intervention
149Ek677 Scope of Inquiry on Review of Administrative Decision
149Ek689 k. Assessments and Impact Statements. Most Cited Cases
A party may challenge an environmental impact report (EIR) by showing the agency has abused its discretion either by reaching factual conclusions unsupported by substantial evidence or by failing to proceed in the manner California Environmental Quality Act (CEQA) provides. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[5] Environmental Law 149E 689

149E Environmental Law
149EXIII Judicial Review or Intervention
149Ek677 Scope of Inquiry on Review of Administrative Decision
149Ek689 k. Assessments and Impact Statements. Most Cited Cases
Where the alleged defect in an environmental impact report (EIR) under California Environmental Quality Act (CEQA) is that the agency's conclusions are not supported by substantial evidence, courts must accord deference to the agency's factual conclusions and may not weigh conflicting evidence to determine who has the better argument. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[6] Environmental Law 149E 689

149E Environmental Law
149EXIII Judicial Review or Intervention
149Ek677 Scope of Inquiry on Review of Administrative Decision
149Ek689 k. Assessments and Impact Statements. Most Cited Cases
Courts may not set aside an agency's approval of an environmental impact report (EIR) under California Environmental Quality Act (CEQA) on the ground that an opposite conclusion would have been equally or more reasonable. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[7] Environmental Law 149E 689

149E Environmental Law
149EXIII Judicial Review or Intervention
149Ek677 Scope of Inquiry on Review of Administrative Decision
149Ek689 k. Assessments and Impact Statements. Most Cited Cases
Where the alleged defect in an environmental impact report (EIR) is that the agency has failed to proceed in a manner provided by California Environmental Quality Act (CEQA), judicial review is de novo. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[8] Environmental Law 149E 599

149E Environmental Law
149EXII Assessments and Impact Statements
149Ek598 Adequacy of Statement, Consideration, or Compliance
149Ek599 k. In General. Most Cited Cases
An agency that fails to require an applicant to disclose information mandated by California Environmental Quality Act (CEQA) and to include that information in the environmental impact report (EIR), fails to proceed in a manner prescribed by CEQA. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[9] Environmental Law 149E 599

149E Environmental Law
149EXII Assessments and Impact Statements
149Ek598 Adequacy of Statement, Consideration, or Compliance
149Ek599 k. In General. Most Cited Cases
Where a party challenges an environmental impact report (EIR) under California Environmental Quality

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Act (CEQA) because it fails to disclose evidence that conflicts with its conclusions, the party must show that the failure to disclose the conflicting evidence precludes informed decision making or informed public participation. West's Ann.Cal.Pub.Res.Code § 21000 et seq.

[10] Environmental Law 149E 604(3)

149E Environmental Law
149EXII Assessments and Impact Statements
149Ek598 Adequacy of Statement, Consideration, or Compliance
149Ek604 Particular Projects
149Ek604(3) k. Waters and Water Courses; Dams and Flood Control. Most Cited Cases
Under California Environmental Quality Act (CEQA), water service portion of environmental impact report (EIR) for residential subdivision was not inadequate as it related to availability of water from water transfer agreement involved in pending litigation; EIR acknowledged that litigation made transfer legally uncertain, but substantial evidence supported finding that degree of uncertainty was small as transfer was intended to be permanent and any adverse outcome in litigation was unlikely to "unwind" transfer agreement in light of existing law and contracts. West's Ann.Cal.Pub.Res. Code § 21000 et seq.
See 12 Witkin, Summary of Cal. Law (10th ed. 2005) Real Property, § 840 et seq.; 9 Miller & Starr, Cal. Real Estate (3d ed. 2001) § 25:182 et seq.; Cal. Jur. 3d, Pollution and Conservation Laws, § 543 et seq.; Cal. Civil Practice (Thomson/West 2003) Environmental Litigation, § 8:17 et seq.

[11] Environmental Law 149E 604(3)

149E Environmental Law
149EXII Assessments and Impact Statements
149Ek598 Adequacy of Statement, Consideration, or Compliance
149Ek604 Particular Projects
149Ek604(3) k. Waters and Water Courses; Dams and Flood Control. Most Cited Cases
Under California Environmental Quality Act (CEQA), environmental impact report (EIR) for residential subdivision was not required to discuss funding to remediate perchlorate contamination of local water wells, since nothing suggested that described mitigation measures would not be implemented. West's Ann.Cal.Pub.Res. Code § 21000 et seq.

****451** Law Office of Alyse M. Lazar and Alyse M. Lazar, Westlake Village, for Plaintiffs and Appellants **Santa Clarita Organization** for **Planning** the **Environment** and Friends of the **Santa** Clara River.
Rossmann & Moore, Antonio Rossmann, Roger B. Moore and David Rowen, for amicus curiae **Planning** and Conservation League in support of Plaintiffs and Appellants.
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Paul, Hastings, Janofsky & Walker, Robert I. McMurry, A. Catherine Norian, **Los Angeles**, and Edgar Kalatian, for Real Parties in Interest and Respondents Newhall Land and Farming Company and Valencia Corporation.

****452** OPINION ON REHEARING

GILBERT, P.J.
152** In ***Santa Clarita Organization** for **Planning** the **Environment** v. **County** of **Los Angeles (2003) 106 Cal.App.4th 715, 131 Cal.Rptr.2d 186 (*Scope I*), we held that the water service portion of an **environmental** impact report (EIR) must analyze the actual amount of water that will be available for a project. In *Scope I*, the EIR for the West Creek residential subdivision did not comply with the California **Environmental** Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.).[FN1] It relied on contractual entitlements to water. Because this water is not of the "wet" variety, it has been called "paper water."

FN1. All statutory references are to the Public Resources Code unless otherwise stated.

After remand, the **County** of **Los Angeles** (**County**) revised and recertified the West Creek EIR. **Santa Clarita Organization** for **Planning** the **Environment** (SCOPE) again challenges the water services portion of the EIR. This time, SCOPE focuses on the EIR's analysis of a water transfer agreement and remediation costs for perchlorate contamination of water wells. The trial court denied SCOPE's petition for writ of administrative mandate.

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After the trial court denied SCOPE's petition, our Supreme Court decided *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 53 Cal.Rptr.3d 821, 150 P.3d 709*(Vineyard).* *Vineyard* states four principles governing the analysis of the water services portion of an EIR. We conclude the West Creek EIR satisfies all four principles.

FACTS

Background

In the 1950s, the Legislature and the voters approved the State Water Project (SWP). It was designed to deliver 4.23 million acre-feet of water annually. It is managed by the Department of Water Resources (DWR).

The DWR contracted to deliver water to water agencies throughout the state. The contracts entitle the agencies to specified amounts of water calculated on the designed capacity of the SWP. Only half of the SWP was constructed. The completion of the SWP was an expectation that has not grown beyond a hope. There is no reasonable expectation that the original plan will ever be completed. This leaves a vast difference between the amount of water to which the local agencies are entitled, and the amount of water the SWP can actually deliver.

***153** A drought in the 1990s highlighted the disparity between water entitlements and actual water. Agricultural and urban agencies disputed how shortfalls in water delivery would be allocated. The interested parties met in Monterey, and produced the Monterey Agreement.

Under the Monterey Agreement, the DWR and the contracting water agencies agreed to a statement of 14 principles. One principle provided for the permanent sale of water among agencies. The Castaic Lake Water Agency (Castaic) purchased 41,000 acre-feet per year (afy) from the Kern County Water Agency. Castaic serves the Santa Clarita Valley area, and the 41,000 afy constitutes over 40 percent of the 95,200 afy available to Castaic.

The Monterey Agreement scuttled the term "entitlement" to describe the amount of water the SWP has contracted to deliver to local water agencies. Instead, the agreement uses the term "Table A Amount." Table A of the agreement lists ****453** the contracting agencies and the amount of water the SWP has contracted to deliver. The change is not substantive.

In *Planning & Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, 100 Cal.Rptr.2d 173 (*PCL*), the court ordered the EIR for the Monterey Agreement decertified. The court determined that the EIR was prepared by the wrong lead agency, a water agency instead of the DWR, and failed to consider the "no project" alternative. Because the EIR for the Kern-Castaic 41,000 afy transfer was "tiered" on the Monterey Agreement EIR, the EIR for the Kern-Castaic transfer was also ordered decertified. (*Friends of Santa Clara River v. Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373, 1387, 116 Cal.Rptr.2d 54(*Friends*).) Although the EIRs for the Monterey Agreement and the Kern-Castaic transfer were decertified, the projects were not enjoined. The agreements remain in effect to this day.

On July 22, 2002, the parties to the *PCL* litigation that decertified the Monterey Agreement EIR entered into a settlement agreement approved by the Sacramento County Superior Court. The settlement agreement requires the DWR as the lead agency to prepare a new EIR for the Monterey Agreement. The settlement agreement acknowledges that certain water transfers listed in Attachment E to the settlement agreement are final, and the parties agree not to challenge those transfers. The Kern-Castaic transfer is not listed in Attachment E. Instead, the settlement agreement provides:

"*Acknowledgement and Agreement Regarding Kern-Castaic Transfer*.With respect to ... the Kern-Castaic Transfer, the Parties recognize that such water transfer is subject to pending litigation in the Los Angeles County Superior Court following remand from the Second District Court of Appeal (See ***154** *Friends of the Santa Clara River v. Castaic Lake Water Agency*, 95 Cal.App.4th 1373, 116 Cal.Rptr.2d 54 (2002); *review denied* April 17, 2002). The Parties agree that jurisdiction with respect to that litigation should remain in that court and that nothing in this Settlement Agreement is intended to predispose the

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remedies or other actions that may occur in that pending litigation."

In 2004, Castaic certified a revised EIR for the Kern-Castaic transfer. This EIR is not tiered on the Monterey Agreement EIR. SCOPE's opening brief states that Castaic's EIR is being challenged in **Los Angeles County** Superior Court by **environmental** groups.

West Creek

West Creek is a proposed mixed residential and commercial development in the **Santa Clarita** Valley area of northern **Los Angeles County**. The project includes 2,545 housing units, 180,000 square feet of commercial retail space and 46 acres of community facilities. The **County** served as the lead agency in preparing the EIR for the project. The project developers are The Newhall Land and Farming Company and Valencia Corporation (hereafter collectively Newhall).

SCOPE challenges the **County's** certification of the West Creek EIR. The trial court denied SCOPE's petition for a writ of administrative mandate. We reversed on the ground that the EIR's evaluation of the availability of the water supply was inadequate. (*Scope I, supra*, 106 Cal.App.4th 715, 131 Cal.Rptr.2d 186.) The EIR relied on water entitlements instead of actual water in analyzing water availability. (*Ibid.*)

The County revised the water supply analysis, and recertified the EIR. SCOPE challenges the water supply analysis in the ****454** recertified EIR. This time it opposes the 41,000 afy Kern-Castaic water transfer.

The recertified EIR states that Castaic's total maximum SWP water allocation is 95,200 afy. The Kern-Castaic transfer accounts for 41,000 afy of that. The EIR acknowledges that the EIR for the Monterey Agreement and the original EIR for the Kern-Castaic transfer were decertified.

With regard to the status of the Kern-Castaic transfer, the EIR states:

"The [Kern-Castaic] transfer of SWP Table A Amount was the type of water transfer that fell within the provisions of the Monterey Agreement. As stated above, under the Monterey Agreement, certain SWP agricultural contractors agreed that 130,000 AF of their Table A Amount could be ***155** transferred to urban contractors. The [Castaic] 41,000-AF acquisition was a part of the 130,000 AF of SWP Table A Amount, which has been transferred under the Monterey Agreement.

"... The Monterey Agreement provides ... for those transfers by the participating SWP contractors, thus facilitating transfers of Table A Amounts from agricultural to urban SWP contractors. As stated above, the environmental documentation for the Monterey Agreement has been decertified. However, the ... legal proceedings (*Planning and Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, 100 Cal.Rptr.2d 173 [*PCL litigation*]) did not invalidate ... the Monterey Agreement or enjoin[ ] either the Monterey Agreement or further implementation of the Monterey Agreement.

"In addition, the subsequent Settlement Agreement in the *PCL litigation* did not invalidate or otherwise enjoin the Monterey Agreement.

"Even in the absence of the Monterey Agreement, [Castaic's] permanent acquisition of an additional 41,000 AF of SWP Table A Amount could occur under existing SWP water supply contract provisions, subject to appropriate environmental review.

"Nothing in the existing SWP water supply contracts, or applicable law, prohibit such water transfers with or without the Monterey Agreement. The Monterey Agreement simply provides a specific vehicle for accomplishing transfers of SWP Table A Amounts from agricultural to urban SWP contractors; the amendments under the Monterey Agreement are not the exclusive means by which that Amount may be transferred. In support of that fact, in 1981 (almost 15 years before the Monterey Agreement), the entire SWP Table A Amount of the Hacienda Water District was permanently transferred to the Tulare Lake Basin Water Storage District, pursuant to an agreement approved by DWR.

"The acquisition could proceed as a water transfer under existing law. See, e.g., Water Code §§ 382, 383

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(authority for transferring surplus water) and Water Code §§ 1745, et seq. (authority for transferring non-surplus water). The Kern County Water Agency has reaffirmed its willingness to allow transfers of up to 130,000 AF of SWP table A Amounts under pre-Monterey Agreement conditions and/or under the terms of the Settlement Agreement....

"Finally, [Castaic] is not a party to the pending Monterey Agreement litigation (*Planning Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, 100 Cal.Rptr.2d 173). Although not a party, an adverse final judgment invalidating the Monterey Agreement could affect [Castaic's] completed ***156** acquisition of the 41,000 AF, which ****455** could in turn impair [Castaic's] supply of SWP water through its contracts with DWR and other SWP contractors. Nevertheless, [Castaic] believes that an adverse outcome in the Monterey Agreement litigation is not likely to adversely affect [Castaic's] water supplies over the long-term because (a) [Castaic] believes that such a result is unlikely to 'unwind' executed and completed agreements with respect to the permanent transfer of SWP water amounts; (b) existing SWP water supply contract provisions allow such transfers (without the need for the Monterey Agreement); and (c) existing law enables [Castaic] to enter into contracts outside the context of the Monterey Agreement."

The EIR also discloses that there is perchlorate contamination in six water wells that will comprise part of the water service for West Creek. The EIR identifies remediation measures, but does not identify any source of funding for those measures.

DISCUSSION

I

[1] Newhall contends the doctrine of law of the case bars SCOPE's Kern-Castaic transfer arguments.

[2] Where an appellate court states in its opinion a principle or rule of law necessary to its decision, that principle or rule becomes the law of the case. (*Clemente v. State of California* (1985) 40 Cal.3d 202, 211, 219 Cal.Rptr. 445, 707 P.2d 818.) The law of the case must be adhered to both in the lower court and upon subsequent appeal. (*Ibid.*) This is true even if the court that issued the opinion becomes convinced in a subsequent consideration that the former opinion is erroneous. (*Ibid.*)

But our former opinion in this case (*Scope I*) stated no principle or rule of law bearing on the adequacy of the West Creek EIR's discussion of the Kern-Castaic transfer. Newhall attempts to turn silence into positive effect by citing section 21005, subdivision (c). The subdivision requires that our opinion discuss all the alleged grounds for noncompliance with CEQA. Newhall concludes that because we did not discuss the Kern-Castaic transfer in *Scope I*, we approved the transfer.

Newhall cites no authority, however, for the proposition that not discussing an issue as required by section 21005, subdivision (c), transforms that issue into law of the case. In *Friends, supra*, 95 Cal.App.4th at page 1387, 116 Cal.Rptr.2d 54, on which Newhall relies, after finding one of appellant's contentions meritorious, the court expressly stated it considered all of appellant's other contentions ***157** and found them without merit. *(iBid.)FRiends* does not discuss the effect of a failure to consider an issue, and does not even mention the doctrine of law of the case. If Newhall believed we failed to discuss an issue raised in *Scope I*, its remedy was a timely petition for rehearing. (Cal. Rules of Court, rule 8.268 (formerly cited as rule 25).) The time for such a petition has long since passed.

Moreover, we discussed all issues raised in *Scope I*. SCOPE mentioned the Kern-Castaic transfer in its opening brief, but SCOPE did not raise the transfer as an issue. In fact, Newhall argued that we could not consider *Friends*, the decision that decertified the Kern-Castaic transfer EIR, because it occurred after the County approved the West Creek project. Newhall pointed out that once a project is approved, new information does not require reopening the approval. (*Scope I, supra*, 106 Cal.App.4th at p. 723, 131 Cal.Rptr.2d 186.) SCOPE replied that it cited *Friends* only to show that SWP entitlements cannot be taken at face value. ****456** (*Ibid.*) Thus, at Newhall's urging, we did not consider in *Scope I* the issues SCOPE now raises. They arose after the County's initial approval of the project. Newhall cites no authority that prevents us from considering issues that arose prior to the recertification of the EIR.[FN2]

FN2. SCOPE contends the EIR's failure to

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properly analyze the Kern-Castaic transfer violated the terms of the remittitur in *Scope I*. It follows from what we have said that the contention has no merit. We did not consider the Kern-Castaic transfer in *Scope I*, and it was not within the terms of our remittitur in that case.

II

Newhall contends SCOPE waived its perchlorate contamination arguments by failing to appeal them. Newhall argues SCOPE's claim is waived because it is essentially identical to that denied by the trial court in the first challenge to the project's EIR.

But SCOPE's first challenge to the project's EIR concerned disclosure of the extent of perchlorate contamination of local water wells. SCOPE did not appeal the trial court's denial of that challenge. Here SCOPE is not challenging the EIR's disclosure of the extent of perchlorate contamination. Instead, it is challenging the mitigation measures suggested by the EIR. That issue is not substantially identical to the issue raised in the first challenge. There has been no waiver.

III

[3][4] We now consider SCOPE's challenge to the West Creek EIR. An EIR approved by the appropriate governmental agency is presumed adequate, and ***158** the party challenging the EIR has the burden of showing otherwise. (*Barthelemy v. Chino Basin Mun. Water Dist.* (1995) 38 Cal.App.4th 1609, 1617, 45 Cal.Rptr.2d 688(*Barthelemy*).) A party may challenge an EIR by showing the agency has abused its discretion either by reaching factual conclusions unsupported by substantial evidence or by failing to proceed in the manner CEQA provides. (*Vineyard, supra*, 40 Cal.4th at p. 435, 53 Cal.Rptr.3d 821, 150 P.3d 709.)

[5][6] In evaluating an EIR for CEQA compliance, we must adjust our scrutiny to the nature of the alleged defect. (*Vineyard, supra*, 40 Cal.4th at p. 435, 53 Cal.Rptr.3d 821, 150 P.3d 709.) Where the alleged defect is that the agency's conclusions are not supported by substantial evidence, we must accord deference to the agency's factual conclusions. (*Ibid.*) We may not weigh conflicting evidence to determine who has the better argument. (*Ibid.*) Thus we may not set aside an agency's approval of an EIR on the ground that an opposite conclusion would have been equally or more reasonable. (*Ibid.*)

[7][8][9] Where the alleged defect is that the agency has failed to proceed in a manner provided by CEQA, our review is de novo. (*Vineyard, supra*, 40 Cal.4th at p. 435, 53 Cal.Rptr.3d 821, 150 P.3d 709.) An agency that fails to require an applicant to disclose information mandated by CEQA and to include that information in the EIR, fails to proceed in a manner prescribed by CEQA. (*Ibid.*) Where a party challenges an EIR because it fails to disclose evidence that conflicts with its conclusions, the party must show that the failure to disclose the conflicting evidence precludes informed decision making or informed public participation. (*Barthelemy, supra*, 38 Cal.App.4th at p. 1617, 45 Cal.Rptr.2d 688.)

IV

[10] SCOPE challenges the adequacy of the EIR's water supply analysis as it relates to the Kern-Castaic transfer.

****457** Recently, our Supreme Court in *Vineyard* articulated four principles for analysis of future water supplies under CEQA:

"First, CEQA's informational purposes are not satisfied by an EIR that simply ignores or assumes a solution to the problem of supplying water to a proposed land use project. Decision makers must, under the law, be presented with sufficient facts to 'evaluate the pros and cons of supplying the amount of water that the [project] will need.' [Citation.]" (*Vineyard,supra*, 40 Cal.4th at pp. 430-431, 53 Cal.Rptr.3d 821, 150 P.3d 709.)

"Second, an adequate environmental impact analysis for a large project, to be built and occupied over a number of years, cannot be limited to the water supply for the first stage or the first few years. While proper tiering ***159** of environmental review allows an agency to defer analysis of certain details of later phases of long-term linked or complex projects until those phases are up for approval, CEQA's demand for meaningful information 'is not satisfied by simply stating information will be provided in the future.' [Citation.]" (*Vineyard, supra*, 40 Cal.4th at p. 431,

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53 Cal.Rptr.3d 821, 150 P.3d 709.)

"Third, the future water supplies identified and analyzed must bear a likelihood of actually proving available; speculative sources and unrealistic allocations ('paper water') are insufficient bases for decisionmaking under CEQA. [Citation.] An EIR for a land use project must address the impacts of *likely* future water sources, and the EIR's discussion must include a reasoned analysis of the circumstances affecting the likelihood of the water's availability. [Citation.]" (*Vineyard, supra*, 40 Cal.4th at p. 432, 53 Cal.Rptr.3d 821, 150 P.3d 709.)

"Finally, where, despite a full discussion, it is impossible to confidently determine that anticipated future water sources will be available, CEQA requires some discussion of possible replacement sources or alternatives to use of the anticipated water, and of the environmental consequences of those contingencies. [Citation.] The law's informational demands may not be met, in this context, simply by providing that future development will not proceed if the anticipated water supply fails to materialize. But when an EIR makes a sincere and reasoned attempt to analyze the water sources the project is likely to use, but acknowledges the remaining uncertainty, a measure for curtailing development if the intended sources fail to materialize may play a role in the impact analysis. [Citation.]" (*Vineyard, supra*, 40 Cal.4th at p. 432, 53 Cal.Rptr.3d 821, 150 P.3d 709.)

The West Creek EIR does not simply ignore or assume a solution to the problem of supplying water to the project. It identifies specific water sources, including the Kern-Castaic transfer. Nor is the EIR's water supply analysis limited to the first stage or the first few years of the project. The EIR analyzes the Kern-Castaic transfer as part of the permanent supply for the entire project.

SCOPE's concerns center on the third principle articulated in *Vineyard*, that "the future water supplies identified and analyzed must bear a likelihood of actually proving available...."(*Vineyard, supra*, 40 Cal.4th at p. 432, 53 Cal.Rptr.3d 821, 150 P.3d 709.)

SCOPE challenges the EIR's conclusion that an adverse outcome in the Monterey Agreement litigation is unlikely to affect Castaic's water supplies over the long term. The EIR supports this conclusion by stating that an adverse outcome in the Monterey Agreement litigation is unlikely to "unwind" existing agreements for permanent transfer of SWP water amounts, ****458** and that existing law and contracts allow transfers without the need for the Monterey Agreement.

***160** SCOPE argues the EIR fails to disclose that the Kern-Castaic transfer is not final and permanent. SCOPE points out that the Kern-Castaic transfer is not included among the water transfers listed as final and permanent in the Monterey Settlement Agreement.

But the Monterey Settlement Agreement makes it clear that the Kern-Castaic transfer is not listed among the final transfer agreements because its EIR is subject to pending litigation in the Los Angeles Superior Court. (Citing *Friends, supra*, 95 Cal.App.4th 1373, 116 Cal.Rptr.2d 54.) SCOPE points to no evidence that the parties to the Monterey Settlement Agreement consider the transfer as anything other than permanent now that the revised EIR for the transfer has been certified. The Monterey Settlement Agreement did not make the Kern-Castaic transfer temporary. A disclosure that the Monterey Settlement Agreement does not include the Kern-Castaic transfer on its list of final transfer agreements adds nothing substantial to an understanding of water availability.

In *California Oak Foundation v. City of Santa Clarita* (2005) 133 Cal.App.4th 1219, 1237-1238, 35 Cal.Rptr.3d 434, the court reviewed the adequacy of the discussion of the Kern-Castaic transfer contained in an EIR for an unrelated project. The court determined the EIR was inadequate because it failed to discuss the legal uncertainty of the Kern-Castaic transfer; specifically, the uncertainty created by the decertification of the transfer's original EIR.

In contrast, here the EIR discloses that the Monterey Agreement litigation makes the Kern-Castaic transfer legally uncertain. The EIR states that a judgment invalidating the Monterey Agreement could affect Castaic's acquisition of the 41,000 acre feet of water. The EIR concludes, however, that as a practical matter an adverse outcome in the Monterey Agreement litigation is unlikely to "unwind" the transfer agreement. Contrary to SCOPE's argument,

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this conclusion is supported by reasoned analysis. The EIR points out that the Kern-Castaic transfer is intended to be permanent, and that the transfer can be valid even without the Monterey Agreement.

SCOPE argues the Monterey Agreement is necessary to validate the Kern-Castaic transfer because all transfers of SWP water require the DWR's consent. SCOPE cites no authority that expressly requires the DWR's consent for water transfers. Instead, SCOPE reasons the DWR's consent is required because it controls the SWP facilities necessary for delivery of the water. Assuming DWR's consent is necessary, SCOPE cites no authority that the consent must come through the Monterey Agreement. In fact, the EIR discloses that the transfer of surplus and nonsurplus water is authorized by statute. (Water Code, §§ 382, 383, 1745 et seq.) The EIR also notes that at ***161** least one Table A Amount of water was permanently transferred with the DWR's consent almost 15 years prior to the Monterey Agreement.

Quite aside from the Monterey Agreement, the legislative policy of this state is to facilitate water transfers. (See Water Code, §§ 475, 480 et seq.) SCOPE points to no evidence whatsoever that the DWR has any inclination to disapprove the Kern-Castaic transfer even if the Monterey Agreement is ultimately invalidated.

SCOPE points to a letter from the DWR to Castaic dated July 30, 2004. The letter is in an appendix to the West Creek EIR. ****459** The letter states that the DWR staff has reviewed the draft EIR for the Kern-Castaic transfer and found that the document "adequately and thoroughly discusses the proposed project and its impacts," and provides a good discussion of the relationship between the Kern-Castaic transfer and the current Monterey Agreement process. The letter also states that the DWR is using a new model to assess the potential impacts of Table A transfers in preparing the revised Monterey Agreement EIR. It acknowledges that Castaic used an earlier model to analyze the effect of the Kern-Castaic transfer. It states that the use of the new model "may cause slight changes in results, which may lead DWR to different conclusions than the conclusions made by [Castaic] in the current EIR."Nevertheless, the letter states Castaic's draft EIR adequately discusses SWP reliability and pre- and post-Monterey Agreement conditions.

SCOPE argues the West Creek EIR is deficient in that it fails to include or discuss information that a new water model may lead the DWR to different conclusions than those made by Castaic and its draft EIR. But the letter describes any possible change in result as "slight." The letter does not state that the slight change in results will probably lead to different conclusions; it says only that it "may" lead to unspecified different conclusions. It is highly improbable that a slight change in results will lead to radically different conclusions. In fact, the letter praises the draft EIR's discussion of the proposed project and its impacts. The information contained in the letter adds nothing substantial to West Creek's EIR.

SCOPE argues the EIR is devoid of any factual discussion of the impacts of the *PCL* decision on the West Creek project. But the EIR discloses that a final judgment invalidating the Monterey Agreement could impair Castaic's supply of SWP water. The EIR goes on to state that such a result is unlikely because the Kern-Castaic transfer can be validated outside the Monterey Agreement. SCOPE cites no authority for the proposition that the West Creek EIR must discuss the factors the DWR will be required to consider in preparing a revised Monterey Agreement EIR. The Kern-Castaic transfer is not dependent on the Monterey Agreement. Such a discussion is not necessary for informed decision making or public participation.

***162** SCOPE cites *Vineyard, supra*, 40 Cal.4th at p. 440, 53 Cal.Rptr.3d 821, 150 P.3d 709, for the proposition that it is improper for an EIR to tier from an environmental document that will be completed in the future. SCOPE points out that West Creek's EIR was certified without waiting for the DWR to complete its revised EIR for the Monterey Agreement. But West Creek's EIR was not tiered on future Monterey Agreement environmental documents. In fact, West Creek's water supply analysis is based on the premise that the Monterey Agreement litigation is unlikely to affect the Kern-Castaic transfer.

West Creek's EIR satisfies the third principle of analysis stated in *Vineyard*. The record contains substantial evidence demonstrating a reasonable likelihood that water from the Kern-Castaic transfer

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will be available for the project's near- and long-term needs. (See *Vineyard, supra*, 40 Cal.4th at p. 437, 53 Cal.Rptr.3d 821, 150 P.3d 709.) The record also shows the County proceeded in a manner required by CEQA. The EIR neither improperly used tiering to defer all analysis of supplies to future stages of the project, nor relied upon demonstrably illusory supplies. (*Ibid.*)

****460** SCOPE argues that West Creek's EIR is deficient because it fails to analyze the project's water supply in the absence of the 41,000 afy Kern-Castaic transfer. When first published, *Vineyard's* fourth principle was slightly different than the one stated in the subsequent modified opinion. Principle four then stated that an EIR requires analysis of replacement or alternative water sources where "a full discussion leaves some uncertainty regarding actual availability of the anticipated future water sources...." Principle four in the modified version of *Vineyard* allows slightly more flexibility in determining the issue of available future water sources. It requires analysis of replacement or alternative sources only if it is "impossible to confidently determine" that anticipated future water sources will be available.

Here West Creek's EIR acknowledges there is at least some legal uncertainty about the Kern-Castaic transfer. The EIR states in part: "An adverse final judgment invalidating the Monterey Agreement could affect [Castaic's] completed acquisition of the 41,000 AF, which could in turn impair [Castaic's] supply of SWP water through its contracts with DWR and other SWP contractors."

Some would argue it is certain that the outcome of litigation is seldom certain. But whatever the outcome of the *PCL litigation*, it is highly unlikely it will affect the Kern-Castaic water transfer. The water is now available, and for years has been available for the project under executed agreements. The recertified EIR notes that the Kern-Castaic transfer can legally occur without the Monterey Agreement. Suffice it to say, however the Monterey Agreement ***163** litigation is eventually decided, the Kern-Castaic transfer will likely not be affected. Per principle four, we can confidently determine that the water will be available.

V

[11] SCOPE contends West Creek's EIR is deficient in that it fails to discuss the impact of the lack of funding to remediate perchlorate contamination of local water wells. SCOPE has no quarrel with the EIR's discussion of perchlorate contamination of local wells. Its contention is limited to the lack of funding for remediation measures.

In addition to SWP water, two local aquifers will serve as part of the project's water supply, the Alluvial Aquifer and the Saugus Aquifer. SCOPE argues there are 67 wells owned by water companies in these aquifers and an undisclosed number of private wells. SCOPE points to evidence that the estimated cost of remediation is $500,000 per well. No source of funding is identified in the EIR to pay for the equipment necessary for remediation.

SCOPE relies on *Federation of Hillside & Canyon Associations v. City of Los Angeles* (2000) 83 Cal.App.4th 1252, 1261-1262, 100 Cal.Rptr.2d 301(*Federation*). There the city adopted a general plan framework (GPF) as part of its general plan. The GPF identified mitigation measures, including a transportation plan designed to mitigate the transportation impacts of the GPF's growth policies. The transportation plan acknowledged that to implement the mitigation measures would require the cooperation of various public agencies, that the city's portion of the costs would exceed its revenues, and that there is "great uncertainty" whether the mitigation measures would ever be funded or implemented. Although the city adopted the mitigation measures, it made no effort to ensure they will actually be implemented or enforceable. The court determined that the city's approval of the GPF must be vacated for failing to ensure that feasible mitigation measures will actually****461** be implemented. (*Id.* at p. 1261, 100 Cal.Rptr.2d 301, citing §§ 21002.1, subd. (b); 21081.)

Here, although water agencies may have 67 wells, only six of them have been identified as being contaminated with perchlorate. Unlike the city in *Federation*, here the County did not acknowledge there is great uncertainty that mitigation measures would ever be funded or implemented. To the contrary, the EIR states in part: "Due to the high value of this local water resource, the purveyors have placed a high priority on replacing the impacted groundwater capacity by installing wellhead

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treatment and the construction of new wells." Here, unlike *Federation*, there is nothing to suggest the mitigation measures will not be implemented. Finally, SCOPE points to nothing in *Federation* or any other case that requires the EIR to discuss funding for mitigation measures.

***164** DISPOSITION

The judgment is affirmed. Costs on appeal are awarded to respondents and real parties in interest.

COFFEE and PERREN, JJ., concur.
Cal.App. 2 Dist.,2007.
Santa Clarita Organization for Planning the Environment v. County of Los Angeles
157 Cal.App.4th 149, 68 Cal.Rptr.3d 449, 07 Cal. Daily Op. Serv. 13,422, 2007 Daily Journal D.A.R. 17,387

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Filed 1/29/08 Sierra Club v. City of Santa Clarita CA2/3

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

California Rules of Court, rule 8.1115(a), prohibits courts and parties from citing or relying on opinions not certified for publication or ordered published, except as specified by rule 8.1115(b). This opinion has not been certified for publication or ordered published for purposes of rule 8.1115.

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

SECOND APPELLATE DISTRICT

DIVISION THREE

SIERRA CLUB et al., Plaintiffs and Appellants, v. CITY OF SANTA CLARITA et al., Defendants and Respondents; THE NEWHALL LAND AND FARMING COMPANY, Real Party in Interest and Respondent.	B194771 (Los Angeles County Super. Ct. No. BS098722)

APPEAL from a judgment of the Superior Court of Los Angeles County, Dzintra Janavs, Judge. Affirmed.

Law Office of Babak Naficy and Babak Naficy for Plaintiffs and Appellants.

Burke, Williams & Sorenson, Carl K. Newton and Geralyn L. Skapik for Defendants and Respondents.

Paul, Hastings, Janofsky & Walker, Robert I. McCurry and A. Catherine Norian for Real Party in Interest and Respondent.

Sierra Club, Center for Biological Diversity, Friends of the Santa Clara River, and California Water Impact Network (collectively Petitioners) challenge the certification by City of Santa Clarita (city) of an environmental impact report (EIR) and the city's approval of a mixed-use development project known as Riverpark. Petitioners appeal a judgment denying their petition for a writ of mandate and denying relief on their complaint. They challenge the adequacy of the EIR and the city's findings under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.) with respect to impacts on water supply and biological resources, and the city's finding under the Planning and Zoning Law (Gov. Code, § 65000 et seq.) that the project is consistent with the city's general plan.

We conclude that the water supply analysis in the EIR, the analysis of impacts on the holly-leaf cherry and San Diego black-tailed jackrabbit, and the discussion of measures to mitigate the impacts on the western spadefoot toad were adequate, and that the city reasonably concluded that the project is consistent with the city's general plan. We therefore affirm the judgment.

FACTUAL AND PROCEDURAL BACKGROUND

1. *Proposed Project*

The Newhall Land and Farming Company (Newhall) proposed the development of 1,183 residential units, consisting of 439 single-family homes and 744 apartment units, and 40,000 square feet of commercial space, together with trails, a 29-acre park, and open space. The proposed project site is in the central part of the city, north of Soledad Canyon Road and east of Bouquet Canyon Road, and includes a section of the

Santa Clara River running east-west through the site. The total site acreage is 695.4 acres including the river, and 357 acres excluding the river.

The Santa Clara River is the last major unchannelized river in Los Angeles County. The city has designated the Santa Clara River a Significant Ecological Area (SEA). The SEA supports a variety of natural habitats including freshwater marsh, coastal sage scrub, oak woodlands, and riparian woodlands. The 100-year storm limit line determined by the Federal Emergency Management Agency defines the boundaries of the SEA. The proposed project includes 16.9 acres of development within the 100-year storm limit line and therefore within the SEA.

The proposed project site is predominantly undeveloped, but with some disturbed areas including several buildings used for construction purposes and electrical transmission lines. Plant communities on the site include coastal sage scrub, southern riparian scrub, native and non-native grasses and ruderal vegetation, small patches of oak trees, and other native and non-native trees. To the north of the site are undeveloped property, a water treatment facility and administrative offices owned by the Castaic Lake Water Agency, and single-family residential uses. To the south of the site, across the river from the proposed development, are retail commercial uses, the Saugus Speedway, a Metrolink commuter railway station, a mobile home park, and a business park. To the east of the site are undeveloped property and a business park, and to the west are retail commercial uses and open space.

2. *Environmental Review and Project Approval*

The city circulated a draft EIR for the proposed project on March 2, 2004. Focused surveys performed on March 5 and 6, 2004, at the request of the Department of Fish and Game disclosed the presence of western spadefoot toads on the proposed project site. The city circulated a revised biological resources section of the draft EIR discussing the western spadefoot toad on March 24, 2004.

The city's planning commission conducted several public hearings on the proposed project and recommended approval of the project with certain modifications. Newhall modified the proposed project accordingly. Those modifications reduced the number of residential units to 1,123, consisting of 419 single-family homes, 380 condominium units, and 324 apartment units, and reduced the area of commercial space to 16,000 square feet, among other changes.

A final EIR was prepared in December 2004. The city council conducted a public hearing on the proposed project in January 2005, and suggested further modifications. The city council conducted additional public hearings in March and May 2005. The final EIR was revised in May 2005. On May 25, 2005, the city council certified the final EIR, made findings under CEQA and other findings, adopted a statement of overriding considerations, and approved the project. The project approvals included a vesting tentative tract map, general plan amendment, conditional use permit, oak tree permit, and setback and wall height adjustments. The city council approved a zone change on second reading, on June 14, 2005.

The project as approved includes 1,098 residential units, consisting of 439 single-family homes and 657 condominium units, and 16,000 square feet of commercial space, in addition to trails, a 29-acre park, and open space.

3. *Trial Court Proceedings*

Petitioners filed a combined petition for writ of mandate and complaint against the city and its city council in the Ventura County Superior Court in June 2005, challenging the city's certification of the EIR and project approval. The city moved for a change of venue to Los Angeles County Superior Court. The court granted the motion.

The trial court conducted a hearing on the merits in May 2006. The court rejected the Petitioners' contentions in a Decision on Submitted Matter filed on August 14, 2006, and entered a judgment denying the petition for writ of mandate. Petitioners timely appealed the judgment.

CONTENTIONS

Petitioners contend (1) the EIR failed to adequately discuss the uncertainty of the proposed water supplies; (2) due to the uncertainty of the proposed water supplies, the EIR was required to discuss alternative sources and the environmental impact of supplying water from those alternative sources, but failed to do so; (3) the Department of Water Resources rather than the Castaic Lake Water Agency should be the lead agency for environmental review of a water transfer from Kern County; (4) the EIR applied an incorrect legal standard to determine the significance of impacts on the holly leaf cherry; (5) the EIR applied an incorrect legal standard to determine the significance

of impacts on the San Diego black-tailed jackrabbit, and the evidence does not support the city's finding that the impacts on the species will be less than significant; (6) the city failed to consider project revisions or feasible alternatives to reduce the significant impacts on the western spadefoot toad to an insignificant level, and the evidence does not support the city's finding that significant impacts on the species are unavoidable; and (7) the evidence does not support the city's finding that the project is consistent with particular general plan goals and policies.

DISCUSSION

1. *CEQA Requirements*

"CEQA is a comprehensive scheme designed to provide long-term protection to the environment. [Citation.] In enacting CEQA, the Legislature declared its intention that all public agencies responsible for regulating activities affecting the environment give prime consideration to preventing environmental damage when carrying out their duties. [Citations.] CEQA is to be interpreted 'to afford the fullest possible protection to the environment within the reasonable scope of the statutory language.' [Citation.]" (*Mountain Lion Foundation v. Fish & Game Com.* (1997) 16 Cal.4th 105, 112 (*Mountain Lion*).)

An EIR is required for any project that a public agency proposes to carry out or approve that may have a significant effect on the environment. (Pub. Resources Code,

§§ 21100, subd. (a), 21151, subd. (a); Guidelines, § 15064,[1] subd. (a)(1).) An EIR must describe the proposed project and its environmental setting, state the objectives sought to be achieved, identify and analyze the significant effects on the environment, state how those impacts can be mitigated or avoided, and identify and analyze alternatives to the project, among other requirements. (Pub. Resources Code, §§ 21100, subd. (b), 21151; Guidelines, §§ 15124, 15125, 15126.6.) "The purpose of an environmental impact report is to provide public agencies and the public in general with detailed information about the effect which a proposed project is likely to have on the environment; to list ways in which the significant effects of such a project might be minimized; and to indicate alternatives to such a project." (Pub. Resources Code, § 21061.)

The lead agency must notify the public of the draft EIR, make the draft EIR and all documents referenced in it available for public review, and respond to comments that raise significant environmental issues. (Pub. Resources Code, §§ 21092, 21091, subds. (a), (d); Guidelines, §§ 15087, 15088.) The agency also must consult with and obtain comments from other agencies affected by the project and respond to their comments. (Pub. Resources Code, §§ 21092.5, 21104, 21153; Guidelines, § 15086.)

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[1] All references to Guidelines are to the CEQA Guidelines (Cal. Code Regs., Tit. 14, § 15000 et seq.) developed by the Office of Planning and Research and adopted by the Resources Agency. (Pub. Resources Code, §§ 21083, 21087.) "[C]ourts should afford great weight to the Guidelines except when a provision is clearly unauthorized or erroneous under CEQA." (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 391, fn. 2 (*Laurel Heights I*).)

The agency must prepare a final EIR including any revisions to the draft EIR, comments received from the public and from other agencies, and responses to comments. (Guidelines, §§ 15089, subd. (a), 15132.)

An agency may not approve a project that will have significant environmental effects if there are feasible alternatives or feasible mitigation measures that would substantially lessen those effects.[2] (Pub. Resources Code, §§ 21002, 21002.1, subd. (b); Guidelines, § 15021, subd. (a)(2); *Mountain Lion*, *supra*, 16 Cal.4th at p. 134.) An agency may find, however, that particular economic, social, or other considerations make the alternatives and mitigation measures infeasible and that particular project benefits outweigh the adverse environmental effects. (Pub. Resources Code, § 21081, subds. (a)(3), (b); Guidelines, § 15091, subd. (a)(3).) Specifically, an agency cannot approve a project that will have significant environmental effects unless it finds as to each significant effect, based on substantial evidence in the administrative record, that (1) mitigation measures required in or incorporated into the project will avoid or substantially lessen the significant effect; (2) those measures are within the jurisdiction of another public agency and have been adopted, or can and should be adopted, by that agency; or (3) specific economic, legal, social, technological, or other considerations make the mitigation measures or alternatives identified in the EIR infeasible, and

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[2] " 'Feasible' means capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, social, and technological factors." (Pub. Resources Code, § 21061.1; see also Guidelines, § 15364.)

specific overriding economic, legal, social, technological, or other benefits outweigh the significant environmental effects. (Pub. Resources Code, §§ 21081, 21081.5; Guidelines, § 15091, subds. (a), (b).) A finding that specific overriding project benefits outweigh the significant environmental effects (Pub. Resources Code, § 21081, subd. (b)) is known as a statement of overriding considerations. (Guidelines, § 15093.)

Thus, a public agency is not required to favor environmental protection over other considerations, but it must disclose and carefully consider the environmental consequences of its actions, mitigate or avoid adverse environmental effects if feasible, explain the reasons for its actions, and afford the public and other affected agencies an opportunity to participate meaningfully in the environmental review process. The purpose of these requirements is to ensure that public officials and the public are aware of the environmental consequences of decisions before they are made. (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553, 564 (*Goleta Valley*).) The EIR process also informs the public of the basis for environmentally significant decisions by public officials and thereby promotes accountability and informed self-government. (*Laurel Heights I, supra*, 47 Cal.3d at p. 392; *Concerned Citizens of Costa Mesa, Inc. v. 32nd Dist. Agricultural Assn.* (1986) 42 Cal.3d 929, 935-936.) Before approving the project, the agency must certify that its decisionmaking body reviewed and considered the information contained in the EIR, that the EIR reflects the agency's independent judgment and analysis, and that the EIR was completed in compliance with CEQA. (Pub. Resources Code, § 21082.1, subd. (c); Guidelines, § 15090.)

"We have repeatedly recognized that the EIR is the 'heart of CEQA.' [Citations.] 'Its purpose is to inform the public and its responsible officials of the environmental consequences of their decisions *before* they are made. Thus, the EIR "protects not only the environment but also informed self-government." [Citations.]' To this end, public participation is an 'essential part of the CEQA process.' [Citations.]" (*Laurel Heights Improvement Assn. v. Regents of University of California* (1993) 6 Cal.4th 1112, 1123 (*Laurel Heights II*).) "The preparation and circulation of an EIR is more than a set of technical hurdles for agencies and developers to overcome. The EIR's function is to ensure that government officials who decide to build or approve a project do so with a full understanding of the environmental consequences and, equally important, that the public is assured those consequences have been taken into account. (*Laurel Heights I*, *supra*, 47 Cal.3d at pp. 391-392.) For the EIR to serve these goals it must present information in such a manner that the foreseeable impacts of pursuing the project can actually be understood and weighed, and the public must be given an adequate opportunity to comment on that presentation before the decision to go forward is made." (*Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412, 449-450 (*Vineyard Area Citizens*).)

" 'Significant effect on the environment' means a substantial, or potentially substantial, adverse change in the environment." (Pub. Resources Code, § 21068.) The Guidelines define "significant effect on the environment" in relevant part as "a substantial, or potentially substantial, adverse change in any of the physical conditions within the area affected by the project including land, air, water, minerals,

flora, fauna, ambient noise, and objects of historic or aesthetic significance."[3] (Guidelines, § 15382.)

"Substantial evidence" under CEQA "includes fact, a reasonable assumption predicated upon fact, or expert opinion supported by fact." (Pub. Resources Code, § 21080, subd. (e)(1); see Guidelines, §§ 15384, subd. (b), 15064, subd. (f)(5).) The Guidelines define "substantial evidence" as "enough relevant information and reasonable inferences from this information that a fair argument can be made to support a conclusion, even though other conclusions might also be reached," and state that this determination must be made "by examining the whole record before the lead agency." (Guidelines, § 15384, subd. (a).) "Substantial evidence is not argument, speculation, unsubstantiated opinion or narrative, evidence that is clearly inaccurate or erroneous, or evidence of social or economic impacts that do not contribute to, or are not caused by, physical impacts on the environment." (Pub. Resources Code, § 21080, subd. (e)(2); accord, *id.* § 21082.2, subd. (c); see also Guidelines, § 15384, subd. (a).)

2. *Standard of Review*

The standard of review of an agency's decision under CEQA is abuse of discretion. Abuse of discretion means the agency failed to proceed in a manner required

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[3] " 'Environment' means the physical conditions which exist within the area which will be affected by a proposed project including land, air, water, minerals, flora, fauna, ambient noise, and objects of historic or aesthetic significance. The area involved shall be the area in which significant effects would occur either directly or indirectly as a result of the project. The 'environment' includes both natural and man-made conditions." (Guidelines, § 15360; see also Pub. Resources Code, § 21060.5.)

by law or there was no substantial evidence to support its decision. (Pub. Resources Code, §§ 21168, 21168.5; *County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 945.) Whether the agency failed to proceed in a manner required by law is a question of law. A court determines de novo whether the agency complied with CEQA's procedural requirements, " 'scrupulously enforc[ing] all legislatively mandated CEQA requirements' (*Citizens of Goleta Valley v. Board of Supervisors* (1990) 52 Cal.3d 553, 564 [276 Cal.Rptr. 410, 801 P.2d 1161])." (*Vineyard Area Citizens, supra*, 40 Cal.4th at p. 435.) The failure to provide information required by CEQA in an EIR is a failure to proceed in a manner required by law. (*Save Our Peninsula Committee v. Monterey County Bd. of Supervisors* (2001) 87 Cal.App.4th 99, 118.) The failure to comply with CEQA's procedural or information disclosure requirements is a prejudicial abuse of discretion if the decision makers or the public is deprived of information necessary to make a meaningful assessment of the environmental impacts. (*Sierra Club v. State Bd. of Forestry* (1994) 7 Cal.4th 1215, 1236-1237; *County of Amador, supra,* at p. 946; see Pub. Resources Code, § 21005.)

Findings of fact made by the agency and factual conclusions stated in an EIR are reviewed under the substantial evidence standard. (*Vineyard Area Citizens, supra*, 40 Cal.4th at p. 435; *Laurel Heights I, supra*, 47 Cal.3d at pp. 392-393, 407.) Under the substantial evidence standard, the court does not determine whether the agency's factual determinations were correct, but only determines whether they were supported by substantial evidence. (*Laurel Heights I, supra*, at pp. 392-393.) On appeal, we

independently review the agency's decision under the same standard of review that governs the trial court. (*Vineyard Area Citizens, supra*, at p. 427.)

3. *Water Supply*

a. *CEQA Requirements for Water Supply Analysis*

An EIR must identify and analyze the significant environmental impacts that may result from the project. (Pub. Resources Code, § 21100, subds. (a), (b); Guidelines, §§ 15126.2, subd. (a), 15143.) It must include facts and analysis sufficient to allow the decision makers and the public to understand the environmental consequences of the project. (Guidelines, § 15151; *Laurel Heights I, supra*, 47 Cal.3d at pp. 404-405; *Napa Citizens for Honest Government v. Napa County Bd. of Supervisors* (2001) 91 Cal.App.4th 342, 356 (*Napa Citizens*).) An EIR for a large, mixed-use development project such as the present project must include an analysis of the reasonably foreseeable environmental impacts of supplying water to the project. (*Vineyard Area Citizens, supra*, 40 Cal.4th at pp. 428, 434.) The analysis must include a discussion of the planned and likely sources of water and the impacts of supplying water from those sources. (*Id.* at pp. 428, 432, 434.)

Vineyard Area Citizens involved an EIR prepared for a community plan and a specific plan for a large, mixed-use development project. The EIR stated that the project would rely on both groundwater and surface water for its water supplies. (*Vineyard Area Citizens, supra*, 40 Cal.4th at p. 423.) The projected long-term water supplies consisted of an unspecified combination of groundwater and surface water in "conjunctive use." (*Id.* at p. 440.) The EIR stated that a full analysis of the

"conjunctive use" program must await the pending environmental review of a master plan update by the county water agency. (*Id.* at p. 440.) Because the project did not have legal rights to the projected water supplies, a mitigation measure provided that subdivision maps, building permits, and other entitlements would not be granted unless agreements and financing for the water supplies were in place. (*Id.* at p. 424.)

Vineyard Area Citizens discussed several opinions by the Courts of Appeal concerning the sufficiency of an EIR's analysis of water supply (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at pp. 428-430) and derived four principles from those opinions:

"First, CEQA's informational purposes are not satisfied by an EIR that simply ignores or assumes a solution to the problem of supplying water to a proposed land use project. Decision makers must, under the law, be presented with sufficient facts to 'evaluate the pros and cons of supplying the amount of water that the [project] will need.' (*Santiago County Water Dist. v. County of Orange* [(1981)] 118 Cal.App.3d [818,] 829.)

"Second, an adequate environmental impact analysis for a large project, to be built and occupied over a number of years, cannot be limited to the water supply for the first stage or the first few years. While proper tiering of environmental review allows an agency to defer analysis of certain details of later phases of long-term linked or complex projects until those phases are up for approval, CEQA's demand for meaningful information 'is not satisfied by simply stating information will be provided

in the future.' (*Santa Clarita* [*Organization for Planning the Environment v. County of Los Angeles* (2003)] 106 Cal.App.4th [715,] 723.) . . . .

"Third, the future water supplies identified and analyzed must bear a likelihood of actually proving available; speculative sources and unrealistic allocations ('paper water') are insufficient bases for decisionmaking under CEQA. (*Santa Clarita, supra*, 106 Cal.App.4th at pp. 720-723.) An EIR for a land use project must address the impacts of *likely* future water sources, and the EIR's discussion must include a reasoned analysis of the circumstances affecting the likelihood of the water's availability. (*California Oak* [*Foundation v. City of Santa Clarita* (2005)] 133 Cal.App.4th [1219,] 1244.)

"Finally, where, despite a full discussion, it is impossible to confidently determine that anticipated future water sources will be available, CEQA requires some discussion of possible replacement sources or alternatives to use of the anticipated water, and of the environmental consequences of those contingencies. (*Napa Citizens, supra*, 91 Cal.App.4th at p. 373.)" (*Vineyard Area Citizens, supra*, 40 Cal.4th at pp. 430-432.)

Vineyard Area Citizens stated further: "[W]e emphasize that the burden of identifying likely water sources for a project varies with the stage of project approval involved; the necessary degree of confidence involved for approval of a conceptual plan is much lower than for issuance of building permits. The ultimate question under CEQA, moreover, is not whether an EIR establishes a likely source of water, but

whether it adequately addresses the reasonably foreseeable *impacts* of supplying water to the project." (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 434.)

Vineyard Area Citizens concluded that the analysis of near-term groundwater supplies in the EIR was adequate. It stated that the county's conclusion that certain groundwater supplies would be available to the project in the near term was supported by substantial evidence, and rejected the petitioners' argument that competing uses were likely to exhaust those water supplies. (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at pp. 436-437.)[4] It stated further that the county did not fail to proceed in the manner required by law in that the EIR neither improperly deferred analysis of water supplies to future stages of the project nor relied on illusory water supplies. (*Id.* at p. 437.)

Vineyard Area Citizens concluded that the analysis of long-term water supplies in the EIR was inadequate. It stated that the county's conclusion that surface water supplies would satisfy the project's long-term demands was not supported by substantial evidence because the EIR failed to explain inconsistencies in the figures provided on total demand and supply, failed to identify the intended and likely long-term water sources, relied on "vague and unquantified" water supplies (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 440), and failed to identify competing uses. (*Id.* at pp. 439-442.)[5]

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[4] "While much uncertainty remains, then, the record contains substantial evidence demonstrating a reasonable likelihood that a water source the provider plans to use . . . will indeed be available at least in substantial part to supply the Sunrise Douglas project's near-term needs." (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 437.)

[5] "Factual inconsistencies and lack of clarity in the FEIR leave the reader—and the decision makers—without substantial evidence for concluding that sufficient water is, in

It stated further that the county failed to proceed in the manner required by law by deferring environmental review of the conjunctive use program to a future EIR (*id.* at pp. 440-441), failing to properly incorporate information or tier from a prior EIR regarding surface water supplies on which the project relied (*id.* at pp. 442-443), failing to include enforceable mitigation measures for those surface water diversions (*id.* at p. 444), and by relying on a provision precluding further development in lieu of identifying and analyzing the project's intended and likely water sources (*ibid.*) *Vineyard Area Citizens* stated that there was "no plainly stated, coherent analysis of how the supply is to meet the demand." (*Id.* at p. 445.)

b. *Background of the State Water Project*

The State Water Project is a water storage and delivery system operated by the Department of Water Resources. It includes reservoirs, dams, power plants, pumping plants, canals, aqueducts, and other facilities. (See *Planning & Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, 898-899 (*PCL*).) California voters approved a bond measure in 1960 to fund its construction. (Stats. 1961, p. cxliii; Wat. Code, § 12930 et seq.) Although the system was designed to deliver 4.23 million acre-feet of water annually, for many years it delivered significantly less than that amount. (See *California Oak Foundation v. City of Santa Clarita* (2005) 133 Cal.App.4th 1219, 1227-1228 (*California Oak*); *PCL*, *supra*, at pp. 898-899.)

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fact, likely to be available for the Sunrise Douglas project at full build-out." (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 439.)

The Department of Water Resources is a party to 29 long-term contracts with local water agencies. Under the original contracts, each agency had the right to receive a proportionate share of the 4.23 million acre-feet of water per year that was projected to be supplied by the State Water Project. (See *PCL, supra*, 83 Cal.App.4th at p. 899; Wat. Code, § 12937, subd. (b).) The agencies were required to pay for their contractual entitlements of water regardless of whether they actually received the water. (See *PCL, supra*, 83 Cal.App.4th at p. 899.) Article 18(a) of the water supply contracts provided that in times of temporary shortage, the agricultural water agencies would receive a reduced allocation. Article 18(b) provided that in times of permanent water shortage, the allocations of all contracting agencies would be reduced proportionately. (See *id.* at pp. 899-900.)

After several years of drought in the late 1980's and early 1990's resulting in disputes between agricultural and urban water agencies, several contracting agencies and the Department of Water Resources entered into an agreement known as the Monterey Agreement. (See *PCL, supra*, 83 Cal.App.4th at pp. 897, 901.) The Monterey Agreement is a statement of 14 principles designed to govern revisions to the water supply contracts. It calls for the elimination of the provision requiring agricultural agencies to absorb the first deficiency and provides that in times of shortage, deliveries to all contracting agencies will be reduced in proportion to their entitlements. (See *Friends of the Santa Clara River v. Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373, 1376 (*Friends*).) The Monterey Agreement also provides for the agricultural agencies to permanently transfer to the urban agencies 130,000

acre-feet of annual water entitlements. (See *id.* at pp. 1376-1377; *PCL, supra*, 83 Cal.App.4th at pp. 901-902.) The Monterey Agreement provides for its implementation through amendments to the long-term water supply contracts. (See *PCL, supra*, at p. 902.) Table A of those contracts states the amount of each agency's annual water allocation from the State Water Project. The amendments pursuant to the Monterey Agreement are known as the Monterey Amendments.

Pursuant to the Monterey Agreement, the Castaic Lake Water Agency entered into an agreement with the Kern County Water Agency in 1999 for the permanent transfer of 41,000 acre-feet of annual State Water Project water entitlement from the Kern County Water Agency to the Castaic Lake Water Agency (Kern-Castaic transfer). The Department of Water Resources approved the transfer in March 1999, and the long-terms water supply contracts between the two water agencies and the Department of Water Resources were amended accordingly.

The Central Coast Water Agency as lead agency prepared a program EIR for the Monterey Agreement and certified the EIR in October 1995.[6] The Department of Water Resources as a responsible agency also made findings and adopted the EIR. (*PCL, supra*, 83 Cal.App.4th at p. 902.) The Sacramento County Superior Court denied a petition for writ of mandate challenging the EIR. In September 2000, the Court of

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[6] A program EIR may be prepared for a series of related actions that can be characterized as one large project. (Guidelines, § 15168, subd. (a).) Subsequent program activities that would cause environmental impacts not analyzed in the program EIR require additional environmental review. (*Id.*, subd. (c).)

Appeal in *PCL* reversed the judgment by the trial court with directions to grant the petition. (*Id.* at pp. 903, 926.) *PCL* held that the Department of Water Resources rather than the Central Coast Water Agency was the proper lead agency, and that the EIR failed to provide a sufficient analysis of the no project alternative. (*Id.* at pp. 907, 916.) *PCL* directed the trial court to vacate the certification of the EIR and make any other order appropriate under Public Resources Code section 21168.9, subdivision (a), but did not direct the court to vacate the project approval, and declined to stay the implementation of the Monterey Agreement. (*PCL*, *supra*, at p. 926 & fn. 16.)

The Castaic Lake Water Agency as lead agency prepared an EIR for the Kern-Castaic transfer in March 1999. It was a project EIR that tiered from three other EIR's, including the Monterey Agreement program EIR.[7] (*Friends*, *supra*, 95 Cal.App.4th at pp. 1379-1380.) The Los Angeles County Superior Court denied a petition for writ of mandate challenging the Castaic Lake Water Agency's EIR. (*Id.* at p. 1381.) The appellate opinion invalidating the Monterey Agreement EIR (*PCL*, *supra*, 83 Cal.App.4th 892) was filed while the appeal in *Friends* was pending. (*Friends*, *supra*, at p. 1382.) In January 2002, the Court of Appeal in *Friends* reversed the

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[7] A project EIR "examines the environmental impacts of a specific development project." (Guidelines, § 15161.) " 'Tiering' or 'tier' means the coverage of general matters and environmental effects in an environmental impact report prepared for a policy, plan, program or ordinance followed by narrower or site-specific environmental impact reports which incorporate by reference the discussion in any prior environmental impact report and which concentrate on the environmental effects which (a) are capable of being mitigated, or (b) were not analyzed as significant effects on the environment in the prior environmental impact report." (Pub. Resources Code, § 21068.5.)

judgment by the trial court with directions to grant the petition. (*Id.* at p. 1388.) *Friends* concluded that the Castaic Lake Water Agency's EIR relied on the analysis of environmental impacts in the Monterey Agreement EIR and that the decertification of the Monterey Agreement EIR precluded reliance on that analysis. (*Id.* at pp. 1384-1387.) *Friends* directed the trial court to vacate the certification of the EIR and make any other order appropriate under Public Resources Code section 21168.9, but did not direct the court to vacate the project approval, and stated that the trial court should determine whether to enjoin the project. (*Friends*, *supra*, at p. 1388.) The trial court entered a judgment on remand in October 2002 vacating the certification of the EIR but not the project approval. The trial court declined the petitioners' request to enjoin the use of water received pursuant to the transfer. The Court of Appeal in an unpublished opinion affirmed the judgment, rejecting the petitioners' challenge to the denial of an injunction (*Friends of the Santa Clara River v. Castaic Lake Water Agency* (Dec. 1, 2003, B164027)).

The parties to the proceeding involving a challenge to the Monterey Agreement EIR (*PCL*, *supra*, 83 Cal.App.4th 892) entered into a settlement agreement in May 2003 specifying certain subjects to be discussed in a new Monterey Agreement EIR to be prepared by the Department of Water Resources. Those subjects included the environmental impacts relating to the transfers of water rights effected pursuant to the Monterey Agreement. The settlement agreement included an Attachment E listing certain transfers other than the Kern-Castaic transfer. The settlement agreement separately identified the Kern-Castaic transfer, and stated that the new Monterey

Agreement EIR would include an analysis of the impacts of both the Attachment E transfers and the Kern-Castaic transfer.

The settlement agreement stated with respect to the Attachment E transfers: "[N]otwithstanding the analysis of the potential impacts of the Attachment E Transfers in the New EIR and without specifically endorsing or opposing those transfers or any prior environmental assessments of them, the Parties recognize that such water transfers are final. Each of the Parties agrees not to, and it shall be a condition to the initial and continuing effectiveness of this Settlement Agreement that Plaintiffs do not, hereafter challenge the effectiveness or validity of such water transfers." It stated with respect to the Kern-Castaic transfer: "[R]egarding the Kern-Castaic Transfer, the Parties recognize that such water transfer is subject to pending litigation in the Los Angeles County Superior Court following remand from the Second District Court of Appeal (*See* Friends of the Santa Clara River v. Castaic Lake Water Agency, 95 Cal.App.4th 1373, 116 Cal.Rptr.2d 54 (2002); *review denied* April 17, 2002). The Parties agree that jurisdiction with respect to that litigation should remain in that court and that nothing in this Settlement Agreement is intended to predispose the remedies or other actions that may occur in that pending litigation."

The settlement agreement included certain proposed amendments to the long-term water service contracts, known as the Attachment A amendments. The settlement agreement stated that the parties would request an order authorizing the operation of the State Water Project on an interim basis in accordance with the Monterey Agreement, the

Attachment A amendments, and other terms of the settlement. The trial court approved the settlement and issued the requested order.

The Castaic Lake Water Agency prepared a second EIR for the Kern-Castaic transfer and certified the EIR in December 2004. The Los Angeles County Superior Court granted a petition for writ of mandate challenging the second EIR for the Kern-Castaic transfer in May 2007 (*Planning and Conservation League v. Castaic Lake Water Agency* (Super. Ct. L.A. County No. BS098724)).[8] The court concluded that although the EIR analyzed the environmental impacts of the project assuming three different State Water Project water allocation scenarios, it failed to adequately explain how those scenarios could result from the pending environmental review of the Monterey Amendments and any challenge to the new Monterey Agreement EIR. The court rejected all other challenges to the EIR. The petitioners, the Castaic Lake Water Agency, and the Kern County Water Agency appealed the judgment. That appeal is currently pending in the Second District Court of Appeal (No. B200673).

c. *Petitioners' Specific Contention*

Petitioners contend the ongoing environmental review of the Monterey Agreement and the possibility that the Department of Water Resources ultimately will exercise its discretion to disapprove or modify the Kern-Castaic transfer render the

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[8] We granted a joint request by the city and Newhall to judicially notice the judgment filed on May 22, 2007, and the statement of decision filed on April 2, 2007, in *Planning and Conservation League v. Castaic Lake Water Agency*, *supra*, No. BS098724.

transfer uncertain. They argue that the EIR fails to acknowledge that uncertainty. Petitioners cite a statement by the department in *Planning and Conservation League v. Castaic Lake Water Agency, supra*, No. BS098724, that, "[T]he contract amendments that effectuated the transfers under the Monterey Amendment do not preclude DWR in its choice of alternatives in the Monterey Amendment EIR or mitigation measures that may need to be imposed to reduce significant impacts to less than significant. Any contractual agreement to transfer SWP water from one contractor to another is always subject to possible changes or curtailments."[9]

d. *Draft EIR, Response to Comments, and the City's Findings*

The draft EIR here stated that the Castaic Lake Water Agency serves the proposed project area and relies on imported water from the State Water Project. It described the State Water Project and the Monterey Agreement. It stated that the agency's total annual water allocation from the State Water Project is 95,200 acre-feet and that the Kern-Castaic transfer represents 41,000 acre-feet of that amount. It explained that the amounts requested by the contracting agencies from the State Water Project and the amounts actually delivered to the agencies by the State Water Project vary from year to year and can be less than the maximum amounts allocated. It projected that 59.7 percent of the State Water Project water allocation would be available to the city in average years, and that 20 to 39.8 percent would be available in

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[9] We granted Petitioners' request for judicial notice of the Department of Water Resource's opposition brief filed on December 6, 2006, in *Planning and Conservation League v. Castaic Lake Water Agency, supra*, No. BS098724.

dry years. It stated that water transfer agreements made pursuant to the Monterey Agreement "are effective upon execution . . . and, therefore, are considered permanent water reallocations of SWP Table A water."

The draft EIR stated that the agency had completed an EIR for the Kern-Castaic transfer, that the trial court had rejected the petitioners' challenges to the EIR, and that the Court of Appeal had reversed the judgment on the sole ground that the EIR tiered from another EIR (the Monterey Agreement EIR) that had been decertified. It stated that neither the Court of Appeal nor the trial court had ordered the agency to vacate its approval of the transfer agreement pending completion of a new EIR, and that the trial court on remand had allowed the agency to continue to operate under the agreement. It stated that the agency was in the process of preparing a new EIR for the transfer.

The draft EIR stated further that the Court of Appeal had ordered the decertification of the Monterey Agreement EIR on the grounds that the Department of Water Resources should have been the lead agency and that the analysis of the no project alternative was inadequate. It stated that the Court of Appeal had directed the trial court to order the preparation of a new EIR and that neither the Court of Appeal nor the trial court had stayed the implementation of the Monterey Agreement.

The draft EIR stated that the Kern-Castaic transfer could have taken place even without the Monterey Agreement, "under existing SWP water supply contract provisions, subject to appropriate environmental review." It stated that the Kern-Castaic transfer "has been completed, CLWA has paid approximately $47 million for the additional Table A Amount, the monies have been delivered, . . . and DWR has

increased CLWA's SWP maximum Table A Amount to 95,200 AFY because it was a permanent transfer/reallocation of SWP Table A entitlement between SWP contractors." It stated further, "an adverse outcome in the Monterey Agreement litigation is not likely to adversely affect CLWA's water supplies over the long term because CLWA believes that such a result is unlikely to 'unwind' executed and completed agreements with respect to the permanent transfer of SWP Water Amounts."

Thus, the draft EIR characterized the Kern-Castaic transfer as "permanent" and downplayed the likelihood that the "permanent transfer" could be affected by the Monterey Agreement litigation. The draft EIR did not acknowledge the possibility that the environmental review of the Monterey Agreement by the Department of Water Resources could result in the modification of the Kern-Castaic transfer and a reduced allocation to the Castaic Lake Water Agency.

The draft EIR estimated the amounts of groundwater and imported water supplies that would be available in the project area. The estimate of imported water supplies was based on different percentages of the total Table A amount for average years and dry years. The draft EIR also estimated the demand for water and concluded that the supplies would be sufficient to meet the demand.

Several comments to the draft EIR objected to its reliance on the Kern-Castaic transfer and stated that the transfer was uncertain due to pending litigation and the absence of a certified EIR for either the transfer or the Monterey Agreement. The city in a "topical response" to the comments reiterated the discussion in the EIR of the reasons that it considered the transfer reliable "despite potential uncertainty arising from

litigation." The topical response stated, "Because the 41,000 AFY was a permanent water transfer, because DWR includes the 41,000 AFY in calculating CLWA's share of SWP Table A Amount, and because the courts have not prohibited CLWA from using or relying on those additional SWP supplies, the City has determined that it remains appropriate for the Riverpark project to include those water supplies in its water supply and demand analysis, while acknowledging and disclosing the potential uncertainty created by litigation." It stated further that the ongoing environmental review by the Department of Water Resources of the Monterey Agreement, including the Kern-Castaic transfer, did not preclude the city's reliance upon the transfer in these circumstances.

The city's findings under CEQA stated that the project would have no significant impacts on water supply and that no mitigation was required.

e. *The EIR Adequately Analyzed the Uncertainty of the Kern-Castaic Transfer*

We repeat with emphasis, "An EIR for a land use project must address the impacts of likely future water sources, and the EIR's discussion must include a reasoned analysis of the circumstances affecting the likelihood of the water's availability. (*California Oak, supra*, 133 Cal.App.4th at p. 1244.)" (*Vineyard Area Citizens, supra*, 40 Cal.4th at p. 432.) The sufficiency of an analysis in an EIR is measured by reference to a practical standard that demands neither technical perfection nor full disclosure of all information available on a subject. (*Berkeley Keep Jets Over the Bay Com. v. Board of Port Cmrs.* (2001) 91 Cal.App.4th 1344, 1355; *Al Larson Boat Shop, Inc. v. Board of*

Harbor Commissioners (1993) 18 Cal.App.4th 729, 748.) "The courts have looked not for perfection but for adequacy, completeness, and a good faith effort at full disclosure." (Guidelines, § 15151.) " 'To facilitate CEQA's informational role, the EIR must contain facts and analysis, not just the agency's bare conclusions or opinions.' [Citations.] An EIR must include detail sufficient to enable those who did not participate in its preparation to understand and to consider meaningfully the issues raised by the proposed project." (*Laurel Heights I*, *supra*, 47 Cal.3d at pp. 404-405.) The role of a reviewing court is not to determine whether the EIR's conclusions are correct, but only whether they are supported by substantial evidence and sufficient analysis to serve the EIR's informational purposes. (*Id.* at p. 407.)

The absence of relevant information from an EIR does not necessarily constitute a prejudicial abuse of discretion. Rather, a prejudicial abuse of discretion occurs only if the absence of relevant information precludes informed decisionmaking and informed public participation and thereby thwarts the statutory goals of the EIR process. (*Berkeley Keep Jets Over the Bay Com. v. Board of Port Cmrs.*, *supra*, 91 Cal.App.4th at p. 1355.)

The draft EIR and the final EIR, including the responses to comments, explained at length and in detail the reasons for the city's conclusion that water provided by the State Water Project pursuant to the Kern-Castaic transfer would continue to be available to serve the area of the proposed project. The analysis provided was incomplete because it failed to acknowledge the possibility that the environmental review of the Monterey Agreement by the Department of Water Resources could result in the

modification of the transfer and a reduced allocation to the Castaic Lake Water Agency. In our view, the analysis nonetheless was "a reasoned analysis" (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 432) that was adequate in these circumstances. This is true particularly in light of the indications that the Department of Water Resources, Castaic Lake Water Agency, and Kern County Water Agency did not wish to disturb the transfer and the fact that the trial courts and Courts of Appeal in the litigation directly involving the Monterey Agreement and the Kern-Castaic transfer never vacated the approval of either of those projects or enjoined the flow of water. These circumstances do not compel the conclusion that the transfer will be "permanent," but they support our conclusion that the failure to acknowledge the uncertainty of the transfer arising from the department's ongoing environmental review of the Monterey Agreement was not so momentous as to render the analysis provided in the EIR inadequate for its informational purposes.

The water supply analysis here did not rely on inconsistent figures or "vague and unquantified" water supplies (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 440), or fail to provide a complete and coherent analysis of water supply and demand as did the analysis of long-term water supply in *Vineyard Area Citizens*. Moreover, the city did not fail to comply with procedures required by law by, for example, deferring environmental review to a future EIR (*id.* at pp. 440-441), relying on a prior EIR without proper incorporation or tiering (*id.* at pp. 442-443), or relying on a provision precluding further development in lieu of identifying and analyzing the project's intended and likely water sources (*id.* at p. 444).

California Oak, *supra*, 133 Cal.App.4th 1219 is distinguishable. *California Oak* involved a proposed industrial/business park in Santa Clarita. (*Id.* at p. 1224.) The city certified an EIR and approved the project in June 2003. (*Id.* at p. 1225.) The primary dispute on appeal concerned the same 41,000 acre-feet of State Water Project water allocation at issue here. The text of the EIR failed to mention the January 2002 invalidation of the Castaic Lake Water Agency's EIR for the Kern-Castaic transfer and offered no explanation for the city's continued reliance on the transfer (*id.* at p. 1236), and apparently also failed to mention the invalidation of the Monterey Agreement EIR. The city's response to comments was "completely devoid of any direct discussion of the 41,000 AFY" (*id.* at p. 1237) and only referred obliquely to litigation "challenge[s]" (*id.* at pp. 1232-1233). The only mention of the invalidation of the Castaic Lake Water Agency's EIR was in an appendix to the final EIR. (*Id.* at p. 1239.) *California Oak* stated that the issue should be discussed, or at least referenced, in the text of the EIR and that the brief mention of the invalidation in the appendix with no meaningful and forthright discussion was insufficient in any event.[10] (*Ibid.*) Absent a reasoned analysis in the EIR of the uncertainty created by the invalidation of the EIR for the Kern-Castaic transfer, *California Oak* concluded that there was no substantial evidence to support the

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[10] *Vineyard Area Citizens* later endorsed this view, stating, " '[I]nformation "scattered here and there in EIR appendices," or a report "buried in an appendix," is not a substitute for "a good faith reasoned analysis . . . ." ' (*California Oak*, *supra*, 133 Cal.App.4th at p. 1239, quoting *Santa Clarita*, *supra*, 106 Cal.App.4th at pp. 722-723." (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 442.)

conclusion that the water supplies for the project were sufficient. (*Id.* at pp. 1226, 1240.)

Here, in contrast to *California Oak*, *supra*, 133 Cal.App.4th 1219, the EIR contains a reasoned analysis of the circumstances affecting the availability of the 41,000 acre-feet of water allocation. The analysis is supported by facts and discloses pertinent facts, including the invalidation of both the Castaic Lake Water Agency's EIR for the Kern-Castaic transfer and the Department of Water Resource's EIR for the Monterey Agreement. The city's EIR neither relegates that discussion to an appendix to the final EIR nor assumes without analysis that the 41,000 acre-feet of water allocation will be available. In light of that discussion, the EIR's failure to acknowledge the particular uncertainty arising from the Department's ongoing environmental review of the Monterey Agreement stands in stark contrast to the complete failure to offer any reasoned analysis of the circumstances affecting the availability of the transferred water in *California Oak*.

Petitioners also argue that the EIR for the Kern-Castaic transfer should tier from the Monterey Agreement EIR and that absent a proper EIR for the transfer, the present EIR cannot rely on the transfer. The question whether the EIR for the Kern-Castaic transfer complies with CEQA is beyond the scope of this appeal. The EIR for the Kern-Castaic transfer is the subject of a separate mandamus proceeding and a separate appeal (No. B200673). Absent a judgment determining that the EIR for the Kern-Castaic transfer fails to comply with CEQA in the manner asserted, we will not determine in this appeal the merits of a separate proceeding.

Petitioners argue further that due to the uncertainty of the Kern-Castaic transfer, the EIR here was required to discuss alternative sources of water and the environmental impact of supplying water from those alternative sources. *Vineyard Area Citizens* stated, "[W]here, despite a full discussion, it is impossible to confidently determine that anticipated future water sources will be available, CEQA requires some discussion of possible replacement sources or alternatives to use of the anticipated water, and of the environmental consequences of those contingencies. (*Napa Citizens*, *supra*, 91 Cal.App.4th at p. 373.)" (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 432.) "If the uncertainties inherent in long-term land use and water planning make it impossible to confidently identify the future water sources, an EIR may satisfy CEQA if it acknowledges the degree of uncertainty involved, discusses the reasonably foreseeable alternatives—including alternative water sources and the option of curtailing the development if sufficient water is not available for later phases—and discloses the significant foreseeable environmental effects of each alternative, as well as mitigation measures to minimize each adverse impact. ([Pub. Resources Code,] § 21100, subd. (b).)" (*Id.* at p. 434.)

Napa Citizens, *supra*, 91 Cal.App.4th 342, involved a subsequent EIR for an updated specific plan providing for the industrial development of a formerly agricultural area. (*Id.* at pp. 352-353.) The EIR stated that the City of American Canyon supplied water to the project area and would continue to do so in the future. The EIR acknowledged that American Canyon's current water supply would be inadequate in the longer term, but stated that American Canyon was in the process of reaching an

agreement with another municipality that would provide additional water. The EIR assumed that an agreement would be reached and therefore concluded that the project would have no significant impact on long-term water supply. (*Id.* at p. 372.) *Napa Citizens* concluded that the EIR could not rely on the uncertain water supplies without identifying alternative water sources and analyzing the environmental impacts of supplying water from those sources. *Napa Citizens* stated: "Because of the uncertainty surrounding the anticipated sources for water . . . , the FSEIR also cannot simply label the possibility that they will not materialize as 'speculative,' and decline to address it. The County should be informed if other sources exist, and be informed, in at least general terms, of the environmental consequences of tapping such resources. Without either such information or a guarantee that the resources now identified in the FSEIR will be available, the County simply cannot make a meaningful assessment of the potentially significant environmental impacts of the Project. [Citation.]" (*Id.* at pp. 373-374.)

We conclude that whether an EIR can "confidently determine that anticipated future water sources will be available" (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 432; see also *id.* at p. 434) is a question of fact. If the EIR confidently concludes that future water supplies will be sufficient to serve the project, and if that conclusion is supported by reasoned analysis and facts stated in the EIR, the EIR satisfies its informational purposes and a reviewing court must defer to the EIR's conclusion. (See *Laurel Heights*, *supra*, 47 Cal.3d at pp. 404-405, 407.) In those circumstances, the EIR need not evaluate alternative water sources and the environmental impacts of supplying

water from those sources. On the other hand, if the EIR reveals a substantial degree of uncertainty as to the availability of future water supplies, as in *Napa Citizens*, *supra*, 91 Cal.App.4th 342, the EIR must discuss alternative sources of water or alternatives to use of the water and the environmental impacts of those contingencies. (*Vineyard Area Citizens*, *supra*, 40 Cal.4th at p. 432 ["[W]here, despite a full discussion, it is impossible to confidently determine that anticipated future water sources will be available, CEQA requires some discussion of possible replacement sources or alternatives to use of the anticipated water, and of the environmental consequences of those contingencies"].)

After explaining in detail the circumstances affecting the availability of the imported water, the EIR here confidently concluded that water provided by the State Water Project pursuant to the Kern-Castaic transfer would continue to be available to serve the proposed project area despite the pending Monterey Agreement environmental review and litigation challenges. The EIR did not reveal a substantial degree of uncertainty as to the continued availability of the transferred water, unlike the situation in *Napa Citizens*, *supra*, 91 Cal.App.4th 342, where no agreement had been reached to secure the water transfer and no deliveries had occurred. We conclude that the facts stated in the EIR, including the executed agreements effecting the transfer, the implementation of those agreements and delivery of water for several years, and the absence of any court order vacating the approval of the transfer or the Monterey Agreement or staying the implementation of those agreements, constitute substantial evidence supporting the EIR's conclusion. Accordingly, we conclude that the EIR need

not identify alternative water sources or other alternatives to use of the anticipated water.

4. *Holly-Leaf Cherry*

Petitioners contend the EIR applied an incorrect legal standard in determining that the impacts on the holly-leaf cherry would be insignificant. They argue that in evaluating the impact of the proposed elimination of 3.6 acres of the species on the project site, the EIR failed to apply the Guidelines definition of "rare" (Guidelines, § 15380, subd. (b)(2)). We conclude that they have not shown a prejudicial abuse of discretion.

a. *CEQA Requirements*

A project will have a significant effect on the environment if it will cause "a substantial, or potentially substantial, adverse change in the environment." (Pub. Resources Code, § 21068; see also Guidelines, § 15382.) The "environment" means the existing physical conditions in the area of the proposed project, including flora, fauna, and other conditions. (Pub. Resources Code, § 21060.5; Guidelines, § 15360.) "The determination of whether a project may have a significant effect on the environment calls for careful judgment on the part of the public agency involved, based to the extent possible on scientific and factual data. An ironclad definition of significant effect is not always possible because the significance of an activity may vary with the setting." (Guidelines, § 15064, subd. (b).)

An EIR must identify and analyze the significant environmental effects of a project. (Pub. Resources Code, § 21100, subd. (b)(1); Guidelines, § 15126.2.) An

EIR must identify mitigation measures for each significant effect and discuss alternatives to the project that would avoid or substantially lessen the significant effects, and the lead agency must make detailed findings on the infeasibility of any mitigation measures and alternatives rejected as infeasible. (Pub. Resources Code, §§ 21100, subd. (b)(3), (4), 21081, subd. (a)(3); Guidelines, §§ 15126.4, subd. (a)(1)(A), 15126.6, subd. (a), 15091, subd. (a)(3).) If an EIR determines that particular environmental impacts are insignificant, it must "contain a statement briefly indicating the reasons for determining that various effects on the environment of a project are not significant and consequently have not been discussed in detail in the environmental impact report." (Pub. Resources Code, § 21100, subd. (c); see also Guidelines, § 15128.)

Guidelines section 15065 describes certain impacts that necessarily are significant and therefore require the preparation of an EIR and must be analyzed in an EIR. (*Id.* subds. (a), (c).) These are known as mandatory findings of significance. A project necessarily will have a significant effect on the environment if it will "substantially degrade the quality of the environment; substantially reduce the habitat of a fish or wildlife species; cause a fish or wildlife population to drop below self-sustaining levels; threaten to eliminate a plant or animal community; substantially reduce the number or *restrict the range of an endangered, rare or threatened species*; or eliminate important examples of the major periods of California history or prehistory." (Guidelines, § 15065, subd. (a)(1), italics added; see *Mountain Lion, supra*, 16 Cal.4th at p. 124 [equating "range" with "habitat"]; *Endangered Habitats League, Inc. v. County of Orange* (2005) 131 Cal.App.4th 777, 792 (*Endangered Habitats*).)

Guidelines section 15065 describes impacts that must be considered significant, but "an impact need not satisfy the requirements of a mandatory finding of significance to be considered a significant impact." (*Mejia v. City of Los Angeles* (2005) 130 Cal.App.4th 322, 338, fn. 9.)

A species is "rare" under the Guidelines if "[a]lthough not presently threatened with extinction, the species is existing in such small numbers throughout all or a significant portion of its range that it may become endangered if its environment worsens; or [¶] [t]he species is likely to become endangered within the foreseeable future throughout all or a significant portion of its range and may be considered 'threatened' as that term is used in the Federal Endangered Species Act."[11] (*Id.*, § 15380, subd. (b)(2).) A species also is "presumed to be endangered, rare or threatened, as it is listed in" federal regulations under the Federal Endangered Species Act and California regulations under the Fish and Game Code. (Guidelines, § 15380, subd. (c).) "A species not included in any listing identified in subdivision (c) shall nevertheless be considered to be endangered, rare or threatened, if the species can be shown to meet the criteria in subdivision (b)." (*Id.*, subd. (d).)

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[11] A species is "endangered" under the Guidelines if "its survival and reproduction in the wild are in immediate jeopardy from one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, disease, or other factors." (Guidelines, § 15380, subd. (b)(1).)

b. *Draft EIR, Response to Comments, and the City's Findings*

A rare plant survey conducted in the spring of 2003 and attached as an appendix to the draft EIR described "a unique stand of holly-leaf cherry scrub" on the project site. The survey stated, "The stand is dominated by relatively large, mature shrubs of holly-leaf cherry (*Prunus ilicifolia* ssp. *ilicifolia*), 3 to 5 m in height." It stated that although "mainland cherry forest" is ranked "very threatened" by the California Natural Diversity Database, "[t]he canopy cover of the holly-leaf cherry shrubs at this site did not amount to a forest canopy. Holly-leaf cherry scrub, as identified in this survey, is not defined in Holland (1986), and therefore, it has no assigned ranking. However, it should be recognized as a unique and sensitive community at the site."

The draft EIR described the holly-leaf cherry on the project site and stated that the project would result in the direct and permanent loss of 3.6 acres of holly-leaf cherry, which it quantified as approximately 67.9 percent of the holly-leaf cherry on the site. It stated further, "Because holly-leaf cherry scrub on the project site is not known to support special-status plant or wildlife species, and because this plant community is not considered to be sensitive by resource agencies, the loss of 3.6 acres of this habitat type is not considered a significant impact." The draft EIR defined "special-status plant or wildlife species" as "those species considered Rare, Threatened, Endangered, or otherwise sensitive by various state and federal resource agencies," and identified several published listings used as references.

The Department of Fish and Game stated in a comment letter: "The Department considers holly-leafed cherry woodland a declining vegetative community the loss of

which would be considered a significant adverse impact to wildlife habitat. This vegetative community is being systematically eliminated and/or degraded within the Santa Clara River watershed by development. . . . All holly-leafed cherry habitat should be avoided by project alternatives." The comment stated further that even temporary impacts to the plant community involving removal and replanting "will still result in an unacceptable impact to this resource."

The city responded: "The holly-leaf cherry habitat on-site is considered scrub habitat because the canopy cover of this habitat did not amount to a woodland canopy. According to the CDFG's [California Department of Fish and Game] List of California Terrestrial Natural Communities Recognized by the California Natural Diversity Data Base (September 2003 Edition), holly-leaf cherry scrub is not considered a special-status plant community. As stated in Revised Riverpark Draft EIR Section 4.6, Biological Resources, p. 4.6-65, because of the relatively small amount of habitat (3.6 acres) to be lost and because this stand of trees was not considered a sensitive plant community as identified by CDFG, the loss of the 3.6 acres was not considered a significant impact under CEQA."

The city's findings under CEQA stated that the impacts of the proposed project on the holly-leaf cherry would be less than significant.

c. *The EIR Adequately Analyzed the Impacts on the Holly-Leaf Cherry*

The draft EIR described the holly-leaf cherry on the project site and explained the impact of the project on the species. It stated that holly-leaf cherry scrub was not

a designated special status species and was not considered to be sensitive by the resource agencies, and that the loss of 3.6 acres of the species was not a significant impact. The response to the comment explained that the holly-leaf cherry on the project site was in scrub habitat rather than woodland, and therefore was different from the holly-leaf cherry woodland noted by the Department of Fish and Game to be in decline. We conclude that the information provided in the EIR supports the conclusion that the holly-leaf cherry on the project site is not "rare" as defined in Guidelines section 15380(b)(2) because it is not existing in such small numbers that it may become endangered, and that it does not otherwise satisfy the Guidelines definition. The EIR provided information and analysis sufficient to serve the EIR's informational purposes, and Petitioners have shown no abuse of discretion.

5. *San Diego Black-tailed Jackrabbit*

Petitioners contend the EIR failed to apply the correct legal standard to determine the significance of impacts on the San Diego black-tailed jackrabbit, and the evidence does not support the city's finding that the impact on the species will be less than significant. We conclude that they have not shown a prejudicial abuse of discretion.

a. *Draft EIR, Response to Comments, and the City's Findings*

The draft EIR stated that the San Diego black-tailed jackrabbit is designated by California as a species of special concern and is designated by the federal government as a species of concern. It stated that several San Diego black-tailed jackrabbits had been observed on the project site in areas that are subject to natural or manmade disturbances and that the species' habitat on site is considered to be of moderate quality.

It stated: "Where this species occurs within the region, it is common and found in relatively high numbers in some locations (e.g., coastal Orange County and the high desert of northern Los Angeles County). The habitat on the project site for this species is considered of moderate quality. Most individual jackrabbits are expected to disperse to remaining open space areas and the actual number of individual animals that would be lost due to grading and/or construction activities is expected to be low. Because this species is not state or federally listed as Endangered or Threatened, because it is considered relatively abundant in suitable habitat areas within its range, and because the direct loss of individual jackrabbits is expected to be low, it is expected that the regional population would not drop below a self-sustaining level with the implementation of this project. Therefore, the loss of any individual jackrabbits associated with the implementation of this project would not be considered a significant impact."
A biology report in the appendix stated that the species was "relatively common in the project area."

The draft EIR also described the Natural River Management Plan (NRMP), a long-term management plan for projects and activities potentially affecting the Santa Clara River and San Francisquito Creek. It stated that a certified combined EIR and federal environmental impact statement (EIS) for the NRMP had analyzed impacts associated with various proposed infrastructure improvements along the Santa Clara River, including bank stabilization, bridges, utility crossings, and storm drain outlets, and that the United States Army Corps of Engineers, Department of Fish and Game, and California Regional Water Quality Control Board had approved the NRMP. It also

stated that certain proposed infrastructure improvements on the project site (including two bridges, bank stabilization, and outlets) were governed by the NRMP and were subject to mitigation requirements imposed by the NRMP, including the capture of San Diego black-tailed jackrabbits and their relocation "to nearby undisturbed areas with suitable habitat," and the creation or enhancement of habitat for jackrabbits and other species. The draft EIR stated that those mitigation measures had been incorporated into the proposed project.

The draft EIR concluded that although the project impacts to the San Diego black-tailed jackrabbit would be insignificant, cumulative impacts to biological resources, apparently including the San Diego black-tailed jackrabbit, from the proposed project and related projects would be significant due to loss of habitat and increased human activities.

The Department of Fish and Game stated in a written comment: "The DEIR states that the San Diego black-tailed jackrabbit is common where it occurs in the region and abundant in coastal Orange County and the high deserts of Los Angeles County; that displaced individuals of this jackrabbit species will disperse to remaining open space; and that individuals lost i.e. killed by the project is expected to be low. This conclusion is difficult to draw since population estimates were not submitted with the DEIR.

"It is the Department's opinion that the project will result in a cumulative adverse impact to San Diego black-tailed jackrabbit, a California Species of Special Concern. This subspecies is localized within the coastal plains of southern California

including the Santa Clara River Valley. These areas have been and are continuing to be heavily developed and degraded. Jackrabbits do not adapt well to habitat losses and associated disturbances from human proximity. . . . The assumption that displaced jackrabbits will somehow survive by dispersing into remaining degraded open areas of uncertain protected status does not meet the mitigation requirements set forth and described under Section 15021 of CEQA. Insufficient mitigation measure for this subspecies will further assist its decline and may in the future cause more restrictive regulatory measures to protect this resource. The Department recommends a more detailed discussion in the EIR of the project related impacts to San Diego black-tailed jackrabbit with a tangible habitat avoidance and/or preservation element."

The city responded that because the habitat on site is "moderate in quality," "the Riverpark site is not considered to be occupied by a significant population of San Diego black-tailed jackrabbits." The response stated that NRMP mitigation measures had been incorporated into the proposed project with respect to infrastructure improvements governed by the NRMP. It stated that the EIR/EIS for the NRMP had analyzed in detail the impacts on the San Diego black-tailed jackrabbit and had concluded that certain NRMP mitigation measures "requiring capture and relocation of sensitive species including the San Diego black-tailed jackrabbit, and . . . replacement of habitat . . . reduced the impacts to less than significant." The response stated further that some of the infrastructure improvements in the proposed project were less extensive than those contemplated in the NRMP. The response also noted that the draft EIR had

concluded that cumulative impacts due to the loss of habitat were significant and unavoidable.

The city's findings under CEQA stated that the cumulative impacts on biological resources were unavoidable, and the city adopted a statement overriding considerations with respect to that cumulative impact.

b. *The EIR Adequately Analyzed the Impacts on the San Diego Black-tailed Jackrabbit*

The draft EIR explained its conclusion that the project's impacts on the San Diego black-tailed jackrabbit would be insignificant. It stated that the jackrabbit habitat on site was only moderate in quality, that the species is relatively common in other areas within the region, that most individuals of the species are expected disperse to other areas, and that the species is not designated endangered or threatened. The draft EIR also stated that mitigation measures from the NRMP had been incorporated into the project, including the capture and relocation of individual jackrabbits to suitable habitat nearby and the creation or enhancement of habitat for the species. The response to the comment explained further that the jackrabbit population on the site was low.

The statement that the species is relatively common in the region is supported by the statement in the biology report to that effect. The characterization of the habitat on site as only moderate in quality and the statement that individual jackrabbits are likely to disperse to other areas also are supported by substantial evidence, which "includes fact, a reasonable assumption predicated upon fact, or expert opinion supported by fact" (Pub. Resources Code, § 21080, subd. (e)(1)).

We conclude further that the information provided in the EIR supports the conclusion that the San Diego black-tailed jackrabbit is not "rare" as defined in Guidelines section 15380(b)(2) because it is not existing in such small numbers that it may become endangered, and that it does not otherwise satisfy the Guidelines definition. The EIR provided information and analysis sufficient to serve the EIR's informational purposes, and Petitioners have shown no abuse of discretion.

Endangered Habitats, supra, 131 Cal.App.4th 777, is distinguishable. The EIR in *Endangered Habitats* stated that an environmental impact was considered significant only if it caused the population of a species to drop below a self-perpetuating level or caused the species to become threatened or endangered. (*Id.* at pp. 792-793.) *Endangered Habitats* concluded that that was an impermissibly lenient standard and that the county failed to proceed in the manner required by law. (*Id.* at p. 793.) Here, in contrast, the statement in the EIR, "it is expected that the regional population would not drop below a self-sustaining level with the implementation of this project" was not the sole reason provided for the conclusion that the project's impacts on the San Diego black-tailed jackrabbit would be insignificant. Rather, the EIR also explained that the impacts would be insignificant because the jackrabbit population on the site was low, the habitat on site was only moderate in quality, and because individual jackrabbits were likely to disperse to other areas.

6. *Western Spadefoot Toad*

Petitioners challenge the EIR's failure to discuss project revisions or alternatives that would reduce the significant impacts on the western spadefoot toad to an

insignificant level. They argue that the proposed mitigation of constructing ponds and relocating the toads is inadequate and the city was required to consider more effective feasible mitigation. We conclude that Petitioners have not shown an abuse of discretion.

a. *Draft EIR, Response to Comments, and the City's Findings*

The city circulated a revised biological resources section of the draft EIR in March 2004 after the discovery of western spadefoot toads on the project site. The western spadefoot toad is designated by California as a species of special concern and by the federal government as a species of concern. The draft EIR estimated that 16 to 20 pairs of breeding western spadefoot toads were present in three seasonal rainpools on the site, all of which were located in areas of proposed development. A biology report in the appendix described the three seasonal rainpools. The draft EIR stated that the potential loss of that population of toads and their eggs would be a significant impact.

The draft EIR recommended several mitigation measures described in the biology report, including the construction of ponds, of a design and location to be approved by the Department of Fish and Game, and the capture and relocation of western spadefoot toads and their eggs to the new ponds. The biology report stated that although very few attempts had been made to relocate western spadefoot toads, there was "a very good possibility of success." The draft EIR concluded nonetheless that the impacts would remain significant despite mitigation: "While mitigation measures can be implemented to create habitat and relocate individuals observed on the project site, these measures are not considered highly effective. It is expected that not all individual

toads would be captured and relocated and that the created habitat might not meet the specific requirements for this species, thus, not supporting the relocated individuals. The loss of those individuals that are not captured and relocated, and those that are not adaptable to the created habitat, would be considered a significant and unavoidable impact."

The Department of Fish and Game stated in a written comment: "The continual loss of western spadefoot habitat within the Santa Clarita Valley, and Southern California as a whole, concerns the Department. The seasonal pools and associated uplands and floodplains habitats associated with the species are often lost with project development. Mitigation measures for this species are often experimental, and not always successful. The recent discovery of western spadefoot on the project site, despite past negative survey results for this species suggests the potential undocumented loss of occupied habitat for this species in the Santa Clarita area. These potential undocumented losses increase the importance of the known populations on the project site. The preservation, avoidance and protection of all existing seasonal pools which support or could support western spadefoot should be accomplished on the project site." The department stated further that if habitat avoidance is not feasible, breeding pools should be created away from areas of human activity and at least 150 feet away from any road or recreational trail.

The city responded that the existing seasonal pools were in disturbed areas and cited a discussion in another EIR stating that the western spadefoot toad " 'is apparently capable of adapting to a variety of artificial habitats in which to breed.' " The response

stated that this "illustrates that the species adapts well to disturbed environments." It also stated: "[W]estern spadefoot toads have no federal or State protected status, but are classified only as California Species of Special Concern and as a federal Species of Concern, which indicates that the species warrants monitoring due to population decline. Therefore, the species is not entitled to legal protection and a project redesign to preserve existing habitat is not required." The Department of Fish and Game later approved a habitat enhancement and relocation plan for the western spadefoot toad on the site.

The city's findings under CEQA stated that the proposed project's impacts on the western spadefoot toad cannot feasibly be mitigated to a level of insignificance and therefore are considered unavoidable, and the city adopted a statement of overriding considerations with respect to those impacts.

b. *The Discussion of Measures to Mitigate the Impacts on the Western Spadefoot Was Adequate*

CEQA does not require the avoidance of all significant environmental impacts or ensure that an approved project will minimize environmental harm. Rather, an adequate EIR that complies with CEQA's procedural requirements and serves its purpose as an informational document, together with appropriate findings by the lead agency, can support an agency's decision to approve the project despite adverse environmental consequences.

An EIR must discuss mitigation measures designed to avoid or reduce each significant impact, but need not discuss project alternatives that would avoid each

significant impact. (*Big Rock Mesas Property Owners Assn. v. Board of Supervisors* (1977) 73 Cal.App.3d 218, 227; see 1 Kostka & Zischke, Practice Under the California Environmental Quality Act (Cont.Ed.Bar 2006) § 15.15, p. 745.) Rather, an EIR must discuss a reasonable range of alternatives to the proposed project as a whole. (*Big Rock Mesas*, *supra*, at p. 227.) The draft EIR discussed several project alternatives, including a no project alternative that would not disturb the existing seasonal rainpools. Petitioners do not challenge the reasonableness of the range of alternatives. We conclude that the discussion of measures to mitigate the significant impacts on the western spadefoot toad was sufficient to serve CEQA's informational purposes and therefore was adequate, that the EIR need not discuss either a project revision or alternative (other than the no project alternative) that would reduce the impacts to the species to an insignificant level, and that Petitioners have shown no abuse of discretion in this regard.

Petitioners challenge the statement in the city's response to comments that "the species is not entitled to legal protection and a project redesign to preserve existing habitat is not required." They argue that the city declined to consider any project revision or alternative to avoid significant impacts to the western spadefoot toad and therefore could not reasonably conclude that the significant impacts to the species are unavoidable. We construe the statement to mean not that the city believed that it had no obligation to avoid or reduce the significant impacts to the western spadefoot toad, if feasible, but that the city understood that it had the discretion to determine that the

benefits of the project outweighed the significant impacts to the species. Petitioners have not shown an abuse of discretion.

7. *Consistency with the General Plan*

Every county and city must adopt a "comprehensive, long-term general plan" for its physical development. (Gov. Code, § 65300.) A general plan must include "a statement of development policies and . . . objectives, principles, standards, and plan proposals." (*Id.*, § 65302.) A general plan embodies fundamental policy decisions (*Goleta Valley*, *supra*, 52 Cal.3d at p. 571) and serves as a "charter for future development" (*Lesher Communications, Inc. v. City of Walnut Creek* (1990) 52 Cal.3d 531, 540). "The policies in a general plan typically reflect a range of competing interests. [Citation.]" (*Federation of Hillside & Canyon Assns. v. City of Los Angeles* (2004) 126 Cal.App.4th 1180, 1194.)

A subdivision must be consistent with applicable general and specific plans. (Gov. Code, §§ 66473.5, 66474.) A subdivision is consistent with an adopted plan only if "the proposed subdivision or land use is compatible with the objectives, policies, general land uses, and programs specified in such a plan." (*Id.*, § 66473.5.)

Consistency does not require full compliance with all general and specific plan policies. Rather, "[o]nce a general plan is in place, it is the province of elected city officials to examine the specifics of a proposed project to determine whether it would be 'in harmony' with the policies stated in the plan. [Citation.]" (*Sequoyah Hills Homeowners Assn. v. City of Oakland* (1993) 23 Cal.App.4th 704, 719 (*Sequoyah Hills*).) A local agency has unique competence to interpret the policies of its own

general plan and weigh competing interests in determining how to apply those policies. (*Save Our Peninsula Committee v. Monterey County Bd. of Supervisors*, *supra*, 87 Cal.App.4th at p. 142; *Sequoyah Hills*, *supra*, at p. 719.) "It is, emphatically, *not* the role of the courts to micromanage these development decisions." (*Sequoyah Hills*, *supra*, at p. 719.)

We review the city's finding that the subdivision is consistent with its general plan under the abuse of discretion standard. (Code Civ. Proc., § 1094.5, subd. (b); *Youngblood v. Board of Supervisors* (1978) 22 Cal.3d 644, 651, fn. 2; *Sequoyah Hills*, *supra*, 23 Cal.App.4th at p. 717.) To prevail on their contention that the project is inconsistent with the general plan, Petitioners must show that there is no substantial evidence to support the city's finding. (Code Civ. Proc., § 1094.5, subd. (b); *Sequoyah Hills*, *supra*, at p. 717.) In other words, Petitioners must show that no reasonable decision maker could conclude that the project is in harmony with the stated policies. (*No Oil, Inc. v. City of Los Angeles* (1987) 196 Cal.App.3d 223, 243.)

The Open Space and Conservation Element of the city's general plan states several goals and policies promoting the protection of natural features, significant ecological resources, and SEA's. The general plan goals cited by Petitioners include: "To preserve the special natural features which define the Santa Clarita planning area and give it its distinct form and identity," and, "To protect significant ecological resources and ecosystems, including, but not limited to, sensitive flora and fauna habitat areas." The general plan policies cited by Petitioners include: "Utilize major environmental features (significant landforms, significant ridgelines, significant

vegetation, ecologically significant areas, other natural resources) as open space within the planning area," "Identify and protect areas of significant ecological value, including, but not limited to, significant ecological habitats . . . and preserve and enhance existing Significant Ecological Areas (SEAs)," and "Preserve to the extent feasible natural riparian habitat and ensure that adequate setback is provided between riparian habitat and surrounding urbanization." Petitioners also cite a Land Use Element policy that "New development must be sensitive to the Significant Ecological Areas (SEAs) through utilization of creative site planning techniques to avoid and minimize disturbance of these and other sensitive areas."

The draft EIR discussed these general plan goals and policies. It stated that the proposed project would preserve the Santa Clara River and much of the significant vegetation on the site, restrict development on the steepest slopes on the site, and mitigate impacts on the portions of the SEA located on the project site, and concluded that the project was consistent with these goals and policies. The draft EIR also discussed numerous other general plan goals and policies and the project's consistency with them. The city in approving the project found that the project would preserve large areas of open space, including the river, and that the project was consistent with the general plan.

Petitioners' argument that the project is inconsistent with the cited general plan goals and policies is based on the presumption that any development incursion within the SEA necessarily would be inconsistent with those goals and policies. The argument largely disregards the city's considerable discretion to determine that the project, on

balance, is in harmony with those goals and policies, and merely expresses Petitioners' contrary point of view. Moreover, Petitioners focus only on particular goals and policies and do not attempt to show, and have not shown, that the project necessarily is inconsistent with the general plan as a whole. We conclude that they have not shown an abuse of discretion.

DISPOSITION

The judgment is affirmed. The city and Newhall are entitled to recover their costs on appeal.

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

CROSKEY, J.

WE CONCUR:

KLEIN, P. J.

KITCHING, J.

CH2MHill, "Effect of Urbanization on Aquifer Recharge in the Santa Clarita Valley" (February 22, 2004)

Effect of Urbanization on Aquifer Recharge in the Santa Clarita Valley

TO: Tom Worthington/Impact Sciences, Inc.

FROM: John Porcello/CH2M HILL

DATE: February 22, 2004

Introduction

In a groundwater basin, the effect of urbanization on recharge to underlying groundwater is dependent on land uses, water uses, vegetative cover, and geologic conditions. Groundwater recharge from undeveloped lands occurs from precipitation alone, whereas areas that are developed for agricultural or urban land uses receive both precipitation and irrigation of vegetative cover. In an urban area, groundwater recharge occurs directly beneath irrigated lands and in drainages whose bottoms are not paved or cemented. This memorandum discusses the general effects of urbanization on groundwater recharge and the specific effects in the Santa Clarita Valley.

Summary of Findings

In the Santa Clarita Valley, stormwater runoff finds its way to the Santa Clara River and its tributaries, whose channels are predominantly natural and consist of vegetation and coarse-grained sediments (rather than concrete). The stormwater that flows across paved lands in the Santa Clarita Valley is routed to stormwater detention basins and to the river channels, where the porous nature of the sands and gravels forming the streambeds allow for significant infiltration to occur to the underlying groundwater.

Increased urbanization in the Valley has resulted in the irrigation of previously undeveloped lands. The effect of irrigation is to maintain higher soil moisture levels during the summer than would exist if no irrigation were occurring. Consequently, a greater percentage of the fall/winter precipitation recharges groundwater beneath irrigated land parcels than beneath undeveloped land parcels. In addition, urbanization in the Santa Clarita Valley has occurred in part because of the importation of State Water Project (SWP) water, which began in 1980. SWP water use has increased steadily, reaching nearly 44,500 acre-feet (AF) in 2003. Two-thirds of this water is used outdoors, and a portion of this water eventually infiltrates to groundwater. The other one-third is used indoors and is subsequently routed to local water reclamation plants (WRPs) and then to the Santa Clara River (after treatment). A portion of this water flows downstream out of the basin, and a portion infiltrates to groundwater.

Records show that groundwater levels and the amount of groundwater in storage were similar in both the late 1990s and the early 1980s, despite a significant increase in the

urbanized area during these two decades. This long-term stability of groundwater levels is attributed in part to the significant volume of natural recharge that occurs in the streambeds, which do not contain paved, urban land areas. On a long-term historical basis, groundwater pumping volumes have not increased due to urbanization, compared with pumping volumes during the 1950s and 1960s when water was used primarily for agriculture. Also, the importation of SWP water is another process that contributes to recharge in the Valley. In summary, urbanization has been accompanied by long-term stability in pumping and groundwater levels, plus the addition of imported SWP water to the Valley, which together have not reduced recharge to groundwater, nor depleted the amount of groundwater that is in storage within the Valley.

Effect of Pavement on Recharge Beneath Specific Land Parcels

The amount of paved cover on the ground affects the degree to which rainfall and outdoor-applied urban water will be able to infiltrate to groundwater. In heavily industrialized areas with high percentages of paved cover, such as exist in portions of the Los Angeles Basin, less rainfall recharge will occur than if the land is in an undeveloped condition. Furthermore, if the bottoms of rivers and other drainages are paved, then the majority of stormwater generated during a rainfall event will be unable to infiltrate to groundwater. In contrast, the amount of recharge to groundwater will be greater in urbanized areas, such as the Santa Clarita Valley, that have natural soils in the bottoms of rivers and local drainages or that have lower percentages of paved cover on the developed areas lying outside the principal drainages. In these areas, the outdoor use of water for irrigation landscape vegetation or agricultural lands can notably increase the amount of groundwater recharge, particularly if the outdoor water is imported from outside the local groundwater basin. This is discussed further below.

Effect of Vegetative Cover and Water Use

From the 1930s through the 1960s, H.F. Blaney and other researchers at the U.S. Department of Agriculture performed numerous studies to measure the amount of infiltration to groundwater that occurs beneath undeveloped lands and irrigated farmlands, and the differences in recharge rates for different types of native vegetation and crops. In California, these studies included a 1933 study by Blaney in Ventura County, a 1963 study by Blaney and others in the Lompoc Uplands, studies by the U.S. Geological Survey and various consultants in the Montecito and Carpenteria groundwater basins, and a groundwater basin study by Santa Barbara County[1] that incorporated the results of these earlier studies.

Together, these studies concluded that deep percolation to groundwater from undeveloped lands occurs only during years of average or above-average precipitation. This occurs because:

1. Southern California's rainfall is highly seasonal in nature, whereupon most rainfall occurs during the relatively cool period November through March, when plant water

[1] See Santa Barbara County Water Agency, December 15, 1977. *Report on Adequacy of the Groundwater Basins of Santa Barbara County.*

requirements are low, and little, if any, rainfall occurs during the remaining (and warmer months) when plant water requirements increase.

2. During the summer, when little or no rainfall occurs, the native vegetation extracts the residual moisture that is present in the soil, which substantially decreases the soil moisture within the root zone of the vegetation. At the end of the dry season, soil moisture levels on undeveloped lands are below the soil's field capacity, which is the amount of moisture that must be present in the soil before free drainage of water can occur below the rooting zone of the native vegetation.

3. When the seasonal rains arrive, the incident rainfall that is not consumed by plants and does not become stormwater runoff must first raise the soil moisture level to the soil's field capacity before any groundwater recharge will occur. The various studies indicate that about 17 inches/year of rainfall is necessary to raise the soil moisture to the field capacity on an undeveloped parcel of land. This is similar to the average annual rainfall in the Santa Clarita Valley and in other lowland coastal and near-coastal valleys in southern California.

On irrigated lands, irrigation occurs during several months of the year, with the exact duration depending on the amount and timing of rainfall and also the crops or type of urban landscaping being irrigated. The principal effect of converting undeveloped land to land that receives agricultural or urban irrigation is to increase the amount of water that is applied to the land during the low-rainfall months. This application of water to the vegetative cover on the surface of the developed land parcel results in the maintenance of higher soil moisture levels during the warm, dry months than would occur without development. This has three effects:

1. Because irrigation will generally be performed in a manner that maintains the health of the vegetative cover, enough water will be applied to maintain the soil moisture at, or close to, the field capacity of the soil. This in turn will allow some deep percolation to occur from the irrigation water itself.

2. When the rainy season begins, because irrigation has maintained soil moisture at or near field capacity, less of the initial rainfall entering the root zone needs to be stored in the soil (to meet soil moisture deficits) beneath an irrigated parcel than in the case of an undeveloped parcel. Therefore, a greater percentage of the initial rainfall and annual rainfall will be able to infiltrate to groundwater. The southern California studies estimated that irrigated land parcels would allow rainfall infiltration to occur in years when annual rainfall is at least 10.5 inches/year. This threshold rainfall value is 6.5 inches less than the threshold rainfall value that the studies estimated to be necessary for generating groundwater recharge beneath undeveloped land parcels.

3. Because the majority of irrigation occurs during the dry (low-rainfall) months, the total annual recharge to groundwater from irrigated developed lands is the sum of: (a) the deep percolation arising from irrigation (during the low-rainfall months); and (b) rainfall (during the months when less irrigation is occurring). Therefore, groundwater recharge beneath developed lands is greater and occurs for a longer period of time each year than in the case of undeveloped lands where no irrigation is occurring.

Historical Observations of Groundwater Conditions in the Santa Clarita Valley

The findings of the studies described above for other groundwater basins in southern California are consistent with observations that have been made in the Santa Clarita Valley, which are based on long-term water level records, water budget analyses, and groundwater modeling. Based on a month-by-month calibration to a 20-year record of historical water level records (throughout the Valley) and stream gaging records (at the Los Angeles – Ventura County line), the model simulates 10 percent of the applied outdoor water as being available for recharge to groundwater in retail and residential areas, with greater percentages infiltrating beneath golf courses and agricultural lands. This is consistent with a 1980 study by DWR of the groundwater resources of the Santee and El Monte hydrologic subareas of San Diego County. In that study, which was performed to evaluate reclaimed water use plans, DWR concluded that approximately 20 percent of the applied outdoor water in municipal areas infiltrates to the water table, with the remaining 80 percent going to evapotranspiration and direct evaporation. DWR also concluded that there would likely be no significant change in these percentages as urbanization continues.[2]

In the Santa Clarita Valley, as in any urbanized area, urbanization increases the paved area and can increase the magnitude and intensity of stormwater runoff from paved land areas. In the Santa Clarita Valley, this stormwater runoff will find its way to the Santa Clara River and its tributaries, whose channels are predominantly natural and consist of vegetation and coarse-grained sediments (rather than concrete). The stormwater that flows across paved lands in the Santa Clarita Valley is routed to stormwater detention basins and to the river channels, where the porous nature of the sands and gravels forming the streambeds allow for significant infiltration to occur to the underlying groundwater. Consequently, for a developed land parcel, the water that runs off of the paved portion of the land parcel will infiltrate to groundwater from a detention basin or a riverbed, rather than infiltrating onsite.

Riverbed infiltration is a significant percentage of total recharge in the Santa Clarita Valley in any given year. Streamflow records and the model calibration process together demonstrate that year-to-year fluctuations in total recharge in the Valley arise not just from year-to-year variations in incident rainfall within the Valley, but also from year-to-year variations in streamflows in the Santa Clara River and its tributaries. Because the areas contributing flow to the rivers are located both within and outside of the Valley, the recharge that occurs from riverbeds is a significant source of groundwater recharge within the Valley.

Evidence that stormwater infiltration to groundwater is not significantly decreased by urbanization comes from long-term water level records at wells completed in the Alluvial aquifer. These records show that groundwater levels and the amount of groundwater in storage were similar in both the late 1990s and the early 1980s, despite a significant increase in the urbanized area during these two decades. This long-term stability is attributed in part to the significant volume of natural recharge that occurs in the streambeds, which do not contain paved, urban land areas. Also, groundwater pumping volumes have not increased

[2] See State of California, Department of Water Resources, Southern District. August 1984, *San Diego County Cooperative Ground Water Studies: Reclaimed Water Use, Phase II*. Pages 40-41.

due to urbanization, compared with pumping volumes during the 1950s and 1960s when water was used primarily for agriculture. Additionally, beginning in 1980, water was imported into the Santa Clarita Valley from the State Water Project (SWP) for urban use, with SWP water use reaching nearly 30,000 acre-feet per year (AF/yr) by the end of the 1990s, and progressively increasing from about 32,500 AF in 2000 to nearly 44,500 AF in 2003. Because two-thirds of the total urban water demand is used outdoors, a substantial portion of the imported SWP water has been and continues to be applied to urban landscaping, thereby increasing the amount of recharge to groundwater. The remaining urban water is used indoors, and is subsequently routed to local water reclamation plants (WRPs) and then to the Santa Clara River (after treatment). A portion of this water flows downstream out of the basin, and a portion infiltrates to groundwater.

In summary, urbanization has been accompanied by long-term stability in pumping and groundwater levels, plus the addition of imported SWP water to the Valley, which together have not reduced recharge to groundwater, nor depleted the amount of groundwater that is in storage within the Valley.

Luhdorff & Scalmanini Consulting Engineers, "Evaluation of Groundwater Recharge Methods for the Saugus Formation in the Newhall Ranch Specific Plan Area" (March 2006)

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TECHNICAL MEMORANDUM

LUHDORFF & SCALMANINI CONSULTING ENGINEERS

Evaluation of Groundwater Recharge Methods for the Saugus Formation in the Newhall Ranch Specific Plan Area

Prepared for: Tom Worthington, Impact Sciences

Prepared by: Joseph C. Scalmanini

Date: March 8, 2006

Project Number: 06-1-017

Introduction

Included with the approval of the Newhall Ranch Specific Plan was a condition that "prior to approval of the first subdivision map which permits construction, a report will be provided by the applicant which evaluates methods to recharge the Saugus Aquifer within the Specific Plan, including the identification of appropriate candidate land areas for recharge". In response to that condition, this technical memorandum has been prepared to address recharge of the Saugus Formation in general, as well as within the Specific Plan area. It also addresses groundwater recharge methods as might be applicable to the Saugus Formation, and it provides a summary of artificial recharge feasibility that was previously assessed for the Saugus Formation. Finally, this technical memorandum includes a summary of the recently completed analysis of groundwater basin yield, where that yield is comprised of both the Alluvial and Saugus aquifers, as a basis for concluding about the need for identifying land areas for recharge of the Saugus Formation within the Specific Plan area.

The Saugus Formation

The Saugus Formation is one of two significant aquifers in the Santa Clara River Valley Groundwater Basin, East Subbasin, the other being the less extensive Alluvium that overlies part of the Saugus Formation, generally near the main Santa Clara River and several of its tributaries. The Alluvium extends to a maximum depth of about 200 feet and has been estimated to have a maximum storage capacity of about 240,000 acre-feet. The geologically older Saugus Formation extends several thousand feet in total depth but, for groundwater supply purposes, contains sand and gravel units that represent aquifer materials generally between depths of about 300 and 2,500 feet. The fresh water storage capacity of the Saugus in that depth interval has been estimated to be about 1.65 million acre-feet.

In general, natural groundwater recharge in the Santa Clarita Valley occurs in the eastern portion of the basin, and at the northern and southern limits of the basin. Natural groundwater discharge occurs from the Saugus Formation and the Alluvium in the west-central portion of the basin, in the alluvial valley occupied by the Santa Clara River. Of course, groundwater pumping is also a groundwater discharge mechanism that occurs at distinct locations throughout the basin. Ultimately, however, in the general context of the Specific Plan condition regarding recharge of the Saugus Formation, the occurrence of natural groundwater discharge in the west-central portion of the basin is suggestive of prevailing groundwater conditions that support such a discharge; in other words, the basin has sufficient natural recharge and groundwater flow toward the west that additional efforts to identify and potentially utilize new recharge areas in the Newhall Ranch Specific Plan area, which is where groundwater is already discharging from the basin, would be counter-productive. To place that in some context, however, artificial recharge methods and their potential applicability in the basin are discussed in some detail below, as is the operating plan for groundwater use in the basin and its associated effects on the prevailing groundwater flow direction and associated groundwater storage and discharge.

Groundwater Recharge Methods

The implied intent of the Specific Plan condition addressed in this technical memorandum is an evaluation of purposeful supplemental groundwater recharge, commonly called artificial recharge, to augment natural recharge processes, presumably to benefit the yield of the basin. By specifically noting that the evaluation of recharge methods should also identify appropriate land areas for recharge, the condition further implies that potential artificial recharge would most likely involve the spreading of surface water for infiltration and deep percolation to the water table. Despite the latter implication, however, rather than limit this overall discussion to potential surface spreading of water for artificial recharge, and recognizing the nature of the aquifer systems in the basin, and particularly in the Specific Plan area, the following discussion of artificial recharge methods is included to provide a context for considering the applicability of artificial recharge in that local setting, and also to provide a context for the recent investigation of the feasibility of injection as a potential recharge mechanism, the results of which are summarized in the next section of this technical memorandum.

In most general terms, artificial recharge can be defined as augmenting the natural movement of surface water into underground formations by some method of construction, by spreading of water, or by artificially changing natural conditions. While a variety of artificial recharge methods have been developed and applied in various areas, they can generally be grouped into three categories: water spreading on the ground surface to increase infiltration, recharging through wells to directly introduce water into the aquifer system, and pumping in proximity to surface water bodies to induce recharge from them.

Of the three general categories of artificial recharge methods, the most widely practiced are water spreading operations, where surface waters are purposely introduced to a spreading basin,

or onto selected lands, or into a stream channel such that the water can infiltrate from the surface and then deep percolate to the water table, thus adding to other waters that "naturally" recharge the aquifer, e.g. precipitation, water applied for irrigation, etc. In contrast to surface spreading, artificial recharge of groundwater through wells is much less widely practiced and is typically much smaller in rate of recharge. Individual wells might be capable of recharge rates of a few acre-feet per day, where surface spreading, depending on the nature and physical extent of the spreading ponds or in-channel watercourse, can infiltrate tens to hundreds of acre-feet per day. Despite such limitations, two key factors that lead toward the potential applicability of recharge wells, rather than spreading basins, in some settings are the physical presence of confining layers in the aquifer system that could impede the deep percolation of infiltration from the surface, and the lack of available surface area for surface spreading. In this setting, the nature and depth of the Saugus Formation, which contains alternating layers of fine (confining) and coarse aquifer materials, would likely warrant consideration of recharge wells for those reasons, if artificial recharge of the Saugus were being considered. However, as discussed below, neither recharge method (surface spreading or recharge wells) is warranted in the basin, and particularly in the westerly portion of the Saugus Formation in the vicinity of the Newhall Ranch Specific Plan.

Feasibility of Injection for Saugus Formation Recharge

Early considerations of potential water supply for the Newhall Ranch Specific Plan included so-called Aquifer Storage and Recovery, or "ASR", whereby water from outside the local basin would be imported and injected into the Saugus Formation, where it would be stored for subsequent recovery by pumping for the municipal water requirements of the project. While ASR is not part of the integrated groundwater/imported surface water/reclaimed water supply that is the current and planned future water supply in the valley, the consideration of ASR as a water supply concept for Newhall Ranch resulted in field testing and analysis to assess the hydrogeologic feasibility of injecting and recovering water in the Saugus Formation. That work, briefly summarized as follows, provides some useful insight to potential artificial recharge of the Saugus Formation since it specifically tested both injection (recharge) into, and recovery of water from that aquifer.

A detailed description of the assessment of the hydrogeologic feasibility of injection and recovery in the Saugus Formation, which was conducted in the summer-fall of 2000, is documented in **Assessment of the Hydrogeologic Feasibility of Injection and Recovery of Water in the Saugus Formation, Santa Clarita Valley** (Richard C. Slade & Associates, 2001). That feasibility assessment included the injection of water from Valencia Water Company's municipal distribution system into Valencia's Saugus Well No. 205 for seven day periods at each of 500, 800, and 1,100 gallons per minute (gpm). That injection was followed by a brief (9 days) observation of groundwater storage, followed in turn by pumping (recovery) of water from the same well at its normal operating capacity of about 2,300 gpm over a period of 10 days. During injection, groundwater quality sampling at a nearby production well was conducted to assess any discernable impacts of injection on groundwater quality during injection. During subsequent

pumping of the tested injection well, daily water quality sampling was conducted to assess the "recovery" of injected water, followed by extraction of typical formation water quality after recovery of the injected water. Other related work at the time of injection feasibility testing included the separate pumping of another Saugus Formation well, and concurrent observation of groundwater response in a number of wells completed in either the Saugus Formation or the overlying Alluvium. The purpose of the latter testing was to examine the extent of direct effects, if any, of Saugus pumping on the Alluvium.

The results of the testing described above were interpreted by Slade to conclude that it is hydrogeologically feasible to inject (recharge) and recover water in the Saugus Formation. The aquifer readily accepted water from the injection well, and it subsequently yielded a comparable volume to the same well when it was pumped. The measured effects of injection and pumping were indistinguishable from normal seasonal fluctuations in groundwater levels in the Saugus Formation. The yield of the injection/production well, as measured by its specific capacity (injection or pumping rate divided by water level increase during injection, or drawdown during pumping) was determined to be as generally expected; specific capacity during injection was about 60 to 80 percent of specific capacity during pumping, a phenomenon typically attributed to clogging during injection by some combination of sediment and air. Finally, the injection into, and pumping from the Saugus wells were observed to have no measurable effect on water levels in the overlying Alluvial aquifer system.

In the context of this technical memorandum, the conclusions derived from the assessment of hydrogeologic feasibility of injection and extraction in the Saugus Formation can be extrapolated to project that the Saugus can be recharged via injection at capacities that correlate with fractions of the yields of equivalent Saugus production wells. Some amount of clogging of the injection wells can be expected, resulting in a probable need to regularly interrupt injection (recharge) for routine "purging" of the wells by pumping and, probably less frequently, for well rehabilitation of a more complex nature, e.g. using chemical and/or mechanical means to restore and maintain well injectivity. In the more focused context of the Specific Plan condition regarding land areas for potential recharge, the feasibility assessment and conclusions to date suggest that typical well sites, plumbed with provisions to deliver water from the municipal distribution system for injection and also to discharge water from routine and other well rehabilitation efforts, can be adequate to provide for the installation of injection (recharge) wells if artificial recharge of the Saugus were to be desired for some reason. In that light, however, the next section discusses the yield of the local groundwater basin, and the integration of supplemental water supplies with that yield to meet existing and projected water requirements in the basin, including those of the Specific Plan area.

Groundwater Basin Yield

Total water requirements in the Santa Clarita Valley were nearly 88,000 acre-feet in 2004. That total demand represents an average annual increase of about 3.5 percent per year since 1980,

when surface water from the State Water Project (SWP) was initially imported to supplement local groundwater for municipal and agricultural water supply. Current groundwater use is lower than peak historic, pre-SWP use, and it has remained within a generally constant range of about 38,000 to 44,000 acre-feet per year over the last 15 years. That historical groundwater use and resultant conditions, i.e. no long-term changes in groundwater levels and storage, have been such that there has been no need to initiate and operate artificial groundwater recharge projects. In effect, natural recharge processes have resulted in recharge that sustains, i.e. refills, the aquifer system sufficiently that there has been no long-term depletion of groundwater. Groundwater levels have remained basically unchanged for several decades throughout the western half of the basin; to varying degrees, groundwater levels in the eastern part of the basin have fluctuated through wet and dry hydrologic cycles, but fully recover through natural recharge processes in wet and normal periods of rainfall and stream flow. Thus, with particular focus on the western portion of the basin where the Specific Plan is located, the aquifer system has remained basically full, discharging to some degree to the Santa Clara River to sustain surface water flows out of the basin and downstream to Ventura County.

Based on empirical observation of groundwater basin conditions in response to historical pumping, and also in recognition of the increases in Santa Clara River flows and related groundwater recharge that indirectly derive in part from increased imported SWP water, the concept of a groundwater operating plan was developed to define the groundwater component of overall water supply in the basin. The groundwater operating plan is also a product of the formal Groundwater Management Plan adopted for the basin in 2003, which incorporates a number of elements aimed at developing groundwater in conjunction with other water supplies to meet existing and projected water requirements, and to do so without overdrafting the groundwater basin. The groundwater operating plan is based on the concept that pumping can vary from year to year to allow increased groundwater use in dry periods and increased recharge during wet periods, and to collectively assure that the groundwater basin is adequately replenished through various wet/dry cycles, thus maintaining the basin in a sustainable condition, i.e. no long-term depletion of groundwater or interrelated surface water. In summary, the operating yield concept has been quantified as ranges of annual pumping volumes as follows:

Alluvium – Pumping from the Alluvial Aquifer in a given year is governed by local hydrologic conditions in the eastern Santa Clara River watershed. Pumping ranges between 30,000 and 40,000 afy during normal and above-normal rainfall years. However, due to hydrogeologic constraints in the eastern part of the Basin, pumping is reduced to between 30,000 and 35,000 afy during locally dry years.

Saugus Formation – Pumping from the Saugus Formation in a given year is tied directly to the availability of other water supplies, particularly from the SWP. During average-year conditions within the SWP system, Saugus pumping ranges between 7,500 and 15,000 afy. Planned dry-year pumping from the Saugus Formation ranges between 15,000 and 25,000 afy during a drought year and can increase to between 21,000 and

25,000 afy if SWP deliveries are reduced for two consecutive years and between 21,000 and 35,000 afy if SWP deliveries are reduced for three consecutive years. Such high pumping would be followed by periods of reduced (average-year) pumping, at rates between 7,500 and 15,000 afy, to further enhance the effectiveness of natural recharge processes that would recover water levels and groundwater storage volumes after the higher pumping during dry years.

To examine the sustainability of the groundwater basin under the operating plan, which already derived from observation of actual basin response to generally comparable historical operations, the municipal purveyors in the Santa Clarita Valley commissioned the development and calibration of a numerical groundwater flow model which could be used to project groundwater level and storage response to the variations in pumping planned through wet and dry hydrologic cycles as described in the operating plan. That model was developed and calibrated in 2004 (CH2M Hill, 2004) to simulate the basin's response to the various natural recharge processes (e.g. infiltration of precipitation, infiltration of applied water, infiltration of stream flow) and discharge processes (e.g. pumping, groundwater discharge to streams). The calibrated model was then used to analyze the yield of the basin, i.e. the groundwater operating plan, in 2005 (CH2M Hill and LSCE, 2005). Basin yield was examined by running the model over a 78-year hydrologic period, which was selected from actual historical precipitation to examine a number of hydrologic conditions which could be expected to affect both groundwater pumping and groundwater recharge. The selected 78-year simulation period was assembled from an assumed recurrence of 1980 to 2003 conditions, followed by an assumed recurrence of 1950 to 2003 conditions. The 78-year period was analyzed to define both local hydrologic conditions (normal and dry), which affect the rate of pumping from the Alluvium, and hydrologic conditions that affect SWP operations, which in turn affect the rate of pumping from the Saugus. The resultant simulated pumping cycles included the distribution of pumping among existing and planned Alluvial and Saugus Aquifer wells, for normal and dry years respectively, including the planned restoration of wells that have been impacted by perchlorate in the central part of the basin.

Simulated Alluvial Aquifer and Saugus Formation response to the ranges of pumping under assumed recurrent hydrologic conditions is essentially a long-term repeat of the historical conditions that have resulted from similar pumping over the last several decades in the Alluvium, and consistent with actual experience under smaller pumping rates in the Saugus Formation. The resultant response consists of: (1) generally constant groundwater levels in the middle to western portion of the Alluvium and fluctuating groundwater levels in the eastern portion as a function of wet and dry hydrologic conditions, (2) variations in natural recharge that directly correlate with wet and dry hydrologic conditions, and (3) no long-term decline in groundwater levels or storage. The combination of actual experience with Alluvial Aquifer pumping at capacities similar to those in the operating plan, and the resultant natural recharge of groundwater levels and storage, complemented by modeled projections of similar recharge to future pumping, result in a conclusion that the operating plan represents a sustainable yield of the Alluvium.

In the Saugus Formation, the simulated response consists of (1) short-term declines in groundwater levels and storage near pumped wells during dry-period pumping, (2) rapid recovery of groundwater levels and storage after cessation of dry-period pumping, and (3) no long-term decreases or depletion of groundwater levels or storage. The combination of actual experience with Saugus pumping and recharge up to about 15,000 afy, complemented by modeled projections of aquifer response that show long-term utility of the Saugus at 7,500 to 15,000 afy in normal years and rapid recovery from higher pumping rates during intermittent dry periods, all without any purposeful artificial recharge, shows that the Saugus Formation can be considered a sustainable water supply source to meet the Saugus portion of the operating plan for the groundwater Basin.

As a result of the analysis described in the preceding, i.e. the combination of actual historical basin conditions and simulated future basin conditions, the groundwater operating plan and the natural recharge associated with it have become the existing and projected groundwater supply component of water supply to meet ongoing water requirements in the valley.

For purposes of this technical memorandum, the existence of historical and existing groundwater conditions, combined with the balance of the hydrogeologic setting in the Specific Plan area, indicates that there has been no need for artificial recharge of the aquifer system in that portion of the basin. Since natural recharge processes have maintained long-term stable groundwater conditions, including sufficiently high groundwater storage that there is groundwater discharge from the aquifer to the Santa Clara River, efforts to artificially augment natural recharge in that area could be expected to result in "rejected" recharge, i.e. recharged water would simply add to groundwater discharging from the aquifer system, resulting in no net benefit to the basin's yield or storage. Recent analysis of the groundwater basin's yield and the projected impact of the operating plan for groundwater pumping in the basin shows that future conditions are expected to generally repeat historical observations, resulting in no need for artificial recharge in the western (Specific Plan) portion of the basin.

Need for Saugus Formation Recharge Locations in Newhall Ranch Area

All the preceding description and discussion of the occurrence of groundwater, its recharge and discharge areas, and its sustainable yield maintained by natural recharge processes can be summarized to conclude that there is no definable need to identify land areas for artificial recharge of the Saugus Formation. More specifically, there is no need to identify land areas for artificial recharge of the Saugus Formation in the small part of that aquifer system that underlies the Newhall Ranch Specific Plan area. In summary form, that conclusion derives from the following points.

- The Upper Santa Clara River Groundwater Basin, East Subbasin is comprised of two aquifers, the Alluvium and the Saugus Formation, which are generally recharged in the east to central portion of the basin, well east of the Newhall Ranch Specific Plan

area. Groundwater flow in the basin is generally east to west, with resultant groundwater discharge at the western end of the basin.

- The Newhall Ranch Specific Plan area overlies a very small portion of the Saugus Formation at the far western end of the basin, as illustrated in Figure 1, where the basin is discharging water that flows downstream toward Ventura County.

- Historical observations for several decades have shown no long-term changes in groundwater storage or levels. Natural recharge processes have sustained groundwater levels, including long-term essentially constant, high groundwater levels. There has thus been no need for addition of artificial recharge operations to augment natural recharge to the basin.

- The presence of high, relatively constant groundwater levels in the Specific Plan area is indicative of no vacant aquifer storage space into which artificial recharge might be introduced. Thus, attempts to artificially recharge the basin in that area can be expected to result in rejected recharge, or the rapid discharge of any recharged water to the overall outflow from the basin.

- The future operating plan for the basin includes future pumping that is generally similar to historic pumping, with one notable change whereby short-term intermittent increases in Saugus pumping would occur during dry periods when supplemental imported State Water Project deliveries might be reduced. Simulation of basin response to such pumping projects conditions generally comparable to historic experience: future Alluvial aquifer levels and storage comparable to historical conditions; and future Saugus Formation levels and storage lowered during dry periods (in response to increased pumping) but fully replenished by natural recharge processes in subsequent wet/normal conditions.

- While there is no defined need for artificial recharge in the western part of the basin, the nature of the Saugus Formation is such that, physically, recharge to that formation would likely be more effective through injection wells. Thus, if artificial recharge of the Saugus Formation were to become desirable for some reason, feasibility testing of injection has been undertaken, with results showing such a mechanism to be hydrogeologically feasible.

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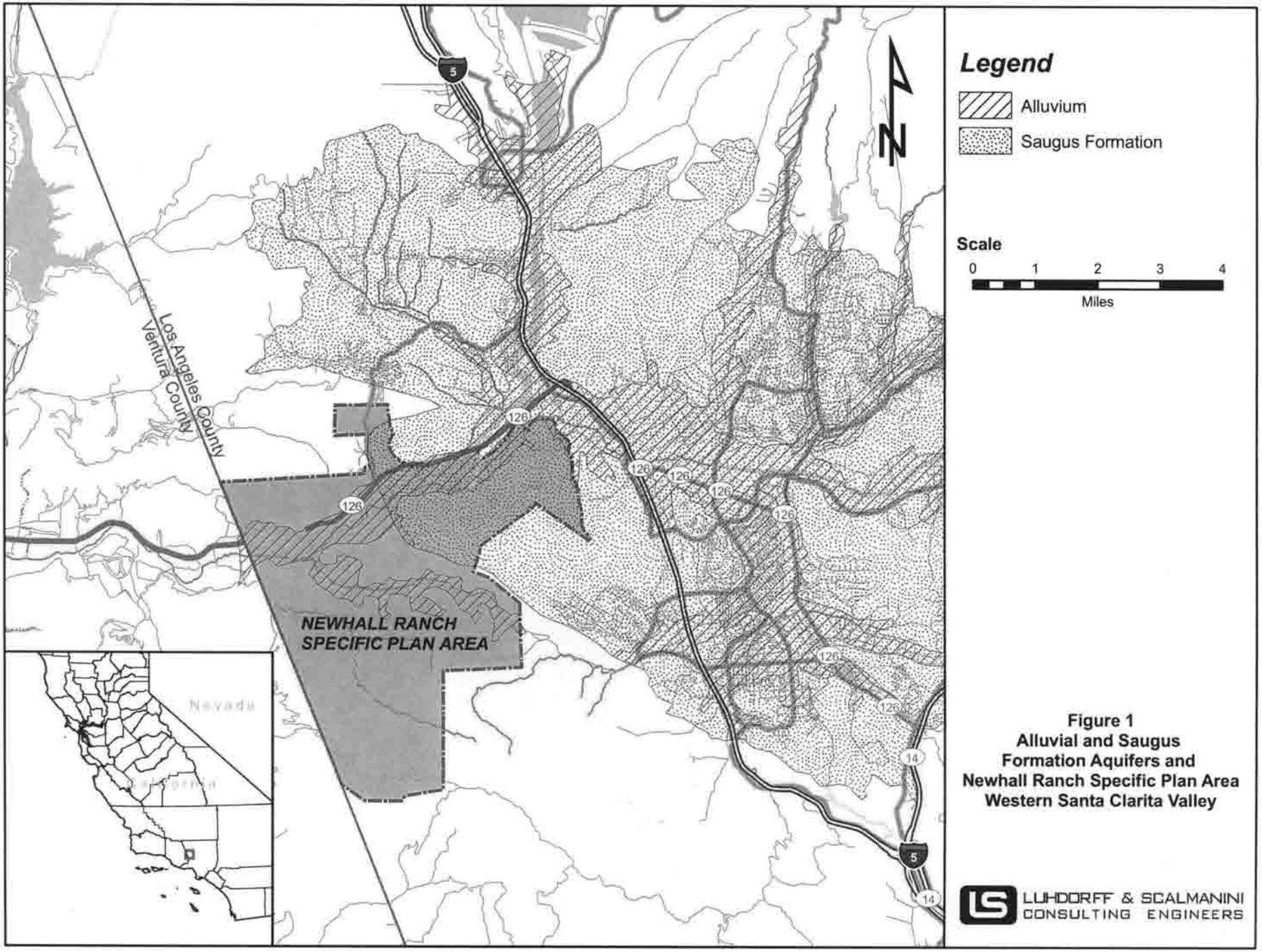

Figure 1
Alluvial and Saugus Formation Aquifers and Newhall Ranch Specific Plan Area Western Santa Clarita Valley

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TRANSMITTAL

Date March 17, 2006

TO: Tom Worthington
Steve Zimmer
Mark Dillon
Glenn Adamick

Phone

FROM: Bob DiPrimio
Valencia Water Company
24631 Avenue Rockefeller
Valencia, CA 91355

Phone 661-295-6501
Fax Phone 661-294-3806

CC:

REMARKS: ☐ Urgent ☒ For your review ☐ Reply ASAP ☐ Please Comment

Note: Here is Joe's signed Tech memo.

Bob

Filed 5/13/09 Cal. Water Impact Network v. Newhall County Water Dist. CA2/8

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

California Rules of Court, rule 8.1115(a), prohibits courts and parties from citing or relying on opinions not certified for publication or ordered published, except as specified by rule 8.1115(b). This opinion has not been certified for publication or ordered published for purposes of rule 8.1115.

IN THE COURT OF APPEAL OF THE STATE OF CALIFORNIA

SECOND APPELLATE DISTRICT

DIVISION EIGHT

CALIFORNIA WATER IMPACT NETWORK, Plaintiff and Appellant, v. NEWHALL COUNTY WATER DISTRICT et al., Defendants and Respondents; GATE KING PROPERTIES et al., Real Parties in Interest.	B203781 (Los Angeles County Super. Ct. No. BS098727)
CALIFORNIA OAK FOUNDATION et al., Plaintiffs and Appellants, v. CITY OF SANTA CLARITA, Defendant and Respondent; GATE KING PROPERTIES et al., Real Parties in Interest.	B203782 (Los Angeles County Super. Ct. No. BS084677)

APPEAL from judgments of the Superior Court of Los Angeles County, Dzintra Janavs, Judge. Affirmed.

Law Offices of Babak Naficy and Babak Naficy for Plaintiffs and Appellants.

Lagerlof, Senecal, Gosney & Kruse LLP, Thomas S. Bunn III; Carl K. Newton, City Attorney; Burke Williams & Sorensen LLP, Brian A. Pierik and Gregory M. Murphy for Defendants and Respondents.

Cox, Castle & Nicholson, Anne E. Mudge and Sarah E. Owsowitz for Real Parties in Interest.

This is the second time we address issues associated with a proposal to develop an industrial park in the City of Santa Clarita, the City's environmental impact report (EIR) for the proposed project, and water. Four years ago, we ruled that the City's EIR did not include an adequate discussion on the subject of water supplies for the proposed project. (See *California Oak Foundation v. City of Santa Clarita* (2005) 133 Cal.App.4th 1219 (*California Oak*).) At that time, we directed the trial court to issue a writ of mandate commanding the City to decertify its EIR, and to prepare and recertify an EIR complying with the requirements of the California Environmental Quality Act (CEQA).[1] We further directed the trial court to retain jurisdiction over the cause until the City recertified its EIR.

The consolidated appeals before our court today arise from two judgments which, together, have the effect of approving the City's recertification of its EIR — with a final additional analysis (FAA) — for the proposed project. We agree with the trial court that the City's EIR/FAA now complies with CEQA, and affirm both judgments.

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[1] See Public Resources Code section 21000 et seq. All section references are to the Public Resources Code, except where noted otherwise. All references to the CEQA Guidelines are to the California Code of Regulations, title 14, section 15000 et seq.

FACTS

I. Water

We begin our examination of the current appeal by revisiting some foundational background facts summarized in our prior opinion on the first appeal. The State Water Project (SWP) was authorized in the 1950s, and was envisioned to become a system of reservoirs, dams and other facilities for the storage and delivery of 4.23 million acre-feet of water per year (AFY). The Department of Water Resources (DWR) manages the SWP and operates its facilities. (*California Oak, supra*, 133 Cal.App.4th at p. 1227.)

When the SWP began, DWR entered into a number of long-term contracts with water suppliers (DWR contractors) throughout the state. The central provisions of these long-term contracts were the same: a DWR contractor was allotted an entitlement to a certain amount of water from the SWP each year, in exchange for which the contractor agreed to pay, on a proportionate basis, the costs of financing and maintaining the SWP's facilities. (*California Oak, supra*, 133 Cal.App.4th at p. 1227.) The long-term contracts also included a provision — "Article 18" — outlining the procedures for the reallocation of water among contractors in the event of water shortages within the SWP system. (See generally, *Planning & Conservation League v. Department of Water Resources* (2000) 83 Cal.App.4th 892, 898-900 (*PCL*).)

The entitlements to SWP water which were allotted to the contractors under their long-term contracts with DWR were based on the predicate that the state would actually build out the SWP as planned, so that it actually had the capacity and capability to store and deliver 4.23 million AFY of water. The state, however, never completed the SWP as envisioned, and, today, the SWP simply does not have the physical capability to deliver 4.23 million AFY of water to its contractors. On the contrary, the actual, reliable water supply in the SWP is more in the vicinity of 2 to 2.5 million AFY of water. (*California Oak, supra,* 133 Cal.App.4th at pp. 1227-1228.)

With this general background of the state's water resources and some relevant statutory schemes in mind, we move on to other events.

II. The Monterey Agreement and Monterey Amendments

During the late 1980s and early 1990s, ongoing drought conditions in California diminished the supply of water in the SWP, and generated "Article 18 disputes" among state's agricultural water contractors, urban water contractors, and DWR regarding the distribution of water from the SWP. In the fall of 1994, DWR and its contractors met in Monterey to discuss the allocation of SWP water in times of shortage. These so-called "Article 18 negotiations" morphed into an attempt to implement an "omnibus revision of the SWP long-term contracts and their administration" (see *PCL, supra*, 83 Cal.App.4th at p. 901), and, in early 1995, DWR and a number of contractors took the first step toward that end by agreeing to a statement of principles known as the Monterey Agreement.

For purposes of the appeal before us today, the Monterey Agreement embodied two key principles: first, it contemplated that the then-existing long-term contracts with DWR would be amended to allow for the reallocation of the entitlements to SWP water which the state's agricultural contractors and urban contractors had previously enjoyed, and, second, it envisioned that these amendments would authorize contractors to transfer SWP water amongst themselves on a "willing buyer/willing seller" basis. (*California Oak, supra*, 133 Cal.App.4th at p. 1228; *PCL, supra*, 83 Cal.App.4th at pp. 900-902.)

In the years following the Monterey Agreement, various DWR contractors began implementing the agreement's principles by negotiating and purchasing transfers of SWP water. These consummated transfers of entitlements to SWP water became known as the Monterey Amendments. In 1999, the Castaic Lake Water Agency (CLWA) purchased a transfer of an entitlement to 41,000 AFY of SWP water from the Kern County Water Agency (KCWA). (*California Oak, supra*, 133 Cal.App.4th at p. 1228.)[2]

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[2] "CLWA is a public agency created and governed by the uncodified Castaic Lake Water Agency Law. (Stats. 1962, 1st Ex. Sess., ch. 28, §1, p, 208 . . . .) CLWA was formed to provide a . . . supply of imported water to . . . water purveyors of the Santa Clarita Valley. . . . CLWA contracts with [DWR] for water from the [SWP] . . . , treats those supplies at its treatment plants, and delivers the treated water to [local] water

As we will see below, the 1999 transfer of SWP water from KCWA to CLWA is the proverbial seed from which the appeal before us today is grown. With this second part of our story tucked away in mind, we turn to still more events.

III. Related Litigation

A. The CEQA Case Involving the Monterey Agreement/Monterey Amendments

The DWR contractors who negotiated the Monterey Agreement, along with DWR, recognized that implementation of the agreement's principles for the reallocation of water from the SWP might have potential adverse environmental effects, and, thus required the preparation of an EIR, including an opportunity for public input during the environmental review process. To that end, the Monterey Agreement adherents appointed one of their own contractors to serve as the "lead agency" in charge of preparing an EIR. In 1995, the contractor certified an EIR for the Monterey Agreement, and, later that same year, DWR, acting in the role of a "responsible agency," issued findings and adopted the EIR. (*PCL, supra,* 83 Cal.App.4th at p. 902.)

Shortly thereafter, two citizens groups (and others) filed a petition for writ of mandate in the Sacramento County Superior Court, challenging the sufficiency of the EIR for the Monterey Agreement. In 1996, the trial court entered judgment rejecting the

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retailers within [the Santa Clarita Valley] area." (*Friends of the Santa Clara River v. Castaic Lake Water Agency* (2004) 123 Cal.App.4th 1, 4.) CLWA is a statutorily-defined "urban water supplier" under the Urban Water Management Planning Act or UWMPA. (Stats. 1983, ch. 1009, § 1, p. 3555; Wat. Code, § 10610 et. seq.) The UWMPA requires all such water suppliers to prepare an Urban Water Management Plan (UWMP) every five years. Among other elements, a UWMP must provide information on a supplier's water usage, resources, reliability planning, demand management measures, and shortage contingency planning. A UWMP is intended to function as a planning tool to guide broad-perspective decision-making by the management of the water supplier; an UWMP is not a substitute for project-specific planning documents, such as those which are required under CEQA. In *Friends of the Santa Clara River v. Castaic Lake Water Agency*, *supra*, 123 Cal.App.4th 1, the Fifth District Court of Appeal in Fresno addressed challenges to CLWA's 2000 UWMP. In 2005, CLWA prepared its most recent UWMP. CLWA's UWMP envisions use of the transfer of the 41,000 AFY of SWP water purchased from KCWA.

CEQA challenges, ruling that, although the appointed contractor should not have been the lead agency for the preparation of the EIR, the EIR was nonetheless adequate, which meant that the CEQA violation was not prejudicial.

In 2000, the Third District Court of Appeal agreed with the trial court that DWR, not the appointed contractor, should have acted as the lead agency for the preparation of the EIR for the Monterey Agreement, but disagreed with the trial court that the EIR itself was adequate. The Third District reversed the judgment, concluding that the omissions in the EIR mandated preparation of a new EIR for the Monterey Agreement, under DWR's direction. (*PCL*, *supra*, 83 Cal.App.4th at p. 898.)

In June 2003, the Sacramento County Superior Court entered an order approving a settlement agreement in the CEQA case involving the Monterey Agreement. The order provided that the trial court would issue a writ of mandate compelling DWR to prepare a new EIR for the Monterey Agreement, and that the court would retain jurisdiction over the cause until DWR filed a return to the writ of mandate showing that it had complied with CEQA, and the court issued an order discharging the writ of mandate. (*Planning & Conservation League v. Department of Water Resources* (Super. Ct. Sacramento County, 2003, No. 95CS03216.)

The record before us today shows that the parties who are involved in the current appeal are of the understanding that, notwithstanding the passage of more than five years, DWR still has not yet completed its EIR for the Monterey Agreement.

With this summary of the CEQA litigation involving the Monterey Agreement, we turn to still more events.

B. The First CEQA Case Involving the Transfer of 41,000 AFY of SWP Water from KCWA to CLWA

In 1999, while the CEQA case involving the Monterey Agreement as a whole was pending in the Third District, the Castaic Lake Water Agency (CLWA) — in accord with the Monterey Agreement — agreed to purchase an entitlement to 41,000 AFY of SWP water from the Kern County Water Agency (KCWA) for approximately $47 million. The transfer of 41,000 AFY of water was memorialized in an amendment to the water supply

contract between DWR and CLWA, which now reflects that CLWA is entitled to receive its original entitlement of SWP water, and is entitled to receive an additional entitlement of 41,000 AFY of SWP water, i.e. the water KCWA transferred to CLWA. Also in 1999, CLWA certified an EIR for the transfer of the 41,000 AFY of SWP water. (*Friends of the Santa Clara River v. Castaic Lake Water Agency* (2002) 95 Cal.App.4th 1373, 1379 (*Friends I*).)

Shortly after CLWA certified its EIR for the transfer of the 41,000 AFY of SWP water from KCWA, a nonprofit corporation filed a petition for writ of mandate in the Los Angeles County Superior Court, challenging the sufficiency of CLWA's EIR. In 2000, the trial court entered a final judgment denying the petition.

In 2002, Division Four of our court ruled that the decision by the Third District Court of Appeal in *PCL, supra,* 83 Cal.App.4th 892 — decertifying the original EIR for the Monterey Agreement/Monterey Amendments as a whole program — required the decertification of CLWA's "tiered" EIR for the ensuing transfer of the 41,000 AFY of SWP water from KCWA to CLWA. As Division Four explained, "tiering" — meaning the practice of incorporating prior environmental studies — is permitted under CEQA, but had resulted in a "defect" in CLWA's EIR when the original, underlying EIR for the Monterey Agreement as a whole, upon which CLWA's ensuing EIR had been expressly tiered, was decertified. (*Friends I, supra,* 95 Cal.App.4th at pp. 1375-1376, 1384-1387.) In short, Division Four ruled that an EIR may not be "tiered" on a decertified EIR. CLWA's options, suggested Division Four, were to wait until the EIR review process in the CEQA case involving the Monterey Agreement/Monterey Amendments had been completed (see *III., A., ante*), or to prepare its own independent EIR for the transfer of the 41,000 of SWP water from KCWA.

After *Friends I* was remanded to the trial court, the case litigants agreed the trial court should issue a writ of mandate directing CLWA to decertify its EIR, but a "bone of contention" remained whether the trial court should also enjoin CLWA from proceeding with the transfer of the entitlement to the 41,000 AFY of SWP water from KCWA before CLWA completed an adequate EIR for the transfer. (*Friends of the Santa Clara River v.*

Castaic Lake Water Agency (Dec. 1, 2003, B164027) [nonpub. opn. at p. 3] (*Friends II*).) In October 2002, the trial court denied the request to enjoin the transfer, and another appeal ensued. In December 2003, Division Four of our court affirmed the denial of injunctive relief. (*Ibid*.)

In February 2005, the California Water Impact Network (CWIN) dismissed its petition with prejudice.

C. The Second CEQA Case Involving the Transfer of 41,000 AFY of SWP Water from KCWA to CLWA

In 2004 (after Division Four decided *Friends II*), the CLWA certified an EIR for the permanent transfer of 41,000 AFY of SWP water from the Kern County Water District (KCWD). In January 2005, CWIN filed a petition for writ of mandate in the Ventura County Superior Court, challenging the EIR.[3] According to CWIN's petition, the EIR did not adequately discuss the threat posed by the permanent transfer of the water, i.e., the promotion of large-scale urban sprawl in Ventura and Los Angeles Counties, while diverting water forever from Kern County. On the same day that CWIN filed its petition, the Planning and Conservation League filed its own petition in Ventura County Superior Court challenging the transfer of water from KCWD to CLWA. The two petitions in Ventura County were consolidated, and, in June 2005, the consolidated Ventura County petitions were transferred to the Los Angeles County Superior Court and assigned case number BS098724.

On April 2, 2007, the trial court (Hon. James Chalfant) ruled that CLWA properly acted as the lead agency for the preparation of the 2004 EIR for the water transfer from KCWD to CLWA, and that CLWA's 2004 EIR "was properly prepared," except for one element — the EIR did not explain that the availability of water from the SWP "may be

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[3] CWIN filed its petition in the Ventura County Superior Court about one month before it filed its request for dismissal of its action in the Los Angeles County Superior Court (case No. BS056954) in which its request for a preliminary injunction had been denied. (See *III., B.*, *ante*; and see also *Friends II*, *supra*, B164027.)

impacted" by the outcome of DWR's pending preparation of an EIR for the Monterey Agreement/Monterey Amendments as a whole. For this reason, the trial court issued a writ commanding CLWA to set aside its approval of its 2004 EIR for the transfer of the 41,000 AFY of SWP water from KCWD, and to comply with CEQA, either through the preparation of a new EIR or an addendum "addressing the analytic route of the three water allocations." Judge Chalfant expressly ruled that that the transfer itself would not be set aside.

With this part of the related litigation in mind, we can now take a look at the proposed project at the heart of the appeal which is before us today.

IV. The Proposed Industrial Park Project, and the EIR Process for the Project

A. The Proposed Project

In 1999, Gate King Properties submitted a series of project requests to the City of Santa Clarita related to a proposal to develop an industrial/commercial park on a 584-acre site in the southern portion of the City. As described in our prior opinion, Gate King's original proposal envisioned the development of approximately 4.45 million square feet of industrial/commercial structures on 170.1 acres, with another 64.3 acres dedicated to rights-of-way (including public streets) and water wells. The remaining acreage was to include a combination of slopes, trails and open space. (See *California Oak, supra*, 133 Cal.App.4th at p. 1224.)

Gate King's proposed project envisions that the water which will be consumed on site by the industrial park's eventual occupants will be delivered at the retail level by the Newhall County Water District (NCWD). Moving up along the supply channel, NCWD obtains water at the wholesale level from the CLWA, and, as noted above, CLWA obtains water from the SWP, including an entitlement/transfer of an additional 41,000 AFY of SWP water from the KCWA.

B. The EIR Process for Gate King's Proposed Project

In January 2002, the City circulated a draft EIR for Gate King's proposed project. Section 4.10 of the City's draft EIR addressed the subject of "Utilities," including "Water Supplies." The discussion of water supplies explained that the NCWD would supply

water for the Gate King site at the retail level, and that NCWD obtained its water from local groundwater wells and the CLWA. The City's draft EIR also explained that CLWA obtained water from the SWP, and that CLWA's current total water entitlement from the SWP included 41,000 AFY of SWP water which CLWA had purchased from the KCWD. The draft EIR's discussion of water supplies included this broad proviso: "It should be noted . . . that CLWA's . . . entitlement [to SWP water] can fluctuate from year to year based on a number of factors, including hydrologic conditions, the status of [SWP] facilities, construction, environmental requirements, and evolving policies for the Bay-Delta."

During the comment period on the City's draft EIR, the Santa Clarita Organization for Planning the Environment (SCOPE) objected that the discussion of water supplies in the draft EIR for Gate King's proposed project was inadequate because it did not disclose that there was ongoing litigation which might affect the availability of the 41,000 AFY of SWP water transferred from KCWA to CLWA. The City, in turn, prepared a response to SCOPE's comments in which the City explained that the Newhall County Water District (NCWD) had completed a water supply assessment (WSA) for Gate King's proposed project, and that NCWD had concluded that it would have sufficient water to supply the needs of the project.

In October 2002, the City circulated a final EIR for Gate King's proposed project. In June 2003, the City passed a resolution adopting the findings set forth in the EIR, and certifying the EIR as final. The City's final EIR did not make any material alterations in the discussion of water supplies set forth in the draft EIR. SCOPE's comments regarding ongoing litigation involving the transfer of the 41,000 AFY of SWP water from KCWD to CLWA, along with the City's response, were included — along with other comments and responses — in the final EIR as "Appendix H." The final EIR also included a document prepared by NCWD entitled "Additional Water Supply Information" as "Appendix K."

Now, with the basic framework of Gate King's proposed project in mind, and the City's EIR for the project in mind, we may finally turn to the litigation from which the current appeal arises.

V. The Two Cases Giving Rise to the Current Appeal

A. Santa Clarita Oak Conservancy v. City of Santa Clarita (the California Oak case)

In July 2003, shortly after the City certified its final EIR for Gate King's proposed project, the Santa Clarita Organization for Planning the Environment (SCOPE) and other groups filed a petition for writ of mandate seeking to compel the City to decertify its EIR on the ground that it did not include adequate information on the "uncertainties" which were then still attendant to the transfer of the 41,000 AFY of SWP water from KCWA to CLWA. (L.A. Super. Ct. No. BS084677.) In March 2004, the trial court entered judgment denying SCOPE's writ petition, and, shortly thereafter, SCOPE filed an appeal.

In November 2005, we ruled that the information on the subject of water supplies set forth in the City's EIR for Gate King's proposed project was inadequate. There, we determined "the EIR's failure to present . . . an analysis of how demand for water would be met without the 41, 000 AFY entitlement, or of why it is appropriate to rely on the 41,000 transfer . . . render[ed] the EIR defective . . . ." (*California Oak, supra,* 133 Cal.App.4th at p. 1242.) We reversed the judgment, and remanded the cause with directions to the trial court to issue a writ of mandate compelling the City to decertify its EIR for Gate King's project, and to retain jurisdiction over the cause until such time as the City certified an EIR which complied with CEQA. (*Id*. at p. 1245.)

In March 2006, NCWD completed preparation of a new WSA for Gate King's proposed industrial park project. That same month, the City circulated a draft additional analysis for the EIR for Gate King's proposed project. The City's draft additional analysis stated that, "[b]ased on th[e] . . . [new WSA] prepared by NCWD, an adequate supply of water is available to serve the Gate-King project, [and] existing and planned future uses in the Santa Clarita [area]. No significant water supply . . . impacts are expected from supplying available water to meet the demands of both the project and

cumulative development in the [area]." The report went into detail in explaining its conclusions.

In July 2006, the City certified a final additional analysis (FAA) for the EIR for Gate King's proposed project. In August 2006, the City filed a return in the trial court, including requests to discharge the peremptory writ of mandate which had been issued in accord with *California Oak*, and to dismiss SCOPE's petition. In October 2006, SCOPE filed an objection to the City's return to the peremptory writ of mandate.

In June 2007, the adequacy of the City's EIR/FAA was argued to the trial court. On August 15, 2007, the trial court entered a statement of decision setting forth its ruling that the City's EIR/FAA was adequate. On September 5, 2007, the trial court entered judgment accepting the City's return to the court's peremptory writ of mandate, and discharging its preemptory writ of mandate.

In November 2007, SCOPE filed a timely notice of appeal. (case No. B203782.)

B. California Water Impact Network v. Newhall County Water District

In July 2005, about three months before we issued our opinion in *California Oak*, NCWD approved a water supply assessment (WSA) in connection with an application by Gate King to have the site of its proposed industrial park project annexed into NCWD's service territory. In August 2005, the California Water Impact Network (CWIN) filed a petition for writ of mandate, coupled with a complaint for declaratory and injunctive relief, challenging NCWD's WSA for purposes of annexation, and seeking to enjoin NCWD from proceeding with the annexation of the site of Gate King's proposed industrial park. (L.A. Super. Ct. No. BS098727.)

In November 2005, we issued our decision in *California Oak*. As noted above, we directed the trial court to issue a writ of mandate compelling the City to decertify its EIR for Gate King's proposed project on the ground that the EIR's discussion of the subject of water supplies was inadequate, and compelling the City to recertify an EIR after it had complied with CEQA.

In spring 2006, before the adequacy of the City's EIR for Gate King's proposed project had been resolved, CWIN and NCWD agreed on a stipulation for judgment in their parallel annexation case. On June 1, 2006, the trial court entered a judgment on the parties' stipulation. The judgment provided that the trial court would issue a peremptory writ of mandate commanding NCWD to set aside its WSA for the annexation of the Gate King site, and to stay all proceedings to annex the Gate King site, until such time as the City recertified its EIR for Gate King's proposed project in compliance with *California Oak*, and NCWD then "considered the project based on the City['s] certified EIR."

As noted above, the City certified its EIR/FAA for Gate King's proposed project in July 11, 2006. On July 13, 2006, NCWD adopted a resolution approving the City's EIR/FAA, and reaffirming NCWD's annexation of the Gate King site.

In October 2006, NCWD filed a return to the trial court's peremptory writ of mandate in which it requested an order discharging the trial court's writ, and dismissing CWIN's case. Broadly summarized, NCWD's return argued that the trial court's writ should be discharged because CWIN had complied with the writ's command to consider Gate King's project based on the City's recertified EIR/FAA. In November 2006, CWIN filed an objection to the return.

In June 2007, CWIN's objections to NCWD's return were argued to the trial court (on the same day that SCOPE's contentions were argued regarding the adequacy of the City's recertified EIR/FAA). On August 15, 2007, the trial court issued a statement of decision in which it ruled that NCWD had not violated CEQA by incorporating the City's environmental findings regarding Gate King's project. It followed, concluded the court, that its writ should be discharged, and that CWIN's petition should be dismissed.

On September 5, 2007, the trial court entered a formal order discharging its peremptory writ of mandate, and dismissing CWIN's petition.

In November 2007, CWIN filed a timely notice of appeal. (case No. B203781.)

VI. The Consolidation of the Appeals

In January 2008, the Newhall County Water District (NCWD) filed a motion in our court, asking us to consolidate SCOPE's appeal in the *California Oak* case involving the City's EIR/FAA (case No. B203782), and CWIN's appeal in its parallel annexation-related case (case No. B203781). In February 2008, we granted the motion to consolidate the appeals.

DISCUSSION

I. The City's EIR/FAA Includes Adequate Information on the Subject of Water Supplies for the Proposed Project

Picking up where our prior opinion in *California Oak* left off, CWIN contends the City's recertified EIR/FAA for Gate King's proposed project violates CEQA because the City still has not discussed the subject of water supplies adequately.[4] More specifically, CWIN contends the City's EIR/FAA does not adequately inform the public, and/or the appropriate decision-making government officials, that DWR's still-not-yet-completed "programmatic" review of the Monterey Agreement and Monterey Amendments may "undermine" the continuing viability of the transfer of 41,000 AFY of SWP water from the Kern County Water Agency (KCWA) to the Castaic Lake Water Agency (CLWA). This omission, argues CWIN, means that the relevant decision-makers do not have an adequate understanding of the potential problems that might affect the amount of water which CLWA will receive, meaning they do not have an adequate understanding of the potential problems which CLWA may have in delivering water to the Newhall County Water District (NCWD), meaning they do have an adequate understanding of the potential problems which NCWD may have in delivering water to the Gate King project. We disagree with CWIN's contention that the City's EIR/FAA is inadequate.

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[4] Our references to CWIN include both CWIN and SCOPE, which have filed joint briefs on appeal.

A. CEQA and EIRs

As noted above, the "heart" of CEQA lies in its mandate that a government agency shall prepare an EIR before approving a proposed project which may have a significant effect on the environment. (*Laurel Heights Improvement Assn. v. Regents of University of California* (1988) 47 Cal.3d 376, 392; and see also § 21100, subd. (a).) An EIR is intended to be an *informational* document; its purpose is to provide public officials, and the public, with information regarding the potential environmental consequences that a proposed project may have on the environment, and to identify ways in which those consequences may be minimized, and to indicate alternatives to the project, including a "no project" alternative. (*California Oak, supra*, 133 Cal.App.4th at p. 1225; and see also § 21061.) Once an EIR is adequately presented, the governing agency may find that the project's environmental effects have been reasonably mitigated, and approve the project; or the agency may find that the unmitigated environmental effects of the project are outweighed by the project's benefits, and approve the project, or the agency may find the adverse environmental effects are so profound that the project should not go forward, in which case something else (or nothing else) must be done in place of the proposed project. (*California Oak, supra*, 133 Cal.App.4th at p. 1225.)

In short, "[t]he purpose of CEQA is not to generate paper, but to compel government at all levels to make decisions with environmental consequences in mind." (*Bozung v. Local Agency Formation Com.* (1975) 13 Cal.3d 263, 283.)

B. Analysis

We simply disagree with CWIN's perspective that the City's EIR/FAA for Gate King's proposed project — when viewed as an *informational* document — "never fully admits or explains" the uncertainties which may be attendant with the transfer the 41,000 AFY of water from KCWA to CLWA. In our view, CWIN is just plain wrong that the City's EIR/FAA for Gate King's proposed project fails to *disclose* — and that is the operative word — that DWR may, in preparing its new EIR for the Monterey Agreement, adopt mitigation measures which may undermine the continued availability of the transfer of the 41,000 AFY of water from KCWA to CLWA.

The City's EIR/FAA for Gate King's proposed project expressly discusses the Third District's decision in *PCL, supra*, 83 Cal.App.4th 892 — decertifying the original EIR for the Monterey Agreement — and its aftermath — DWR's pending preparation of a new EIR for the Monterey Agreement. The EIR/FAA also discusses Division Four's decision in *Friends I, supra*, 95 Cal.App.4th 1373 — decertifying the original EIR for the transfer of the 41,000 AFY of SWP water from KCWA to CLWA. The EIR/FAA also discusses our opinion in *California Oak*. And, the EIR/FAA expressly acknowledges that DWR's still-pending preparation of a new EIR for the Monterey Agreement "introduces an element of potential uncertainty" regarding the 41,000 AFY transfer of SWP water from KCWA to CLWA.

The City's EIR/FAA for Gate King's proposed project further sets forth reasons in support of the City's conclusion that DWR's still-pending preparation of an EIR for the Monterey Agreement is not expected to impact the amount of water available to CLWA vis-à-vis the transfer of the 41,000 AFY of SWP water from KCWA to CLWA.

No more is needed in an *informational* document. According to CWIN, the City's EIR/FAA for Gate King's proposed project is deficient because it does not include an "objective analysis" of the potential impacts that may follow when DWR completes its EIR for the Monterey Agreement and Monterey Amendments. We understand CWIN's arguments to embody the proposition that the City's EIR/FAA for Gate King's proposed project will not be adequate until it (1) sets forth, essentially in list form, all of the possible mitigation measures which DWR may adopt in the course of the ongoing EIR review process for the Monterey Agreement and Monterey Amendments, and then (2) sets forth the corresponding amounts of water which will be subtracted from the transfer of the 41,000 AFY of SWP water from KCWA to CLWA.

The cases cited by CWIN in support of its arguments — our decision in *California Oak, supra*, 133 Cal.App.4th 1219, and the Supreme Court's decision in *Vineyard Area Citizens for Responsible Growth, Inc. v. City of Rancho Cordova* (2007) 40 Cal.4th 412 (*Vineyard*) — do not, in our reading, support the proposition that the City's EIR/FAA for Gate King's proposed project must include the intricate specificity demanded by CWIN.

As we explained in *California Oak,* an EIR is adequate when it includes sufficient detail to enable those who did not participate in its preparation to understand and meaningfully consider the environmental issues raised by the proposed project. (See *California Oak, supra,* 133 Cal.App.4th at p. 1237, citing *Santa Clarita Organization for Planning the Environment v. County of Los Angeles* (2003) 106 Cal.App.4th 715, 721.) This standard necessarily contemplates a dose of common sense, and a rejection of the proposition that CEQA demands the inclusion of ever more information in an EIR, until the EIR itself becomes so overwhelmingly complex that it becomes essentially meaningless. We are satisfied that the City's decision-making officials were informed by the City's EIR/FAA for Gate King's proposed project that approval of Gate King's proposed project carried with it a number of potential water supply problems.

CWIN's arguments on appeal offer a well-written treatise explaining the rules governing EIRs. But CWIN's arguments then fail, in our view, to connect those rules to its claims of "inadequacy" in the present case. In other words, CWIN correctly states that CEQA jurisprudence requires an EIR to set forth adequate information upon which an agency may make an educated decision, but we see no discussion in CWIN's arguments in which it specifically offers an example of the type of information which it wants to see in the City's EIR/FAA. We see little explanation by CWIN of any possible mitigation scenario which may result from DWR's ongoing EIR review of the Monterey Agreement.

If we may take another tack, we understand CWIN to be arguing that the City's EIR/FAA for Gate King's proposed project is required to state something to this effect: "If DWR adopts _____ (with the City filling in the blank with a possible mitigation measure), then the 41,000 AFY of water from KCWD to CLWA will be diminished by _____ (with the City filling in the blank with the corresponding AFY figure)." CWIN's argument would be more convincing had CWIN explained to us even one possible mitigation measure which DWR may possibly take. We decline to accept CWIN's contention that the City is required to include something more in its EIR/FAA for Gate King's proposed project when CWIN has not offered us a

suggestion about what sort of "something more" might, in the real world, be a realistic possibility.

The City's EIR/FAA for Gate King's proposed project is now adequate.

II. The City's Conclusions Are Supported by Substantial Evidence

CWIN argues the City's recertification of its EIR/FAA for Gate King's proposed project must be vacated because the City's conclusion that the 41,000 AFY of water is reliable for planning purposes is not supported by substantial evidence. We disagree.

A. The Standard of Review

Noticeably absent from CWIN's argument is any acknowledgment of just what the concept of "substantial evidence" means in the context of judicial review of an agency's conclusions in the course of certifying an EIR. We begin our discussion of CWIN's substantial evidence claim by filling in that void.

Substantial evidence challenges in CEQA cases are resolved in the same manner as substantial evidence claims in other settings: a reviewing court, whether at trial court or on appeal, will resolve reasonable doubts in favor of the governing agency's administrative decision, and will not set aside an agency's determination on the ground that the opposite conclusion would have been equally or more reasonable. (*County of Amador v. El Dorado County Water Agency* (1999) 76 Cal.App.4th 931, 945-946, citing *Laurel Heights Improvement Assn. v. Regents of University of California, supra,* 47 Cal.3d at pp. 392-393.) In other words, an appellate court's review of the administrative record for substantial evidence in a CEQA case "is the same" as the trial court's review of the administrative record. (*Vineyard, supra,* 40 Cal.4th at p. 427.) The appellate court reviews the agency's action, not the trial court's decision, and, "in that sense appellate judicial review under CEQA is de novo" insofar as the trial court's findings are concerned, but deferential to the agency's findings where they are supported by substantial evidence. (*Ibid*.) With this standard as our guide, we turn to an examination of CWIN's claim.

B. The Evidence

The City's EIR/FAA for Gate King's proposed project includes a broad overview of the SWP, a review of the historical deliveries of SWP water to CLWA and other local contractors, and DWR's projections of SWP water supplies which will be available for delivery to CLWA (which were projected for "average/normal" conditions, and "a single dry year . . . based on a repeat of the worst-case historic hydrologic conditions of 1977," and "a multiple dry-year period . . . based on a repeat of the worst-case historic four-year drought of 1931-1934").

The City's EIR/FAA for Gate King's proposed project also includes an extensive review of the myriad of litigation arising from the Monterey Agreement and Monterey Amendments, and the transfer of 41,000 AFY from KCWD to CLWA, and includes the accurate observation that "[n]o court has ordered any stay or suspension of the Monterey Agreement pending certification of a new EIR," and that no court has ordered any stay or suspension of the 41,000 AFY from KCWD to CLWA. The City's EIR/FAA further notes (correctly) that DWR and its contracting water agencies "continue to abide by the Monterey Agreement[,] as implemented by the Amendments, as the operating framework for the SWP."

We are satisfied that the evidence summarized above supports the City's finding that the 41,000 AFY of water from KCWD to CLWA is reliable for planning purposes, and we consider CWIN's real objection not to be that there is an absence of substantial evidence in support of the City's conclusions, but that City's conclusions are, themselves, wrong. Where, as here, substantial evidence supports an agency's findings, we will not substitute our conclusions for those of the agency.

Finally, even assuming we were inclined to discard the City's conclusions, and to take it upon ourselves to make our own independent conclusions based on the evidence, our decision would be the same. Although CWIN is abstractly correct that DWR's new EIR for the Monterey Agreement/Monterey Amendments *may* (if and when feasible mitigation measures are adopted) affect the amount of SWP water which will be delivered to CLWA pursuant to the transfer of 41,000 AFY of water from KCWD, that

potentiality must be juxtaposed against what we do know for a *certainty*, and that is that DWR is not now considering whether the transfer itself is valid.[5]

We find the City reasonably concluded — based on substantial evidence — that the 41,000 AFY of SWP water from KCWD to CLWA is reliable for planning purposes.

III. Alternative Water Sources for the Project

CWIN contends the City's EIR/FAA for Gate King's proposed project violates CEQA because it fails to discuss alternative sources of water for Gate King's proposed project in the event that the transfer of 41,000 AFY of water from KCWD to CLWA becomes unavailable. CWIN's argument is based on *Vineyard, supra*, 40 Cal.4th 412. We find CWIN's reliance on *Vineyard* to be unhelpful within the framework of the case before us today.

In *Vineyard*, the Supreme Court addressed the adequacy of an EIR for a proposed mixed-use project in Sacramento County which was to be built out in phases. A group of "objectors" filed a petition for writ of mandate challenging the EIR. The essential issue presented by the objectors' contentions was that, while the EIR may have adequately evaluated an initial phase of development, it was nonetheless inadequate under CEQA because its promise of future environmental analysis as each phase was to be built side-stepped the County's obligation to disclose and consider at the outset the environmental impacts of supplying water to the entire planned development. (*Vineyard, supra*, at p. 427.)

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[5] In this respect, we note Judge Chalfant's conclusions in the CEQA case involving the transfer itself (L.A. Super. Ct. No. BS098724): "Under contract and validation law, the Kern water transfer contract, entered into in 1999, is valid, has been approved by DWR, and Castaic has paid . . . for it. . . . DWR [cannot] terminate the Kern transfer contract. Nothing in CEQA permits a public agency to void a contract. . . . [¶] Thus, in evaluating the environmental effects of the Monterey Agreement, DWR may impose mitigations that are legal. But it cannot invalidate the Kern transfer."

The trial court denied the objectors' petition, and the Court of Appeal affirmed the trial court, but the Supreme Court reversed the Court of Appeal. Broadly summarizing its decision, the Supreme Court ruled that, while the EIR adequately discussed "near-term" water supplies for the project, it did not adequately discuss "long-term" water supplies.

Vineyard has attained a place of importance in CEQA jurisprudence insofar as the Supreme Court identified four elements which must be included in an EIR's discussion of water supplies for a proposed project that envisions development in stages: (1) the EIR must evaluate the pros and cons of supplying the amount of water that the project — in its entirety — will need; (2) the EIR cannot be limited to a discussion of the water supply which is needed for the first stages of the project's development, and cannot state that "information will be provided in the future" as new stages of development commence, (3) the future water supplies which are identified must bear an actual likelihood of being available; and (4) where it is impossible to determine confidently that future water sources will be available, CEQA requires a discussion of possible replacement water sources or alternatives. (*Vineyard, supra,* at pp. 430-432.)

The case before us today does not present a *Vineyard* problem because the full extent of Gate King's proposed industrial park project is described at the outset in the City's EIR/FAA, including the project's ultimate anticipated water consumption, and the anticipated water supplies for the project. In other words, the City's EIR/FAA for Gate King's proposed project does not limit its assessment of water supplies to a "first stage" of the project, with a mere promise of "further analysis" for later stages of the project. We see no *Vineyard* omission in the City's EIR/FAA for Gate King's proposed project.

IV. The CalSim-II Model

As noted above, the City's EIR/FAA for Gate King's proposed project relies on water supply projections from DWR. Those projection are based on data derived from a computer model used by DWR for predicting future availability of water supplies from the SWP — the so-called "CalSim-II model." CWIN contends the City's EIR/FAA for

Gate King's proposed project violates CEQA because the City's discussion and analysis of the CalSim-II model is inadequate. Again, we disagree.[6]

A. The Discussion of the CalSim-II Model

As noted above, the CalSim-II model is a computer program developed and used by DWR to predict future availability of SWP water. This is the information that the City disclosed about the CalSim-II model in the EIR/FAA for Gate King's proposed project:

> "Comments submitted on the [draft additional analysis for the EIR for Gate King's proposed project] state that the CalSim-II computer model is flawed, and provide articles and other attachments that are critical of DWR's use of the CalSim-II model, pointing out that '[a]ll of [the] documents [provided] clearly lay out the problems for anyone who wants to rely on CalSim-II as the predictor of reliability for the SWP.' . . . [O]ther comments . . . have criticized DWR's reliance upon the CalSim-II model, claiming that the model overstates the amount of water the SWP can deliver during average and dry years. Those comments rely on the . . . decision [to grant a preliminary injunction in *Planning and Conservation League v. United States Bureau of Reclamation* (N.D.Cal. Feb. 15, 2006, No. C 05 – 3527 CW)] as authority for limiting future SWP water deliveries because of flaws in DWR's CalSim-II model. The City . . . is aware of the criticisms leveled against DWR's CalSim-II model, including criticisms noted in the following documents:
>
> "• *A Strategic Review of CALSIM[-]II And Its Use For Water Planning, Management And Operations in Central California*, submitted to the California Bay-Delta Authority Science Program Association of Bay Governments, by A. Close, *et al*., dated December 4, 2003;
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> "• *Musings On A Model: CalSim[-]II In California's Water Community*, San Francisco Estuary and Watershed Science, Vol. 3, Issue 1 (March 2005), Article 1, by Ines C. Ferriera, *et al*;

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[6] We reject respondents' contention that CWIN's arguments regarding the CalSim-II model are barred by the "law of the case doctrine" (see, e.g., *Searle v. Allstate Life Ins. Co*. (1985) 38 Cal.3d 425, 434), and the law of this case as set forth in our prior opinion in *California Oak*. We did not address the validity of the CalSim-II model in *California Oak*. To the extent respondents seem to contend that CWIN should have raised the issue earlier, we are satisfied that CWIN had no meaningful opportunity to address the CalSim-II model until the City filed its return to the trial court's peremptory writ of mandate in 2006.

"• *An Environmental Review Of CalSim[-]II: Defining 'Full Environmental Compliance' And 'Environmentally Preffered' Formulations Of The CalSim[-]II Model*, by Jeffrey T. Payne, *et al.*, dated November 2005;

"• *Gerald Johns' Memo*, prepared by Jan de Leeuw, dated October 23, 2005; and

"• *On The Adequacy Of CALSIM[-]II For Environmental Impact Analysis And SWP Reliability Analysis*, prepared by Arve R. Sjovold, dated August 12, 2004; and *Some Insights On Water Deliveries To Settlement Contractors*, prepared by Arve R. Sjovold, dated October 24, 2004."

"Like any computer model, CalSim-II is subject to criticism, but the City has nonetheless considered DWR's view that CalSim-II is a generally well-rated and accurate model for California's two largest water projects, [the federal Central Valley Project (CVP)] and SWP. DWR has explained that:

'*CALSIM[-]II is a general water resources planning software developed by DWR. CALSIM[-]II, developed through a collaborative effort by DWR and [the United States Bureau of] Reclamation, represents a comprehensive simulation of the SWP and CVP. . . . CALSIM[-]II provides a reasonable planning level simulation of existing project operations, recognizing that the operating environment and regulatory requirements for the projects are in a constant state of transition and change. Since CALSIM[-]II is not a detailed operations model, it does not capture many of the complexities of forecasted and actual operations of project facilities. In determining suitability of these studies to a particular analysis, the user should consult all documentation that accompanies this release and the [Technical Coordination Team] and [Benchmark Study Team] as appropriate*.' [fn. omitted.]

"One of the above articles [fn. omitted.] states that:

'*The CalSim[-]II model is the most prominent water management model in California, and has become central to a variety of water management and policy issues and controversies. . . . CalSim[-]II is a complex model of a complex part of California's changing multi-purpose water system. As such, analytic controversies and misunderstandings are inevitable. . . . While CalSim[-]II is generally seen as a significant improvement over previous models, a wide variety of ideas suggested for improvements*.'

"The City further acknowledges that the CalSim-II model, like other computer models, contains several perceived strengths as well as weaknesses, several of which were noted in the article, *A Strategic Review of CALSIM[-]II And Its Use For Water Planning, Management And Operations in Central California*, [submitted to California Bay-Delta Authority Science Program Association of Bay Governments,] by A. Close,

et al., dated December 4, 2003, pp. 6-9. The City further acknowledges that CalSim[-]II is not a perfect model; no computer model is perfect. However, on balance, and after considering the various articles criticizing the CalSim-II model, the City agrees with DWR's determination that CalSim-II is a 'useful and appropriate tool for assessing the delivery capability of the SWP.' The City further believes that, despite criticisms of CalSim-II, it is still appropriate to rely on DWR for information based on the CalSim-II model, unless and until a new or updated model is known to exist and available for use.

"As stated above, other comments rely on the [federal district court's decision in *Planning and Conservation League v. United States Bureau of Reclamation, supra*] to support the claim that SWP delivery reliability is suspect, because DWR's CalSim-II model is flawed. The City does not believe that the comments properly characterize the *PCL/Bureau* decision.

"In the *PCL/Bureau* decision, the federal court issued an order granting [a] motion for a preliminary injunction . . . which enjoined construction of the 'Intertie' project until the case is decided on the merits. (The Intertie project is a proposed pipeline project that would connect the main delivery canals of two water diversion projects, the federal CVP and the state SWP, in California's Central Valley. The proposed pipeline is known as the 'Delta-Mendota Canal/California Aqueduct Intertie.' At issue is the [*PCL/Bureau* case] is the Bureau's decision to rely on [a negative declaration] for environmental review of the Intertie project under both [federal National Environmental Policy Act (NEPA)] and CEQA *in lieu* of an [Environmental Impact Study] EIS/EIR.)

"In granting the preliminary injunction, the federal court [incorporated its] . . . earlier . . . order granting [an] application for a temporary restraining order . . . In that [prior] order, the court addressed [a] claim that an EIS/EIR was required for the Intertie project because the existing environmental documents that found no significant impacts were based on CalSim-II modeling which [the plaintiff had claimed] was 'too unreliable to rule out the potential for significant impacts.' Order, p. 9. [fn. omitted.] In [addressing] that claim, the federal court did not appear concerned with the perceived shortcomings of the model, but rather the Bureau's failure to *disclose* the shortcomings. In fact, the court specifically stated that the use of CalSim-II 'alone does not show that [the Bureau] was arbitrary and capricious in reaching its finding of no significant impact.' *Id*. at p. 11.

"In short, the federal court did not prohibit the Bureau or any other agency from using or relying on the CalSim-II model, but rather, stated that the Bureau could rely on the model, provided it disclosed relevant shortcomings in the data or model . . . . Here, based on a review of the above reports, the City . . . is apprised of all known, perceived

shortcomings with DWR's CalSim-II model; nonetheless, the City believes that substantial evidence supports is conclusion that the model remains the best available data for assessing SWP operations and constraints."

B. The Discussion of the CalSim-II Model is Sufficient

We are satisfied that the City's EIR/FAA for Gate King's proposed project sets forth a sufficient discussion of the CalSim-II model, including its recognized shortcomings. In our view, the City's EIR/FAA for Gage King's proposed project is adequate because it summarizes points of disagreement regarding the CalSim-II model, and then explains the City's reasons for accepting one set of judgments instead of another. (*Association of Irritated Residents v. County of Madera* (2003) 107 Cal.App.4th 1383, 1390-1391.) A fair review and assessment of the City's EIR/FAA for Gate King's proposed project belies CWIN's contention that the City did not "describe objectively" the expert critiques of the model, and did not explain why, despite those critiques, it elected to consider the model an appropriate predictive tool. The City gave numerous examples of criticisms of the CalSim-II model, and explained that it decided to accept DWR's data based on the CalSim-II model because, for present purpose, the model provides the best available data.

We see nothing in CWIN's arguments which suggests that a better model exists, and, even assuming such a model did exist, the insurmountable problem for CWIN would remain that objections reflecting a conflict amongst conclusions do not show that an EIR is *inadequate.* (See CEQA Guidelines, section 15151 [disagreement among experts does not make an EIR inadequate].) Inadequate means an absence or omission of information needed to make an informed decision, and the City's EIR/FAA for Gate King's proposed project does not suffer from such a deficiency.

V. The State Water Resources Control Board

CWIN contends the City's EIR/FAA for Gate King's proposed project violates CEQA because its does not discuss adequately the potential impact on water supplies

which may result from DWR's compliance with an order issued by the State Water Resources Control Board (SWRCB).[7] Once more we find that CWIN is mistaken.

A. The SWRCB Order

SWRCB is authorized to issue a cease and desist order (CDO) when it determines that a government agency is violating or threatening to violate any condition of a permit or license issued by SWRCB. A CDO may only be issued after notice and an opportunity for hearing. In May 2005, SWRCB issued draft CDOs to DWR and the United States Bureau of Reclamation (USBR) regarding alleged threatened violations of their licenses and permits to divert water from the San Joaquin River and Bay Delta. The water rights granted to DWR and USBR include prescribed salinity standards for water at various specified geographic locations. As we can understand it, salinity levels of the water can be affected by diverting less water, i.e., allowing more water to remain in place, or, alternatively, by building "permanent operable barriers or other equivalent measures along with an operation plan," all designed to prevent salinity-increasing elements from accumulating in the water.

On February 15, 2006, SWRCB issued "Order WR 2006-0006" in the matter of the draft CDOs against DWR and USBR. Relevant provisions of the Order are set forth in the following paragraphs.

B. The EIR/FAA's Discussion of the Order

At about the same time that SWRCB was issuing Order WR 2006-0006, the City was circulating its draft additional analysis for the EIR for Gate King's proposed project. During the comment period on the draft additional analysis, CWIN claimed that Order WR 2006-0006 will require DWR to "shut down its pumps" in the event that prescribed

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[7] As we understand the state's organization structure, DWR and SWRCB appear to function as distinct but co-equal state agencies with possibly overlapping responsibilities. According to its official website, the SWRCB has authority (along with regional boards) over water allocation and water quality protection. According to the official website of its acting director, DWR protects, conserves and manages the state's water supply, which includes, of course, the operation of the SWP.

salinity standards for the San Joaquin River and Bay Delta are not met, and that the result will be "less water pumped to Southern California."

The City's EIR/FAA for Gate King's proposed project provides the following information on Order WR 2006-0006:

> "In . . . Order WR 2006-0006, [SWRCB] issued a cease and desist order requiring . . . DWR and [USBR] to take corrective action under a time schedule to correct threatened violations of their permits and license. *SWRCB Order*, p. 1. Their permits and license require DWR and [USBR] to meet salinity objectives at three locations in the southern Delta between April 1 and August 31 of each year. . . . Starting April 2006, [SWRCB] is now requiring DWR and [USBR] to meet the adopted salinity standards . . . , but not immediately. Instead, it allows the two agencies until July 1, 2009, to meet the adopted salinity objectives. *Id*. at p. 28-29. This is the date by which the agencies now predict completion of a 'permanent barriers project or equivalent measures' that will enable the agencies to meet the salinity objectives. In the interim, the two agencies are required to provide [SWRCB] Board with a detailed plan and schedule for compliance with the conditions set forth in the Order. *Id*. at p. 29-30.
>
> "In the event that DWR or [USBR] project a potential exceedance in the salinity objectives prior to July 1, 2009, the two agencies are required to immediately inform [SWRCB] of the potential exceedance, and describe the corrective actions they are initiating to avoid the exceedance. *Id.*, p. 30. The 'corrective actions' may include, but are not limited to 'additional releases from upstream [CVP] facilities or south of the Delta [SWP] or CVP facilities, modification in the timing of releases from Project facilities, reduction in exports, recirculation of water through the San Joaquin River, purchases or exchanges of water under transfers from other entities, modified operations of temporary barriers, reductions in highly saline drainage from upstream sources, or alternative supplies to Delta farmers (including overland supplies).' *Id.*
>
> "In response to comments, [SWRCB] determined that DWR and [USBR] were partially responsible for the salinity problems at certain locations because of export pumping. Decision 1641, which allocated the responsibility for implementing the salinity objectives of the 1995 Bay-Delta Plan, noted that the implementation of a 'barrier program' could help improve salinity concentrations and that DWR and [USBR] were working together on such a program. (*State Water Resources Control Board Cases* (2006) 136 Cal.App.4th 674, 711.) To the extent that the comment letters on the Gate-King Industrial Park Additional Analysis infer that meeting the salinity objectives will necessarily result in less water to pump to southern California, such an assumption is not accurate because it assumes that the

only way to control salinity is to reduce export pumping. While the reduction of exports is listed as one means of improving salinity concentrations, it is only one of many such methods. As noted above, implementation of a barrier program is another means for improving salinity concentrations and, in fact, DWR and the [USBR] are working on such a program. In addition, the Order itself emphasizes that constructing permanent barriers is not the exclusive method for compliance with the salinity objectives, and that additional potential corrective actions to avoid potential exceedance of the salinity objectives include actions such as additional releases from upstream CVP facilities or south of the Delta SWP or CVP facilities, modifications in the timing of releases from Project facilities, reduction in exports, purchases or exchanges of water under transfers from other entities, modified operations of temporary barriers, and several other options. *Id*. pp. 23, 30.

"Thus, the assertion in comments submitted on the Gate-King Industrial Park Additional Analysis that DWR and [USBR] must 'shut down their pumps if the salinity standards are not met' is not accurate. [SWRCB]'s amended approval of the 'Water Quality Response Plan' (WQRP) requires that DWR and [USBR] be in compliance with the conditions contained in their permits and license, including salinity objectives, in order to enable 'joint points of diversion' (JPOD) operations, and orders that JPOD operations must cease if such conditions are not met. Hence, if the salinity objectives are not met, DWR and [USBR] may not conduct JPOD operations. However, this means that they are only restricted from use of *one another's* facilities – they are not restricted from using their *own* facilities. As such, DWR and [USBR] are not being ordered to 'shut down their pumps.' *Id.*, pp. 25, 32-33.

"As to the Board's Order that DWR and [USBR] take corrective actions under a time schedule to correct threatened violations of their permits and license in order to meet the salinity objectives, it is true that a complete failure to meet the salinity requirements by the time schedule (July 1, 2009) could result in further action by the Board. However, the Order encourages communication by requiring DWR and [USBR] to submit plans and schedules detailing how DWR and [USBR] intend to meet the objectives, periodic updates and progress reports, and notification of the Board if DWR and the [USBR] anticipate a potential exceedance of the salinity objectives, or if an exceedance has occurred. *Id.*, p. 29-31. The Order states that in the event of an exceedance, the Executive Director will *make a recommendation* to [SWRCB] *regarding whether to take enforcement action. Id.*, p. 30. In deciding *whether* to initiate enforcement action, the Executive Director must consider the extent to which the non-compliance was beyond DWR's or [USBR]'s control and the actions taken to correct the exceedance. *Id.*

> "Lastly, the Order provides that upon the failure . . . to comply with the requirements contained in the Order (by July 1, 2009), [SWRCB] Board may request the Attorney General to petition the Superior Court for injunctive relief, as appropriate. *Id.*, pp. 28-32. [SWRCB] also may issue monetary fines. *Id.*, p. 32. However, nowhere does the Order mandate that DWR and [USBR] shut down their pumps."

C. Analysis

In the light of the discussion reproduced above, we reject CWIN's argument that the City's EIR/FAA for Gate King's proposed project "does not provide any discussion or analysis from which the reader could decide the likelihood that meeting the salinity standards will in fact result in a reduction in [SWP] deliveries." Far from not providing "any discussion," the City's EIR/FAA for Gate King's proposed project contains an extensive discussion, and states the City's reasons for its conclusion that there is limited likelihood that measures taken by DWR and USBR to meet salinity standard will reduce SWP deliveries to CLWA.

As with its previous arguments, CWIN's assertions begin with abstractly correct assertions that information must be provided in an EIR, but then just seem to ignore that the City's EIR/FAA does contain information from which the decision-makers could make a reasoned decision on Gate King's proposed project.

VI. The Trial Court' Analysis of NCWD's Annexation Resolution

A. The Resolution

On July 11, 2006, the City recertified its EIR/FAA for Gate King's proposed project. Two days later, on July 13, 2006, the Newhall County Water District (NCWD) adopted a resolution approving the annexation of the Gate King site into NCWD's service territory. Section 2 of NCWD's resolution recites a finding by NCWD to the effect that City had then-recently recertified an EIR which complied with our decision in *California Oak* (i.e., the EIR/FAA), and that, for this reason, NCWD then considered it "appropriate" to annex the Gate King site "based on the [re]certified EIR."

B. The Trial Court's Decision on the Annexation

On August 15, 2007, the trial court entered its statement of decision in which it rejected CWIN's challenges to NCWD's annexation of the Gate King site. The trial court's order expresses the court's conclusion that NCWD — in making its annexation decision — had been required to presume that the City's EIR/FAA complied with CEQA. In other words, the trial court ruled that, for purpose of annexing the site of Gate King's proposed project, NCWD could not independently determine for itself whether the City's EIR/FAA was adequate or inadequate. That determination, the trial court explained, had to be made in a "single forum," i.e., in the context of SCOPE's parallel case directly challenging the City's EIR/FAA for Gate King's proposed project.

C. CWIN's Claim on Appeal

On appeal, CWIN contends the trial court "got it wrong," and that it should have required NCWD to "reach its own conclusions" on the adequacy of the City's EIR/FAA. Although we tend to agree with respondents that "[t]he purpose of [CWIN's] argument is not clear," we construe CWIN to argue that NCWD's reliance on the City's EIR/FAA in July 2006 (when NCWD approved its annexation resolution) must be "undone," and that this means that NCWD should also undo anything and everything which it has already has done in the annexation process, and that NCWD should then start all over again after making its owns determination on whether or not the City's EIR/FAA is adequate. In other words, we understand CWIN to be arguing either (1) NCWD "jumped the gun" by relying on the City's EIR/FAA before it had been approved by the trial court upon the City's return, or (2) NCWD had its own duty to review and pass the City's EIR/FAA for adequacy, and that NCWD did not fulfill that duty. It appears to be CWIN's position (in either event) that NCWD must go back to square one, and that approval of Gate King's proposed project must be delayed accordingly.

D. Analysis

Assuming that CWIN contends NCWD 'jumped the gun" by relying on the City's EIR/FAA prior to judicial review, we find the issue is moot. The trial court approved the City's EIR/FAA, and, for the reasons explained above, we have affirmed the trial court's decision.

Assuming that CWIN contends NCWD had a duty, independent of the trial court's jurisdiction, to review and determine the adequacy of the City's EIR/FAA, we disagree. Section 21167.3, subdivision (b), provides: "In the event that an action or proceeding is commenced [alleging an EIR does not comply with CEQA], but no injunction or similar relief is sought and granted, responsible agencies *shall* assume that the [EIR] . . . for the project does comply with [CEQA] and shall approve or disapprove the project according to the timetable for agency action [prescribed in the Government Code]. Such approval shall constitute permission to proceed with the project at the applicant's risk pending final determination of such action or proceeding [challenging the EIR for the project]."

We agree with NCWD that section 21167.3, subdivision (b), says what it says. A responsible agency must use the EIR prepared by the lead agency, even if the responsible agency believes that the EIR is inadequate. (See *Central Delta Water Agency v. State Water Resources Control Bd*. (2004) 124 Cal.App.4th 245, 274.) A responsible agency with permit authority, however, must still reach its own conclusions on whether and how to approve of the project, regardless of the lead agency's approval the project. (*Ibid*.) We see no error in the trial court's analysis insofar as the determination of the adequacy of the City's EIR/FAA is concerned. We can now turn to CWIN's attacks on NCWD's findings and conclusions.

VII. NCWD's Findings

CWIN contends NCWD violated CEQA and the CEQA Guidelines when it passed its resolution approving the annexation of the Gate King site into NCWD's service territory. More specifically, CWIN contends that NCWD violated CEQA and the CEQA Guidelines in two respects: first, NCWD should not have "incorporated" the City's findings regarding the significant environment effects identified in the City's EIR, and

should not have "incorporated" the City's statement of overriding considerations in favor of Gate King's proposed project, and second, NCWD should have made its own findings, and adopted its statement of overriding considerations. For the most part, the two challenges are corollaries of each other. We find no error in either respect.

A. NCWD's Resolution

Section 3 of NCWD's resolution is entitled "Environmental Impact Findings Required by CEQA." Section 3 sets forth NCWD's finding that the City's EIR/FAA for Gate King's proposed project "identifies and discloses project-specific impacts . . . ." Section 3 also sets forth NCWD's finding that Gate King's proposed project will result in potentially significant environmental impacts, but that the City has imposed mitigation measures and/or changes to the project which the City has determined will eliminate the impacts or reduce them to a level of less significance. Section 3 of NCWD's resolution also includes the following provision which gives rise to CWIN's claim that a responsible agency such as NCWD violates CEQA when it "incorporates" a lead agency's findings:

> "Although . . . NCWD lacks jurisdiction over most of the issues covered in the City's CEQA findings contained in the City's [resolution certifying the EIR for Gate King's proposed project, NCWD now] incorporate[s] by reference, as though fully set forth herein, the City's findings with respect to all significant environmental effects identified in the EIR, including those related to Land Use and Planning, Geology, Hydrology and Water Quality, Air Quality, Transportation and Circulation, Biological Resources, Noise, Human Health and Safety, Public Services, Public Utilities, Aesthetics, Cultural Resources, and Recreation."

B. The CEQA Guidelines

Article 7 of the CEQA Guidelines (§§ 15080–15097) governs the "EIR Process." Broadly summarized, sections 15080 through 15090 prescribe the rules with which the "Lead Agency" for a proposed project must comply during the process of preparing and certifying an EIR for the project.

Section 15091 prescribes the "Findings" which are required in the EIR process. Section 15091(a) provides: "No public agency shall approve or carry out a project for which an EIR has been certified which identifies one or more significant environmental effects of the project unless the public agency makes one or more written findings for each of those significant effects, accompanied by a brief explanation of the rationale for each finding. The possible findings are: [¶] (1) Changes or alterations have been required in, or incorporated into, the project which avoid or substantially lessen the significant environmental effects identified in the final EIR. [¶] 2. Such changes or alterations are within the responsibility and jurisdiction of another public agency and not the agency making the finding. Such changes have been adopted by such other agency or can and should be adopted by such other agency. [¶] 3. Specific economic, legal, social, technological, or other considerations, including provision of employment opportunities for highly trained workers, make infeasible the mitigation measures or project alternatives identified in the final EIR."

CEQA Guidelines section 15092 prescribes the rules governing the Lead Agency's approval of the project; section 15093 governs the Lead Agency's approval of the project with a statement of overriding considerations; section 15094 prescribes the rules under which the Lead Agency files its notice of determination with the appropriate authority; and section 15095 governs the Lead Agency's disposition of a final EIR.

CEQA Guidelines section 15096 specifically addresses the responsibilities of a "Responsible Agency" in the EIR Process. Unfortunately, the section is not a model of internal consistency.

Section 15096(a) provides: "A Responsible Agency complies with CEQA by considering the EIR . . . prepared by the Lead Agency *and by reaching its own conclusions on whether on how to approve the project involved. . . .*" At the same time, however, section 15096(g)(1) states that, "[w]hen considering alternative and mitigation measures, a Responsible Agency is more limited than a Lead Agency. A Responsible Agency has responsibility for mitigating or avoiding only the direct or indirect environmental effects *of those parts of the project which [the Responsible Agency]*

decides to carry out, finance, or approve," and section 15096(g)(2) provides that "the Responsible Agency shall not approve the project as proposed if [it] finds any feasible alternative or feasible mitigation measures *within its powers* that would substantially lessen or avoid any significant effect the project would have on the environment." (Emphasis added.) And then there is section 15096(h), which provides that "[t]he Responsible Agency *shall make the findings required by Section 15091 for each significant effect of the project . . . .*" (Emphasis added.)

C. The CEQA Guidelines Interpreted

We agree with the trial court that the most reasonable interpretation to be given to section 15096's provisions is as follows: section 15096(h)'s mandate that a Responsible Agency must make findings for each significant effect of a proposed project must itself be read in conjunction with section 15096(g), limiting the authority and responsibility of a Responsible Agency to avoid or mitigate only the environmental effects of those parts of the project which the Responsible Agency decides to carry out, finance, or approve. In short, CEQA Guidelines section 15096 requires a Responsible Agency to make findings about alternatives and mitigation measures only in connection with those environmental effects over which it has the jurisdiction to impose alternatives or mitigation measures. Otherwise, the CEQA Guidelines would require a Responsible Agency to make findings regarding matters over which it could no nothing. We decline to interpret the CEQA Guidelines to require such a pointless exercise.

D. NCWD Did Not Violate CEQA by Incorporating the City's Findings

CWIN contends NCWD violated CEQA and CEQA Guidelines section 15091 by "incorporating" the City's findings, instead of independently "adopting" its own findings. We disagree.

CWIN's argument rests (incorrectly) on the predicate that NCWD was required in the first instance to adopt findings regarding the potential adverse environmental impacts identified in the EIR for Gate King's proposed project. We agree with the trial court that NCWD did not have such an obligation, and adopt its reasoning. NCWD acted as a responsible agency for the Gate King project, and, as such, its discretionary authority was

limited to the annexation of the Gate King project into NCWD's service territory, so that NCWD could provide water service to the project. CEQA provides that a responsible agency is responsible for considering only the effect of those activities involved in a project which the agency is required by law to carry out or approve.

NCWD's resolution correctly stated that the City's EIR/FAA for Gate King's proposed project indentified significant effects in the area of air quality, biology, solid waste, and aesthetics. And NCWD's resolution further correctly stated that mitigation measures and alternatives in those areas were the authority and responsibility of the City as lead agency, and not NCWD, whose jurisdictional authority extended only insofar as the annexation of the project site was concerned. Under these circumstances, NCWD did not have a duty to make findings on those issues which were within and under the City's area of control, and thus, cannot be found to have acted inappropriately when it "incorporated" the City's findings. In other words, NCWD's incorporation of the City's findings was, for the most part, a superfluous act, not an act in violation of CEQA.

The bottom line is that the part of the "project" with which NCWD was concerned was the annexation of the Gate King site into NCWD's service territory. It makes no sense in our view to require NCWD to make findings with regard to alternatives and/or mitigation measures which may reasonably be imposed upon Gate King's proposed project when NCWD did not have control over such matters.

E. NCWD Did Not Have a Duty to Make Its Own Independent Findings

In a variation on its "incorporation" theme, CWIN contends NCWD violated CEQA Guidelines section 15091 because it did not make its own independent findings related to the potential adverse environmental impacts posed by Gate King's proposed project. For the reasons explained above, we disagree.

Although NCWD perhaps could have included in its resolution a specific finding that the City's EIR did not identify any project-related environmental impacts associated with NCWD's annexation of the Gate King site into NCWD's service area, we decline to undo the annexation process for no other purpose than to accommodate that technicality. The omitted finding, if any, plainly did not result in any harm under CEQA. By noting

the environmental effects that are attendant with Gate King's proposed project, NCWD's resolution implicitly notes that no other effects pose a significant environmental threat. In short, we find NCWD's findings to be sufficient.

F. NCWD Was Not Required to Adopt an Independent Statement of Overriding Considerations

Section 5 of NCWD's resolution states: "Changes or alternatives to address the significant and unavoidable impacts of the project related to air quality, biology, solid waste, and aesthetics are within the responsibility and jurisdiction of the City . . . , the lead agency under CEQA. NCWD finds that with respect to these impacts, the City has adopted a statement of overriding considerations, which NCWD incorporates herein by reference. Because the [EIR/FAA] identified no significant and unavoidable impacts of the project within the jurisdiction and responsibility of . . . NCWD, no additional statement of overriding considerations is required."

CWIN's objection to NCWD's incorporation of the City's statement of overriding considerations does not include a challenge to the City's decision itself. In other words, CWIN does not dispute that the City obeyed the procedural requirements of CEQA when it decided that the benefits of the project outweigh its environmental impacts. Given this context, we see no showing of harm in NCWD's "incorporation" of the City's statement of overriding considerations. Assuming, NCWD should have included a finding in its resolution to the effect that NCWD itself found that the benefits of the annexation were outweighed by environmental impacts, we find this omission, if any, did not cause any harm under CEQA.

To the extent that CWIN seems to contend that NCWD did not evaluate the City's findings or its statement of overriding considerations, we reject CWIN's claim. NCWD's resolution expressly represents that the City presented its EIR/FAA to NCWD, and that NCWD reviewed and considered the information contained in the City's EIR/FAA. The resolution further states that NCWD's decision to approve the annexation of the Gate King site reflected the independent judgment and analysis of NCWD. In short, NCWD did consider the City's findings and statement of overriding considerations before

incorporating/adopting them. In the absence of evidence to the contrary, we will not presume that NCWD simply rubber-stamped the City's findings and statement of overriding considerations. (Evid. Code, § 664.)

In the final analysis, we see no purpose to be served in requiring NCWD to expend scrivener's ink and paper to restate in rote findings with which it agrees and has adopted after due consideration. (*Fund For Environmental Defense v. County of Orange* (1988) 204 Cal.App.3d 1538, 1552-1553.)

DISPOSITION

The judgment dated September 5, 2007, in case number BS084677, *Santa Clarita Oak Conversancy v. City of Santa Clarita*, is affirmed.

The order dated September 5, 2007, in case number BS098727, *California Water Impact Network v. Newhall County Water District*, is affirmed.

Respondents shall recover their costs on appeal.

NOT TO BE PUBLISHED IN THE OFFICIAL REPORTS

BIGELOW, J.

We concur:

RUBIN, Acting P. J.

O'NEILL, J.*

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* Judge of the Ventura Superior Court, assigned by the Chief Justice pursuant to article VI, section 6 of the California Constitution.

APPENDIX 3.18

Draft City of Santa Clarita General Plan Noise Element; February 2009

NOISE ELEMENT

DRAFT February, 2009

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NOISE ELEMENT

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NOISE ELEMENT

DRAFT – February 24, 2009

PART 1: BACKGROUND AND NOISE ISSUES

A. Purpose and Intent of the Noise Element

Noise is often defined as unwanted or undesired sound. Excessive noise levels are not only a potential annoyance but can constitute a health threat, potentially resulting in temporary or permanent hearing loss and mental distress. Physical health, psychological well-being, social cohesion, property values, and economic productivity can all be affected by excessive amounts of noise. The noise environment is an integral component of the quality of life for Santa Clarita Valley residents.

The Noise Element of the General Plan is a comprehensive program for including noise management in the planning process, providing a tool for local planners to use in achieving and maintaining land uses that are compatible with existing and future environmental noise levels. The Noise Element identifies current noise conditions within the planning area, and projects future noise impacts resulting from continued growth allowed by the Land Use Element. The element identifies noise-sensitive land uses and noise sources, and defines areas of noise impact for the purpose of developing programs to ensure that residents in the One Valley One Vision (OVOV) area will be protected from excessive noise intrusion. As development proposals are reviewed in the future, the City and County will evaluate each proposal with respect to the Noise Element to ensure that noise impacts are reduced through planning and project design. Through implementation of the policies and programs of the Noise Element, current and future adverse noise impacts will be reduced or avoided in order to protect the general health, safety, and welfare of the community.

B. Background

The issues in the Noise Element include those set forth in California Government Code Section 65302(f), which requires that the Noise Element of the General Plan "identify and appraise noise problems in the community." Noise Elements are required to address noise generated from highways and freeways, arterials and major streets, rail operations and transit, aviation and airports, industrial plants, and other stationary noise sources. Noise contours must be shown for all these sources, and the noise contours are to be used as a guide for establishing a pattern of land uses that minimizes the exposure of residents to excessive noise. The California Office of Planning and Research has developed guidelines to assist local agencies in the development of a Noise Element. This Noise Element has been prepared in conformance with the State's General Plan Guidelines and Government Code requirements. The Element quantifies the community noise environment in terms of noise exposure contours for both near and long-term levels of growth and traffic activity.

The Noise Element is directly related to the Land Use and Circulation Elements, because traffic on highways and arterial roadways has been identified as a major source of noise that has the potential to affect sensitive land uses. Within the context of a noise analysis, sensitive land uses are those in which persons occupying the use are particularly sensitive to the effects of noise, including housing, schools, medical facilities, libraries, social care facilities, and similar facilities. The Noise Element contains policies that are intended to protect sensitive land uses

from noise that exceeds recommended levels. Analysis of noise from mobile sources, including traffic on streets and highways, airport activity, and rail operations, has been completed for the Noise Element based on projected traffic volumes identified in the Circulation Element. The Noise Element is consistent with policies of the Safety Element and Housing Element because it contains policies and guidelines designed to protect residents from noise exceeding recommended levels. The Noise Element is also consistent with the Conservation and Open Space Element, because policies in the Noise Element address noise compatibility between sensitive receptors adjacent to parks, sports and recreation uses, and entertainment centers.

The City of Santa Clarita adopted a Noise Element as part of the first comprehensive General Plan on June 25, 1991, and subsequently amended the Noise Element on May 23, 2000. The 2000 Noise Element contained guidelines for acceptable noise levels in residential, commercial, and industrial areas, along with goals and policies designed to protect residents from excessive noise levels. The City has also adopted provisions in the Municipal Code establishing noise standards for various uses and circumstances. Chapter 11.40 of the City's Municipal Code contains restrictions on "noisy street hawking and advertising." Chapter 11.44 (the City's Noise Ordinance) establishes noise limits for residential, commercial and manufacturing zones during daytime and nighttime hours, and addresses noise from machinery, construction, and amplification equipment. The stated purpose of this code section is, in part, "to prohibit unnecessary, excessive and annoying noises from all sources," and the ordinance contains provisions for enforcement and violations.

The Board of Supervisors adopted the first Noise Element for Los Angeles County in 1974. In 2009, the County of Los Angeles adopted an updated Countywide General Plan, including the Noise Element, which contains policies and guidelines for noise applicable to all unincorporated areas within the County. The County also regulates noise in Chapter 12.08 of the County Code, which sets forth acceptable exterior noise levels for noise sensitive areas and for residential, commercial, and industrial uses within the County's jurisdiction. The County's first noise control ordinance was adopted in 1977. In 2001, the County amended Title 13 of the County Code to prohibit loud, unnecessary and unusual noise that disturbs the peace or quiet of any neighborhood. In addition to these Countywide provisions, local communities throughout the County may address local noise concerns in their individual area plans. Within unincorporated portions of the Santa Clarita Valley, noise policies will be adopted through the Santa Clarita Valley Area Plan, developed in conjunction with the One Valley One Vision planning effort by the City of Santa Clarita and the County of Los Angeles.

This Noise Element update was prepared in conjunction with a noise analysis and technical report prepared by Mestre Greve Associates, a noise consultant retained to assist with the element. Their final report, entitled *One Valley One Vision Noise Element of the General Plan (Technical Appendix),* was used as the primary reference and is included as an appendix to the element. This Technical Appendix contains detailed information on the methodology, analysis, and sources of information referenced in the Noise Element.

C. Fundamental Concepts for Noise Analysis

This section of the Noise Element presents background information on the characteristics of noise, in order to provide an understanding of how noise levels are measured for planning purposes.

Sound Level and Frequency

Sound is produced when an action causes air pressure to vibrate in all directions around the source, similar to waves produced in a pond when a stone is thrown into the water. When people hear sounds, they are actually detecting the changes in air pressure on their eardrums. Sound can be described technically in terms of the sound pressure (amplitude) and frequency (similar to pitch). Sound pressure is a direct measure of the magnitude of a sound without consideration for other factors that may influence its perception.

The range of sound pressures that occur in the environment is so large that it is convenient to express these pressures as sound pressure levels on a logarithmic scale, which compresses the wide range of sound pressures to a more usable range of numbers. The standard unit of measurement of sound is the decibel (dB), which describes the pressure of a sound relative to a reference pressure.

The frequency (pitch) of a sound is expressed as Hertz (Hz), or cycles per second. The normal audible frequency for young adults is 20 Hz to 20,000 Hz.[1] Community noise, including aircraft and motor vehicles, typically ranges between 50 Hz and 5,000 Hz. The human ear is not equally sensitive to all frequencies, with some frequencies judged to be louder for a given signal than others. As a result of this, various methods of frequency weighting have been developed. The most common weighting is the A-weighted noise curve (dBA). The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted decibel, everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale. Examples of various sound environments, expressed in dBA, are presented in Exhibit N-1.

Propagation of Noise

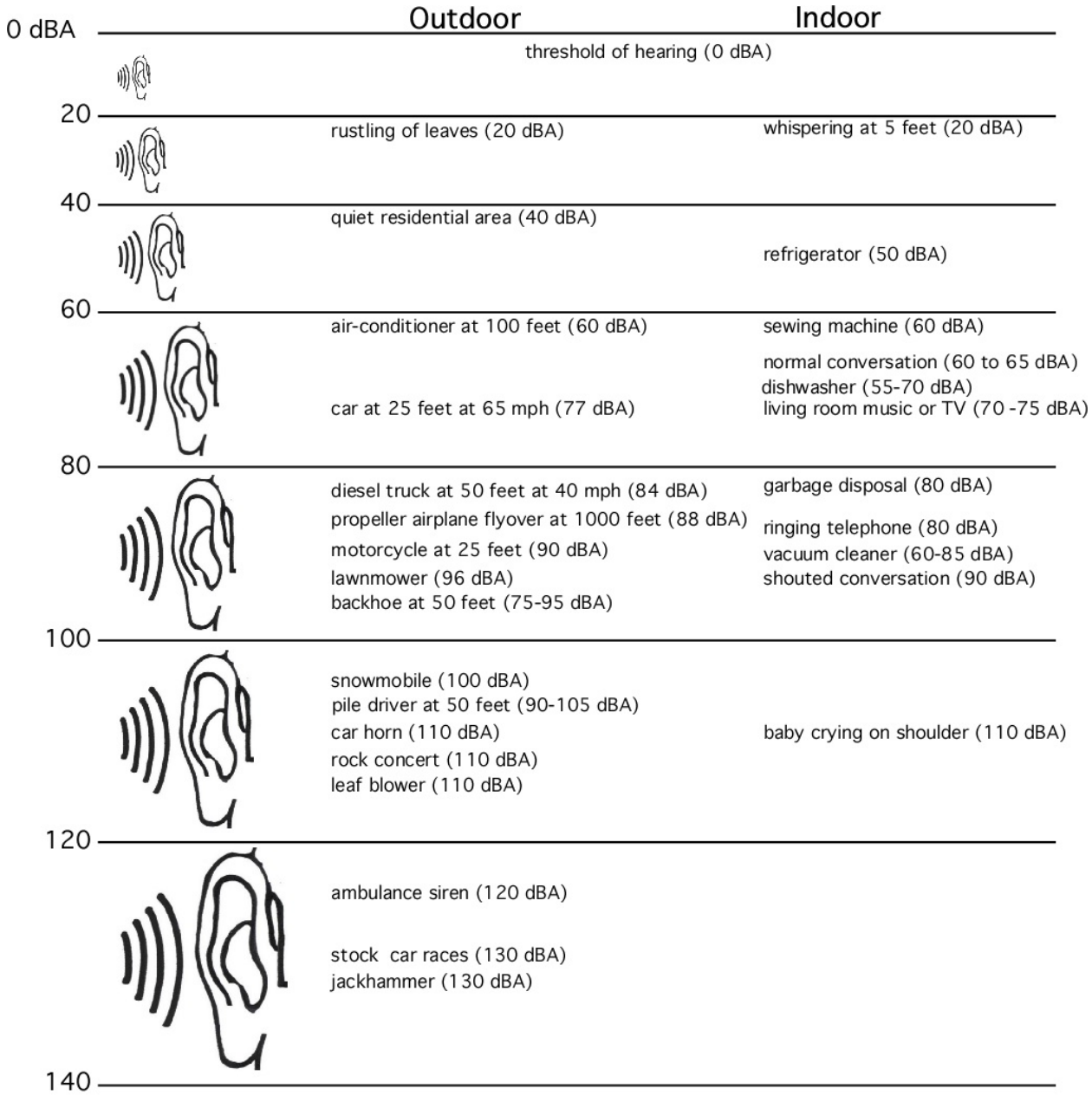
Outdoor sound levels decrease as the distance from the source increases, and as a result of wave divergence, atmospheric absorption, and ground attenuation. Sound radiating from a source in a homogeneous and undisturbed manner travels in spherical waves. As the sound wave travels away from the source, the sound energy is dispersed over a greater area, decreasing the sound power of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance.

Atmospheric absorption also influences the sound levels received by the observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations in sound. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption varies depending on the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest (i.e., sound carries farther) at high humidity and high temperatures. Turbulence and gradients of wind, temperature, and humidity also play a role in determining the degree of sound attenuation. Certain conditions, such as air temperature inversions, can channel or focus the sound waves, resulting in higher noise levels than would result from simple spherical spreading. Absorption effects in the atmosphere vary with frequency, with higher frequencies more readily absorbed than lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated. More information on atmospheric conditions

[1] Young adults are considered a good baseline population for measuring normal hearing, because hearing is typically at its best within this group and deteriorates with age.

affecting the noise environment is included the Technical Appendix. However, for purposes of land use planning based on consideration of the effects of continuous noise sources, local weather conditions are typically not a factor in land use decisions because they are changeable and intermittent.

Exhibit N-1: Typical Sound Levels in A-Weighted Decibels



Sources: League For The Hard Of Hearing, www.lhh.org
Handbook of Noise Control, McGraw Hill, Edited byCyril Harris, 1979
Measurements by Mestre Greve Associates

Duration of Sound

Annoyance from a noise event increases with increased duration of the noise event; in general, the longer the noise event lasts, the more annoying it is. The "*effective duration*" of a sound is the time between when a sound rises above the background sound level until it drops back below the background level. Psycho-acoustic studies have determined the relationship between duration and annoyance, and the amount that a sound must be reduced in order to be judged equally annoying for an increased duration. Duration is an important factor in describing sound in a community setting.

The relationship between duration and noise level is the basis of the equivalent energy principal of sound exposure. Reducing the *acoustic energy* of a sound by one half results in a 3 dB reduction. Doubling the *duration* of the sound increases the total energy of the event by 3 dB. This equivalent energy principal is based on the premise that the potential for a noise to impact a person is dependent on the total acoustical energy content of the noise. Defined in subsequent sections of this element, noise metrics such as CNEL, DNL, LEQ and SENEL are all based on the equal energy principle.

Change in Noise

The concept of change in ambient sound levels can be understood with an explanation of the receptor's reaction to sound. The human ear is a far better detector of relative differences in sound levels than absolute values of levels. Under controlled laboratory conditions, listening to a steady unwavering pure tone sound that can be changed to slightly different sound levels, a person can just barely detect a sound level change of approximately one decibel for sounds in the mid-frequency region. When ordinary noises are heard, a young healthy ear can detect changes of two to three decibels. A five-decibel change is readily noticeable, while a 10 decibel change is judged by most people as a doubling or a halving of the loudness of the sound. It is typical in environmental documents to consider a 3 dB change as potentially discernable.

Masking Effect

The tendency for one sound to limit a listener from hearing another sound is known as the masking effect. The presence of one sound effectively raises the threshold of audibility for the second sound. For a signal to be heard, it must exceed the threshold of hearing for that particular individual *and* exceed the masking threshold for the background noise.

The masking characteristics of sound depend on many factors, including the spectral (frequency) characteristics of the two sounds, the sound pressure levels, and the relative start time of the sounds. Masking effect is greatest when the frequencies of the two sounds are similar or when low frequency sounds mask higher frequency sounds. High frequency sounds do not easily mask low frequency sounds.

Factors Influencing Human Response to Sound

Many factors influence sound perception and annoyance. These factors include not only physical characteristics of the sound, but also secondary influences such as sociological and external factors. Molino, in the *Handbook of Noise Control,* describes human response to sound in terms of both acoustic and non-acoustic factors. These factors are summarized in Table N-1.

Table N-1: Factors Affecting Human Response to Noise

Primary Acoustic Factors	• Sound level • Frequency • Duration
Secondary Acoustic Factors	• Spectral complexity • Fluctuations in sound level • Fluctuations in frequency • Rise-time of the noise • Localization of noise source
Non-Acoustic Factors	• Physiology • Adaptation and past experience • How the listener's activity affects annoyance • Predictability of when a noise will occur • Whether the noise is necessary • Individual differences and personality

Source: C. Harris, 1979

Sound rating scales are developed in reaction to the factors affecting human response to sound. Nearly all of these factors are relevant in describing how sounds are perceived in the community. Many non-acoustic parameters play a prominent role in affecting individual response to noise. Background sound, an additional acoustic factor not specifically listed, is also important in describing sound in rural settings. Researchers have identified the effects of personal and situational variables on noise annoyance, and have identified a clear association of reported annoyance and various other individual perceptions or beliefs. Thus, it is important to recognize that non-acoustic factors as well as acoustic factors contribute to human response to noise.

Sound Rating Scales

The description, analysis, and reporting of community sound levels is made difficult by the complexity of human response to sound, and the large number of sound-rating scales and metrics developed to describe acoustic effects. Various rating scales have been developed to approximate the human subjective assessment to the "loudness" or "noisiness" of a sound. Noise metrics have also been developed to account for additional parameters such as duration of sound, and the cumulative effect of multiple noise events.

Noise metrics are categorized as single event metrics and cumulative metrics. Single event metrics describe the noise from individual events, such as one aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure throughout the day. Noise metrics used in this study are described below.

Single Event Metrics

- *Frequency Weighted Metrics (dBA).* In order to simplify the measurement and computation of sound loudness levels, frequency weighted networks have obtained wide acceptance. The A-weighting (dBA) scale has become the most prominent of these scales and is widely used in community noise analysis. Its advantages are that it has shown good correlation with community response and is easily measured. The metrics used in the Noise Element are all based on the dBA scale.

- *Maximum Noise Level or Lmax* is the highest noise level reached during a noise event. For example, as an aircraft approaches, the sound of the aircraft begins to rise above ambient noise levels. The closer the aircraft gets the louder it is, until the aircraft is at its closest point directly overhead. Then as the aircraft passes, the noise level decreases until the sound level again settles to ambient levels. Such a history of a flyover is plotted at the top of Exhibit N-2. It is this metric to which people generally instantaneously respond when an aircraft flyover or a loud vehicle like a truck or motorcycle passes by.

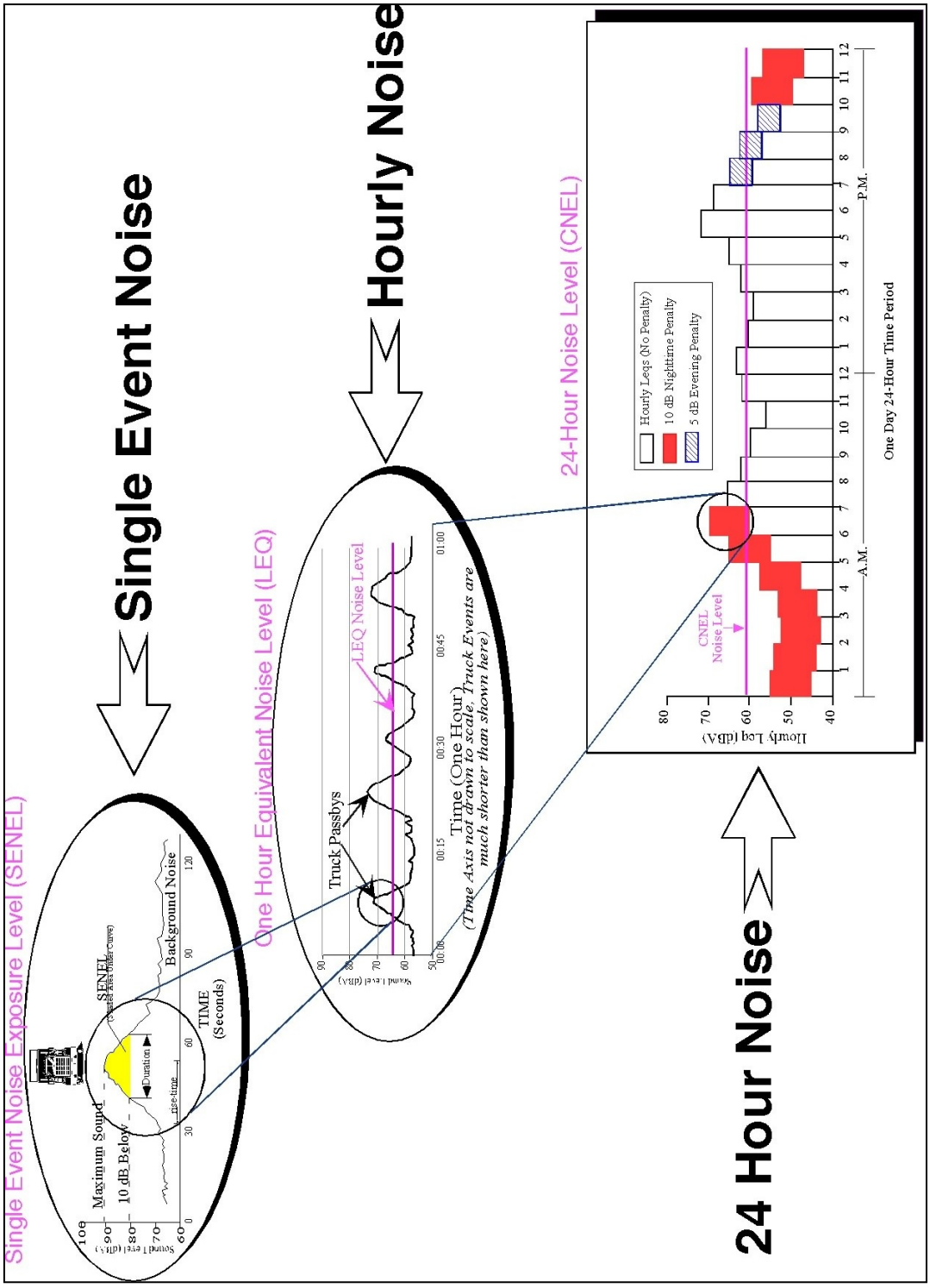
- *Single Event Noise Exposure Level (SENEL) or Sound Exposure Level (SEL)* is computed from dBA sound levels, and is used to quantify the total noise associated with an event such as an aircraft overflight or a train pass-by. Referring again to the top of Exhibit N-2, the shaded area, or the area within 10 dB of the maximum noise level, is the area from which the SENEL is computed. The SENEL value is the integration of all the acoustic energy contained within the event. Speech and sleep interference research can be assessed relative to SENEL data. The SENEL metric takes into account the maximum noise level of the event and the duration of the event. Single event metrics are a convenient method for describing noise from individual aircraft events. This metric is useful in that airport noise models contain aircraft noise curve data based upon the SENEL metric. In addition, cumulative noise metrics such as LEQ, CNEL and DNL can be computed from SENEL data.

Cumulative Metrics

Cumulative noise metrics assess community response to noise by including the loudness of the noise, the duration of the noise, the total number of noise events, and the time of day these events occur into one single number rating scale.

- *Equivalent Noise Level (Leq)* is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as several SEL events during a given sample period. Leq is the "energy" average noise level during the time period of the sample. It is based on the observation that the potential for noise annoyance is dependent on the total acoustical energy content of the noise. This is graphically illustrated in the middle graph of Exhibit N-2. Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour or 24-hours. Leq for a one-hour period is used by the Federal Highway Administration for assessing highway noise impacts. Leq for one hour is called Hourly Noise Level (HNL) in the California Airport Noise Regulations and is used to develop Community Noise Equivalent Level (CNEL) values for aircraft operations.

Exhibit N-2: Single and Cumulative Noise Metric Definitions



Source: Mestre Greve Associates, 1998

- *Community Noise Equivalent Level,* or CNEL is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. The term "time-weighted" refers to the penalties attached to noise events occurring during certain sensitive time periods. In the CNEL scale, noise occurring between the hours of 7 p.m. and 10 p.m. is penalized by approximately 5 dB. This penalty accounts for the greater potential for noise to cause communication interference during these hours, as well as typically lower ambient noise levels during these hours. Noise that takes place during the night (10 p.m. to 7 a.m.) is penalized by 10 dB. This penalty was selected to attempt to account for the higher sensitivity to noise in the nighttime, and the expected further decrease in background noise levels that typically occur in the nighttime.

  CNEL is graphically illustrated at the bottom of Exhibit N-2. Examples of various noise environments in terms of CNEL are presented in Exhibit N-3. The State's General Plan Guidelines specify the use of CNEL or Ldn by local planning agencies in preparation of the General Plan Noise Element for purposes of land use compatibility planning. This element uses CNEL for that purpose.

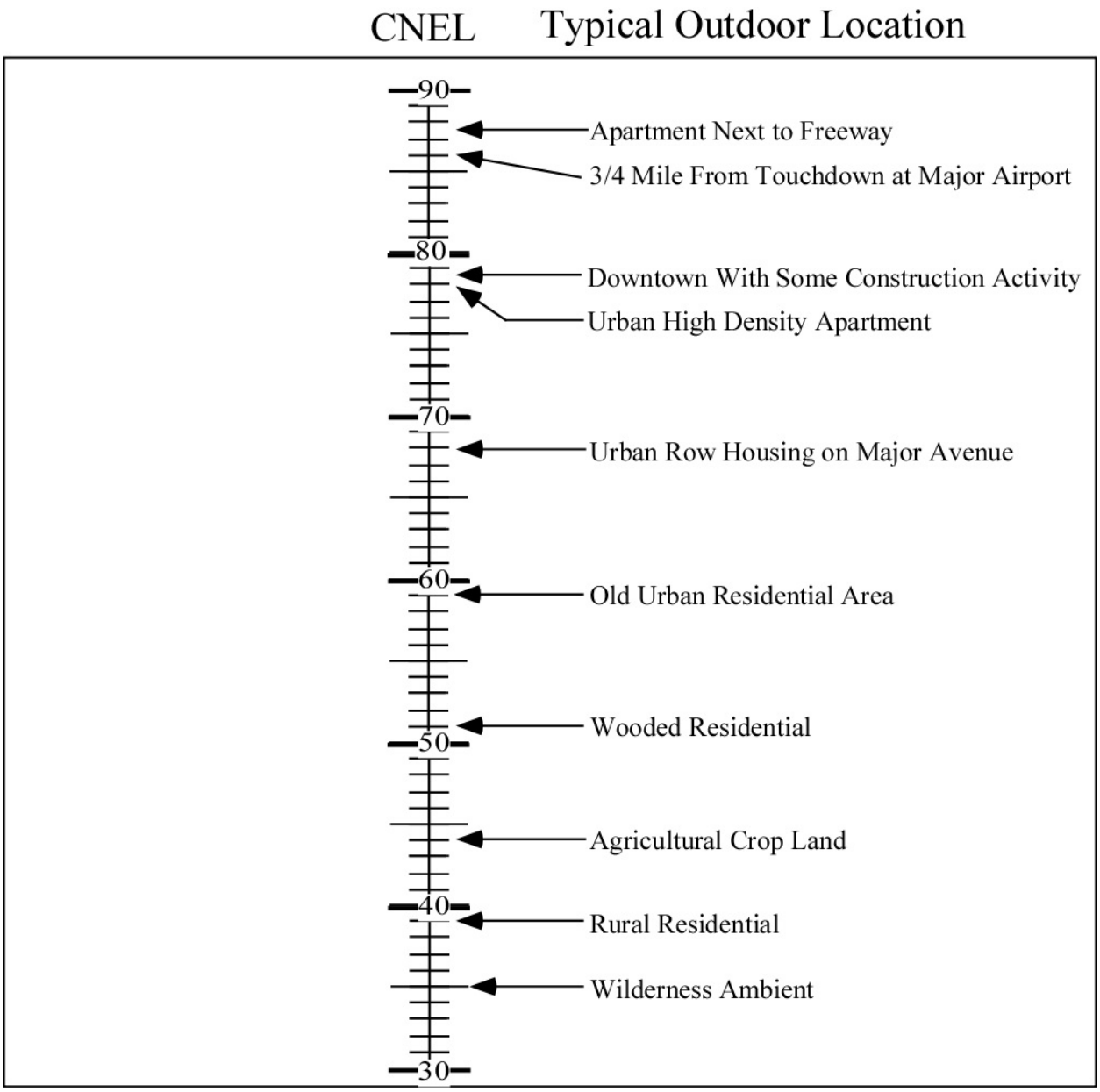
- *The Daily Noise Level (DNL)* index is very similar to CNEL, but does not include the evening (7 p.m. to 10 p.m.) penalty that is included in CNEL. It does include the nighttime (10 p.m. to 7 a.m.) penalty. Typically, DNL is about 1 dB lower than CNEL, although the difference may be greater if there is an abnormal concentration of noise events in the 7 p.m. to 10 p.m. time period. DNL is specified for use in all states except California.

- *L(%), Lmax and Lmin* are statistical methods of describing noise which accounts for variance in noise levels throughout a given measurement period. L(%) is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example, since five minutes is 25% of 20 minutes, L(25) is the noise level that is equal to or exceeded for five minutes in a 20- minute measurement period. It is L(%) that is used for most Noise Ordinance standards. Lmax represents the loudest noise level that is measured. The Lmax only occurs for a fraction of a second with all the other noise less than the Lmax level. Lmin represents the quietest noise level during a noise measurement. All other noise during the measurement period is louder than the Lmin.

D. Health Effects of Noise

Noise, often described as unwanted sound, is known to have several adverse effects on humans. From these known adverse effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. These criteria are based on effects of noise on people such as hearing loss (not a factor with typical community noise), communication interference, sleep interference, physiological responses, and annoyance. Each of these potential noise impacts on people is briefly discussed below.

Exhibit N-3: Examples of Typical Outdoor CNEL Levels



Source: Adapted from "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety", EPA, 1974

Hearing Loss

Hearing loss is generally not a concern in community noise problems, even very near a major airport or a major freeway. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry, very noisy work environments with long term exposure, or certain very loud recreational activities such as target shooting, motorcycle or car racing. The Occupational Safety and Health Administration (OSHA) identifies a noise exposure limit of 90 dBA for 8 hours per day to protect workers from hearing loss (higher limits are allowed for shorter duration exposures). Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

Communication Interference

Communication interference is one of the primary concerns in environmental noise problems, and includes speech interference and interference with activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA, and any noise in this range or louder may interfere with speech. There are various methods of describing speech interference as a function of distance between speaker and listener and voice level.

Sleep Interference

Sleep interference is a major noise concern in noise assessment and is most critical during nighttime hours. Sleep disturbance is one of the major causes of annoyance due to community noise. Noise can make it difficult to fall asleep, create momentary disturbances of natural sleep patterns by causing shifts from deep to lighter stages, and cause awakening. Noise may even cause awakening that a person may not be able to recall.

Extensive research has been conducted on the effect of noise on sleep disturbance, with varying results. Recommended values for desired sound levels in residential bedroom space range from 25 to 45 dBA, with 35 to 40 dBA being the norm. In 1981, the National Association of Noise Control Officials published data on the probability of sleep disturbance with various single event noise levels. Based on laboratory experiments conducted in the 1970's, this data indicated that noise exposure from a 75 dBA interior noise level event will cause noise-induced awakening in 30 percent of the cases. More information on these studies is contained in the Technical Appendix.

Physiological Responses to Noise

Physiological responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, and other vital signs. While such effects can be induced and observed, the extent to which these physiological responses cause harm or are a sign of harm is unknown. Generally, physiological responses are a reaction to a loud short-term noise such as a rifle shot or a very loud jet over flight.

Health effects from noise have been studied around the world for over thirty years. Scientists have attempted to determine whether high noise levels can adversely affect human health in ways other than auditory damage, which is well documented. These research efforts have covered a broad range of potential impacts, from cardiovascular response to fetal weight and mortality. While a relationship between noise and health effects seems plausible, it has yet to be conclusively demonstrated by multiple scientific studies. Health effects from noise may also

be associated with a wide variety of other environmental stressors. Isolating the effects of aircraft noise alone as a source of long-term physiological change has proved to be difficult in studies completed to date. More information on these studies is contained in the Technical Appendix.

Annoyance

Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. Noise that one person considers tolerable can be unbearable to another of equal hearing capability. The level of annoyance depends both on the characteristics of the noise (including loudness, frequency, time, and duration), and how much activity interference (such as speech interference and sleep interference) results from the noise. However, the level of annoyance is also a function of the attitude of the receiver. Personal sensitivity to noise varies widely. It has been estimated that 2 to 10 percent of the population is highly susceptible to annoyance from any noise not of their own making, while approximately 20 percent are unaffected by noise. Attitudes may also be affected by the relationship between the person affected and the source of noise, and whether attempts have been made to abate the noise.

Various studies have correlated annoyance levels to CNEL levels, including a well-known analysis developed by Theodore Schultz. Schultz developed a curve that estimates the percent of a populace that can be expected to be annoyed by various DNL (CNEL in California) values for residential land use with outdoor activity areas. At 65 dB DNL, the Schultz curve predicts approximately 14% of the exposed population reporting themselves to be "highly annoyed." At 60 dB DNL this decreases to approximately 8% of the population.

However, the Schultz curve and recent updates include data showing that some communities report much higher percentages of population highly annoyed at these noise exposure levels. A 1981 study in Orange County of communities near John Wayne Airport found that populations in some areas were approximately 5 dB CNEL more sensitive to noise than the average population predicted by the Schultz curve. While the precise reasons for this increased noise sensitivity were not identified, it is possible that non-acoustic factors, including the socio-economic status of the surveyed population, may have played a role in increasing the sensitivity of these communities during the period of the survey. Also, it should be noted that annoyance levels have never been correlated statistically to single event noise exposure levels in airport related studies. More information on these studies is contained in the Technical Appendix.

School Room Effects

Interference with classroom activities and learning from aircraft noise is an important consideration, and the subject of much recent research. Studies from around the world indicate that noise from vehicle traffic, railroads, and aircraft operations can have adverse effects on reading ability, concentration, motivation, and long term learning retention among students who are subjected to such noise[2]. A complicating factor in this research is the extent of background noise from within the classroom itself. The studies that indicated the most adverse effects examined cumulative noise levels equivalent to 65 CNEL or higher, and single event maximum noise levels ranging from 85 to 95 dBA. In other studies, the level of noise was unstated or ambiguous. According to these studies, a variety of adverse school room effects can be

[2] For more information, see "Effects of Aircraft Noise: Research Update on Selected Topics," by Vincent Mestre, published by the Transportation Research Board of the National Academies, 2008.

expected from *interior* noise levels equal to or exceeding 65 CNEL and or 85 dBA SEL. Some interference with classroom activities can be expected with noise events that interfere with speech. As discussed in other sections of this element, speech interference begins at 65 dBA, which is the level of normal conversation. Typical building design and construction materials attenuate outdoor noise by 20 dBA with windows closed, and 12 dBA with windows open. Thus, some interference of classroom activities can be expected at outdoor levels of 77 to 85 dBA.

E. Analysis of Existing and Future Noise Environment in the Planning Area

The Noise Element of the City of Santa Clarita General Plan that was adopted in May, 2000 identified roadways as the primary source of noise in the City. While traffic noise is still the major noise source in the City, other sources of noise have also become a concern. The City of Santa Clarita and County of Los Angeles retained a noise consultant, Mestre Greve Associates, to conduct a noise study for the 2009 OVOV General Plan update. This study evaluated existing noise conditions throughout the planning area, and projected future noise levels based upon growth and traffic projections developed through the OVOV planning process. This section of the element describes existing sources of noise in the Santa Clarita Valley, and the methodology used to analyze noise levels.

Methodology

Twenty sites in the OVOV planning area were selected for measurement of the existing noise environment. A review of noise complaints, discussions with City and County staff, and identification of major noise sources in the community provided the initial basis for development of the community noise survey. The measurement locations were selected on the basis of proximity to major noise sources and noise sensitivity of the land use. The measurement locations are depicted in Exhibit N-4.

Noise measurements were made of the short-term Leq values. These measurements provide a short 'snapshot' view of the noise environment. The noise measurements were made at an average human receptor height of about five feet above the ground. Measurements were made on August 7 and 8, 2007. The measurements were made with a Bruel & Kjaer Type 2236 Sound Level Meter, and calibrated every few hours. These noise measurement systems meet the American National Standards Institute "Type 1" specifications, which is the most accurate for community noise measurements. The meter and calibrator have current certification traceable to the National Institute of Standards and Technology (NIST).

Results

The results of the noise measurements for existing conditions are shown in Exhibit N-5a, N-5b, and N-5c. These figures also depict the date and time of the measurement. The cause of the loudest event is identified and the most predominant noise source(s) are identified. The quantities measured were the Equivalent Noise Level (Leq), the maximum noise level (Lmax) and the minimum noise levels (Lmin).

EXHIBIT N-4
LOCATIONS OF NOISE MEASUREMENTS TAKEN IN PLANNING AREA

- OVOV Planning Area
- City of Santa Clarita
- Angeles National Forest
- Sphere of Influence
- Noise Measurement Locations (xx)

Hydrography
- Waterbody and Perennial Stream

0 4,000 8,000 16,000 Feet

0 0.375 0.75 1.5 Miles

N W E S

Source: City of Santa Clarita - Planning and LA County - Regional Planning, OVOV Boundary, 2008.
City of Santa Clarita City Boundary - 2008; Thomas Bros., Hydrology, Waterbodies, and Streets, 2008; LA County - Regional Planning, Forest Boundaries, 2007. Mestre Greve Associates - Noise Contours, December 2008.

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When examining the noise data shown in Exhibit N-5, it is important to note that this data is intended to identify noise levels over a broad range of the study area; it is not an assessment of impacts at these sites. The noise levels measured cover a wide range of noise exposure throughout the planning area. In almost all cases the major sources of noise were motor vehicles. The quietest environment was in a residential area in the foothills, where noise levels were often below 50 dBA. The loudest events were generated by buses and trucks, and these events would push the noise levels into the mid 80 dBA range. In general, aircraft noise, industrial noise, and commercial noise sources did not appear to contribute significantly to the noise levels measured.

A detailed discussion of the noise measurements at each of the twenty sites is presented in the Noise Study prepared by Mestre Greve Associates in 2008, attached as the Technical Appendix.

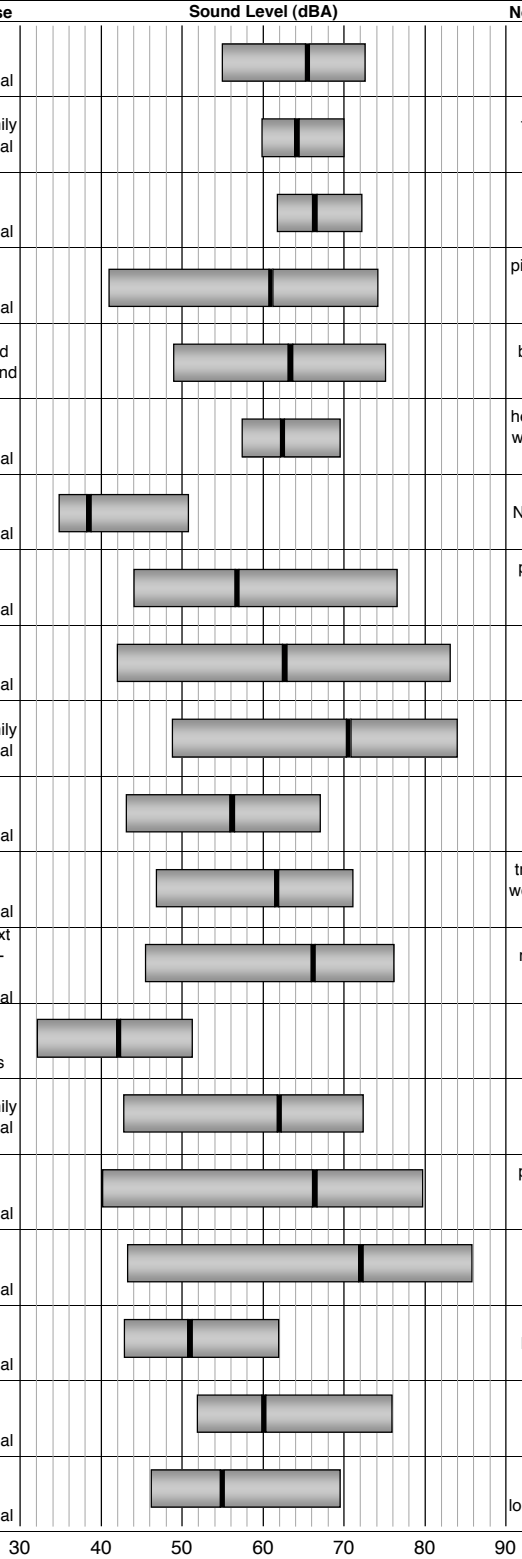
Noise Contour Maps

Noise contour maps of the planning area were prepared to show both existing and anticipated future noise levels. The contour map of existing noise levels was based on field measurements described above. Based on this data, the consultant concluded that the noise environment in Santa Clarita is attributable primarily to roadways, which include both surface streets and freeways. The Southern Pacific Railroad, which runs from the southern portion of the City to the center of the City and then directly to the east, is also a major noise source. The Agua Dulce Airport is located in the study area; however, sporadic airplane or helicopter operations that occur across the OVOV study area were not determined to be loud enough and consistent enough to be substantial noise generators.

The noise contours for the planning area are presented in Exhibit N-6 for existing conditions as of August, 2007, and in Exhibit N-7 for buildout conditions projected for the OVOV General Plan/Area Plan update. The existing contours are based on the existing conditions of traffic volumes and other sources of noise in the community derived from field measurements. The future contours represent a year 2030 scenario, based on traffic volumes estimated by a traffic study performed by Austin Foust, a traffic consultant. The traffic noise contours, including the average daily traffic, are also presented in a tabular form in the Appendix to the Noise Element.

Graphic Summary of Short-Term Ambient Noise Measurment Results

Site	Location	Date	Time	Land Use	Noise Sources
1	End of Hunter Ln	8/8	9:45 a.m.	single family residential	traffic
2	End of Golfview Dr	8/7	1:44 p.m.	multi-family residential	traffic, trucks on fwy
3	Corner of Wabuska St and Hawkbryn Ave	8/7	12:20 p.m.	single family residential	traffic, cars on local streets
4	Playground next to Sierra Hwy	8/8	1:32 p.m.	single family residential	pickup trucks were loudest; other traffic
5	Park next to Lyons Ave	8/7	11:50 a.m.	Park and Playground	bus was loudest; other traffic
6	End of Fuji St	8/8	3:22 p.m.	single family residential	heavy truck on fwy was loudest; other traffic
7	San Francisquito Canyon Road	8/8	9:18 a.m.	single family residential	Neighbors, planes
8	Corner of 4th and Pine St	8/8	12:39 p.m.	single family residential	pickup truck was loudest; other traffic
9	Corner of Via Princessa and Sheffield Ln	8/7	12:50 p.m.	single family residential	traffic
10	Condo site off of Magic Mountain Pkwy	8/7	2:49 p.m.	multi-family residential	traffic
11	End of Mistletoe Ct	8/7	2:27 p.m.	single family residential	traffic
12	End of Quilla Rd	8/7	1:21 p.m.	single family residential	trucks on Mcbean were loudest, other traffic
13	Park on Newhall Ranch Rd	8/7	3:29 p.m.	Park next to multi-family residential	bus and motorcyles were loudest; other traffic
14	Cul-de-sac next to Sweetheart Ranch	8/8	2:34 p.m.	single family ranches	Trucks were loudest, other traffic
15	Condo Site next to Stevenson Ranch Pkwy	8/8	11:17 a.m.	multi-family residential	traffic
16	Corner of Shadow Valley Rd and Bouquet Canyon Rd	8/7	4:44 p.m.	single family residential	pickup truck was loudest; other traffic
17	Corner of Plum Canyon Rd and Golden Valley Rd	8/7	4:22 p.m.	single family residential	school bus was loudest; other traffic
18	End of Larkhaven Pl	8/8	1:52 p.m.	single family residential	Trucks were loudest; cars on fwy
19	End of Salem Ct	8/8	10:13 a.m.	single family residential	Trucks were loudest; other trucks
20	End of Robindale Ct	8/7	5:19 p.m.	single family residential	Trucks were loudest;other traffic



Legend Lmin LEQ Lmax

City of Santa Clarita Noise Element
Mestre Greve Associates

The noise contours for arterial roadways and highways were generated using a mathematical model developed by the Federal Highway Administration ("Traffic Noise Model," Version 2.5, April 14, 2004). The Traffic Noise Model (TNM) uses traffic volume, vehicle mix, average vehicle speed, roadway geometry, and sound propagation path characteristics to predict hourly A-weighted Leq values adjacent to a road. Vehicle mix is reported in terms of the number of automobiles, medium trucks, and heavy trucks. The truck categories are defined in the TNM model by number of axles and weight. In order to compute a CNEL value for roadways, the hourly data for a 24-hour period are used according to the CNEL formula. Vehicle distribution over the 24 hour day must be known, including the percent of vehicles in the daytime period (7 a.m. to 7 p.m.), evening period (7 p.m. to 10 p.m.), and night period (10 p.m. to 7 a.m.). The mix of automobiles, medium trucks and heavy trucks has an effect on noise levels. The assumption used to model noise is based on known traffic mix data. For arterial roadways, the vehicle mix data are obtained from mix data collected by the County of Orange during extensive surveys of 53 intersections within the County. This survey is the most comprehensive conducted in Southern California, and is considered representative for the vast majority of arterial highways throughout Southern California. Caltrans conducts periodic traffic counts on freeways and publishes them on their website (www.dot.ca.gov/hq/traffops/saferesr/trafdata/). The various truck percentages reported by Caltrans were used for the projections on Interstate 5, SR-14 and SR-126. The traffic mix data used for the Noise Element are contained in the Noise Study prepared for the project by Mestre Greve Associates, included as a the Technical Appendix .

EXHIBIT N-6
EXISTING ROADWAY NOISE CONTOURS

OVOV Planning Area

City of Santa Clarita

Angeles National Forest

Sphere of Influence

Existing Roadway Noise Contours

- 60CNEL
- 65CNEL
- 70CNEL

Hydrography

- Waterbody and Perennial Stream

0 6,500 13,000 26,000 Feet

0 0.5 1 2 Miles

N W E S

Source: City of Santa Clarita - Planning and LA County - Regional Planning, OVOV Boundary, 2008.
City of Santa Clarita City Boundary - 2008;
Thomas Bros., Hydrology, Waterbodies, and Streets, 2008; LA County - Regional Planning,
Forest Boundaries, 2007. Mestre Greve Associates - Noise Contours, December 2008.

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LANCASTER
PALMDALE
LOS ANGELES
LOS PADRES NATIONAL FOREST
ANGELES NATIONAL FOREST
ANGELES NATIONAL FOREST
LOS ANGELES COUNTY
VENTURA COUNTY
RIDGE ROUTE RD
ELIZABETH LAKE RD
COLUMBIA WY
LODDE HILL RD
SPUNKY CANYON RD
SAN FRANCISQUITO CANYON RD
SIERRA HWY
AGUA DULCE CANYON RD
ESCONDIDO CANYON RD
DAVENPORT RD
VASQUEZ CANYON RD
SOLEDAD CANYON RD
HILLCREST PKWY
HASLEY CANYON RD
SAN MARTINEZ RD
HENRY MAYO DR
NEWHALL RANCH RD
DECOURO DR
MAGIC MOUNTAIN PKWY
SOLEMINT RD
PICO CANYON RD
LYONS AV
NEWHALL AV
GOLDEN VALLEY RD
PLACERITA CANYON RD
SAND CANYON RD
LITTLE TUJUNGA RD
LOPEZ CANYON RD
BORDEN AV
SEPULVEDA BLVD
5
14
126
210

EXHIBIT N-7
FUTURE PROJECTED NOISE CONTOURS

CITY OF SANTA CLARITA · COUNTY OF LOS ANGELES · one valley one vision · VALLEYWIDE GENERAL PLAN

- OVOV Planning Area
- City of Santa Clarita
- Angeles National Forest
- Sphere of Influence

Existing Roadway Noise Contours

- 60CNEL
- 65CNEL
- 70CNEL

Hydrography

- Waterbody and Perennial Stream

0 6,500 13,000 26,000 Feet

0 0.5 1 2 Miles

N W E S

Source: City of Santa Clarita - Planning and LA County - Regional Planning, OVOV Boundary, 2008.
City of Santa Clarita City Boundary - 2008;
Thomas Bros., Hydrology, Waterbodies, and Streets, 2008; LA County - Regional Planning,
Forest Boundaries, 2007. Mestre Greve Associates - Noise Contours, February 2009.

COUNTY OF LOS ANGELES CALIFORNIA · CITY OF SANTA CLARITA FOUNDED 15 DECEMBER 1987

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LANCASTER
COLUMBIA WY
ELIZABETH LAKE RD
SPUNKY CANYON RD
LODDE HILL RD
PALMDALE
RIDGE ROUTE RD
SAN FRANCISQUITO CANYON RD
LOS PADRES NATIONAL FOREST
ANGELES NATIONAL FOREST
LAKE HUGHES RD
SIERRA HWY
AGUA DULCE CANYON RD
ESCONDIDO CANYON RD
DAVENPORT RD
VASQUEZ CANYON RD
HILLCREST PKWY
HASLEY CANYON RD
SAN MARTINEZ RD
NEWHALL RANCH RD
DECO RD
HENRY MAYO DR
MAGIC MOUNTAIN PKWY
SOLEDAD CANYON RD
GOLDEN VALLEY RD
PICO CANYON RD
LYONS AV
DOCKWEILER DR
PLACERITA CANYON RD
SAND CANYON RD
LITTLE TUJUNGA RD
LOPEZ CANYON RD
BORDEN AV
LOS ANGELES
LOS ANGELES COUNTY
VENTURA COUNTY
5
14
126
210

The Southern Pacific Railroad line handles two types of trains in the Santa Clarita area, Metrolink commuter rail and freight. In terms of rail noise, freight is the more dominant noise source. Published train schedules were consulted in 2008 and it was determined that 24 Metrolink trains run through Santa Clarita each day. No precise numbers of daily freight train operations could be provided; however, it was estimated that 12 freight trains pass through the planning area each day. According to the Multi-County Goods Movement Action Plan prepared for Los Angeles County in April, 2008, the number of freight trains expected to use the Union Pacific rail line from Los Angeles through the Santa Clarita Valley by 2025 ranges from 27-49 trains per day. Based on this information, the model included 48 freight trains per day. Metro, which operates the Metrolink system, has also prepared an updated draft 2008 Long Range Transportation Plan (LRTP) that shows proposed rail facilities and increased operations throughout its service area. The list of projects for North Los Angeles County in the LRTP includes adding reverse commute service on the Antelope Valley line, expanding capacity on existing trains, and adding four Metrolink trains from Santa Clarita to Los Angeles. These two documents contain the most recent available data on existing and future planned rail operations in the Santa Clarita Valley, and were used to generate the existing and projected train noise contours shown on Exhibits N-6 and N-7.

Noise contours on the contour map exhibits represent lines of equal noise exposure, just as the contour lines on a topographic map show lines of equal elevation. The contours shown on the map are for the 60, 65 and 70 dB CNEL noise levels. These noise contour maps can be used as a guide for land use planning decisions. The 60 CNEL contour defines the Noise Referral Zone. This is the noise level for which noise considerations should be included when making land use policy decisions.

The contours presented in this report are a graphic representation of the existing and future projected noise environment. These distances to contour values are also shown in tabulated format in Appendix A of the Noise Element. However, it should be understood when consulting these maps and tables that topography and intervening buildings or barriers have a very complex effect on the propagation of noise, because barriers deflect sound waves. The effect of topography and building placement on specific development sites was not considered when preparing the noise contour maps for the entire planning area; therefore, the contours present a worst-case projection of existing and future noise levels, and should be considered in conjunction with local conditions when evaluating specific development plans.

Projected Noise Impacts from General Plan/Area Plan Buildout

Because of continued growth and development allowed by the General Plan and Area Plan, traffic levels will change throughout the planning area in future years, and the resulting noise levels will also undergo a corresponding change. In order to evaluate the future estimated noise levels, a comparison was made between the existing noise levels and future noise levels within the OVOV planning area (i.e., cumulative noise increase), based on the anticipated growth permitted by the OVOV General Plan/Area Plan update.

Table N-2 shows the expected incremental traffic noise level increases on the primary arterial roadways that were analyzed in the OVOV traffic study. The traffic study divided up the arterial roadway network into 318 roadway links; the roadway segment numbers on Table N-2 correspond to the segment number identified by the traffic engineer. However, only those arterial roadway links on which discernable changes in noise levels are projected are included on Table N-2; roadway links with negligible change in noise levels are not listed. Also, since the traffic study did not include local and collector streets, these streets were not included in the

noise model. Such streets carry substantially less traffic, with lower speed limits, than arterial streets, which reduces the noise generated.

A significance threshold of five (5) dB is often used to evaluate a change in environmental noise that occurs slowly over a long period of time. A total of 29 roadway links were identified that showed a change in noise level between the existing conditions and future build-out of the General Plan/Area Plan of 5 dB or more. The noise analysis also compared projected future noise levels under the OVOV planning update with the noise levels anticipated to be generated under build-out of the 2008 City General Plan and County Area Plan that were in effect prior to the OVOV plans. Table N-2 shows roadway links that will experience an increase of one (1) dB with the OVOV General Plan, as compared to the 2008 General Plan and Area Plan. As shown by the minus signs in the fourth column of Table N-2, many roadway segments will experience decreased noise impacts under the OVOV General Plan, as compared with the previous City General Plan and County Area Plan. The land uses listed in the fifth column of Table N-2 were based on observations from aerials and on-site visits. It should be noted that the land use listed on the table may not be the same as the zoning designation, as these are generalized land use categories rather than General Plan designations or zones.

The Santa Clarita Valley will experience substantial population growth in upcoming years, and as a result noise levels will increase substantially along many roadways. Some of the roadway links that will experience much of the noise increase that are bordered by residential uses include portions of Pico Canyon, Via Princessa, Golden Valley Road, and Lost Canyon Road. However, with development under the OVOV General Plan, the noise levels will go down on more roadways than will go up in comparison to the current General Plan and Area Plan. There are only three roadway links out of the 318 links that make up the entire roadway network where the noise levels with the OVOV General Plan increase by one (1) dB or more, in comparison to the current General Plan. For purposes of evaluating environmental noise, a difference of three (3) dB is barely discernable. Only one roadway link, specifically Ridge Route north of Castaic, will experience a noise increase of 3 dB in comparison to the current General Plan and Area Plan. This area is primarily developed and planned for commercial uses, which are not considered to be sensitive to that level of noise increase. Therefore, although the Santa Clarita Valley will experience substantial increases in traffic over existing levels and corresponding increases in traffic noise, the OVOV General Plan will result in slightly lower noise levels for more streets than would otherwise occur under the 2008 General Plan and Area Plan.

Even for the residential areas where the noise levels are projected to increase by more than one (1) dB over existing conditions, the Noise Study determined that in most cases residences are currently protected by existing sound walls or are set back far enough from the roadway so that future noise levels generated by build-out under the OVOV General Plan and Area Plan will be consistent with the Noise and Land Use Compatibility Guidelines. Therefore, noise impacts in these areas from General Plan build out were determined to be minimal.

Noise levels were also projected for the railroad line that passes through the OVOV study area. Both Metrolink and freight trains utilize the railroad line. In future years both the operations of freight and Metrolink are expected to increase. A moderate increase in the CNEL noise level of 2.4 dB is projected to occur between existing levels and OVOV General Plan/Area Plan build-out. This level of noise increase is expected to occur with build-out under either the 2008 General Plan/Area Plan or the proposed OVOV General Plan/Area Plan. The projected 2.4 dB increase for rail-generated noise is not considered to be a substantial noise increase that would adversely affect community noise levels.

Table N-2: Projected Noise Increases Along Roadway Links in CNEL (dB) Based on OVOV General Plan/Area Plan Build-out

Segment No.	Roadway Link	Cumulative Increase[3]	Change Due to OVOV [4]	Land Use
2	Agua Dulce n/o Davenport	6.4	0.0	Sparse Residential
3	Agua Dulce n/o SR-14	6.7	0.0	Open Space
4	Agua Dulce s/o SR-14	4.8	1.8	Open Space
8	Ave Stanford s/o Vanderbilt	5.3	0.8	Commercial
29	Chiquito Cyn (Long Cyn) n/o SR-126	11.0	-0.3	Open Space
41	Copper Hill e/o Haskell	5.3	-0.2	Residential
43	Davenport e/o Sierra Hwy	4.8	1.8	Commercial
53	Dockweiler w/o Sierra Hwy	6.8	-0.2	Sparse Residential
55	Franklin e/o Wolcott Way	9.0	0.0	Open Space
57	Golden Valley s/o Plum Cyn	7.8	0.0	Residential
59	Golden Valley n/o Soledad	5.0	0.0	Commercial/Indust
68	Hasley Cyn w/o Del Valle	6.4	0.7	Open Space
72	Henry Mayo e/o Commerce Center	5.1	-0.3	Residential
77	Lake Hughes e/o Castaic	6.1	-0.7	Mixed
78	Lake Hughes e/o Ridge Route	5.4	-2.3	Commercial
84	Lost Cyn n/o Jakes Way	n/a	1.1	Residential
85	Lost Cyn n/o Canyon Park	n/a	1.1	Residential
87	Lost Cyn s/o Via Princessa	7.4	-0.4	Residential
98	Magic Mtn w/o The Old Road	7.3	0.1	Open Space
99	Magic Mtn e/o The Old Road	5.0	0.2	Office
105	Magic Mtn e/o Valencia	5.3	0.2	Mixed
128	Newhall Ranch e/o Bouquet Cyn	8.2	0.2	Mixed
143	Pico Cyn w/o Stevenson Ranch	9.9	0.0	Residential
161	Ridge Route n/o Lake Hughes	8.5	-0.1	Mixed
162	Ridge Route n/o Castaic	2.0	3.0	Commercial
172	San Martinez Grande Cyn n/o SR-126	7.0	-1.5	Open Space
233	Stevenson Ranch n/o Poe	-0.7	1.4	Open Space
238	The Old Road n/o Hillcrest	6.4	-0.3	Mixed
254	Tibbitts s/o Newhall Ranch	5.8	0.0	Commercial
262	Valencia w/o The Old Road	5.8	0.1	Residential
276	Via Princessa e/o Oak Ridge	5.7	0.0	Residential
279	Via Princessa w/o Rainbow Glen	11.3	0.7	Residential
280	Via Princessa e/o Rainbow Glen	7.6	0.5	Residential
283	Via Princessa n/o Lost Cyn	6.8	0.2	Residential
290	Wiley Cyn e/o Orchard Village	5.8	0.34	Residential
295	Wolcott n/o SR-126	7.8	0.0	Open Space

[3] "Cumulative increase" refers to projected noise levels over existing conditions based on development allowed by the OVOV General Plan/Area Plan Update.

[4] "Change due to OVOV" refers to the net increase or decrease in projected noise levels between the General Plan/Area Plan in effect prior to OVOV, and the OVOV update. A minus sign in this column indicates that future noise levels are projected to be less under the OVOV plans than under the 2008 plans.

F. Other Noise Issues in the Planning Area

In addition to traffic-generated noise impacts, several other noise-related issues were identified during preparation of the Noise Element, based on discussions with staff. Some of these additional noise issues may be addressed in local planning decisions by the City of Santa Clarita and the County of Los Angeles, as described below. With regard to other noise issues that are outside the authority of local planning agencies, the discussion below is provided for informational purposes only.

High-Speed Rail Line

A high-speed rail line is being planned by the California High-Speed Rail Authority to connect northern and southern California. The anticipated route of this railway would run from Sacramento to Los Angeles, and would likely traverse the Santa Clarita Valley in the area of the Antelope Valley Freeway (SR-14) corridor. As the planning for this project proceeds, a separate environmental impact report will be required to evaluate potential impacts of the proposed high-speed rail line, including noise. At this time, the precise route of the future high-speed rail line through the planning area is not known, and the type of train and corresponding noise levels have not been determined. Therefore, no substantive planning in regard to future noise impacts from high-speed rail can be addressed in the Noise Element at this time. However, a policy has been included in the element that calls for the City and County to participate in the review of the high-speed rail plan documents to ensure adequate mitigation of noise and other impacts, if and when the rail project is approved.

High Density Residential Development Adjacent to Railroad

As part of the OVOV strategy to encourage Transit-Oriented Development (TOD) in the Santa Clarita Valley, higher density residential housing, and mixed-use commercial districts that may contain residential uses, are planned in proximity to portions of the railroad currently used for freight and Metrolink passenger service. Most notably this will occur in the areas where the railroad parallels Railroad Avenue and along Soledad Canyon Road, especially in the vicinity of the Soledad Metrolink Station, which is well-suited for future transit-oriented development for occur. The TOD strategy will provide residents with ready access to public transit for commuting to work and service centers that are accessible by Metrolink, thereby decreasing dependence on single-use automobile trips, reducing vehicle emissions, and vehicle-generated noise.

Developing residential uses along railroads presents special challenges with respect to noise. First, constructing sound walls along railroads is often not feasible because of height restrictions. Sound walls that are constructed may provide some protection for lower residential floors, but provide little or no protection for the upper floors. Secondly, although the CNEL noise scale is the best scale to use for environmental noise, it is not the only measurement to consider when dealing with train events (and, to a similar extent, aircraft noise). Train noise is what is referred to as “single event noise”. When a train passes a residence, it generates loud levels of noise for a short period of time, and then there will be no railroad noise for an extended period of time. The CNEL scale accounts for the number of trains, the time of day that they occur, and how loud the trains are; but it can be argued that the annoyance and activity disruption that is generated by the single event of a train is not fully accounted for in such CNEL measurements. For example, if a train passes by and awakens a resident, his or her main focus is on that one train and not on the other factors that go into the CNEL scale calculation. The use of CNEL (or the similar Ldn scale) for noise and land use planning is required by State code. In most

instances, the use of the CNEL scale provides the best correlation with how people view the noise environment.

One of the actions the City and County can take to address potential annoyance from train noise is to require disclosure to potential buyers and renters of homes near the railroad. This notification would provide information to buyers and renters about the location and type of noise sources in the area, and the fact that there may be loud events generated by these sources. A policy has been included in this element to address disclosure requirements for residents near the railroad.

In many cases, high-density residential and mixed uses developments contain few outdoor private areas where quiet can be anticipated. Generally, dwellings in such developments might be provided with small balcony or patio areas, but there is little expectation that the noise levels for these private outdoor areas will be low. A noise barrier, often made of glass, is the only way to provide noise protection for a small balcony area adjacent to a noise source such as a freeway or railroad. Balcony barriers are often disliked by residents because they create a "closed-in" feeling. In order to address this issue, it is recommended that the design of high-density residential uses include one or more outdoor areas in the complex where peace and quiet can be found. Such an area may be provided in communal courtyards, or a pool area where people can sit and relax. It is important to provide noise protection for these areas. Such common outdoor areas can often be protected through site design, such as by locating buildings or parking structures between noise sources and common open space. A policy has been included in the element to encourage site designs for multi-family and mixed-use projects that promote the inclusion of common recreational or open space areas that are protected from noise.

Mixed-Use Developments that Combine Residential and Non-Residential Uses

The OVOV General Plan/Area Plan land use map shows several areas that can be developed with mixed uses. In addition, the zoning codes of both the City of Santa Clarita and the County of Los Angeles allow mixed uses in certain zone districts, with discretionary approval of a development plan. The commercial/residential interface that can occur in mixed-use developments presents special challenges in terms of noise mitigation. The primary concern is that some commercial uses may operate through the evening hours and into the nighttime hours. Clubs, theaters, late-night restaurants, and banquet facilities are some examples of commercial uses that could locate in a mixed-use area and generate noise into nighttime hours. Another characteristic of commercial areas is that the tenants in a building often change over time. For example, a bookstore that did not operate at night could be replaced by a popular restaurant where operations could extend through the evening and into nighttime hours. Because of changes in use, the noise levels that are reviewed when a development plan is approved may change over time. For these reasons it is difficult to properly soundproof residences that are constructed in a mixed-use development.

It would be desirable to take some additional action in mixed-use developments so that residents would view the noise environment as favorable. Putting time limits on the commercial uses might be viable in some cases, but it may also deter some commercial uses from locating in or near a mixed-use development. The State requires that buildings be designed to meet a 45 CNEL indoor noise standard for multi-family residences. It would not be possible to set an indoor noise standard more restrictive than the State standard, because the State law has precedence.

Buyer and renter notification is often the only recourse in trying to improve the noise acceptability for residents in mixed-use projects. The notification should inform the potential residents that commercial uses are located nearby, that their hours of operation may change from time to time, and that the use within the commercial area, along with the noise generation potential, may also change over time. A policy has been included in this element to encourage proper notification of residents in mixed-use developments of potential noise levels.

Agua Dulce Airport

The Agua Dulce Airport is located in the northeast quadrant of the OVOV planning area, in a sparsely populated area under the jurisdiction of the County of Los Angeles. The airport is privately owned but is open to the public. The airport has a single 4,600 foot-long runway and serves general aviation aircraft only. There are many noise restrictions in place for flight operations. No night operations are allowed at the airport. Aircraft are not allowed to fly within 1,000 feet of the school, which is located 1 mile southwest of the airport. If aircraft depart to the north on Runway 4, they are to avoid flying over the homes 2,000 feet northeast of the end of the runway. Finally, touch and go practices are not allowed at the airport. A 65 CNEL noise contour has been generated for the airport by the County of Los Angeles and is included in the Technical Appendix. The noise contour barely extends past the ends of the runway and does not impact any residences. Therefore, no significant noise effects from airport operations were identified in the Noise Study.

Six Flags Magic Mountain Theme Park

Six Flags Magic Mountain is an amusement park located in the southwest quadrant of the planning area. The park operates a large number of thrill rides including 17 roller coasters, has live entertainment, and periodically puts on firework displays. The fireworks displays occur predominantly during the summer months and at Thanksgiving and Christmas. With the exception of the display on July 4th, which typically lasts 15 minutes, the displays last between one and two minutes. All displays occur before 10:00 p.m. Fireworks are an impulsive noise source, which means, under Section 12.08.190 of the County's Noise Ordinance, that it is of short duration, usually less than one second and of high intensity, with an abrupt onset and rapid decay.

The noise levels and hours of operation around the park vary considerably depending on the time of day, the day of the week, the presence of holidays, and the season of the year. The noise levels generated by park activities can be heard for a considerable distance around the park at certain times. People buying or renting homes in the area may be surprised later when they can hear park activities. A buyer/renter notification program may be appropriate for new developments that locate in the area, and a policy has been included in the element to encourage proper notification where appropriate.

Special Events

Special events, such as outdoor concerts, may be held in the planning area on an irregular or regular basis. The noise levels as they impact surrounding parcels would be limited by the Los Angeles County Noise Ordinance and the Santa Clarita Noise Ordinance. The noise ordinances apply to any events that are held on private property. The City of Santa Clarita Noise Ordinance consists of Chapter 11.44 of Municipal Code. The limits contained in the ordinance would apply to any special event, with only "lawfully conducted parades" and "emergency work" exempted from the ordinance. The Los Angeles County noise ordinance is

contained in Chapter 12.08 of the County Code. Similar to the City of Santa Clarita Noise Ordinance, the Los Angeles County ordinance contains specific noise limits that cannot be exceeded at the property boundary. The limits vary depending on the time of day and land uses involved. Finally, it should be noted that the noise ordinances are contained in the city or county codes, and are not part of the Noise Element of the General Plan. Control of noise sources on private property is usually regulated through the imposition of a city or county regulation, and is not typically part of the General Plan.

Emergency Vehicles

Noise generated by emergency vehicles is not under the control of the City or the County. Both the City and County noise ordinances exempt emergency operations from noise regulation. The State has preempted local jurisdictions from controlling noise generated by emergency equipment. The use of sirens on police vehicles, ambulances, and fire trucks cannot be controlled by the City or County. Similarly, emergency flights of helicopters and airplanes cannot be controlled by the City or County. Therefore, noise from these sources is not subject to policies in the Noise Element. However, the location of heliports and helipads is subject to zoning requirements for discretionary review, and to environmental impact review pursuant to CEQA.

G. Planning Strategies to Minimize Noise Impacts

The information on existing and future projected noise levels described in the previous sections of this element has been used as a guideline for the development of policies to ensure that land uses are compatible with the noise environment. This information will also provide baseline levels and noise source identification for enforcement of local noise regulations.

The most basic planning strategy to minimize adverse impacts on new land uses due to noise is to avoid designating sensitive land uses in areas that are subject to high levels of noise. Uses such as schools, hospitals, child care, senior care, congregate care, churches, and all types of residential use should be located outside of any area anticipated to exceed acceptable noise levels as defined by the Noise and Land Use Compatibility Guidelines, or should be protected from noise through sound attenuation measures such as site and architectural design and sound walls. The State of California has adopted guidelines for acceptable noise levels in various land use categories (California Office of Planning and Research, General Plan Guidelines 2003, Appendix C). The City of Santa Clarita and the County of Los Angeles have adopted these guidelines in a modified form as a basis for planning decisions based on noise considerations. The modified guidelines are shown in Exhibit N-8. Modifications were made to eliminate overlap between categories in the table, in order to make the guidelines easier for applicants and decision makers to interpret and apply to planning decisions.

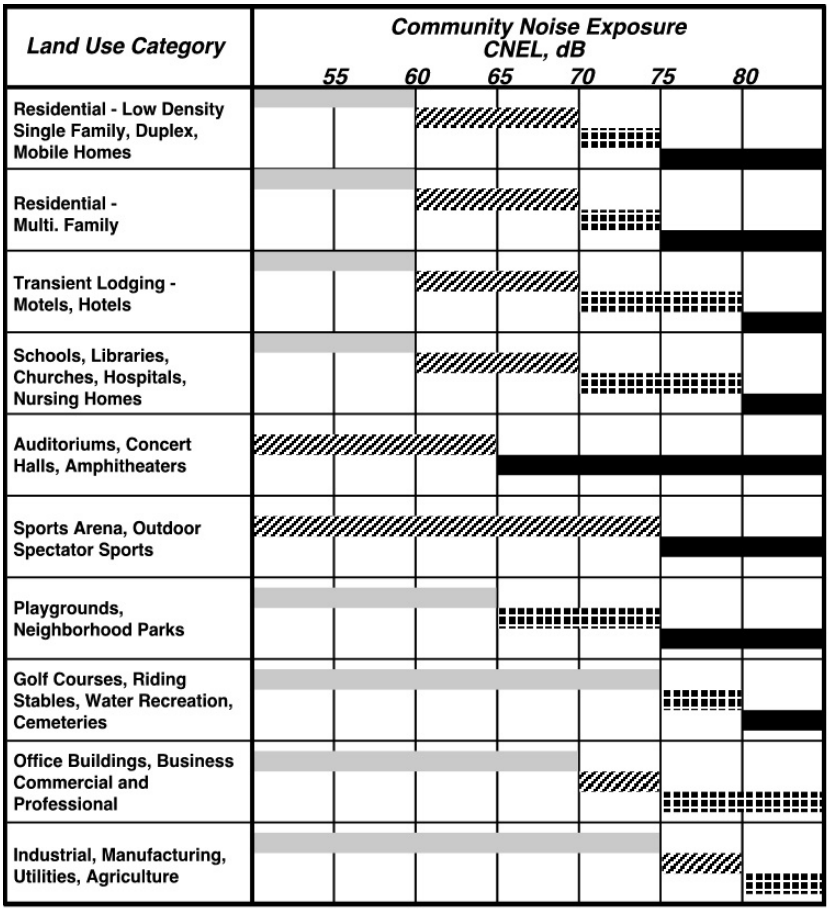
As described earlier in this element, most residential uses throughout the planning area have generally been designed with adequate setbacks from noise sources such as arterial roadways, or have been protected by sound walls. This measure has already been implemented throughout the planning area and will continue to be applied in the future, based on the policies in the element. However, future residential development next to Interstate 5 may require increased wall height for sound attenuation, based on projected traffic volumes. Excessive wall height needed for noise control is subject to both engineering and aesthetic constraints. Sound wall heights greater than 16 feet are generally considered to be infeasible, and the appearance of walls this high may not be acceptable in rural residential areas. Therefore, a policy has been

included in the element that prohibits residential buildings within 150 feet of the Interstate 5 centerline. The policy references the centerline because the right-of-way width for I-5 varies throughout the planning area. It should be noted that the recommendation to require a separation between freeways and residential uses for purposes of noise attenuation is in accordance with other adopted State guidelines. The California Air Resources Board (CARB) has identified airborne pollutants generated from diesel exhaust as a potential health risk to residents next to freeways, and has also adopted recommended spacing criteria for residential uses adjacent to freeways.

For uses that are not classified as noise sensitive but which may be subject to potentially significant noise impacts, site planning and design standards can be used to reduce noise impacts. Through the design and environmental review processes, mitigation measures may be applied such as buffer zones to increase separation between uses; earthen berms, walls, and other noise attenuation devices; site planning and building orientation to shield outdoor spaces; orienting windows away from noise sources; and use of acoustical building materials and double-paned windows. Policies encouraging these measures have also been included in the element.

For uses that are subject to single event noise levels, such as noise generated by trains, mixed uses, or entertainment uses, it is recommended that adequate disclosure of these noise sources be provided to potential renters and homebuyers. A policy has been included in the element with suggested disclosure language.

Exhibit N-8: Noise and Land Use Compatibility Guidelines



LEGEND

NORMALLY ACCEPTABLE
Specified land use is satisfactory, based upon the assumption that any buildings involved are of normal conventional construction, without any special noise insulation requirements

CONDITIONALLY ACCEPTABLE
New construction or development should be undertaken only after a detailed analysis of the noise reduction requirements is made and needed noise insulation features included in the design. Conventional construction, but with closed windows and fresh air supply systems or air conditioning will normally suffice.

NORMALLY UNACCEPTABLE
New construction or development should generally be discouraged. If new construction or development does proceed, a detailed analysis of the noise reduction requirements must be made and needed noise insulation features included in the design. Sound walls, window upgrades, and site design modifications may be needed in order to achieve City standards.

CLEARLY UNACCEPTABLE
New construction or development should generally not be undertaken.

CONSIDERATIONS IN DETERMINATION OF NOISE-COMPATIBLE LAND USE

A. NOISE EXPOSURE INFORMATION DESIRED

Where sufficient data exists, evaluate land use suitability with respect to a worst-case value of CNEL. Usually, a future projection of noise levels represents the worst case. Existing and future noise contours for freeway, roadway, airport and railroads are provided in the Noise Element.

B. NOISE SOURCE CHARACTERISTICS

The land use-noise compatibility recommendations should be viewed in relation to the specific source of the noise. For example, aircraft and railroad noise is normally made up of higher single noise events than auto traffic but occurs less frequently. Therefore, different sources yielding the same composite noise exposure do not necessarily create the same noise environment. The State Aeronautics Act uses 65 dB CNEL as the criterion which airports must eventually meet to protect existing residential communities from unacceptable exposure to aircraft noise. In order to facilitate the purposes of the Act, one of which is to encourage land uses compatible with the 65 dB CNEL criterion wherever possible, and in order to facilitate the ability of airports to comply with the Act, residential uses located in areas with an aircraft noise level greater than 65 CNEL should be discouraged and considered located within normally unacceptable areas.

C. SUITABLE INTERIOR ENVIRONMENTS

One objective of locating residential units relative to a known noise source is to maintain a suitable interior noise environment at no greater than 45 dB CNEL. This requirement, coupled with the measured or calculated noise reduction performance of the type of structure under consideration, should govern the minimum acceptable distance to a noise source.

D. ACCEPTABLE OUTDOOR ENVIRONMENTS

Another consideration, which in some communities is an overriding factor, is the desire for an acceptable outdoor noise environment. The acceptable outdoor noise level is 65 CNEL for rear yard areas, neighborhood parks, and pool recreation areas at multi-family developments.

H. Summary of Noise Planning Issues

Based on the existing conditions and projected growth as described in the background sections of the Noise Element, the major noise issues for the Santa Clarita Valley are summarized below. Policies and objectives in Part 2 of the element have been developed to address these issues.

1. Existing and projected noise generated by traffic on freeways, highways, and arterial streets were evaluated, and noise levels should be considered in land use planning for adjacent areas.

2. Existing and projected noise generated by Metrolink and freight rail were evaluated, and noise levels should be considered in land use planning for areas adjacent to the railroad.

3. Residential neighborhoods and other noise sensitive land uses should be protected from excessive noise.

4. Potential noise impacts from any future high-speed rail project should be evaluated and mitigated through the appropriate environmental review process.

5. Proposed new development projects should be reviewed to ensure that noise impacts are mitigated to acceptable levels.

6. Coordination with other agencies should be ongoing to ensure that noise impacts from freeway projects and other public improvements are mitigated.

7. Compatibility of land uses in mixed-use developments with respect to noise should be considered in future land use decisions.

8. Adequate disclosure should be required to residents who may be affected by possible noise sources that cannot be abated.

9. Consistency between the City of Santa Clarita and the County of Los Angeles with respect to the Noise and Land Use Compatibility Guidelines contained in Exhibit N-8 is intended to maintain a safe and healthy noise environment for all Valley residents.

FUTURE PROJECTED NOISE CONTOURS CURRENT CITY GENERAL PLAN

- OVOV Planning Area
- City of Santa Clarita
- Angeles National Forest
- Sphere of Influence

Existing Roadway Noise Contours

- 60CNEL
- 65CNEL
- 70CNEL

Hydrography

- Waterbody and Perennial Stream

0 6,500 13,000 26,000 Feet

0 0.5 1 2 Miles

N W E S

Source: City of Santa Clarita - Planning and LA County - Regional Planning, OVOV Boundary, 2008.
City of Santa Clarita City Boundary - 2008;
Thomas Bros., Hydrology, Waterbodies, and Streets, 2008; LA County - Regional Planning, Forest Boundaries, 2007. Mestre Greve Associates - Noise Contours, December 2008.

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PART 2: NOISE GOALS AND POLICIES

Noise Environment

Goal N 1: A healthy and **safe noise environment** for Santa Clarita Valley residents, employees, and visitors.

Objective N 1.1: Protect the health and safety of the residents of the Santa Clarita Valley by the **elimination, mitigation, and prevention** of significant existing and future noise levels.

Policy N 1.1.1: Use the **Noise and Land Use Compatibility Guidelines** contained on Exhibit N-8, which are consistent with State guidelines, as a policy basis for decisions on land use and development proposals related to noise.

Policy N 1.1.2: Continue to implement the adopted **noise ordinance** and other applicable code provisions, consistent with state and federal standards, which establish noise impact thresholds for noise abatement and attenuation, in order to reduce potential health hazards associated with high noise levels.

Policy N 1.1.3: Include consideration of potential noise impacts in **land use planning** and development review decisions.

Policy N 1.1.4: **Control noise sources** adjacent to residential, recreational, and community facilities, and those land uses classified as noise sensitive.

Policy N 1.1.5: Monitor and update **data and information** regarding current and projected noise levels in the planning area.

Policy N 1.1.6: Provide development review comments on projects proposed by **other agencies** and special districts that may generate noise impacts affecting land uses within the Santa Clarita Valley, including any freeway and high-speed rail projects.

Reduction of Noise from Traffic

Goal N 2: Protect residents and sensitive receptors from **traffic-generated** noise.

Objective N 2.1: Prevent and mitigate adverse effects of noise generated from traffic on arterial streets and highways through implementing **noise reduction standards** and programs.

Policy N 2.1.1: Encourage owners of existing noise-sensitive uses, and require owners of proposed noise sensitive land uses, to construct **sound barriers** to protect users from significant noise levels, where feasible and appropriate.

Policy N 2.1.2: Encourage the use of **noise absorbing barriers**, where appropriate.

Policy N 2.1.3: Where appropriate, coordinate with the California Department of Transportation (Caltrans) to ensure that **sound walls** or other noise barriers are constructed along Interstate 5 and State Route 14 in the immediate vicinity of residential

and other noise sensitive developments, where setbacks and other sound alleviation devices do not exist.

Policy N 2.1.4: Reduce significant noise levels related to through-traffic in residential areas by promoting **subdivision circulation designs** to contain a hierarchy of streets, which efficiently direct traffic to highways.

Policy N 2.1.5: Encourage employers to develop van pool and other **travel demand management** programs to reduce vehicle trip generated noise in the planning area.

Policy N 2.1.6: Work with the City of Santa Clarita Transit to improve and expand current **public transit services** and routes to reduce vehicle trips and resulting noise levels.

Policy N 2.1.7: Require vehicle owners to properly **maintain their equipment** to avoid generating excessive noise levels.

Residential Neighborhoods

Goal N 3: Protect **residential neighborhoods** from excessive noise.

Objective N 3.1: Prevent and **mitigate significant noise levels** in residential neighborhoods.

Policy N 3.1.1: Require that developers of new single-family and multi-family residential neighborhoods in areas where the ambient noise levels exceed 60 CNEL provide mitigation measures for the new residences to **reduce interior noise levels to 45 CNEL**, based on future traffic and railroad noise levels.

Policy N 3.1.2: Require that developers of new single-family and multi-family residential neighborhoods in areas where the projected noise levels exceed 65 CNEL provide mitigation measures (which may include noise barriers, setbacks, and site design) for new residences to **reduce outdoor noise levels to 65 CNEL,** based on future traffic conditions. This requirement would apply to rear yard areas for single-family developments, and to private open space and common recreational and open space areas for multi-family developments.

Policy N 3.1.3: Through enforcement of the applicable **Noise Ordinance**, protect residential neighborhoods from noise generated by machinery or activities that produce significant discernible noise exceeding recommended levels for residential uses.

Policy N 3.1.4: Require that those responsible for construction activities develop techniques to mitigate or minimize the noise impacts on residences, and adopt standards that regulate noise from **construction activities** that occur in or near residential neighborhoods.

Policy N 3.1.5: Require that developers of private schools, childcare centers, senior housing, and other **noise sensitive uses** in areas where the ambient noise level exceeds 65 dBA (day), provide mitigation measures for these uses to reduce interior noise to acceptable levels.

Policy N 3.1.6: Ensure that new residential buildings shall not be located within 150 feet of the centerline for **Interstate 5**.

Policy N 3.1.7: Ensure that design of **parks, recreational facilities, and schools** minimize noise impacts to residential neighborhoods.

Policy N 3.1.8: As a condition of issuing permits for **special events**, require event promoters to mitigate noise impacts to adjacent sensitive uses through limiting hours of operation and other means as appropriate, which may include notification to affected residents.

Policy N 3.1.9: Implement a buyer and renter **notification program** for new residential developments where appropriate, to educate and inform potential buyers and renters of the sources of noise in the area and/or new sources of noise that may occur in the future. As determined by the reviewing authority, notification may be appropriate in the following areas:

a. Within one mile of **Six Flags Magic Mountain** theme park, potential buyers and renters should receive notice that noise may occasionally be generated from this facility and that the frequency and loudness of noise events may change over time.

b. Within 1,000 feet of the **railroad**, potential buyers and renters should receive notice that noise may occasionally be generated from this facility and that the frequency and loudness of noise events may change over time.

c. Within 200 feet of commercial uses in **mixed-use developments**, potential buyers and renters should receive notice that the commercial uses within the mixed-use developments may generate noise in excess of levels typically found in residential areas, that the commercial uses may change over time, and the associated noise levels and frequency of noise events may change along with the use.

d. Within 1,000 feet of the Saugus Speedway, in the event speedway operations are resumed in the future.

Commercial and Industrial Noise

Goal N 4: Protection of sensitive uses from **commercial and industrial** noise generators.

Objective N 4.1: Prevent, mitigate, and **minimize noise spillover** from commercial and industrial uses into adjacent residential neighborhoods and other noise sensitive uses.

Policy N 4.1.1: Implement and enforce the appropriate **noise ordinance** adopted by the City and the County to control noise from commercial and industrial sources that may adversely impact adjacent residential neighborhoods and other sensitive uses.

Policy N 4.1.2: Require appropriate **noise buffering** between commercial/industrial uses and residential neighborhoods and other sensitive uses.

Policy N 4.1.3: Adopt and **enforce standards** for the control of noise from commercial and entertainment establishments when adjacent to residential neighborhoods and other sensitive uses.

PART 3: IMPLEMENTATION OF THE NOISE ELEMENT

City of Santa Clarita

The City of Santa Clarita will implement the goals, objectives and policies of the Noise Element of the City of Santa Clarita General Plan through the following actions:

1. On the **Land Use Map**, designate areas that are subject to noise for appropriate land uses, in order to reduce exposure of persons and property to hazardous conditions.

2. Implement the noise provisions of the **Municipal Code**, including regulations on special events, vending and hawking, and construction noise.

3. As part of the review process for new discretionary **development applications**, require consistency with the goals and policies of the Noise Element, including the guidelines for land use and noise compatibility, through requiring detailed noise analysis and mitigation of interior and exterior noise levels for residential and other sensitive uses, where appropriate.

4. Review and provide input on projects undertaken by **other agencies**, including Caltrans and high speed rail projects, which may affect the noise environment to ensure that acceptable noise levels are maintained to protect residents.

5. In design of city facilities that have the potential to generate noise, such as **parks**, outdoor concert or sports venues, or transit facilities, ensure that noise impacts are mitigated to protect adjacent sensitive land uses.

6. During construction within public right of way for **road widening** or other improvements, control noise impacts on adjacent sensitive uses through hours of operation, noise reduction requirements on equipment, and other appropriate measures.

7. Through **code enforcement**, monitor noise conditions throughout the City and enforce noise regulations as needed to protect public safety and welfare.

8. As part of the annual General Plan review process, conduct an **annual review** of the Noise Element, along with other General Plan elements, to determine compliance, and file a report with the California Office of Planning and Research and Department of Community Development pursuant to Government Code Section 65400(a) (2).

9. Ensure compliance with **building standards** for noise attenuation, such as insulation and window types, through plan review and inspection procedures on all new construction, pursuant to adopted codes and ordinances.

10. Review any proposed **General Plan Amendments** to ensure compliance with applicable goals and policies of the Noise Element; coordinate this review with the County of Los Angeles as appropriate.

11. **Monitor effectiveness** of the Noise Element in achieving the goals of protecting property, public health, and safety; initiate amendments thereto as needed to meet changing conditions, needs, and policies, coordinating such amendments with the County as appropriate.

12. Work with owners of **commercial and industrial** uses to encourage businesses to limit employee exposure to loud noise, and to reduce noise spillover onto adjacent businesses and properties.

13. Require the provision of **disclosures** to potential renters and buyers of residences in areas subject to noise events, where appropriate.

14. Control noise from **special events** through conditions of approval and enforcement.

15. Where feasible, assist or cooperate in the building of **sound walls** to mitigate noise impacts on sensitive land uses.

County of Los Angeles

The County of Los Angeles will implement the goals, objectives and policies of the Noise Element of the Santa Clarita Valley Area Plan through the following actions:

1. On the **Land Use Map**, designate areas that are subject to noise for appropriate land uses, in order to reduce exposure of persons and property to hazardous conditions.

2. Implement the noise provisions of the **County Code**.

3. As part of the review process for new discretionary **development applications**, require consistency with the goals and policies of the Noise Element, including the guidelines for land use and noise compatibility, through requiring detailed noise analysis and mitigation of interior and exterior noise levels for residential and other sensitive uses, where appropriate.

4. Review and provide input on projects undertaken by **other agencies**, including Caltrans and high speed rail projects, which may affect the noise environment to ensure that acceptable noise levels are maintained to protect residents.

5. In the design of County facilities that have the potential to generate noise, such as **parks and recreation facilities**, ensure that noise impacts are mitigated to protect adjacent sensitive land uses.

6. During construction within public right-of-way for **road widening** or other improvements, control noise impacts on adjacent sensitive uses through hours of operation, noise reduction requirements on equipment, and other appropriate measures.

7. Through **code enforcement**, monitor noise conditions throughout the unincorporated portions of the Santa Clarita Valley, and enforce noise regulations as needed to protect public safety and welfare.

8. Ensure compliance with **building standards** for noise attenuation, such as insulation and window types, through plan review and inspection procedures on all new construction, pursuant to adopted codes and ordinances.

9. Review any proposed **Area Plan Amendments** to ensure compliance with applicable goals and policies of the Noise Element; coordinate this review with the City of Santa Clarita, as appropriate.

10. **Monitor effectiveness** of the Noise Element in achieving the goals of protecting property, public health, and safety; initiate amendments thereto as needed to meet changing conditions, needs, and policies, coordinating such amendments with the City of Santa Clarita as appropriate.

11. Work with owners of **commercial and industrial** uses to encourage businesses to limit employee exposure to loud noise, and to reduce noise spillover onto adjacent businesses and properties.

12. Require the provision of **disclosures** to potential renters and buyers of residences in areas subject to noise events, where appropriate.

13. Control noise from **special events** through conditions of approval and enforcement.

14. Where feasible, assist or cooperate in the building of **sound walls** to mitigate noise impacts on sensitive land uses.

NOISE ELEMENT APPENDIX A

RECOMMENDED NOISE CONTOURS BASED ON OVOV GENERAL PLAN/AREA PLAN BUILDOUT

City of Santa Clarita Noise Element
Proposed Traffic Noise Contours for Arterial Streets

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
LAKE HUGHES ROAD	North Section	North Section	7,000	50	65.8	32	55	94
SAN FRANCISQUITO CANYON	South of Dry Gulch Road	North of Dry Gulch Road	7,000	45	64.4	27	47	82
BOUQUET CANYON ROAD	North End	North End	6,000	40	62.2	20	36	64
SIERRA HIGHWAY	Aqua Dolce Canyon Road	E of Aqua Dolce Canyon	2,000	40	57.4	12	21	37
LAKE HUGHES ROAD	Mid-Section	North Section	7,000	45	64.4	27	47	82
SAN FRANCISQUITO CANYON	Mid-Section	South of Dry Gulch Road	7,000	45	64.4	27	47	82
RIDGE ROUTE ROAD	Lake Hughes Road	N of Lake Hughes Road	35,000	50	72.8	68	117	201
LAKE HUGHES ROAD	Castaic Road	Ridge Route Road	37,000	45	71.6	60	105	183
RIDGE ROUTE ROAD	Castaic Road	Lake Hughes Road	8,000	50	66.4	34	58	100
CASTAIC ROAD	Parker Road	Lake Hughs Road	24,000	50	71.1	57	98	168
THE OLD ROAD	Parker Road	Sloan Canyon Road	3,000	50	62.1	21	36	63
AGUA DULCE CANYON ROAD	Escondido Canyon Road	Sierra Highway	8,000	45	65.0	28	50	87
ESCONDIDO CANYON ROAD	Aqua Dolce Cyn Road	East End	5,000	45	62.9	23	40	69
AGUA DULCE ROAD	Davenport Road	Escondido Canyon Road	13,000	55	69.8	49	84	142
DAVENPORT ROAD	Tick Canyon Road	Aqua Dulce Road	3,000	45	60.7	18	31	54
DAVENPORT ROAD	Sierra Highway	Tick Canyon Road	6,000	35	60.5	16	29	53
SAN FRANCISQUITO CANYON	N of Copper Hill Drive	Mid-Section	7,000	45	64.4	27	47	82
MCBEAN PARKWAY			9,000	40	64.0	25	44	79
SECO CANYON ROAD	Copper Hill Drive	N of Copper Hill Drive	10,000	35	62.8	21	38	69
COPPER HILL DRIVE	Sycamore	High Ridge	17,000	55	71.0	56	95	161
COPPER HILL DRIVE	Haskell Canyon Road	Sycamore	17,000	45	68.2	41	72	126
COPPER HILL DRIVE	Seco Canyon Road	Haskell Canyon Road	30,000	55	73.5	72	123	209
BOUQUET CANYON ROAD	David Way	Vasquez Canyon Road	19,000	50	70.1	51	87	151
HASLEY CANYON ROAD	Del Valle Road	Sloan Canyon Road	13,000	40	65.6	30	53	95
SIERRA HIGHWAY	Vasquez Canyon Road	Davenport Road	16,000	40	66.5	33	59	105
HASLEY CANYON ROAD	The Old Road	Commerce Center Drive	38,000	40	70.2	51	91	162
SIERRA HIGHWAY	Sand Canyon Road	Vasquez Canyon Road	16,000	35	64.8	27	49	89
SIERRA HIGHWAY	S of Vasquez Canyon Rd	Vasquez Canyon Road	16,000	45	68.0	40	70	122
COPPER HILL DRIVE	Decoro Drive	McBean Parkway	45,500	45	72.5	66	116	203
PLUM CANYON ROAD	West of Golden Valley	West of Golden Valley	12,000	45	66.7	35	61	106
COPPER HILL DRIVE	Alta Vista Way	Decoro Drive	52,000	60	75.9	93	158	269
DECORO DRIVE	Rye Canyon	Dickason Drive	8,000	35	61.8	19	34	62
DECORO DRIVE	Dickason Drive	McBean Parkway	14,000	55	70.2	51	86	147
PLUM CANYON ROAD	West of Golden Valley	South of Skyline Ranch Rd	13,000	45	67.1	36	63	110
THE OLD ROAD	Newhall Ranch Road	N of Newhall Ranch	21,000	45	69.1	45	80	139

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
		Road						
THE OLD ROAD	Henry Mayo Drive	Newhall Ranch Road	16,000	55	70.7	54	92	156
RYE CANYON ROAD	Avenue Scott	Newhall Ranch Road	48,000	50	74.2	79	136	234
WHITES CANYON ROAD	South of Skyline Ranch Rd	Skyline Ranch Road	19,000	55	71.5	59	100	169
AGUA DULCE ROAD	Soledad Canyon Road	Davenport Road	14,000	55	70.2	51	86	147
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	9,000	45	65.5	30	53	92
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	9,000	40	64.0	25	44	79
DICKASON DRIVE	Newhall Ranch Road	Decoro Drive	21,000	50	70.6	53	92	158
NEWHALL RANCH ROAD	Dickenson Drive	Rye Canyon Road	49,000	50	74.2	79	137	236
SOLEDAD CANYON ROAD	Aqua Dolce Road	East of Aqua Dolce Rd	17,000	55	71.0	56	95	161
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	16,000	45	68.0	40	70	122
AVE TIBBITTS	Avenue Scott	Newhall Ranch Road	34,000	35	68.1	40	72	131
THE OLD ROAD	Rye Canyon Road	Henry Mayo Drive	48,000	50	74.2	79	136	234
AVE SCOTT	Avenue Tibbitts	Rockefeller Avenue	25,000	35	66.7	34	62	112
AVE TIBBITTS	Avenue Scott	Hopkins	32,000	35	67.8	39	70	127
NEWHALL RANCH ROAD	Bouquet Canyon Road	E of Bouquet Canyon Rd	46,000	50	74.0	77	133	229
NEWHALL RANCH ROAD			49,000	45	72.8	69	120	210
SANTA CLARITA PARKWAY	Newhall Ranch Road	Bouquet Canyon Road	38,000	45	71.7	61	106	186
AVE TIBBITTS	Hopkins	Magic Mountain Parkway	32,000	55	73.8	74	127	215
BOUQUET CANYON ROAD	Soledad Canyon / Valencia	Newhall Ranch Road	77,000	45	74.8	85	150	262
THE OLD ROAD	Magic Mountain Parkway	Rye Canyon Road	52,000	35	69.9	50	90	163
HENRY MAYO DRIVE	Commerce Center Drive	Chiquito Canyon Road	9,000	40	64.0	25	44	79
MAGIC MOUNTAIN PARKWAY	The Old Road	Magic Mountain Theme Park	85,000	55	78.0	117	199	338
LOST CANYON ROAD	Sand Canyon Road	East of Sand Canyon Rd	16,000	45	68.0	40	70	122
MAGIC MOUNTAIN PARKWAY			60,000	50	75.1	87	151	260
SAND CANYON ROAD	South of Jakes Way	Jakes Way	14,000	45	67.4	37	65	114
MAGIC MOUNTAIN PARKWAY	Bouquet Canyon Road	Valencia Blvd	52,000	50	74.5	82	141	243
HENRY MAYO DRIVE	West of Chiquito Cyn Rd	West of Chiquito Cyn Rd	9,000	45	65.5	30	53	92
WHITES CANYON ROAD	Via Princessa	Soledad Canyon Road	48,000	50	74.2	79	136	234
THE OLD ROAD	North of Valencia Blvd	Magic Mountain Parkway	30,000	55	73.5	72	123	209
TOURNEY ROAD	Valencia Boulevard	Magic Mountain Parkway	14,000	35	64.2	25	46	83
VALENCIA BOULEVARD	Tourney Road	Rockwell Canyon Road	59,000	45	73.6	75	131	230
VALENCIA BOULEVARD	Interstate 5	Tourney Road	68,000	45	74.2	80	141	246
THE OLD ROAD	Valencia Blvd	North of Valencia Blvd	30,000	40	69.2	46	81	144
VALENCIA BOULEVARD	The Old Road	Interstate 5	61,000	45	73.8	76	134	234
HENRY MAYO DRIVE	Wes of Chiquito Cyn Rd	to West End	9,000	40	64.0	25	44	79

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
VIA PRINCESSA	North of Lost Canyon	Sierra Highway	41,000	35	68.9	44	80	144
VIA PRINCESSA	Lost Canyon Road	North of Lost Canyon	24,000	35	66.6	33	60	109
MAGIC MOUNTAIN PARKWAY			46,000	45	72.5	67	116	204
VIA PRINCESSA			52,000	35	69.9	50	90	163
VIA PRINCESSA			52,000	40	71.6	60	107	190
GOLDEN VALLEY ROAD	Sierra Highway	Via Princessa	51,000	60	75.8	92	157	267
ROCKWELL CANYON ROAD	McBean Parkway	Valencia Blvd	23,000	50	71.0	55	96	165
VIA PRINCESSA	Railroad Avenue	West of Railroad Canyon	27,000	40	68.7	43	77	137
RAILROAD AVENUE	Via Princessa	South of Via Princessa	40,000	40	70.4	53	94	166
16TH STREET	Newhall Avenue	Orchard Village Road	9,000	35	62.3	20	36	66
STEVENSON RANCH PARKWAY	The Old Road	North of Pico Canyon Road	33,000	50	72.5	66	114	196
LYONS AVENUE EXTENSION	Railroad Canyon	Walnut	52,000	55	75.9	93	158	269
THE OLD ROAD	Pico Canyon Road	Stevensons Ranch Parkway	35,000	40	69.9	49	88	156
SAND CANYON ROAD	Placerita Canyon Road	South of Jakes Way	14,000	45	67.4	37	65	114
LYONS AVENUE	Newhall Avenue	Walnut	52,000	45	73.1	71	124	216
NEWHALL AVENUE	Lyons Avenue	16th Street	1,000	45	55.9	10	18	32
PICO CANYON ROAD	The Old Road	Stevenson Ranch Parkway	41,000	55	74.8	83	142	241
STEVENSON RANCH PARKWAY	Pico Canyon Road	North of Pico Canyon Road	13,000	50	68.5	42	73	126
WILEY CANYON ROAD	Lyons Avenue	Tournament Canyon Road	34,000	40	69.7	48	86	153
LYONS AVENUE EXTENSION			30,000	55	73.5	72	123	209
NEWHALL AVENUE	Market Street	Lyons Avenue	27,000	45	70.2	51	90	157
SIERRA HIGHWAY	Intersection Dockweiler	Intersection Dockweiler	40,000	45	71.9	62	109	190
SIERRA HIGHWAY	Newhall Avenue	Dockweiler Drive	23,000	45	69.5	47	83	145
NEWHALL AVENUE	Sierra Highway	East of Sierra Highway	50,000	45	72.9	69	121	212
CALGROVE BOULEVARD	Wiley Canyon	East End	19,000	55	71.5	59	100	169
CALGROVE BOULEVARD	The Old Road	Wiley Canyon	18,000	55	71.3	57	97	165
THE OLD ROAD	Calgrove Boulevard	North of Calgrove Blvd	13,000	45	67.1	36	63	110
THE OLD ROAD	North of Calgrove Blvd	Pico Canyon Road	13,000	35	63.9	24	44	80
THE OLD ROAD	Sierra Highway	Calgrove Boulevard	20,000	45	68.9	44	78	136
SAN FERNANDO RD (LA)	Sierra Highway	S of Sierra Highway	20,000	45	68.9	44	78	136
CHIQUITO CANYON ROAD	Lower Mid Point	North End	25,000	45	69.9	49	87	151
CHIQUITO CANYON ROAD	South End	Lower Mid-Point	25,000	45	69.9	49	87	151
HILLCREST PARKWAY	The Old Road	Sloan Canyon Road	17,000	45	68.2	41	72	126
SAND CANYON ROAD	S of Placerita Canyon	Little Tujunga Canyon Rd	14,000	45	67.4	37	65	114

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
PLACERITA CANYON ROAD	W of Sand Canyon Road	W of Sand Canyon Road	4,000	40	60.4	17	30	53
PLACERITA CANYON ROAD	Mid-Section	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	45	61.9	20	35	62
SOLEDAD CANYON ROAD	Shadow Pines Blvd	Aqua Dolce Road	17,000	55	71.0	56	95	161
SIERRA HIGHWAY	Davenport Road	North of Davenport Rd	2,000	45	58.9	14	25	44
SIERRA HIGHWAY	North of Davenport Rd	Aqua Dolce Canyon Road	2,000	45	58.9	14	25	44
BOUQUET CANYON ROAD	Vasquez Canyon Road	Mid Section	19,000	50	70.1	51	87	151
BOUQUET CANYON ROAD	Mid Section	North End	19,000	50	70.1	51	87	151
VASQUEZ CANYON ROAD	Sierra Highway	North of Sierra Highway	10,000	45	65.9	32	55	97
VASQUEZ CANYON ROAD	North of Sierra Highway	East of Bouquet Canyon	10,000	40	64.4	26	47	83
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	W of Shadow Pines Blvd	10,000	50	67.3	37	65	111
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	Shadow Pines Blvd	10,000	35	62.8	21	38	69
SOLEDAD CANYON ROAD	West of Sand Canyon	Sand Canyon Road	22,000	40	67.8	39	69	123
SOLEDAD CANYON ROAD	East of Sand Cayon	Sand Canyon Road	31,000	50	72.3	64	110	190
SOLEDAD CANYON ROAD	East of Sand Cayon	East of Sand Cayon	31,000	50	72.3	64	110	190
SAND CANYON ROAD	Jakes Way	South of Soledad Canyon	25,000	45	69.9	49	87	151
SAND CANYON ROAD	South of Soledad Canyon	Soledad Canyon Road	25,000	50	71.3	58	100	172
SOLEDAD CANYON ROAD	West of Sand Canyon	West of Sand Canyon	25,000	50	71.3	58	100	172
SOLEDAD CANYON ROAD	East of Sierra Highway	Sierra Highway	34,000	50	72.7	67	115	199
SOLEDAD CANYON ROAD	East of Sierra Highway	West of Sand Canyon	34,000	45	71.2	57	101	176
SOLEDAD CANYON ROAD	East of Sierra Highway	East of Sierra Highway	34,000	45	71.2	57	101	176
SOLEDAD CANYON ROAD	East of Whites Canyon	Whites Canyon Road	44,000	40	70.9	55	98	174
SOLEDAD CANYON ROAD	East of Whites Canyon	East of Whites Canyon	44,000	45	72.4	65	114	199
SOLEDAD CANYON ROAD	West of Sierra Highway	Sierra Highway	44,000	45	72.4	65	114	199
SOLEDAD CANYON ROAD	West of Sierra Highway	East of Whites Canyon	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Whites Canyon	Whites Canyon	38,000	45	71.7	61	106	186
WHITES CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	41,000	40	70.5	53	95	168
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	42,000	50	73.6	74	127	219
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	42,000	40	70.7	54	96	170
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	42,000	30	67.3	36	66	123
WHITES CANYON ROAD	N of Soledad Canyon	N of Soledad Canyon	42,000	55	74.9	84	144	244

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
	Road	Road						
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	42,000	35	69.0	44	81	146
WHITES CANYON ROAD	N of Soledad Canyon Road	South of Plum Canyon	42,000	45	72.2	64	111	195
WHITES CANYON ROAD	South of Plum Canyon	Plum Canyon Road	42,000	35	69.0	44	81	146
PLUM CANYON ROAD	West of Golden Valley	East of Bouquet Canyon	13,000	40	65.6	30	53	95
PLUM CANYON ROAD	Bouquet Canyon Road	East of Bouquet Canyon	23,000	40	68.0	40	71	126
BOUQUET CANYON ROAD	David Way	Susan	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Plum Canyon	Susan	23,000	45	69.5	47	83	145
COPPER HILL DRIVE	High Ridge	Benz Road	17,000	60	71.0	56	95	161
HASKELL CANYON ROAD	Jeffers Lane	Copper Hill Drive	13,000	45	67.1	36	63	110
HASKELL CANYON ROAD	Bouquet Canyon Road	Ridgegrove Drive	13,000	35	63.9	24	44	80
HASKELL CANYON ROAD	Jeffers Lane	Ridgegrove Drive	13,000	45	67.1	36	63	110
BOUQUET CANYON ROAD	Urbandale Avenue	Plum Canyon	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Haskell Canyon Road	Urbandale Avenue	32,000	45	71.0	56	98	171
BOUQUET CANYON ROAD	Alamogordo Road	Centurion Way	54,000	45	73.2	72	126	220
BOUQUET CANYON ROAD	Centurion Way	Haskell Canyon Road	49,000	45	72.8	69	120	210
BOUQUET CANYON ROAD	Seco Canyon Road	Santa Clarita Parkway	54,000	50	74.7	83	143	247
BOUQUET CANYON ROAD	Santa Clarita Parkway	Urbandale Avenue	31,000	40	69.3	46	82	146
SECO CANYON ROAD	Bouquet Canyon Road	N of Bouquet Canyon Rd	34,000	40	69.7	48	86	153
SECO CANYON ROAD	N of Bouquet Canyon Rd	Decoro Drive	34,000	35	68.1	40	72	131
SECO CANYON ROAD	Decoro Drive	North of Decoro Drive	34,000	35	68.1	40	72	131
SECO CANYON ROAD	North of Decoro Drive	S of Copper Hill Drive	19,000	35	65.5	29	53	97
SECO CANYON ROAD	S of Copper Hill Drive	Copper Hill Drive	19,000	35	65.5	29	53	97
COPPER HILL DRIVE	San Francisquito Canyon	Seco Canyon Road	41,000	35	68.9	44	80	144
COPPER HILL DRIVE	McBean Parkway	San Francisquito Canyon	41,000	50	73.5	73	126	217
MCBEAN PARKWAY	Sunset Hills Drive	Copper Hill Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	South of Sunset Hills	Sunset Hills Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	Decoro Drive	North of Decoro Drive	35,000	40	69.9	49	88	156
MCBEAN PARKWAY	South of Sunset Hills	North of Decoro Drive	35,000	40	69.9	49	88	156
MCBEAN PARKWAY	North of Decoro Drive	North of Decoro Drive	35,000	40	69.9	49	88	156
DECORO DRIVE	McBean Parkway	Grandview	19,000	45	68.7	43	76	133
DECORO DRIVE	Grandview	Hillsburough	14,000	45	67.4	37	65	114
DECORO DRIVE	Hillsburough	Bidwell Lane	17,000	45	68.2	41	72	126
DECORO DRIVE	Bidwell Lane	Delgado Drive	11,000	55	69.1	46	77	132
DECORO DRIVE	Delgado Drive	Seco Canyon Road	11,000	60	69.1	46	77	132
MCBEAN PARKWAY	Newhall Ranch Road	Fairveiw Drive	48,000	40	71.2	58	102	182
MCBEAN PARKWAY	Fairveiw Drive	Decoro Drive	48,000	40	71.2	58	102	182

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
COPPER HILL DRIVE	Alta Vista Way	Smyth Drive	55,000	55	76.1	96	162	276
COPPER HILL DRIVE	Newhall Ranch Road	Smyth Drive	54,000	60	76.0	95	161	274
AVE SCOTT	Avenue Tibbitts	Stanford Avenue	37,000	45	71.6	60	105	183
AVE SCOTT	Stanford Avenue	Rye Canyon	10,000	40	64.4	26	47	83
NEWHALL RANCH ROAD	Rye Canyon Road	Interstate 5 ramp	72,000	45	74.5	83	145	253
BOUQUET CANYON ROAD	Newhall Ranch Road	Espuella Avenue	54,000	55	76.0	95	161	274
BOUQUET CANYON ROAD	Espuella Avenue	Seco Canyon Road	54,000	45	73.2	72	126	220
NEWHALL RANCH ROAD	Bouquet Canyon Road	Hillsburough	68,000	45	74.2	80	141	246
NEWHALL RANCH ROAD	Hillsburough	West of Hillsburough	68,000	45	74.2	80	141	246
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	47,000	45	72.6	67	118	206
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	47,000	50	74.1	78	134	231
NEWHALL RANCH ROAD	W of Hillsburough	East of McBean Pkwy	68,000	50	75.7	93	160	276
NEWHALL RANCH ROAD	East of McBean Pkwy	McBean Parkway	68,000	50	75.7	93	160	276
MCBEAN PARKWAY	Avenue Scott	Newhall Ranch Road	58,000	45	73.6	74	130	228
AVE SCOTT	Rockefeller Avenue	McBean Parkway	27,000	35	67.1	35	64	116
NEWHALL RANCH ROAD	Interstate 5 ramp	Interstate 5 ramp	66,000	50	75.5	91	158	272
NEWHALL RANCH ROAD	E of Interstate 5 ramp	E of Interstate 5 ramp	66,000	45	74.1	79	139	243
COMMERCE CENTER DRIVE			35,666	55	74.2	78	133	226
COMMERCE CENTER DRIVE	Henry Mayo Drive	Hasley Canyon Road	43,000	55	75.0	85	145	247
THE OLD ROAD	South of Hasley Canyon	Hasley Canyon Road	16,000	40	66.5	33	59	105
RIDGE ROUTE ROAD	N of Lake Hughes Road	Templin Parkway	35,000	50	72.8	68	117	201
THE OLD ROAD	Sloan Canyon Road	N of Sloan Canyon Road	20,000	40	67.4	37	66	118
THE OLD ROAD	Hasley Canyon Road	S of Hillcrest Parkway	23,000	40	68.0	40	71	126
THE OLD ROAD	S of Hillcrest Parkway	Hillcrest Parkway	23,000	50	71.0	55	96	165
LONG CANYON ROAD			32,000	45	71.0	56	98	171
STEVENSON RANCH PARKWAY	The Old Road	East of the Old Road	11,000	50	67.8	39	68	116
MCBEAN PARKWAY	Rockwell Canyon Road	Interstate 5 ramp	53,000	45	73.2	71	125	218
MCBEAN PARKWAY	Interstate 5 ramp	Interstate 5 ramp	53,000	45	73.2	71	125	218
PICO CANYON ROAD	The Old Road	Interstate 5 ramp	44,000	55	75.1	86	147	249
LYONS AVENUE	Interstate 5 ramp	Interstate 5	44,000	50	73.8	75	130	224
PICO CANYON ROAD	Interstate 5 ramp	West of Wiley Canyon	44,000	40	70.9	55	98	174
LYONS AVENUE	Wiley Canyon Road	Interstate 5 ramp	44,000	50	73.8	75	130	224
LYONS AVENUE	Interstate 5 ramp	Interstate 5	52,000	50	74.5	82	141	243
RYE CANYON ROAD	The Old Road	NE of The Old Road	58,000	50	75.0	86	148	256
RYE CANYON ROAD	South of Avenue Scott	Avenue Scott	49,000	45	72.8	69	120	210
RYE CANYON ROAD	NE of The Old Road	South of Avenue Scott	58,000	45	73.6	74	130	228
MAGIC MOUNTAIN PARKWAY	The Old Road	Interstate 5	82,000	50	76.5	101	175	301
MAGIC MOUNTAIN PARKWAY	Interstate 5	Tourney Road	58,000	50	75.0	86	148	256

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
MAGIC MOUNTAIN PARKWAY	Interstate 5	Interstate 5	83,000	45	75.1	89	155	272
MAGIC MOUNTAIN PARKWAY	Int of Mag Mt. & Tibbitts	Int of Mag Mt. & Tibbitts	57,000	45	73.5	74	129	226
MAGIC MOUNTAIN PARKWAY	Tourney Road	West of McBean Parkway	60,000	45	73.7	76	132	232
MAGIC MOUNTAIN PARKWAY	McBean Parkway	West of McBean Parkway	60,000	45	73.7	76	132	232
MAGIC MOUNTAIN PARKWAY	West of McBean Parkway	West of McBean Parkway	59,000	50	75.0	87	149	258
MCBEAN PARKWAY	Magic Mountain Parkway	Creekside	72,000	45	74.5	83	145	253
MCBEAN PARKWAY	Creekside	Avenue Scott	77,000	45	74.8	85	150	262
MAGIC MOUNTAIN PARKWAY	McBean Parkway	East of McBean Parkway	54,000	45	73.2	72	126	220
MAGIC MOUNTAIN PARKWAY	East of McBean Parkway	East of McBean Parkway	54,000	40	71.7	61	109	193
MAGIC MOUNTAIN PARKWAY	Valencia Blvd	West of Valencia Blvd	51,000	40	71.5	59	106	188
MAGIC MOUNTAIN PARKWAY	West of Valencia Blvd	West of Valencia Blvd	51,000	40	71.5	59	106	188
MCBEAN PARKWAY	South of Magic Mountain	Magic Mountain Parkway	63,000	40	72.4	66	117	209
MCBEAN PARKWAY	Valencia Blvd	North of Valencia Blvd	63,000	45	73.9	77	136	237
MCBEAN PARKWAY	North of Valencia Blvd	South of Magic Mountain	63,000	45	73.9	77	136	237
VALENCIA BOULEVARD	McBean Parkway	East of McBean Parkway	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	East of McBean Parkway	SW of Magic Mountain Pkwy	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	SW of Magic Mountain Pkwy	East of McBean Parkway	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	McBean Parkway	West of McBean Parkway	61,000	50	75.2	88	152	262
VALENCIA BOULEVARD	West of McBean Parkway	Rockwell Canyon Road	61,000	40	72.3	65	116	205
MCBEAN PARKWAY	Del Monte Drive	Valencia Blvd	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	Arroyo Park Drive	Del Monte Drive	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	South of Arroya Park Dr	Arroyo Park Drive	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	Orchard Village Road	North of Orchard Village	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	North of Orchard Village	South of Arroya Park Dr	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	Rockwell Canyon Road	Singing Hills Drive	44,000	45	72.4	65	114	199
MCBEAN PARKWAY	East of Singing Hills Dr	Orchard Village Road	44,000	45	72.4	65	114	199
MCBEAN PARKWAY	Singing Hills Drive	East of Singing Hills Dr	44,000	45	72.4	65	114	199
TOURNAMENT ROAD	Wiley Canyon Road	Mid-Section	7,000	40	62.9	22	39	70
TOURNAMENT ROAD	Mid-Section	South of McBean Parkway	7,000	55	67.2	37	63	107
WILEY CANYON ROAD	Lyons Avenue	South of Lyons Avenue	20,000	35	65.8	30	55	100
WILEY CANYON ROAD	Calgrove Boulevard	North of Calgrove Blvd	20,000	35	65.8	30	55	100
WILEY CANYON ROAD	North of Calgrove Blvd	South of Lyons Avenue	19,000	40	67.2	36	64	115
VALLEY STREET	Lyons Avenue	South of Lyons Avenue	11,000	45	66.3	33	58	102
LYONS AVENUE	Apple Street	Orchard Village Road	42,000	50	73.6	74	127	219
LYONS AVENUE	Apple Street	Rotella	42,000	50	73.6	74	127	219
LYONS AVENUE	Wiley Canyon	Everette Drive	44,000	50	73.8	75	130	224

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
LYONS AVENUE	Newhall Avenue	Arcadia Street	52,000	50	74.5	82	141	243
LYONS AVENUE	Arcadia Street	Valley Street	52,000	55	75.9	93	158	269
RAILROAD AVENUE	Lyons Avenue	North of Lyons Avenue	36,000	40	70.0	50	89	158
RAILROAD AVENUE	North of Lyons Avenue	South of Via Princessa	36,000	45	71.5	59	103	181
RAILROAD AVENUE	South of Via Princessa	South of Via Princessa	36,000	45	71.5	59	103	181
WILEY CANYON ROAD	East of Tournament	Orchard Village Road	32,000	45	71.0	56	98	171
WILEY CANYON ROAD	Tournament	East of Tournament	32,000	40	69.5	47	84	149
ORCHARD VILLAGE ROAD	Wiley Canyon Road	Mill Valley	54,000	45	73.2	72	126	220
ORCHARD VILLAGE ROAD	Mill Valley	McBean Parkway	54,000	50	74.7	83	143	247
ORCHARD VILLAGE ROAD	Lyons Avenue	Dalbey Drive	34,000	50	72.7	67	115	199
ORCHARD VILLAGE ROAD	Dalbey Drive	16th Street	34,000	35	68.1	40	72	131
RAILROAD AVENUE	Via Princessa	North of Via Princessa	40,000	45	71.9	62	109	190
RAILROAD AVENUE	North of Via Princessa	South of Magic Mountain	40,000	50	73.4	72	124	214
RAILROAD AVENUE	South of Magic Mountain	Magic Mountain Parkway	54,000	50	74.7	83	143	247
MAGIC MOUNTAIN PARKWAY			45,000	40	71.0	56	99	176
VALENCIA BOULEVARD	Magic Mountain Parkway	N of Magic Mountain Pkwy	60,000	45	73.7	76	132	232
VALENCIA BOULEVARD	N of Magic Mountain Pkwy	W of Bouquet Canyon	60,000	35	70.5	53	97	176
VALENCIA BOULEVARD	West of Bouquet Canyon	Bouquet Canyon Road	50,000	50	74.3	80	138	238
VALENCIA BOULEVARD	West of Bouquet Canyon	West of Bouquet Canyon	50,000	50	74.3	80	138	238
BOUQUET CANYON ROAD	Magic Mountain Parkway	Cenema Drive	54,000	45	73.2	72	126	220
BOUQUET CANYON ROAD	Cenema Drive	Valencia Blvd	54,000	45	73.2	72	126	220
VIA PRINCESSA	Railroad Avenue	East of Railroad Canyon	27,000	35	67.1	35	64	116
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	27,000	35	67.1	35	64	116
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	27,000	55	73.0	69	117	199
VIA PRINCESSA			55,000	55	76.1	96	162	276
VIA PRINCESSA			55,000	50	74.7	84	145	249
VIA PRINCESSA			55,000	40	71.8	62	110	195
VIA PRINCESSA			55,000	50	74.7	84	145	249
SANTA CLARITA PARKWAY	Via Princessa	South of Via Princessa	38,000	45	71.7	61	106	186
SANTA CLARITA PARKWAY	South of Via Princessa	South of Via Princessa	38,000	45	71.7	61	106	186
SANTA CLARITA PARKWAY	Sierra Highway	West of Sierra Highway	39,000	45	71.8	61	107	188
SANTA CLARITA PARKWAY	Soledad Canyon Road	South of Soledad Canyon	30,000	45	70.7	54	95	166
SANTA CLARITA PARKWAY	Via Princessa	North of Via Princessa	34,000	45	71.2	57	101	176
DOCKWEILER DRIVE	Mid-Section	Mid-Section	18,000	25	61.9	17	33	64
NEWHALL AVENUE	Sierra Highway	Valle Del Oro	40,000	45	71.9	62	109	190
NEWHALL AVENUE	NW of Valle Del Oro	NW of Valle Del Oro	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	The Old Road	North of The Old Road	30,000	45	70.7	54	95	166
SIERRA HIGHWAY	North of The Old Road	Newhall Avenue	33,000	45	71.1	57	99	173

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
SIERRA HIGHWAY	Dockweiler Drive	North of Dockweiler	39,000	45	71.8	61	107	188
SIERRA HIGHWAY	North of Dockweiler	Placerita Canyon Road	39,000	50	73.3	71	123	212
GOLDEN VALLEY ROAD	Sierra Highway	SR-14	36,000	50	72.9	69	118	204
GOLDEN VALLEY ROAD	SR-14	East of SR-14	15,000	55	70.5	53	89	152
GOLDEN VALLEY ROAD			37,000	40	70.1	51	90	160
GOLDEN VALLEY ROAD	East of SR-14	East End	15,000	50	69.1	45	78	135
SIERRA HIGHWAY	Golden Valley Road	North of Golden Valley Rd	30,000	50	72.1	63	109	187
SIERRA HIGHWAY	North of Golden Valley Rd	North of Golden Valley Rd	30,000	50	72.1	63	109	187
SIERRA HIGHWAY	North of Golden Valley Rd	South of Via Princessa	30,000	45	70.7	54	95	166
SIERRA HIGHWAY	South of Via Princessa	Via Princessa	30,000	45	70.7	54	95	166
SIERRA HIGHWAY	Via Princessa	North of Via Princessa	34,000	45	71.2	57	101	176
SIERRA HIGHWAY	North of Via Princessa	Jakes Way	34,000	45	71.2	57	101	176
JAKES WAY/CANYON PARK BL	Sierra Highway	Lost Canyon	12,000	25	60.1	14	27	51
VIA PRINCESSA	Whites Canyon	West of Whites Canyon	27,000	40	68.7	43	77	137
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	27,000	40	68.7	43	77	137
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	27,000	60	73.0	69	117	199
VIA PRINCESSA	SE of Whites Canyon	NW of Sierra Highway	52,000	50	74.5	82	141	243
SOLEDAD CANYON ROAD	West of Whites Canyon	West of Whites Canyon	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Whites Canyon	East of Golden Valley Rd	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	East of Golden Valley Rd	East of Golden Valley Rd	50,000	45	72.9	69	121	212
SOLEDAD CANYON ROAD	Golden Valley Road	East of Golden Valley Rd	50,000	40	71.4	59	105	186
SOLEDAD CANYON ROAD	West of Golden Valley	E of Santa Clarita Pkwy	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	Golden Valley Road	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Golden Valley	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	E of Santa Clarita Pkwy	W of Santa Clarita Pkwy	50,000	50	74.3	80	138	238
SOLEDAD CANYON ROAD	W of Santa Clarita Pkwy	Bouquet Canyon Road	45,000	50	73.9	76	131	227
SANTA CLARITA PARKWAY	Soledad Canyon Road	Newhall Ranch Road	30,000	45	70.7	54	95	166
GOLDEN VALLEY ROAD	Soledad Canyon Road	Nth of Soledad Cyn Road	44,000	50	73.8	75	130	224
NEWHALL AVENUE	Railroad Avenue	Market Street	27,000	50	71.7	60	103	178
NEWHALL AVENUE	SE of Railroad Avenue	Railroad Avenue	27,000	50	71.7	60	103	178
SHADOW PINES BOULEVARD		South of Davenport Road	12,000	45	66.7	35	61	106
LYONS AVENUE	Rotella	Peachland Avenue	43,000	55	75.0	85	145	247
LYONS AVENUE	Peachland Avenue	Everette Drive	42,000	55	74.9	84	144	244
ORCHARD VILLAGE ROAD	16th Street	North of 16th Street	44,000	35	69.2	45	82	150
ORCHARD VILLAGE ROAD	North of 16th Street	Wiley Canyon Road	44,000	50	73.8	75	130	224
TOURNAMENT ROAD	South of McBean Parkway	McBean Parkway	7,000	55	67.2	37	63	107
NEWHALL AVENUE	Valle Del Oro	NW of Valle Del Oro	33,000	55	73.9	76	128	218

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
NEWHALL AVENUE	NW of Valle Del Oro	SE of Railroad Avenue	33,000	50	72.5	66	114	196
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	32,000	50	72.4	65	112	193
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	32,000	50	72.4	65	112	193
SIERRA HIGHWAY	Placerita Canyon Road	Golden Valley Road	25,000	45	69.9	49	87	151
SIERRA HIGHWAY	Golden Valley Road	N of Golden Valley Rd	30,000	45	70.7	54	95	166
DOCKWEILER DRIVE	Sierra Highway	Mid-Section	24,000	35	66.6	33	60	109
HASLEY CANYON ROAD	Commerce Center Drive	Del Valle Road	14,000	50	68.8	44	76	130
WILEY CANYON ROAD	Orchard Village Road	E of Orchard Village Rd	41,000	40	70.5	53	95	168
THE OLD ROAD	Hillcrest Parkway	South of Parker Road	13,000	50	68.5	42	73	126
THE OLD ROAD	South of Parker Road	Parker Road	13,000	45	67.1	36	63	110
LAKE HUGHES ROAD	The Old Road	Castaic Road	37,000	35	68.4	42	75	137
THE OLD ROAD	Stevensons Ranch Parkway	Valencia Boulevard	41,000	45	72.0	63	110	193
NEWHALL RANCH ROAD	McBean Parkway	Avenue Tibbitts	71,000	45	74.4	82	144	252
GOLDEN VALLEY ROAD	Plum Canyon Road	South of Plum Cyn Rd	44,000	55	75.1	86	147	249
GOLDEN VALLEY ROAD			39,000	50	73.3	71	123	212
SIERRA HIGHWAY	South of Sand Canyon	South of Sand Canyon	17,000	45	68.2	41	72	126
SIERRA HIGHWAY	North of Skyline Ranch Rd	South of Sand Canyon	17,000	40	66.7	34	61	108
SIERRA HIGHWAY	North of Skyline Ranch Rd	North of Skyline Ranch Rd	38,000	40	70.2	51	91	162
SIERRA HIGHWAY	South of Skyline Ranch Rd	North of Skyline Ranch Rd	38,000	40	70.2	51	91	162
SIERRA HIGHWAY	Soledad Canyon Road	South of Skyline Ranch Rd	52,000	40	71.6	60	107	190
SAND CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	14,000	50	68.8	44	76	130
SAND CANYON ROAD			8,000	45	65.0	28	50	87
SHADOW PINES BOULEVARD	North of Soledad Canyon	South of Davenport Road	9,000	40	64.0	25	44	79
LOST CANYON ROAD			15,000	45	67.7	39	68	118
LOST CANYON ROAD			16,000	45	68.0	40	70	122
LOST CANYON ROAD	Jakes Way	North-East of Jakes Way	16,000	55	70.7	54	92	156
VIA PRINCESSA	Sierra Highway	NW of Sierra Highway	52,000	40	71.6	60	107	190
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	27,000	40	68.7	43	77	137
SIERRA HIGHWAY	Jakes Way	Soledad Canyon Road	36,000	45	71.5	59	103	181
HASLEY CANYON RD	The Old Road	North of The Old Road	6,000	40	62.2	20	36	64
PARKER ROAD	The Old Road	Sloan Canyon Drive	1,000	50	57.3	13	22	37
PARKER ROAD	The Old Road	Interstate 5	10,000	50	67.3	37	65	111
PARKER ROAD	Interstate 5	Castaic Road	10,000	45	65.9	32	55	97

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	Distance to CNEL Contour from CL(ft.)		
						70'	65'	60'
LAKE HUGHES ROAD	Ridge Route Road	North-East of Ridge Route	7,000	35	61.2	18	32	58
LAKE HUGHES ROAD	North-East of Ridge Route	Mid-Section	7,000	50	65.8	32	55	94
LAKE HUGHES ROAD	North-East of Ridge Route	North-East of Ridge Route	7,000	50	65.8	32	55	94
SHADOW PINES BOULEVARD	North of Soledad Canyon	North of Soledad Canyon	9,000	40	64.0	25	44	79
SHADOW PINES BOULEVARD	Soledad Canyon Road	North of Soledad Canyon	9,000	40	64.0	25	44	79
VIA PRINCESSA	Lost Canyon Road	South of Lost Canyon	3,000	35	57.5	11	21	37
LOST CANYON ROAD	Via Princessa	Jakes Way	21,000	50	70.6	53	92	158
VASQUEZ CANYON ROAD	East of Bouquet Canyon	East of Bouquet Canyon	6,000	35	60.5	16	29	53
VASQUEZ CANYON ROAD	East of Bouquet Canyon	Bouquet Canyon Road	6,000	35	60.5	16	29	53
GOLDEN VALLEY ROAD	Via Princessa	Soledad Canyon Road	32,000	60	73.8	74	127	215
COPPER HILL DRIVE	Benz Road	David Way	17,000	45	68.2	41	72	126
DRY GULCH RD			4,000	45	61.9	20	35	62
TEMPLIN PK	At Interstate 5	At Interstate 5	8,000	50	66.4	34	58	100
TEMPLIN PK	Templin Highway	North of Templin Highway	6,000	40	62.2	20	36	64
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	9,000	40	64.0	25	44	79
SLOAN CANYON RD	Hasley Canyon Road	Hillcrest Parkway	3,000	40	59.2	14	26	46
SLOAN CANYON RD	Parker Road	The Old Road	2,000	40	57.4	12	21	37
SLOAN CANYON RD	Parker Road	West of Parker Road	2,000	40	57.4	12	21	37
POTRERO CANYON RD			9,000	40	64.0	25	44	79
VALENCIA BLVD	Magic Mountain Parkway	West of Magic Mountain	30,000	45	70.7	54	95	166
VALENCIA BLVD	Magic Mountain Parkway	South of Magic Mountain	51,000	55	75.8	92	157	267
VALENCIA BLVD	Pico Canyon Road	East of Pico Cyn Road	33,000	50	72.5	66	114	196
VALENCIA BLVD	The Old Road	West of The Old Road	61,000	45	73.8	76	134	234
PICO CANYON ROAD			44,000	45	72.4	65	114	199
PICO CANYON ROAD	Stevenson Ranch Parkway	W of Stevenson Ranch	29,000	55	73.3	71	121	206
SKYLINE RANCH RD	Whites Canyon	Sierra Highway	16,500	45	68.1	40	71	124
LOST CANYON ROAD	Sand Canyon Road	West of Sand Canyon Rd	12,000	40	65.2	29	51	91
COPPER HILL DRIVE			45,500	55	75.3	88	149	253
NEWHALL RANCH ROAD	Interstate 5 ramp	The Old Road	66,000	55	76.9	104	177	300
JAKES WAY	Jakes Way	Lost Canyon	12,000	40	65.2	29	51	91
NEWHALL RANCH ROAD	Santa Clarita Pkwy	E of Santa Clarita Pkwy	47,000	45	72.6	67	118	206
LITTLE TUJUNGA CANYON RO	Sand Canyon Road	South	20,000	40	67.4	37	66	118
RAILROAD AVENUE	Newhall Avenue	Lyons Avenue	26,000	50	71.5	59	101	175

Proposed Traffic Noise Contours for Freeways

FREEWAY SEGMENT	ADT	FREEWAY	CNEL @50'	Distance to CNEL Contour from CL(ft.)		
				70'	65'	60'
I-5 n/o Lake Hughes	193,000	I-5	88.0	394	698	1237
I-5 s/o Lake Hughes	205,000	I-5	88.3	406	719	1275
I-5 s/o Parker	239,000	I-5	89.0	438	776	1375
I-5 s/o Hasley Cyn	245,000	I-5	89.1	444	786	1393
I-5 s/o SR-126	219,000	I-5	88.6	420	743	1317
I-5 s/o Rye Cyn	239,000	I-5	89.0	438	776	1375
I-5 s/o Magic Mtn	249,000	I-5	89.2	447	792	1404
I-5 s/o Valencia	259,000	I-5	89.3	456	808	1431
I-5 s/o McBean	264,000	I-5	89.4	460	816	1445
I-5 s/o Lyons	271,000	I-5	89.5	466	826	1464
I-5 s/o Calgrove	267,000	I-5	89.5	463	820	1453
SR-14 n/o Aqua Dulce	154,000	SR-14	85.5	259	441	749
SR-14 s/o Aqua Dulce	158,000	SR-14	85.6	262	446	757
SR-14 s/o Soledad Cyn	177,000	SR-14	86.1	277	470	798
SR-14 s/o Sand Cyn	185,000	SR-14	86.3	282	479	814
SR-14 s/o Via Princessa	193,000	SR-14	86.5	288	489	830
SR-14 s/o Sierra Hwy	217,000	SR-14	87.0	304	516	877
SR-14 s/o Golden Valley	202,000	SR-14	86.7	294	499	848
SR-14 s/o Placerita Cyn	216,000	SR-14	87.0	303	515	875
SR-14 n/o I-5	231,000	SR-14	87.3	313	531	902

ONE VALLEY ONE VISION (OVOV)
NOISE ELEMENT OF THE GENERAL PLAN
TECHNICAL APPENDIX

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ONE VALLEY ONE VISION NOISE ELEMENT TECHNICAL APPENDIX

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1.0 INTRODUCTION

The Noise Element of a General Plan is a comprehensive program for including noise management in the planning process. It is a tool for local planners to use in achieving and maintaining land uses that are compatible with environmental noise levels. The Noise Element identifies noise sensitive land uses and noise sources, and defines areas of noise impact for the purpose of developing programs to ensure that residents in the One Valley One Vision (OVOV) area will be protected from excessive noise intrusion.

The OVOV planning area includes all of the City of Santa Clarita and portions of the County of Los Angeles. The current Noise Element of the General Plan for the City of Santa Clarita was last updated in May 2000. It identifies roadways as the most significant source of noise in the City. While traffic noise is still the major noise source in the City, other sources have become a concern. Additionally, the method for controlling noise and incorporating noise concerns into planning decisions has become more sophisticated over the years since the first Element was adopted. Thus, the decision was made by the City and the County to update the planning for the OVOV area to more effectively protect and plan for the residents of the area.

This document constitutes the Technical Appendix of the Noise Element and provides the technical background for the Noise Element. Topics covered in the Technical Appendix include background information on noise, health effects related to noise pollution, methodologies used to monitor and model noise levels throughout the study area, the results of the noise monitoring program, and the noise contours for the area. Additionally, the noise impacts of the OVOV plan are discussed, specific noise issues for the OVOV are addressed, and policy recommendations are made.

The Noise Element, including the Technical Appendix, follows the revised State guidelines ("General Plan Guidelines," Governors Office of Planning and Research, October 2003) and State Government Code Section 65302(f). The Element quantifies the community noise environment in terms of noise exposure contours for both near and long-term levels of growth

and traffic activity. The information will become a guideline for the development of land use policies to achieve compatible land uses and provide baseline levels and noise source identification for local noise ordinance enforcement.

2.0 BACKGROUND INFORMATION ON NOISE

This section presents background information on the characteristics of noise and summarizes the methodologies used to study the noise environment. This section will give the reader an understanding of the metrics and methodologies used to assess noise impacts. The section is divided as follows:

- *Properties of sound that are important for technically describing sound*
- *Acoustic factors influencing human subjective response to sound.*
- *Potential disturbances to humans and health effects due to sound.*
- *Sound rating scales used in this study*
- *Summary of noise assessment criteria*

2.1 Characteristics of Sound

Sound Level and Frequency. Sound can be technically described in terms of the sound pressure (amplitude) and frequency (similar to pitch). Sound pressure is a direct measure of the magnitude of a sound without consideration for other factors that may influence its perception.

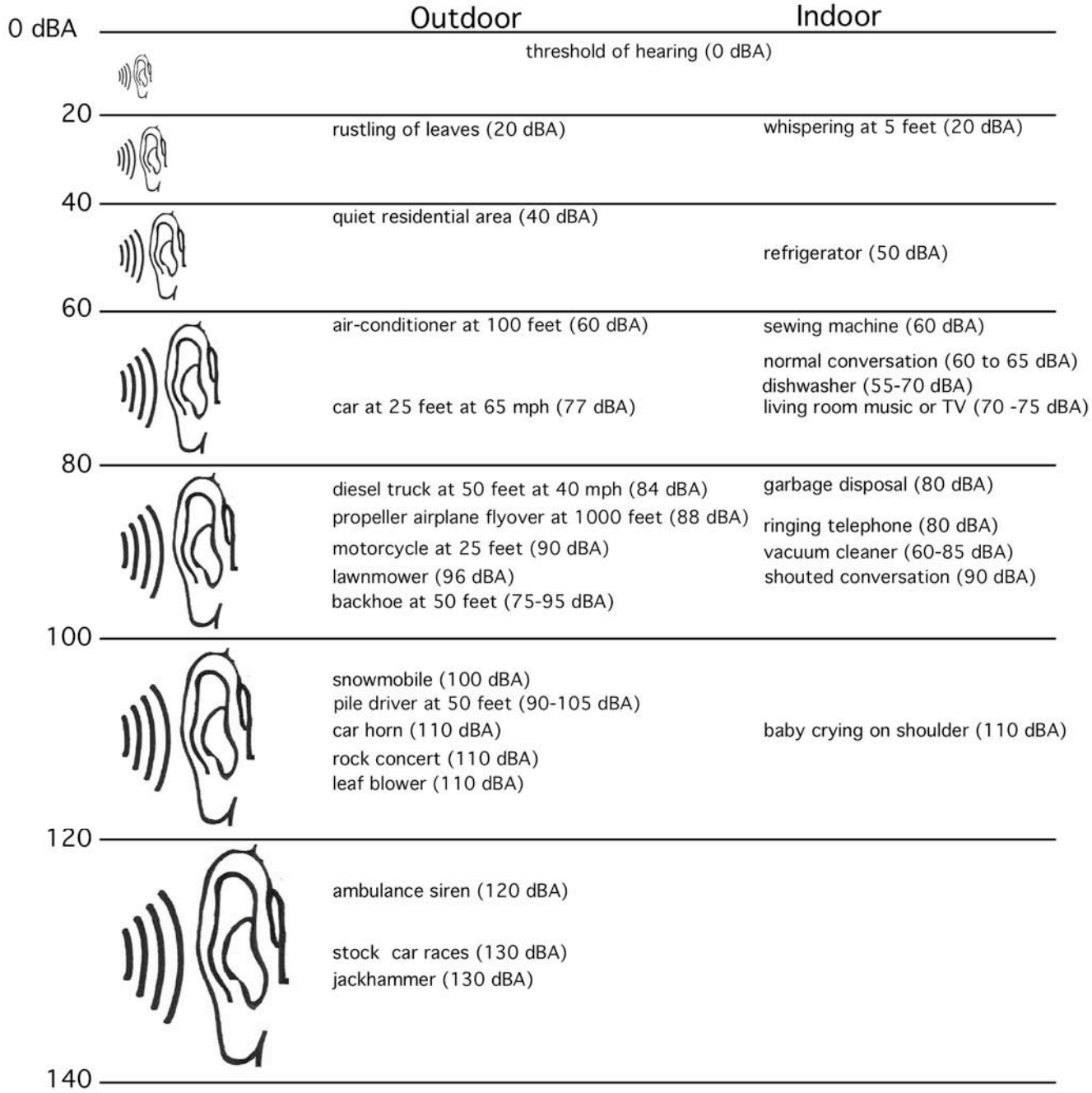
The range of sound pressures that occur in the environment is so large that it is convenient to express these pressures as sound pressure levels on a logarithmic scale which compresses the wide range of sound pressures to a more usable range of numbers. The standard unit of measurement of sound is the decibel (dB), which describes the pressure of a sound relative to a reference pressure.

The frequency (pitch) of a sound is expressed as Hertz (Hz) or cycles per second. The normal audible frequency for young adults is 20 Hz to 20,000 Hz. Community noise, including aircraft and motor vehicles, typically ranges between 50 Hz and 5,000 Hz. The human ear is

not equally sensitive to all frequencies, with some frequencies judged to be louder for a given signal than others. As a result of this, various methods of frequency weighting have been developed. The most common weighting is the A-weighted noise curve (dBA). The A-weighted decibel scale (dBA) performs this compensation by discriminating against frequencies in a manner approximating the sensitivity of the human ear. In the A-weighted decibel, everyday sounds normally range from 30 dBA (very quiet) to 100 dBA (very loud). Most community noise analyses are based upon the A-weighted decibel scale. Examples of various sound environments, expressed in dBA, are presented in Exhibit 1.

Propagation of Noise. Outdoor sound levels decrease as the distance from the source increases, and as a result of wave divergence, atmospheric absorption and ground attenuation. Sound radiating from a source in a homogeneous and undisturbed manner travels in spherical waves. As the sound wave travels away from the source, the sound energy is dispersed over a greater area decreasing the sound power of the wave. Spherical spreading of the sound wave reduces the noise level at a rate of 6 dB per doubling of the distance.

Atmospheric absorption also influences the levels received by the observer. The greater the distance traveled, the greater the influence of the atmosphere and the resultant fluctuations. Atmospheric absorption becomes important at distances of greater than 1,000 feet. The degree of absorption varies depending on the frequency of the sound as well as the humidity and temperature of the air. For example, atmospheric absorption is lowest (i.e., sound carries farther) at high humidity and high temperatures. A schematic diagram of how weather including temperature gradients and wind can affect sound propagation is shown in Exhibit 2. Turbulence and gradients of wind, temperature and humidity also play a significant role in determining the degree of attenuation. Certain conditions, such as inversions, can channel or focus the sound waves resulting in higher noise levels than would result from simple spherical spreading. Absorption effects in the atmosphere vary with frequency. The higher frequencies are more readily absorbed than the lower frequencies. Over large distances, the lower frequencies become the dominant sound as the higher frequencies are attenuated.



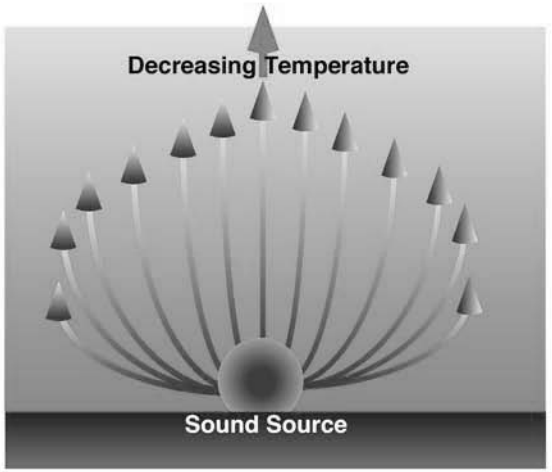
Sources: League For The Hard Of Hearing, www.lhh.org
Handbook of Noise Control, McGraw Hill, Edited byCyril Harris, 1979
Measurements by Mestre Greve Associates

Exhibit 1
Typical Sounds Levels in A-Weighted Decibels (dBA)

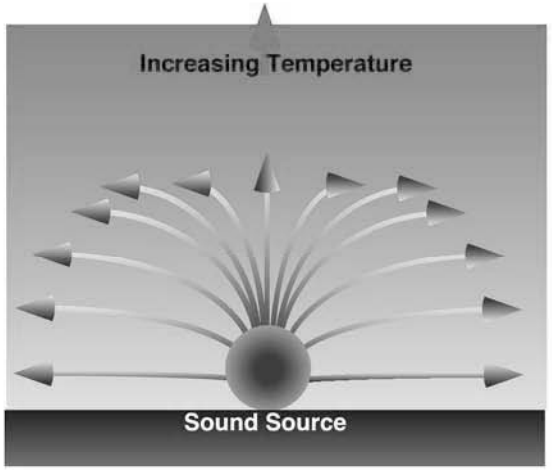
Exhibit 2

THE EFFECTS OF WEATHER ON SOUND PROPAGATION

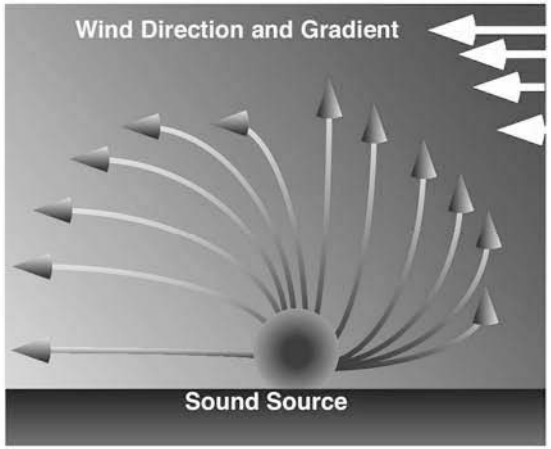
Refraction of sound in an atmosphere with a normal lapse rate. Sound rays are bent upwards.



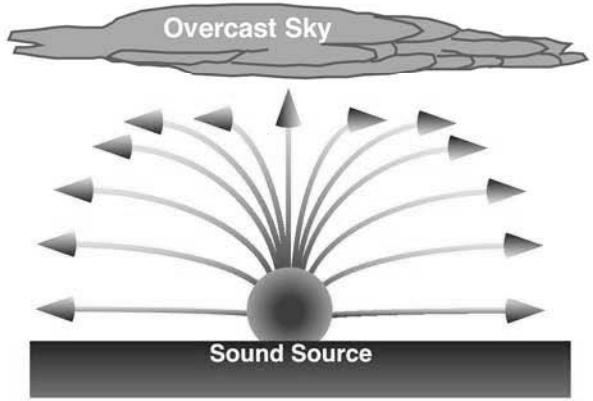
Refraction of sound in an atmosphere with an inverted lapse rate. Sound rays are bent downward.



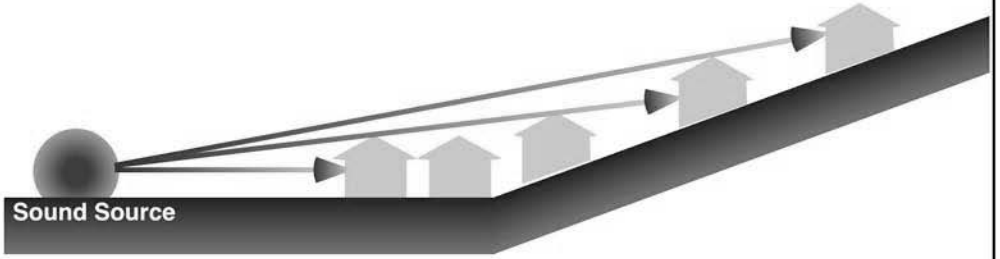
Refraction of sound in an atmosphere with a wind present. Sound rays are bent in the direction of the wind.



Refraction of sound in an atmosphere with overcast sky conditions. Sound rays are bent downward.



Propagation of sound over terrain. Ground absorption and shielding may be present for buildings at the same elevation as the source. No shielding is present for buildings which can 'see' the source.



Source: Adapted from Vancouver International Airport, Noise Management Report.

Duration of Sound. Annoyance from a noise event increases with increased duration of the noise event, i.e., the longer the noise event, the more annoying it is. The "*effective duration*" of a sound is the time between when a sound rises above the background sound level until it drops back below the background level. Psycho-acoustic studies have determined the relationship between duration and annoyance and the amount a sound must be reduced to be judged equally annoying for increased duration. Duration is an important factor in describing sound in a community setting.

The relationship between duration and noise level is the basis of the equivalent energy principal of sound exposure. Reducing the acoustic energy of a sound by one half results in a 3 dB reduction. Doubling the duration of the sound increases the total energy of the event by 3 dB. This equivalent energy principal is based upon the premise that the potential for a noise to impact a person is dependent on the total acoustical energy content of the noise. Defined in subsequent sections of this study, noise metrics such as CNEL, DNL, LEQ and SENEL are all based upon the equal energy principle.

Change in Noise. The concept of change in ambient sound levels can be understood with an explanation of the hearing mechanism's reaction to sound. The human ear is a far better detector of relative differences in sound levels than absolute values of levels. Under controlled laboratory conditions, listening to a steady unwavering pure tone sound that can be changed to slightly different sound levels, a person can just barely detect a sound level change of approximately one decibel for sounds in the mid-frequency region. When ordinary noises are heard, a young healthy ear can detect changes of two to three decibels. A five decibel change is readily noticeable while a 10 decibel change is judged by most people as a doubling or a halving of the loudness of the sound. It is typical in environmental documents to consider a 3 dB change as potentially discernable.

Masking Effect. The ability of one sound to limit a listener from hearing another sound is known as the masking effect. The presence of one sound effectively raises the threshold of audibility for the hearing of a second sound. For a signal to be heard, it must exceed the

threshold of hearing for that particular individual and exceed the masking threshold for the background noise.

The masking characteristics of sound depend on many factors including the spectral (frequency) characteristics of the two sounds, the sound pressure levels, and the relative start time of the sounds. Masking effect is greatest when the frequencies of the two sounds are similar or when low frequency sounds mask higher frequency sounds. High frequency sounds do not easily mask low frequency sounds.

2.2 Factors Influencing Human Response to Sound

Many factors influence sound perception and annoyance. This includes not only physical characteristics of the sound but also secondary influences such as sociological and external factors. Molino, in the *Handbook of Noise Control* describes human response to sound in terms of both acoustic and non-acoustic factors. These factors are summarized in Table 1.

Sound rating scales are developed in reaction to the factors affecting human response to sound. Nearly all of these factors are relevant in describing how sounds are perceived in the community. Many non-acoustic parameters play a prominent role in affecting individual response to noise. Background sound, an additional acoustic factor not specifically listed, is also important in describing sound in rural settings. Researchers have identified the effects of personal and situational variables on noise annoyance, and have identified a clear association of reported annoyance and various other individual perceptions or beliefs.

Thus, it is important to recognize that non-acoustic factors as well as acoustic factors contribute to human response to noise.

Table 1
Factors that Affect Individual Annoyance to Noise

Primary Acoustic Factors
- Sound Level
- Frequency
- Duration

Secondary Acoustic Factors
- Spectral Complexity
- Fluctuations in Sound Level
- Fluctuations in Frequency
- Rise-time of the Noise
- Localization of Noise Source

Non-acoustic Factors
- Physiology
- Adaptation and Past Experience
- How the Listener's Activity Affects Annoyance
- Predictability of When a Noise will Occur
- Is the Noise Necessary?
- Individual Differences and Personality

Source: C. Harris, 1979

2.3 Sound Rating Scales

The description, analysis, and reporting of community sound levels is made difficult by the complexity of human response to sound and myriad sound-rating scales and metrics developed to describe acoustic effects. Various rating scales approximate the human subjective assessment to the "loudness" or "noisiness" of a sound. Noise metrics have been developed to account for additional parameters such as duration and cumulative effect of multiple events.

Noise metrics are categorized as single event metrics and cumulative metrics. Single event metrics describe the noise from individual events, such as one aircraft flyover. Cumulative metrics describe the noise in terms of the total noise exposure throughout the day. Noise

metrics used in this study are summarized below. First single event metrics are discussed followed by discussions of the cumulative metrics.

Single Event Metrics

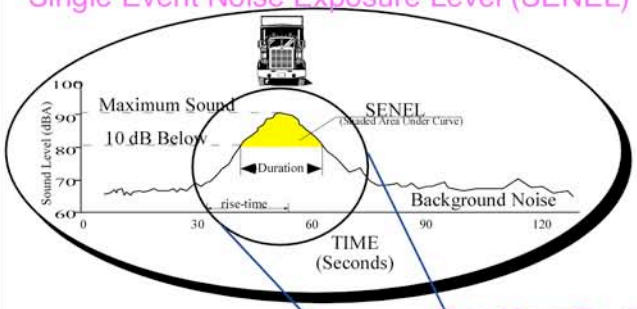
Frequency Weighted Metrics (dBA). In order to simplify the measurement and computation of sound loudness levels, frequency weighted networks have obtained wide acceptance. The A-weighting (dBA) scale has become the most prominent of these scales and is widely used in community noise analysis. Its advantages are that it has shown good correlation with community response and is easily measured. The metrics used in this study are all based upon the dBA scale.

Maximum Noise Level or Lmax is the highest noise level reached during a noise event. For example, as an aircraft approaches, the sound of the aircraft begins to rise above ambient noise levels. The closer the aircraft gets the louder it is until the aircraft is at its closest point directly overhead. Then as the aircraft passes, the noise level decreases until the sound level again settles to ambient levels. Such a history of a flyover is plotted at the top of Exhibit 3. It is this metric to which people generally instantaneously respond when an aircraft flyover or a loud vehicle like a truck or motorcycle passes by.

Single Event Noise Exposure Level (SENEL) or Sound Exposure Level (SEL) is computed from dBA sound levels, and is used to quantify the total noise associated with an event such as an aircraft overflight or a train pass-by. Referring again to the top of Exhibit 3, the shaded area, or the area within 10 dB of the maximum noise level, is the area from which the SENEL is computed. The SENEL value is the integration of all the acoustic energy contained within the event. Speech and sleep interference research can be assessed relative to Single Event Noise Exposure Level data.

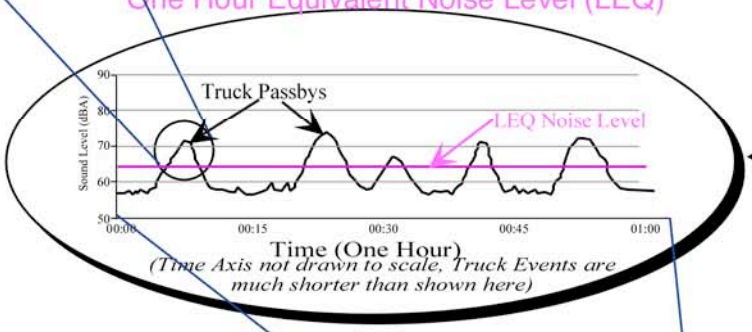
The SENEL metric takes into account the maximum noise level of the event and the duration of the event. Single event metrics are a convenient method for describing noise from individual aircraft events. This metric is useful in that airport noise models contain aircraft

Single Event Noise Exposure Level (SENEL)



Single Event Noise

One Hour Equivalent Noise Level (LEQ)



Hourly Noise

24-Hour Noise Level (CNEL)

24 Hour Noise

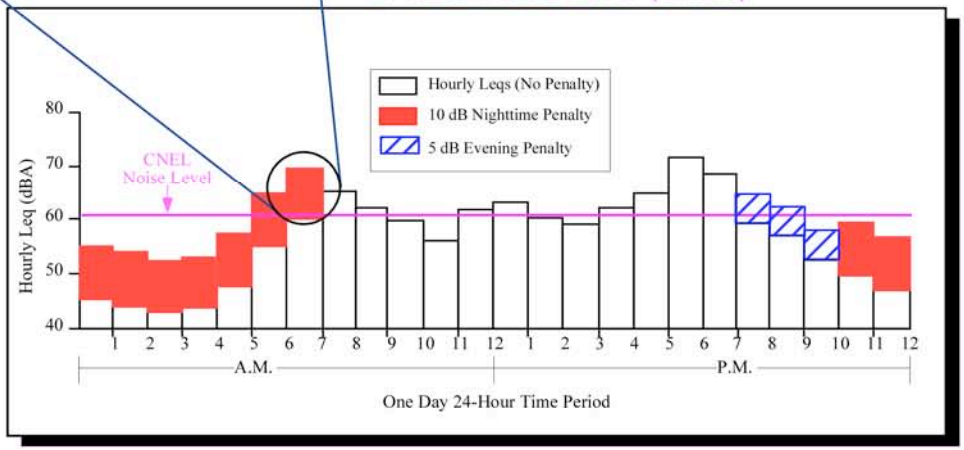


Exhibit 3
Single and Cumulative Noise Metric Definitions
Source: Mestre Greve Associates 1998
OVOV General Plan Noise Element

noise curve data based upon the SENEL metric. In addition, cumulative noise metrics such as LEQ, CNEL and DNL can be computed from SENEL data.

Cumulative Metrics

Cumulative noise metrics assess community response to noise by including the loudness of the noise, the duration of the noise, the total number of noise events and the time of day these events occur into one single number rating scale.

Equivalent Noise Level (Leq) is the sound level corresponding to a steady-state A-weighted sound level containing the same total energy as several SEL events during a given sample period. Leq is the "energy" average noise level during the time period of the sample. It is based on the observation that the potential for noise annoyance is dependent on the total acoustical energy content of the noise. This is graphically illustrated in the middle graph of Exhibit 3. Leq can be measured for any time period, but is typically measured for 15 minutes, 1 hour or 24-hours. Leq for a one hour period is used by the Federal Highway Administration for assessing highway noise impacts. Leq for one hour is called Hourly Noise Level (HNL) in the California Airport Noise Regulations and is used to develop Community Noise Equivalent Level (CNEL) values for aircraft operations.

Community Noise Equivalent Level, or CNEL is a 24-hour, time-weighted energy average noise level based on the A-weighted decibel. It is a measure of the overall noise experienced during an entire day. The term “time-weighted” refers to the penalties attached to noise events occurring during certain sensitive time periods. In the CNEL scale, noise occurring between the hours of 7 p.m. and 10 p.m. is penalized by approximately 5 dB. This penalty accounts for the greater potential for noise to cause communication interference during these hours, as well as typically lower ambient noise levels during these hours. Noise that takes place during the night (10 p.m. to 7 a.m.) is penalized by 10 dB. This penalty was selected to attempt to account for the higher sensitivity to noise in the nighttime and the expected further decrease in background noise levels that typically occur in the nighttime.

CNEL is graphically illustrated in the bottom of Exhibit 3. Examples of various noise environments in terms of CNEL are presented in Exhibit 4. CNEL is specified for use in California by local planning agencies in their General Plan Noise Element for land use compatibility planning.

The DNL index is very similar to CNEL, but does not include the evening (7 p.m. to 10 p.m.) penalty that is included in CNEL. It does include the nighttime (10 p.m. to 7 a.m.) penalty. Typically, DNL is about 1 dB lower than CNEL, although the difference may be greater if there is an abnormal concentration of noise events in the 7 to 10 p.m. time period. DNL is specified for use in all States except California.

L(%), Lmax and Lmin are statistical methods of describing noise which accounts for variance in noise levels throughout a given measurement period. L(%) is a way of expressing the noise level exceeded for a percentage of time in a given measurement period. For example since 5 minutes is 25% of 20 minutes, L(25) is the noise level that is equal to or exceeded for five minutes in a twenty minute measurement period. It is L(%) that is used for most Noise Ordinance standards. Lmax represents the loudest noise level that is measured. The Lmax only occurs for a fraction of a second with all the other noise less than the Lmax level. Lmin represents the quietest noise level during a noise measurement. All other noise during the measurement period is louder than the Lmin.

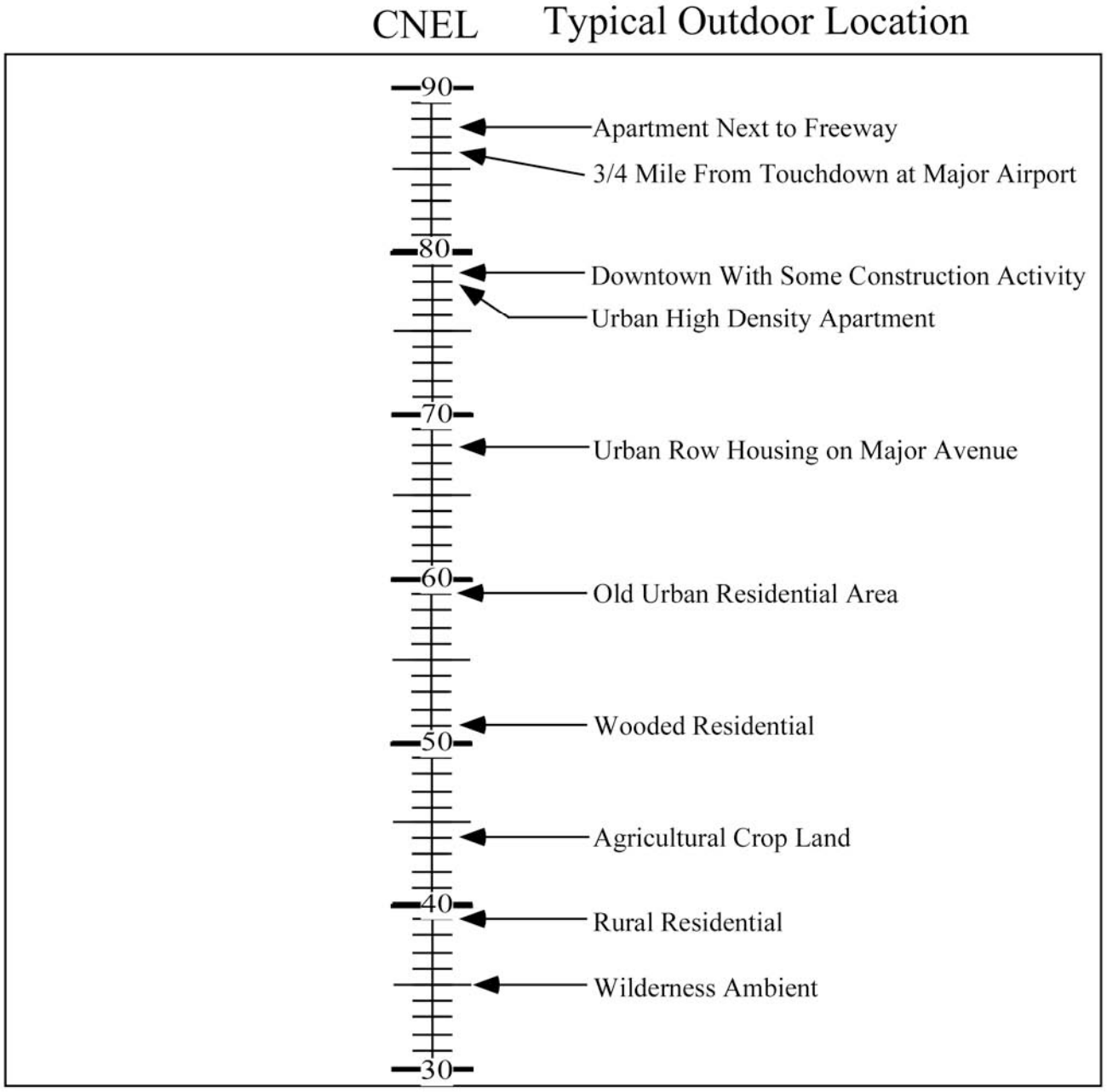


Exhibit 4

Examples of Typical Outdoor CNEL Levels

Source: Adapted from "Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare With an Adequate Margin of Safety", EPA, 1974

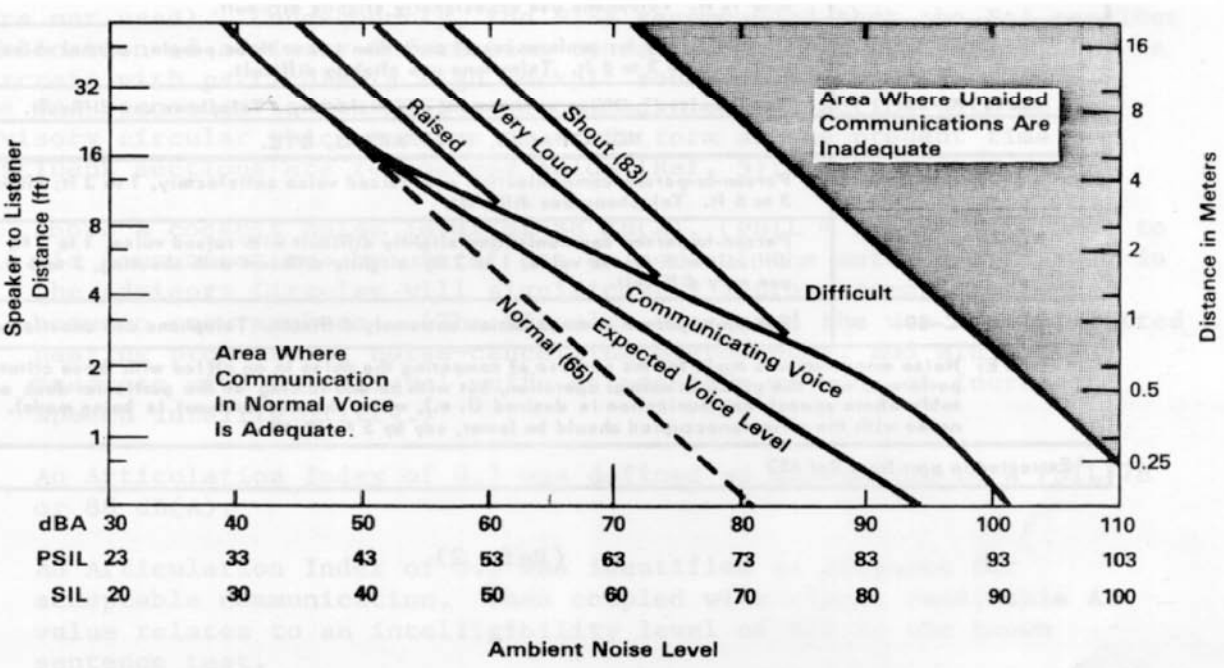
3.0 HEALTH EFFECTS

Noise, often described as unwanted sound, is known to have several adverse effects on humans. From these known adverse effects of noise, criteria have been established to help protect the public health and safety and prevent disruption of certain human activities. These criteria are based on effects of noise on people such as hearing loss (not a factor with typical community noise), communication interference, sleep interference, physiological responses, and annoyance. Each of these potential noise impacts on people are briefly discussed in the following narrative:

Hearing Loss is generally not a concern in community noise problems, even very near a major airport or a major freeway. The potential for noise induced hearing loss is more commonly associated with occupational noise exposures in heavy industry, very noisy work environments with long term exposure, or certain very loud recreational activities such as target shooting, motorcycle or car racing, etc. The Occupational Safety and Health Administration (OSHA) identifies a noise exposure limit of 90 dBA for 8 hours per day to protect from hearing loss (higher limits are allowed for shorter duration exposures). Noise levels in neighborhoods, even in very noisy neighborhoods, are not sufficiently loud to cause hearing loss.

Communication Interference is one of the primary concerns in environmental noise problems. Communication interference includes speech interference and interference with activities such as watching television. Normal conversational speech is in the range of 60 to 65 dBA and any noise in this range or louder may interfere with speech. There are specific methods of describing speech interference as a function of distance between speaker and listener and voice level. Exhibit 5 shows the relation of quality of speech communication with respect to various noise levels.

Sleep Interference is a major noise concern in noise assessment and, of course, is most critical during nighttime hours. Sleep disturbance is one of the major causes of annoyance due to community noise. Noise can make it difficult to fall asleep, create momentary disturbances



Permissible Distance Between a Speaker and Listeners for Specified Voice Levels and Ambient Noise Levels

(The Levels in Parantheses Refer to Voice Levels Measured One Meter From the Mouth.)

Exhibit 5
Speech Interference and Noise Levels

of natural sleep patterns by causing shifts from deep to lighter stages and cause awakening. Noise may even cause awakening that a person may or may not be able to recall.

Extensive research has been conducted on the effect of noise on sleep disturbance with varying results. Recommended values for desired sound levels in residential bedroom space range from 25 to 45 dBA with 35 to 40 dBA being the norm. In 1981, the National Association of Noise Control Officials published data on the probability of sleep disturbance with various single event noise levels. Based on laboratory experiments conducted in the 1970's, this data indicated noise exposure, at 75 dBA interior noise level event will cause noise induced awakening in 30 percent of the cases. Recent research from England, however showed that the probability for sleep disturbance is less than what had been earlier reported. Field studies conducted during the 1990's, using new sophisticated techniques, indicated that awakenings can be expected at a much lower rate than had been expected based on earlier laboratory studies. This research showed that once a person was asleep, it is much more unlikely that they will be awakened by a noise. The significant difference in the recent English study is the use of actual in-home sleep disturbance patterns as opposed to laboratory data that had been the historic basis for predicting sleep disturbance. Some of this research has been criticized because it was conducted in areas where subjects had become habituated to aircraft noise. On the other hand, some of the earlier laboratory sleep studies had been criticized because of the extremely small sample sizes of most laboratory studies, and because the laboratory was not necessarily a representative sleep environment. The 1994 British sleep study compared the various causes of sleep disturbance using in home sleep studies. This field study assessed the effects of nighttime aircraft noise on sleep in 400 people (211 women and 189 men; 20-70 years of age; one per household) habitually living at eight sites adjacent to four U.K. airports, with different levels of night flying. The main finding was that only a minority of aircraft noise events affected sleep, and, for most subjects, that domestic and other non-aircraft factors had much greater effects. As shown in the Exhibit 6, aircraft noise was a minor contributor among a host of other factors that lead to awakening response.

The Federal Interagency Committee on Noise (FICON) in 1992 in a document entitled *Federal Interagency Review of Selected Airport Noise Analysis Issues* recommended an interim dose-

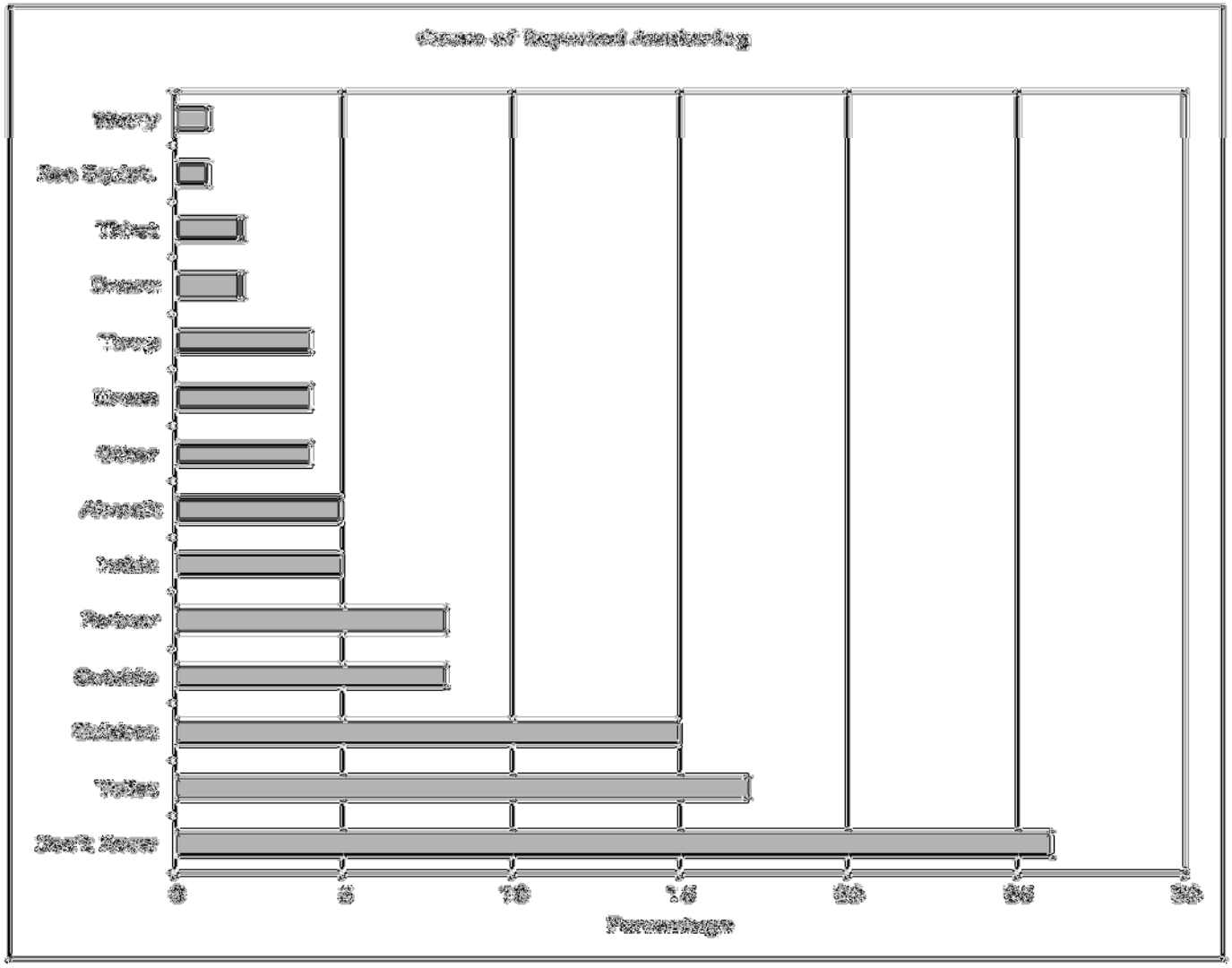


Exhibit 6
Causes and Prevalence of All Awakenings

response curve for sleep disturbance based on laboratory studies of sleep disturbance. In June of 1997, the Federal Interagency Committee on Aviation Noise (FICAN) updated the FICON recommendation with an updated curve based on the more recent in-home sleep disturbance studies which show lower rates of awakening compared to the laboratory studies. FICAN recommended a curve based on the upper limit of the data presented and therefore considers the curve to represent the "maximum percent of the exposed population expected to be behaviorally awakened," or the "maximum awakened." The FICAN recommendation is shown on Exhibit 7. This is a very conservative approach. A more common statistical curve for the data points reflected in Exhibit 7, for example, would indicate a 10% awakening rate at a level of approximately 100 dB SENEL, while the "maximum awakened" curve reflected in Exhibit 7 shows the 10% awakening rate being reached at 80 dB SENEL. (The full FICAN report can be found on the internet at www.fican.org.)

Physiological Responses are those measurable effects of noise on people that are realized as changes in pulse rate, blood pressure, etc. While such effects can be induced and observed, the extent is not known to which these physiological responses cause harm or are a sign of harm. Generally, physiological responses are a reaction to a loud short term noise such as a rifle shot or a very loud jet over flight.

Health effects from noise have been studied around the world for nearly thirty years. Scientists have attempted to determine whether high noise levels can adversely affect human health-apart from auditory damage-which is amply understood. These research efforts have covered a broad range of potential impacts from cardiovascular response to fetal weight and mortality. While a relationship between noise and health effects seems plausible, it has yet to be convincingly demonstrated--that is, shown in a manner that can be repeated by other researchers while yielding similar results.

While annoyance and sleep/speech interference have been acknowledged, health effects, if they exist, are associated with a wide variety of other environmental stressors. Isolating the effects of aircraft noise alone as a source of long term physiological change has proved to be almost impossible. In a review of 30 studies conducted worldwide between 1993 and 1998, a team of

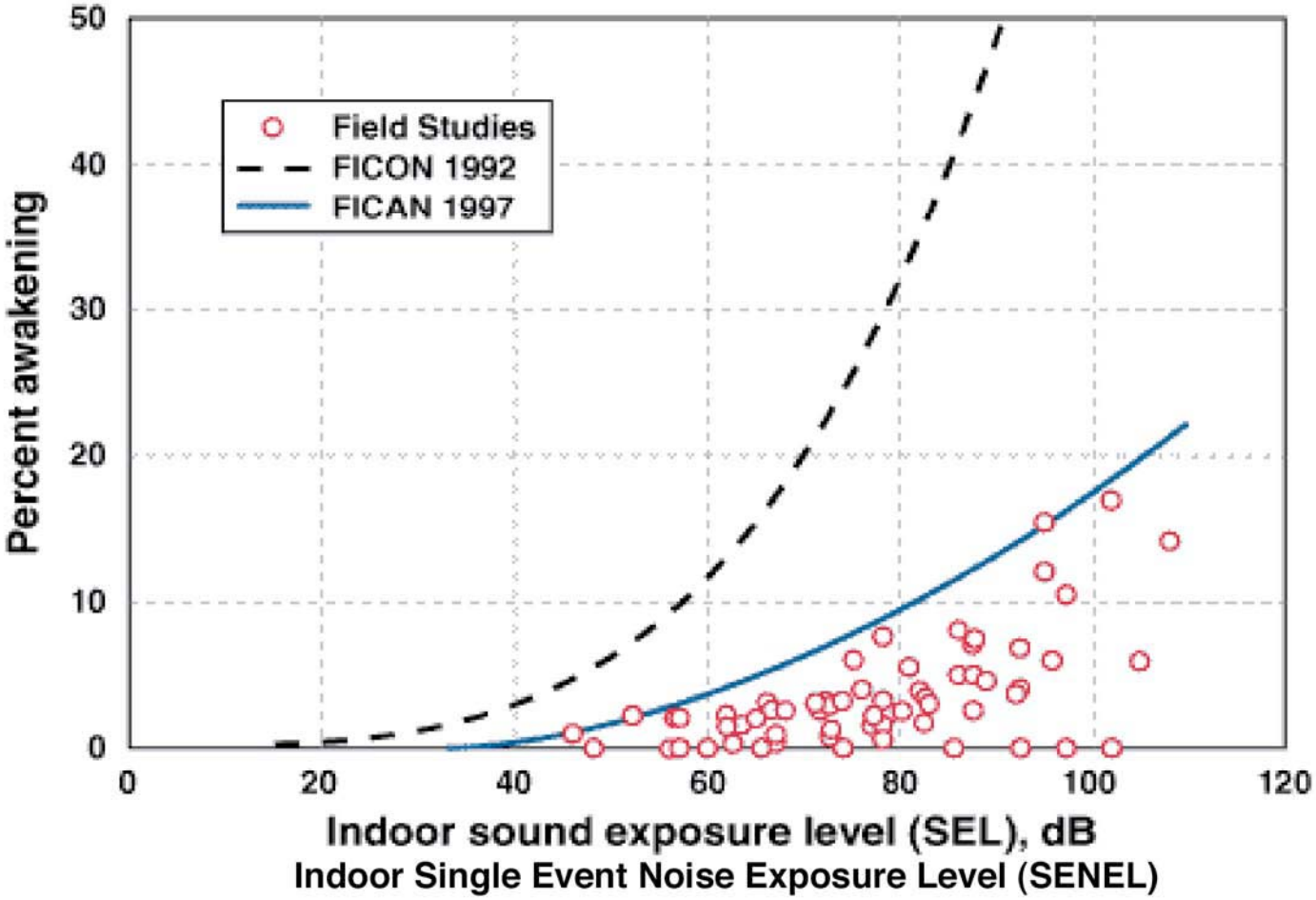


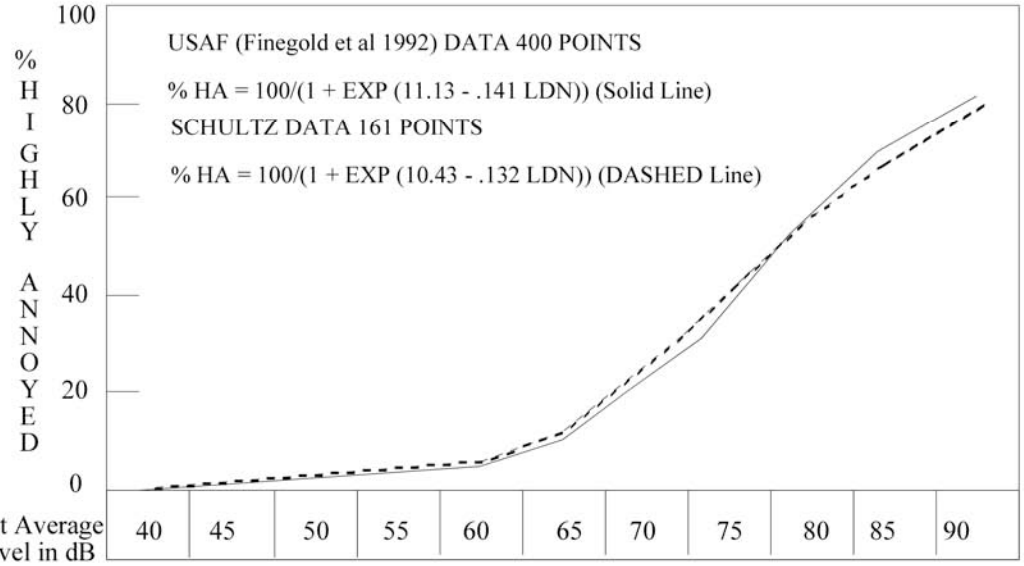
Exhibit 7
Sleep Interference and Noise Level
OVOV General Plan Noise Element

international researchers concluded that, while some findings suggest that noise can affect health, improved research concepts and methods are needed to verify or discredit such a relationship. They called for more study of the numerous environmental and behavioral factors than can confound, mediate or moderate survey findings. Until science refines the research process, a direct link between aircraft noise exposure and non-auditory health effects remains to be demonstrated.

Annoyance is the most difficult of all noise responses to describe. Annoyance is a very individual characteristic and can vary widely from person to person. What one person considers tolerable can be quite unbearable to another of equal hearing capability. The level of annoyance, of course, depends on the characteristics of the noise (i.e.; loudness, frequency, time, and duration), and how much activity interference (e.g. speech interference and sleep interference) results from the noise. However, the level of annoyance is also a function of the attitude of the receiver. Personal sensitivity to noise varies widely. It has been estimated that 2 to 10 percent of the population is highly susceptible to annoyance from any noise not of their own making, while approximately 20 percent are unaffected by noise. Attitudes are affected by the relationship between the person and the noise source (Is it our dog barking or the neighbor's dog?). Whether we believe that someone is trying to abate the noise will also affect our level of annoyance.

Annoyance levels have been correlated to CNEL levels. Exhibit 8 relates DNL noise levels to community response from two of these surveys. One of the survey curves presented in Exhibit 8 is the well-known Schultz curve, developed by Theodore Schultz. It displays the percent of a populace that can be expected to be annoyed by various DNL (CNEL in California) values for residential land use with outdoor activity areas. At 65 dB DNL the Schultz curve predicts approximately 14% of the exposed population reporting themselves to be “highly annoyed.” At 60 dB DNL this decreases to approximately 8% of the population.

However, the Schultz curve and recent updates include data having a very wide range of scatter with communities reporting much higher percentages of population highly annoyed at these noise exposure levels. For example, under contract to the FAA, Bolt Beranek & Newman



Calculated % HA Points

USAF	0.41	0.831	1.66	3.31	6.48	12.29	22.1	36.47	53.74	70.16	82.64
SCHULTZ	0.576	1.11	2.12	4.03	7.52	13.59	23.32	37.05	53.25	68.78	81.0

Exhibit 8

Comparison of logistic fits to original 161 data points of Schultz (1978) and USAF analysis with 400 points (data provided by USAF Armstrong Laboratory).

Source: Ficon 1992

conducted community attitude surveys in the residential areas south of John Wayne Airport in Orange County in 1981 as part of a study of possible "power cutback" departure procedures. That study concluded that the surveyed population (principally in Santa Ana Heights and various Newport Beach neighborhoods) had more highly annoyed individuals at various CNEL levels than would be predicted by the Schultz curve. When plotted similar to the Schultz curve, this survey indicated the populations in Santa Ana Heights and Newport Beach were approximately 5 dB CNEL more sensitive to noise than the average population predicted by the Schultz curve. While the precise reasons for this increased noise sensitivity were not identified, it is possible that non-acoustic factors, including political or the socio-economic status of the surveyed population may have played an important role in increasing the sensitivity of this community during the period of the survey. Annoyance levels have never been correlated statistically to single event noise exposure levels in airport related studies.

School Room Effects. Interference with classroom activities and learning from aircraft noise is an important consideration and the subject of much recent research. Studies from around the world indicate that vehicle traffic, railroad and aircraft noise can have adverse effects on reading ability, concentration, motivation, and long term learning retention. A complicating factor in this research is the extent of background noise from within the classroom itself. The studies indicating the most adverse effects examine cumulative noise levels equivalent to 65 CNEL or higher and single event maximum noise levels ranging from 85 to 95 dBA. In other studies the level of noise is unstated or ambiguous. According to these studies, a variety of adverse school room effects can be expected from *interior* noise levels equal to or exceeding 65 CNEL and or 85 dBA SEL.

Some interference with classroom activities can be expected with noise events that interfere with speech. As discussed in other sections of this report, speech interference begins at 65 dBA that is the level of normal conversation. Typical construction attenuates outdoor noise by 20 dBA with windows closed and 12 dBA with windows open. Thus some interference of classroom activities can be expected at outdoor levels of 77 to 85 dBA.

4.0 Noise Measurements

4.1 Methodology

Twenty (20) sites were selected for measurement of the noise environment in the OVOV planning area. A review of noise complaints, discussions with City staff and identification of major noise sources in the community provided the initial base for development of the community noise survey. The measurement locations were selected on the basis of proximity to major noise sources and noise sensitivity of the land use. The measurement locations are depicted in Exhibit 9.

Noise measurements were made of the short term Leq values. These measurements provide a short 'snapshot' view of the noise environment. The noise measurements were made at a normal receptor height of about 5 feet above the ground. Measurements were made on August 7 and 8, 2007. The measurements were made with a Bruel & Kjaer Type 2236 Sound Level Meter, and calibrated every few hours. These noise measurement systems meet the American National Standards Institute "Type 1" specifications, which is the most accurate for community noise measurements. The meter and calibrator have current certification traceable to the National Institute of Standards and Technology (NIST).

4.2 Results

The results of the noise measurements are shown in Exhibit 10. These figures also depict the date and time of the measurement. The cause of the loudest event is identified and the most predominant noise source(s) are identified. The quantities measured were the Equivalent Noise Level (Leq), the maximum noise level (Lmax) and the minimum noise levels (Lmin).

When examining the noise data shown in Exhibit 10 it is important to note that these data are intended to identify noise levels over a broad range of the study area and are not an assessment of impacts at these sites. In almost all cases the major sources of noise are motor vehicles. The noise levels measured cover a wide range of noise exposure throughout the OVOV area. The quietest environment was in a residential area in the back hills, where noise levels were often below 50 dBA. The loudest events were buses and trucks and these events would push the noise levels into the mid 80 dBA range. In general, aircraft noise, industrial noise, and commercial noise sources did not appear to contribute significantly to the noise levels measured. A discussion of the noise measurements is presented below on a site by site basis.

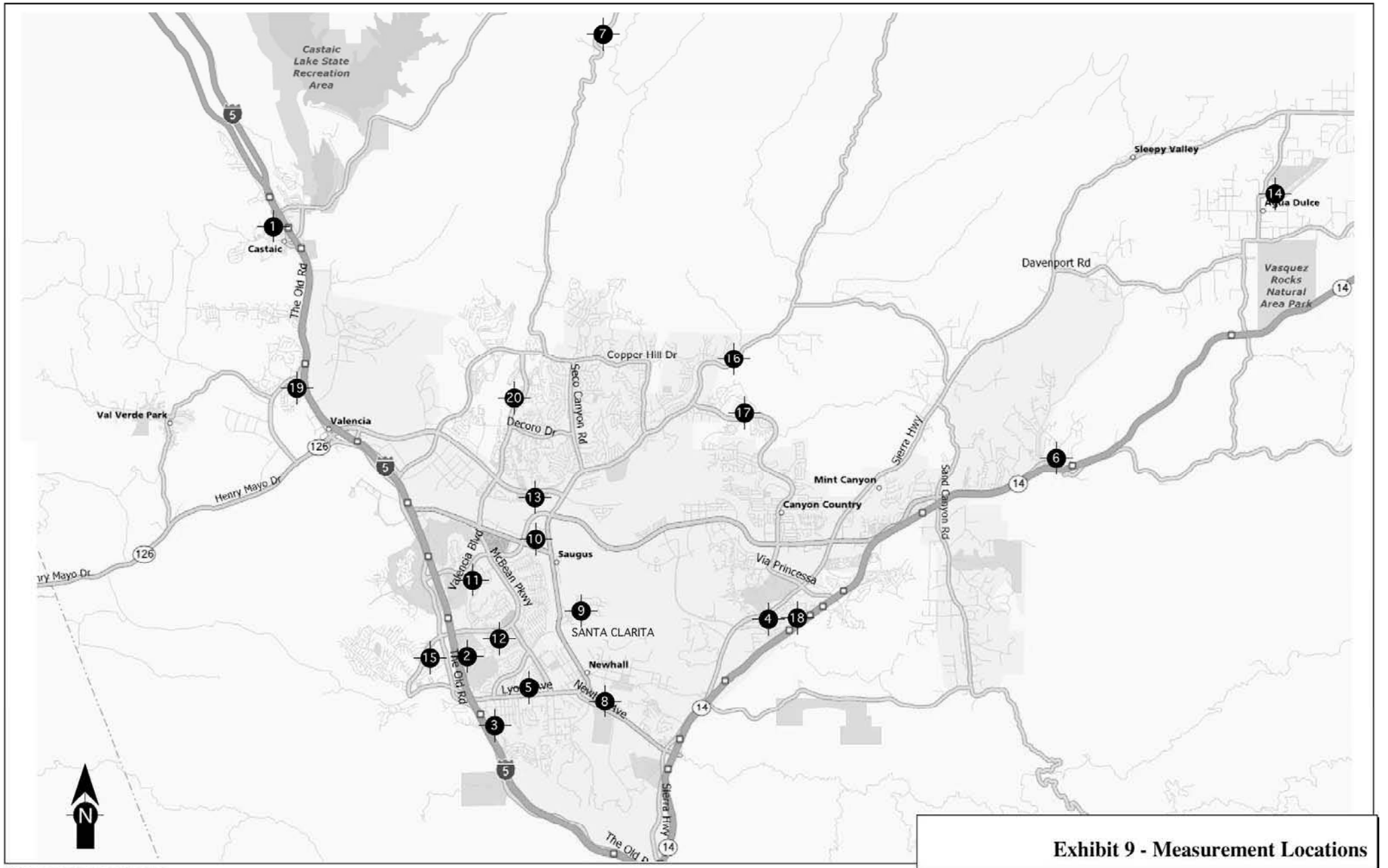
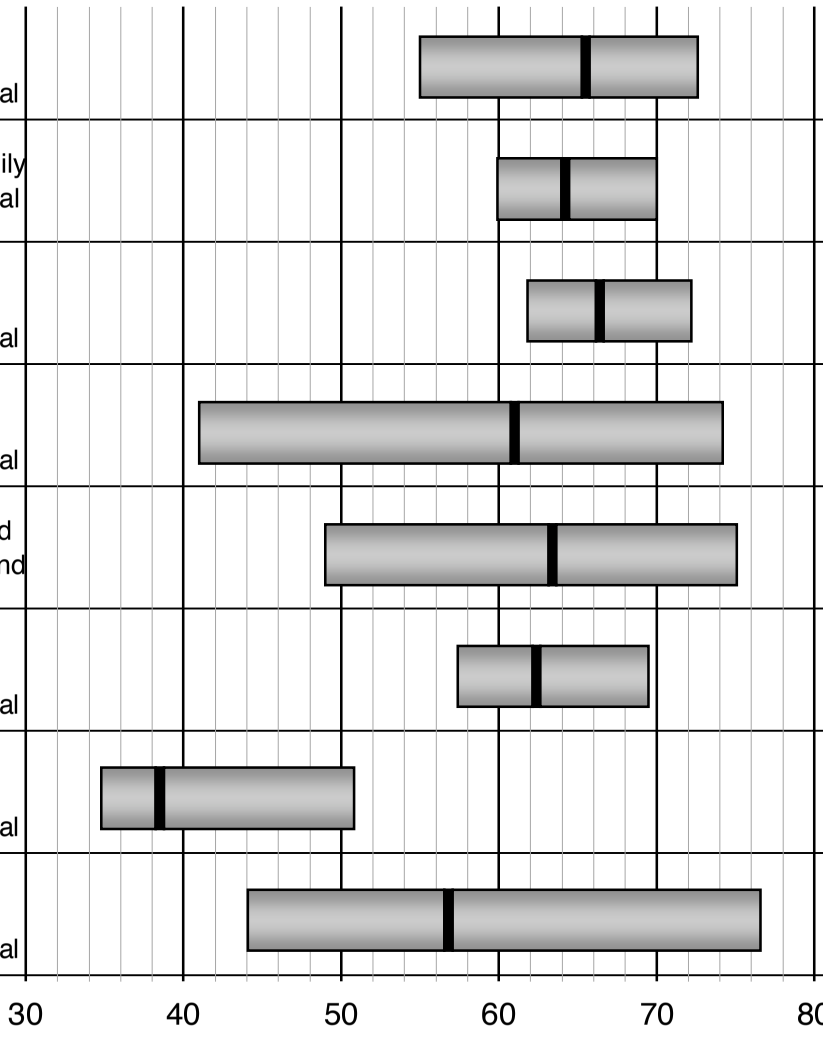
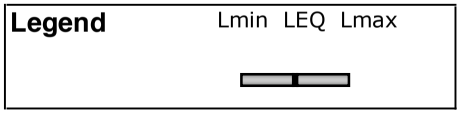


Exhibit 9 - Measurement Locations

Exhibit 10
Graphic Summary of Short-Term Ambeint Noise Measurment Results

Site	Location	Date	Time	Land Use	Noise Sources
1	End of Hunter Ln	8/8	9:45 a.m.	single family residential	traffic
2	End of Golfview Dr	8/7	1:44 p.m.	multi-family residential	traffic, trucks on fwy
3	Corner of Wabuska St and Hawkbryn Ave	8/7	12:20 p.m.	single family residential	traffic, cars on local streets
4	Playground next to Sierra Hwy	8/8	1:32 p.m.	single family residential	pickup trucks were loudest; other traffic
5	Park next to Lyons Ave	8/7	11:50 a.m.	Park and Playground	bus was loudest; other traffic
6	End of Fuji St	8/8	3:22 p.m.	single family residential	heavy truck on fwy was loudest; other traffic
7	End of Stator Ln	8/8	9:18 a.m.	single family residential	Neighbors, planes
8	Corner of 4th and Pine St	8/8	12:39 p.m.	single family residential	pickup truck was loudest; other traffic





OVOV Noise Element
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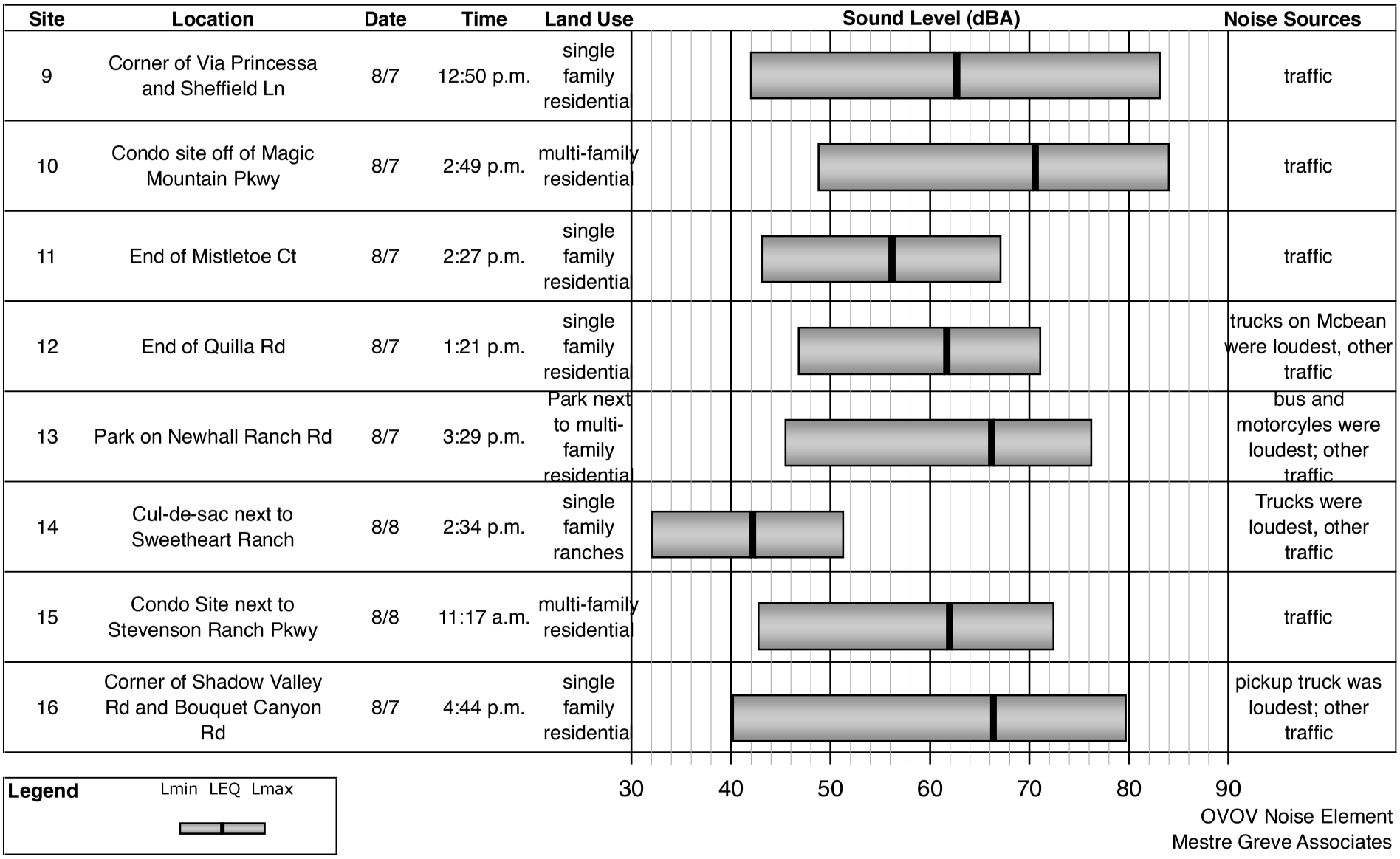
Exhibit 10 (cont'd)
Graphic Summary of Short-Term Ambeint Noise Measurment Results

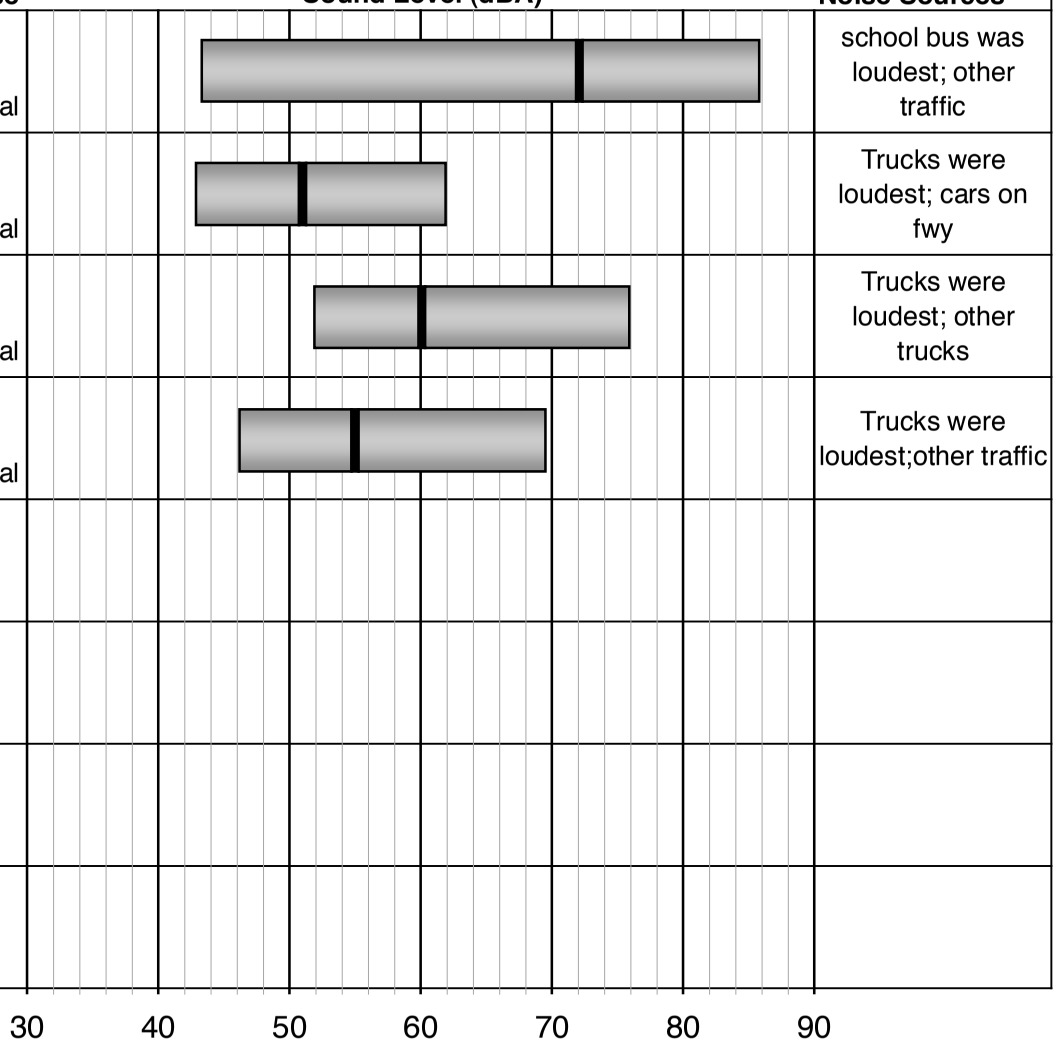
Site	Location	Date	Time	Land Use	Noise Sources
9	Corner of Via Princessa and Sheffield Ln	8/7	12:50 p.m.	single family residentia	traffic
10	Condo site off of Magic Mountain Pkwy	8/7	2:49 p.m.	multi-family residentia	traffic
11	End of Mistletoe Ct	8/7	2:27 p.m.	single family residentia	traffic
12	End of Quilla Rd	8/7	1:21 p.m.	single family residentia	trucks on Mcbean were loudest, other traffic
13	Park on Newhall Ranch Rd	8/7	3:29 p.m.	Park next to multi-family residential	bus and motorcyles were loudest; other traffic
14	Cul-de-sac next to Sweetheart Ranch	8/8	2:34 p.m.	single family ranches	Trucks were loudest, other traffic
15	Condo Site next to Stevenson Ranch Pkwy	8/8	11:17 a.m.	multi-family residentia	traffic
16	Corner of Shadow Valley Rd and Bouquet Canyon Rd	8/7	4:44 p.m.	single family residentia	pickup truck was loudest; other traffic



OVOV Noise Element
Mestre Greve Associates

Exhibit 10 (cont'd)
Graphic Summary of Short-Term Ambeint Noise Measurment Results

Site	Location	Date	Time	Land Use	Sound Level (dBA)	Noise Sources
17	Corner of Plum Valley Rd and Golden Valley Rd	8/7	4:22 p.m.	single family residential		school bus was loudest; other traffic
18	End of Larkhaven Pl	8/8	1:52 p.m.	single family residential		Trucks were loudest; cars on fwy
19	End of Salem Ct	8/8	10:13 a.m.	single family residential		Trucks were loudest; other trucks
20	End of Robindale Ct	8/7	5:19 p.m.	single family residential		Trucks were loudest;other traffic



Legend Lmin LEQ Lmax

OVOV Noise Element
Mestre Greve Associates

4.3 Detailed Discussion of Noise Measurements

Twenty (20) sites were monitored as part of the measurement program. Each site is discussed below. Exhibit 10, previously presented, includes the time of day, exact location, general land use around the site, and more detail on the measurement results, It may be useful for the reader to refer back to this exhibit during the following discussions.

Site 1- This site was at the edge of an old residential area, at the end of a cul-de-sac. The nearby houses were small and distanced from each other. The next neighborhood south is new, with many homes placed into a small space. The houses receive traffic noise from the 5 freeway and the frontage road. The frontage road, called the Old Road, receives truck traffic as well as normal passenger traffic. According to a neighbor the noise from the freeway is the worst at six o'clock AM, when the road receives the most noise from passenger traffic, no doubt workers entering the city. The traffic is also bad at 4:00 PM, when dozens of trucks pass by. In the middle of the night the neighbors also receive noise from the trucks, which use their brakes on the steep hill. The measurements were taken at 10:00 in the morning, which is a time of minimum traffic. The other noise the sound meter may have received includes the sound of a passing mail truck, as well as the neighbors entering and exiting their homes. The average sound level (Leq) was 65.5 dBA. The levels fluctuated between 55.0 dBA, which was the minimum, and 72.6 dBA, which was the maximum. The maximum was caused by passing trucks. While the average sound level is acceptable, the chain link fences between the neighbors and the traffic may not be enough blockage, especially during peak hours.

Site 2- This site was in a residential district with a golf course that borders it. Past the golf course is the 5 freeway. There was a little noise coming from a light breeze in the trees, as well as some noise from neighbors entering and exiting their homes. There was also a little noise from a lawnmower in the distance, and the golfers on the golf course. However, the main source of noise was from large trucks on the freeway. The maximum, caused by one of these large trucks, registered 70.0 dBA. The average was 64.2, caused by the noise from the freeway.

Site 3- This site is on the corner of two streets which intersect right behind a sound wall, in a residential area. Across the street from the houses by which the sound meter was placed, there was a preschool. There were several exiting vehicles from the school's parking lot during the time of the measurement. There was also a car sitting with its engine on about a half a block away. There was also a significant amount of passenger vehicles that drove by, in the neighborhood itself. However, the main source of sound was from the 5 freeway. The average sound level was 66.4 dBA, which implies that the sound barrier is effective in shielding the noise of the freeway. The loudest sound reached 72.2 dBA, which was caused by a large truck passing by on the freeway.

Site 4- This site was at the end of a cul-de-sac, within the bounds of a playground. The street ends, and then a small path winds around to a tiny playground about ten feet away. There is a metal fence which borders the playground from the road. The area receives noise from Sierra Highway, which borders it, as well as the 14 freeway, which is just slightly off in the distance. There was also a small amount of noise coming from the neighbors in the house next door, who were outside washing their car. The playground was not in use at the time of the measurements. The Leq was 61.0 dBA, while the maximum was 74.2 dBA. This maximum was caused by a pickup truck that drove by on Sierra Highway.

Site 5- This site is located in Old Orchard Park, on a sidewalk next to a grassy area, between a baseball field and a playground. The park borders Lyons Avenue. At the time there was construction being done on an area right next to playground, within the realm of the park. However, during most of the measurements the noise effecting the meter coming from this source was barely audible. The park was active, with several families playing with their small children. The measurements were conducted in order see how loud the traffic from Lyons Ave was. The Average (Leq) noise level for the park was 63.4, while the noise levels ranged from 49.0 dBA to 75.1 dBA. The loudest measurements were taken from passing trucks.

Site 6- This site was at the end of a street which overlooked Freeway 14. The neighbors had a small wall (about three feet) surrounding the property, which may have helped to block sound. The freeway was quite a bit far below. Besides the sound of the freeway, the street also receives noise from Soledad Canyon Road, as well as Sequoia Rd, which is at the end of the street, in the opposite direction. In addition, there is a large construction area across the 14, and the neighbors on the left side of the meter were building on the outside, though they were on a break at the time of the measurements, and several planes flew overhead. The noise levels were fairly regular, with little variation. The average (Leq) level was 62.4 dBA, while the maximum and minimum were 69.5 dBA and 57.4 dBA, respectively. These levels are fairly low in comparison to the amount of traffic nearby, and thus this area is well shielded.

Site 7- This location was near the end of Stator Road, back in the hills of the Los Angeles National Forest. It is in a very small residential district. Practically the only sounds reaching to the microphone were those from the residents. There were a few cars passing on San Francisquito Canyon Road, about one every five or ten minutes. Even the noise emanating from these cars barely reached the microphone. The loudest noises were from two planes, a neighbor's air conditioning, someone moving boxes inside of their home. The maximum sound level was 50.8 dBA, and the average (Leq) was 38.5 dBA. This is very low for a residential area.

Site 8 – This site was on the corner 4th and Pine Street. It was on the edge of a residential area, right next to Pine Street. Beyond Pine Street is the railroad tracks, which is separated by a chain link fence and a few feet of ground. About a half a block from the railroad is San Fernando Road. The neighborhood receives sound from all three of these sources, as well as the sound coming from the streets within the neighborhood itself, which are rather busy, and the traffic from a nearby school. Besides these sources, the measurements include a dog barking, neighbors getting in and out of their vehicles, and two planes. The loudest measurement was 76.6 dBA, which was caused by the sound of a truck passing by on San Fernando Road. The measurements did not include the sound of a train passing by, or else no doubt the noise levels would have been much higher. The average noise level (Leq) was 56.8, which is actually rather low considering how many sound sources there are in the area.

Site 9- Site 9 was on the edge of a residential district, next to Via Princessa. There was a considerable amount of traffic on both Via Princessa and within the neighborhood. There was a helicopter that flew overhead, as well as several planes. There were also carpenters working in the distance. The largest sound levels were caused by trucks turning the corner, which measured at 83.1 dBA, because they were right next to the meter. The average measurement was 62.7 dBA.

Site 10- This site was on the corner of the entrance to a residential area, adjacent to Magic Mountain Parkway. Across the street from the area is a car dealership, which has cars constantly entering and leaving. There is also a considerable amount of traffic entering and exiting the residential area, as well as the sound of golf carts driving around the community. The highest sound levels came from the motorcycles and large trucks that accelerate going up the road. These measured a maximum of 84.0 dBA. When there was a break between cars the sound levels were rather low, with a minimum of 48.8 dBA. However, these spaces were rare. The average sound level was 70.6 dBA, which is from the large amount of traffic on Magic Mountain Parkway.

Site 11- This site was at the end of a cul-de-sac which ends right before Valencia Boulevard. There was noise from neighbors, cars on the local neighborhood streets, and a barking dog as well. The traffic was not exceedingly heavy on Valencia Boulevard, with mainly passenger vehicles. The average sound level (Leq) was 56.2 dBA. The maximum sound level was 67.1 dBA, which was caused by a large truck on Valencia.

Site 12- This site was at the edge of residential district bordering McBean Parkway. It was at the end of cul-de-sac, with a small sound wall around the area. The main noise besides the traffic on McBean was the barking dog, and the wind in the trees, as well as neighbors entering and exiting their homes. The loudest noise was a truck on McBean, measuring 71.1 dBA. The average sound level was 61.7 dBA, which is relatively low for a residential area.

Site 13- This site was in a park, along Newhall Ranch Road. The park was adjacent to a residential area, with a iron fence separating the two. There is, however, a sound wall that separates the residential area from Newhall Ranch Road. The measurements were taken when the park was not active. There were several soccer players off in the distance, but other than that the field was not being used. The loudest noises were the cars passing by, with several small trucks and a motorcycle. The small trucks were the largest source of noise, causing the maximum to be 76.2 dBA. When there were few cars the sound levels were low, with at minimum at 45.5 dBA. The average sound level (Leq) was 66.2 dBA, which is not high for a park setting.

Site 14- This site was off of Agua Dulce Road, right next to Sweetheart Ranch. This area is off of Sierra Highway, far back in the hills. There was very little noise in this area at all. The only few audible noises were due to wind chimes, the breeze in nearby bushes, and the occasional plane which passed by. The area received no traffic noise from Sierra Canyon Road. The average noise level (Leq) was 42.2. The maximum noise level was 51.3, which was caused by a car passing by on Agua Dulce Road.

Site 15- This site was at the end of a cul-de-sac, within a gated area with several apartment complexes. The main sources of noise were both from the 5 freeway and from Steinbeck Road. There was also a small amount of noise from planes, birds, and children playing nearby. The loudest event, measured at 72.4 dBA, was a pickup truck on Steinbeck Road. The average noise level (Leq) was 62.0, dBA, which is low for an area that includes both roads, most likely because few cars pass by on Steinbeck.

Site 16- This site was on the corner of Shadow Valley Road and Bouquet Canyon Road. The measurements were taken in order to test the amount of traffic traveling on the main road. We found that there were few cars that passed by, though there were several large trucks and several very loud motorcycles. There were also several planes that passed overhead. The loudest noise, at 79.7 dBA, was a pickup truck that turned the corner onto Shadow Valley Road. The average noise level (Leq) was 66.4 dBA, which reaches the residential area directly behind the noise measuring site.

Site 17- This site was on the corner of Santa Catarina Road and Plum Canyon Road. The site was chosen in order to test the amount of sound the residential district adjacent to Plum Canyon road receives. The main noise was from the cars on the road. Although there were mainly passenger vehicles, because Plum Canyon is a very open road there is an excess of speeding. The acceleration often occurs right next to the neighborhood. Because site only received noise from passing vehicles, there was a large range of noise, from a maximum sound level of 85.8 dBA, to a minimum sound level of 43.3 dBA. The highest noise levels were caused by a school bus, a motorcycle, a garbage truck, and several cars accelerating up the hill. The average noise level was 72.1 dBA, which is too high for a residential area. However, there is a sound wall built around the residential area, but it does not reach around to the corner, where the measurements were taken.

Site 18- This site was at the end of a cul-de-sac. Measurements were taken in order to test the sound levels caused by the nearby road, freeway 14. There were a few birds, as well as two planes, but besides these the only sound was that of the freeway. The average noise level was 51.0 dBA. The maximum was 61.9 dBA, which was caused by several passing trucks. Although the freeway is nearby, it is elevated from the neighborhood and distanced enough to have a fairly low sound impact.

Site 19- These measurements were taken in a residential neighborhood, on the bend right before a cul-de-sac. The cul-de-sac ends next to the Old Road, which is a frontage road next to the 5 freeway. The meter received the most noise from the 5 freeway, though there is considerable traffic on the Old Road. The measurements were taken to consider both noise sources. Also effecting the noise levels was a siren that passed on the 5 freeway, as well as a dog barking in the neighborhood, and a moving van that stopped at the beginning of the street, and then made a U-turn. The loudest noise, at 75.9 dBA, was from a large truck passing by on the Old Road. The average noise level (Leq) was 60.1 dBA, which is moderate for a neighborhood next to a freeway.

Site 20- This site is in a residential area with a main road, McBean Parkway, running adjacent to it. There was a considerable amount of traffic along McBean, mainly passenger vehicles. In addition, the neighborhood was fairly active, with sprinklers going off in two different yards, as well as several neighbors entering and exiting their homes. There was also a plane that flew overhead. The loudest event was a large truck that drove by. The maximum sound level was 69.5 dBA, and the average was 55.0 dBA. This is quite low for a residential area, thanks to a sound was that borders it.

5.0 NOISE CONTOURS

The noise environment in Santa Clarita is attributable primarily to roadways, which include both surface roadways and freeways. The Southern Pacific Railroad is also a significant noise source, which runs from the southern portion of the City to the center of the City and then directly to the east. Sporadic airplane or helicopter operations occur across the OVOV study area that are not loud enough and consistent enough to be significant. The Agua Dulce Airport is located in the study area.

The noise contours for the City of Santa Clarita are presented in Exhibit 11 for existing conditions. Exhibits 12 and 13 are for buildout conditions for the Current General Plan and the OVOV Plan, respectively. The existing contours are based on the existing conditions of traffic volumes and other sources of noise in the community. The future contours represent a year 2030 scenario. (The traffic noise contours, including the average daily traffic, are also presented in a tabular form as an appendix to this report.)

The noise contours were generated using a mathematical model developed by the Federal Highway Administration ("Traffic Noise Model," Version 2.5, April 14, 2004). The Traffic Noise Model (TNM) model uses traffic volume, vehicle mix, average vehicle speed, roadway geometry, and sound propagation path characteristics to predict hourly A-weighted Leq values adjacent to a road. Vehicle mix is reported in terms of the number of automobiles, medium trucks, and heavy trucks. The truck categories are defined in the TNM model by number of axles and weight. In order to compute a CNEL value for roadways the hourly data for a 24

EXHIBIT 11

EXISTING NOISE CONTOURS

(BEING PREPARED BY CITY)

EXHIBIT 12

CURRENT GENERAL PLAN NOISE CONTOURS

(BEING PREPARED BY CITY)

EXHIBIT 13

OVOV NOISE CONTOURS

(BEING PREPARED BY CITY)

hour period are used according to the CNEL formula. Vehicle distribution over the 24 hour day must be known, i.e., the percent of vehicles in the daytime period (7 a.m. to 7 p.m.), evening period (7 p.m. to 10 p.m.) and night period (10 p.m. to 7 a.m.). The mix of automobiles, medium trucks and heavy trucks has an effect on noise levels. The assumption used to model noise is based on known traffic mix data. For arterial roadways the vehicle mix data are obtained from mix data collected by the County of Orange during extensive surveys of 53 intersections within the County. This survey is the most comprehensive conducted in Southern California and is considered representative for the vast majority of arterial highways throughout Southern California. Caltrans conducts periodic traffic counts on freeways and publishes them on the internet (www.dot.ca.gov/hq/traffops/saferesr/trafdata/). The various truck percentages reported by Caltrans were used for the projections. The arterial roadway mix data are provided in Table 2. Freeway mix data are provided in Tables 3 and 4.

Table 2
Arterial Roadway Vehicle Mix Data
(Traffic distribution per time of day in percent of Average Daily Traffic – ADT)

VEHICLE TYPE	DAY (7 a.m. to 7 p.m.)	EVENING (7 p.m. to 10 p.m.)	NIGHT (10 p.m. to 7 a.m.)	TOTAL
Automobile	75.51	12.57	9.34	97.42
Medium Truck	1.56	0.09	0.19	1.84
Heavy Truck	0.64	0.02	0.08	0.74

Table 3
Interstate 5 Vehicle Mix Data
(Traffic distribution per time of day in percent of Average Daily Traffic – ADT)

VEHICLE TYPE	DAY (7 a.m. to 7 p.m.)	EVENING (7 p.m. to 10 p.m.)	NIGHT (10 p.m. to 7 a.m.)	TOTAL
Automobile	57.72	9.48	18.95	86.15
Medium Truck	1.96	0.32	0.64	2.92
Heavy Truck	7.32	1.20	2.40	10.93

Table 4
State Route 14 Vehicle Mix Data
(Traffic distribution per time of day in percent of Average Daily Traffic – ADT)

VEHICLE TYPE	DAY (7 a.m. to 7 p.m.)	EVENING (7 p.m. to 10 p.m.)	NIGHT (10 p.m. to 7 a.m.)	TOTAL
Automobile	63.05	10.51	21.97	95.53
Medium Truck	1.04	0.17	0.36	1.57
Heavy Truck	1.91	0.32	0.67	2.90

The Southern Pacific Railroad line handles two types of train in the Santa Clarita area; Metrolink, and freight. In terms of noise freight is the dominant noise source. Published train schedules were consulted and it was determined that 24 Metrolink trains run through Santa Clarita each day. No precise numbers of daily freight train operations could be provided, however, we estimated that 12 freight trains pass through each day. The number of freight trains is not expected to increase dramatically. By the year 2030 Metrolink trains are anticipated to double each day. Freight train usage was increased to 15 trains per day. These data were used to generate the train noise contours included in Exhibits 11 through 13.

Noise contours represent lines of equal noise exposure, just as the contour lines on a topographic map are lines of equal elevation. The contours shown on the map are the 60, 65 and 70 dB CNEL noise level. The noise contours presented can be used as a guide for land use planning. The 60 CNEL contour defines the Noise Referral Zone. This is the noise level for which noise considerations should be included when making land use policy decisions.

The contours presented in this report are a graphic representation of the noise environment. These distances to contour values are also shown in tabulated format in the appendix. Topography and intervening buildings or barriers have a very complex effect on the propagation of noise. To present a worst case estimate, the topographic affect is not included in these contours to present a worst case projection.

5.1 Projected Noise Impacts

The traffic levels will change throughout the study area in future years, and the noise levels will also undergo a corresponding change. Many comparisons can be made, but the

comparisons of most interest are between the existing noise levels and future noise levels with the OVOV plan (i.e., cumulative noise increase), and the comparison of noise levels between what would occur with the current General Plan and the proposed OVOV plan (i.e., increase due to project). The traffic study divided up the roadway network into 318 roadway links. Table 5 shows the expected incremental traffic noise level increases on the most important roadways. A significance threshold of 5 dB is often used for a change in environmental noise that occurs slowly over a long period of time. Therefore, all roadway links that show a change in noise level between the existing and future buildout of the OVOV of 5 dB or more are shown in Table 5. Additionally, any roadway links that will experience an increase of 1 dB with the OVOV compared to the Current General Plan is also included in the table. The roadway segment number corresponds to the segment number identified by the traffic engineer.

Table 5
CNEL Noise Increases (dB)

Segment No.	Roadway Link	Cumulative Increase	Increase Due to Project	Land Use
2	Agua Dulce n/o Davenport	6.4	0.0	Sparse Residential
3	Agua Dulce n/o SR-14	6.7	0.0	Open Space
4	Agua Dulce s/o SR-14	4.8	1.8	Open Space
8	Ave Stanford s/o Vanderbilt	5.3	0.8	Commercial
29	Chiquito Cyn (Long Cyn) n/o SR-126	11.0	-0.3	Open Space
41	Copper Hill e/o Haskell	5.3	-0.2	Residential
43	Davenport e/o Sierra Hwy	4.0	1.0	Commercial
53	Dockweiler w/o Sierra Hwy	6.8	-0.2	Sparse Residential
55	Franklin e/o Wolcott Way	9.0	0.0	Open Space
57	Golden Valley s/o Plum Cyn	7.8	0.0	Residential
68	Hasley Cyn w/o Del Valle	6.4	0.7	Open Space
72	Henry Mayo e/o Commerce Center	5.1	-0.3	Residential
77	Lake Hughes e/o Castaic	6.1	-0.7	Mixed
78	Lake Hughes e/o Ridge Route	5.4	-2.3	Commercial
84	Lost Cyn n/o Jakes Way	n/a	1.1	Residential
85	Lost Cyn n/o Canyon Park	n/a	1.1	Residential
87	Lost Cyn s/o Via Princessa	7.4	-0.4	Residential
98	Magic Mtn w/o The Old Road	7.3	0.1	Open Space
105	Magic Mtn e/o Valencia	5.2	0.1	Mixed
128	Newhall Ranch e/o Bouquet Cyn	8.3	0.3	Mixed
143	Pico Cyn w/o Stevenson Ranch	9.9	0.0	Residential
161	Ridge Route n/o Lake Hughes	8.5	-0.1	Mixed
162	Ridge Route n/o Castaic	2.0	3.0	Commercial
172	San Martinez Grande Cyn n/o SR-126	7.0	-1.5	Open Space
238	The Old Road n/o Hillcrest	6.4	-0.3	Mixed
254	Tibbitts s/o Newhall Ranch	5.4	-0.4	Commercial
262	Valencia w/o The Old Road	5.8	0.1	Residential
276	Via Princessa e/o Oak Ridge	5.6	-0.1	Residential
279	Via Princessa w/o Rainbow Glen	10.8	0.2	Residential
280	Via Princessa e/o Rainbow Glen	7.2	0.0	Residential
283	Via Princessa n/o Lost Cyn	7.0	0.4	Residential
290	Wiley Cyn e/o Orchard Village	5.7	0.3	Residential
293	Wiley Cyn s/o Lyons	5.4	1.5	Residential
294	Wiley Cyn n/o Calgrove	4.3	1.0	Residential
295	Wolcott n/o SR-126	7.8	0.0	Open Space

n/a – existing traffic volumes were not available.

Table 5 shows that 30 roadway segments will experience a cumulative noise increase of 5 dB or greater. The land uses as observed from aerials and on-site visits are shown in the table. (Land use listed may not be the same as the zoning designation.) The OVOV will experience substantial population growth in upcoming years and as a result noise levels will increase significantly along many roadways. Some of the roadway links that will experience much of

the noise increase and are bordered by residential uses include portions of Wiley Canyon, Via Princessa, and Lost Canyon Road. There will be a significant cumulative noise impact along many roads in the OVOV.

With the proposed OVOV plan the noise levels will go down on more roadways than will go up in comparison to the current General Plan. There are only 7 roadway links out of the 318 links that make up the entire roadway network where the noise levels with the OVOV plan increase by 1 dB or more in comparison to the current General Plan. For environmental noise, a difference of 3 dB is barely discernable. Only one roadway link, specifically Ridge Route north of Castaic, will experience a noise increase of 3 dB in comparison to the current General Plan. This area is primarily commercial uses which are very insensitive to noise and therefore, no project specific impacts are projected for the OVOV plan. Even for the residential areas where the noise levels are projected to increase by more than 1 dB, our review of the sites indicate that the residences are currently protected by an existing soundwall or are setback far enough from the roadway so that future noise levels with the OVOV plan will be acceptable. Therefore, although the OVOV will experience substantial increases in traffic over existing levels and corresponding increases in traffic noise, the proposed OVOV plan will result in slightly lower noise levels for more streets than with the current General Plan and will not result in any significant noise increases in comparison to the current General Plan.

Noise levels were projected for the railroad line that pass through the OVOV study area. Both Metrolink and freight trains utilize the railroad line. In future years both the operations of freight and Metrolink are expected to increase. A moderate increase in the CNEL noise level of 2.4 dB is projected to occur between existing levels and buildout. This level of noise increase is expected to occur with both the current General Plan and the proposed OVOV plan. The 2.4 dB increase is not considered to be a significant noise increase.

6.0 Noise Issues

A number of noise issues have arisen during the development of the OVOV plan. Some of the issues have a direct effect on the planning for the OVOV, while other issues are more for informational purposes only.

6.1 High-Speed Rail Line

A high speed rail line is being planned by the California High-Speed Rail Authority. The first route would likely be from Sacramento to Los Angeles, and would likely run through the OVOV area. A separate environmental study will be done as the plans for the high-speed rail are developed. At this time the potential route or routes through the OVOV area are not know, and the type of train and corresponding noise levels are not known. Therefore, no substantive planning in regards to noise can be done at this time.

6.2 High Density Development Along Railroad

High density residential development and mixed-use commercial district, which may contain residential uses, is being planned along portions of the railroad. Most notably this will occur in the areas where the railroad parallels San Fernando Road, and to a lesser extent where the railroad is adjacent to Soledad Canyon Road. Developing residential along railroads presents special challenges. First, constructing soundwalls along railroads is often not feasible. Soundwalls that are constructed may provide some protection for lower residential floors, but provide little or no protection for the upper floors. Secondly, although the CNEL noise scale is the best scale for use for environmental noise it does have a weakness when dealing with train events (and to a similar extent aircraft noise). Specifically, train noise is what is referred to single event noise. A train event will occur and generate loud levels of noise and then there will be no railroad noise for an extended period of time. The CNEL scale accounts for the number of trains, the time of day that they occur, and how loud the trains are; but some argue that the annoyance and activity disruption that is generated by the single event of a train is not fully accounted for. For example, if a train passes by and awakens you, your main focus is on that one train and not on the other factors that go into the CNEL scale calculation. The use of CNEL (or the similar Ldn scale) for noise/land use planning is required by State code. And in

fact the use of the CNEL scale provides the best correlation with how people view the noise environment. However, some people express annoyance due to the loudness of the single events, and an extra margin of satisfaction with the noise environment can be achieved through the use of a buyer/renter notification program. Basically the notification provides information on the location and type of noise source in the area and the fact that there may loud events generated by these sources.

For high density residential uses (and mixed-use) there are no outside private areas where quiet is anticipated. Generally, these uses might have a small balcony but there is little expectation that the noise levels for these balcony areas will be low. This is especially true when one considers that a balcony noise barrier, often made of glass, is about the only way to provide noise protection for a small balcony area. Balcony barriers are often disliked by the residents because they close-in the balcony too much. For a high density residential use the expectation is that there will be a place in the complex where peace and quiet can be found. It may be communal courtyards or a pool area to lay around and relax. It is important to provide noise protection for these areas. These areas can often be protected through site design, such as locating buildings or parking structures between the noise source and the area to be protected. Recommendations for noise standards and buyer notification are provided in Section 7.0 – Policy Recommendations.

6.3 Mixed-Use Developments

As part of the development of the downtown area mixed-use projects may be constructed. The commercial/residential interface presents special problems. The primary concern is that the commercial uses may operate through the evening hours and into the nighttime hours. Clubs, late-night restaurants, and banquet facilities are some examples of commercial uses that could locate in the mixed-use area and generate noise into nighttime hours. Another characteristic of the commercial areas is that the tenants in a building may change over time. For example, a bookstore that did not operate at night could be replaced by a popular restaurant where operations could extend through the evening and into nighttime hours. Simply stated, the noise levels that are present today will change and noise environment will change accordingly. For

these reasons it is very difficult to properly soundproof residences that are constructed in a mixed-use development.

It would be desirable to take some additional action in mixed-use developments so that residents would view the noise environment as favorable. Putting time limits on the commercial uses might be viable in some cases, but it may also deter some of the specific commercial uses that the City is trying to attract from locating in or near a mixed-use development. The State requires that buildings be designed to meet a 45 CNEL indoor noise standard for multi-family residences. Therefore, it would not be possible to set an indoor noise standard more restrictive than the State standard because the State law has precedence.

Buyer and renter notification is often the only recourse in trying to improve the noise acceptability for residents in mixed-use projects. The notification should inform the potential residents that commercial uses are located nearby, the their hours of operation may change from time to time, and that the use within the commercial area along with the noise generation potential may also change over time. Specific recommendations are made in Section 7.0 – Policy Recommendations.

6.4 Agua Dulce Airport

The Agua Dulce Airport is located in the northeast quadrant of the OVOV study area. The airport is located in a sparsely populated area of the County. The airport is privately owned but open to the public. The airport has a single 4,600 foot long runway and serves general aviation aircraft only. There are many noise restrictions in place for flight operations. No night operations are allowed at the airport. Aircraft are not allowed to fly within 1,000 feet of the school which is located 1 mile southwest of the airport. If aircraft depart to the north on Runway 4, they are to avoid flying over the home 2,000 feet northeast of the end of the runway. Finally, touch and go practices are not allowed at the airport. A 65 CNEL noise contour has been generated for the airport and was provided by the County of Los Angeles. The noise contour barely extends past the ends of the runway and does not impact any residences (Exhibit 14).

Exhibit 14

Agua Dulce Airport 65 CNEL Contour

Mestre Greve Associates

6.5 Magic Mountain

Six Flags Magic Mountain is an amusement park located in the southwest quadrant of the study area. The park has a large number of thrill rides including 17 roller coasters, has live entertainment, and periodically has firework displays. The noise levels and hours of operation around the park vary considerably depending on the time of day, the day of the week, the presence of holidays, and the season of the year. The noise levels generated by park activities can be heard for a considerable distance around the park at certain times. People buying or renting in the area may be surprised later when they can hear park activities. A buyer/renter notification program may be appropriate for new developments that locate in the area. See Section 7.0 – Policy Recommendations.

6.6 Special Events

Special events, such as outdoor concerts, may be held in the study area on an irregular or regular basis. The noise levels as they impact surrounding parcels would be limited per the Los Angeles County Noise Ordinance and the Santa Clarita Noise Ordinance. The noise ordinances apply to any events that are held on private property. The Santa Clarita Noise Ordinance consists of Chapter 11.44 of municipal code. The limits contained in the ordinance would apply to any special event with only "lawfully conducted parades" and "emergency work" exempted from the ordinance. The Los Angeles County noise ordinance is contained in Chapter 12.08 of the county code. Similar to the Santa Clarita ordinance, the Los Angeles County ordinance contains specific noise limits that can not be exceeded at the property boundary. The limits vary depending on the time of day and land uses involved. Finally, it should be noted that the noise ordinances are contained in the city or county code, and are not part of the Noise Element of the General Plan. Control of noise sources on private property is usually regulated through the imposition of a city or county regulation and is not usually part of the General Plan.

6.7 Emergency Vehicles

Noise generated by emergency vehicles is not under the control of the City or County. Both the City and County noise ordinances exempt emergency operations from regulation. The State has preempted local jurisdictions from controlling noise generated by emergency equipment. The use of sirens on police vehicles, ambulances, and fire trucks can not be

controlled by the City or County. Similarly, emergency flights of helicopters and airplanes can not be controlled by the City or County.

7.0 Policy Recommendations

The Santa Clarita Noise Element of the General Plan was updated in May 2000. The Goals and Policies section of the document is excellent. Suggested modifications to the Goals and Policies are made below. In some cases, the change suggested simply provides a clarification to existing policies. Other suggested changes reflect the need to address noise issues that concern higher density developments that will occur as the area develops further.

7.1 Expand Use of Santa Clarita Noise Element to Entire OVOV

The use of the Santa Clarita Noise Element should be expanded to cover the entire OVOV area. Specifically, the Noise and Land Use Compatibility Guidelines (contained in the Element as Exhibit N-2) with the recommended changes suggested below and the Goals and Policies contained in the Noise Element should be applicable to all of OVOV. The Goals and Policies contained in the Noise Element are very appropriate for a developing area and are needed for the OVOV.

7.2 Modifications to Compatibility Matrix

A land use compatibility matrix is presented in the Noise Element as Exhibit N-2. The exhibit identifies the level of acceptability for land use and noise exposure combinations. For example, a land planner may consult the matrix for a residential project that is being considered where the noise exposure is 72 CNEL. The matrix would inform the planner that the compatibility is "normally unacceptable," but if the project does proceed a detail acoustical analysis will be needed as well as noise insulation features in the design. One concern with the matrix is that many categories overlap. For example, if the planner consulted the chart for a residential project in a 57 CNEL noise zone, it would be discovered that the project would fall into two categories; "normally acceptable" and "conditionally acceptable." This ambiguity is makes the matrix less useful.

A revised matrix is shown in Exhibit 15. The overlapping categories have been removed. Additionally, clarifying language has been added to language below the matrix and to the description of the normally unacceptable category.

7.3 Indoor Noise Criteria

Policy 3.1 of the Noise Element identifies the need to protect indoor noise levels. However, it provides a threshold level based on daytime and nighttime noise levels. Normally these levels are not readily available, however, the CNEL noise levels as presented in the noise contour exhibits for the area are easily accessed. Therefore, we are recommending that the threshold level cited should be changed to an equivalent CNEL level. Additionally, a specific indoor criterion should be cited rather than a vague phrase such as "provide mitigation measures." The recommended language for Policy 3.1 is as follows:

> *Require that developers of new single-family and multi-family residential neighborhoods in areas where the projected noise levels exceeds 60 CNEL to provide mitigation measures for new residences to reduce indoor noise levels to 45 CNEL based on future traffic and railroad noise levels.*

7.4 Outdoor Noise Criteria

The Noise Element does not contain any specific standards in regards to outdoor areas for new residential developments. It is important to protect certain outdoor areas for the benefit of the residents. In fact, the City generally imposes an outdoor noise standard as a condition of approval on new residential developments. However, this standard should be included in the Noise Element so that the planning for new developments will clearly addresses the need to protect certain outdoor areas. A new Policy 3.5 is recommend and would read as follows:

> *Require that developers of new single-family and multi-family residential neighborhoods in areas where the projected noise levels exceeds 65 CNEL to provide mitigation measures (e.g., noise barriers, setbacks, site design) for new residences to reduce outdoor noise levels to 65 CNEL based on future traffic conditions. This criteria would apply to rear yard areas for single family*

developments and private patio areas and community recreation facilities (e.g., parks and swimming pools) for multi-family developments.

7.5 Development of Sensitive Land Uses Along Interstate 5

The noise levels along Interstate 5 are projected to increase with either the Current General Plan or the proposed OVOV Plan. Traffic levels are projected to increase and the percent of nighttime traffic will also continue to increase. Residential development very close to the freeway results in very high soundwalls, or in some cases, wall height requirements that are infeasible. (Generally soundwall heights greater than 16 feet are considered infeasible.) Very high soundwalls are also not consistent with the area's character that is suburban or even rural in some locations. Additionally, the California Air Resources Board has recommended that residences be located 500 feet from the edge of the freeway due to potential air toxic impacts unless detailed air studies are done. Therefore, a new Policy 3.6 is recommended below which prohibits residential buildings within 150 feet of the Interstate 5 centerline. The purpose of the policy is to avoid placing residential uses in an area that can not adequately be noise mitigated, and to reduce the use of high soundwalls along the I-5. It should be noted that the centerline was utilized as a reference instead of the right of way, because the right of way width varies greatly as the freeway passes through the study area. The proposed Policy 3.6 reads as follows:

New residential buildings shall not be located within 150 feet of the Interstate 5 centerline.

7.6 Disclosure Statements for Special Areas

Three land use situations were identified above where buyer/renter notification programs would be beneficial. A new Policy 3.7 is recommended and would read as follows:

A buyer and renter notification program should be developed for new residential developments to educate and inform potential buyers and renters of the sources of noise in the area or new sources that may occur. Potential buyers and renters within 1 mile of Magic Mountain or within 1,000 feet of the railroad should receive notice that these sources occasionally generate high levels of noise and

that the frequency and loudness of these noise events may change over time. Potential buyers and renters in or within 200 feet of high-density mixed use developments should be noticed that the commercial uses within the mixed use developments may generate noise in excess of levels typically found in residential areas, and that the commercial uses may change over time and the associated noise levels and frequency of noise events may also change along with the use.

APPENDIX

Traffic Noise Contours

Santa Clarita Noise Element / Existing Traffic Noise Contours (Arterial):

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	70	65	60
LAKE HUGHES ROAD	North Section	North Section	9,000	50	66.9	36	61	106
SAN FRANCISQUITO CANYON	South of Dry Gulch Road	North of Dry Gulch Road	0	45	0	0	0	0
BOUQUET CANYON ROAD	North End	North End	5,000	40	61.4	19	33	59
SIERRA HIGHWAY	Aqua Dolce Canyon Road	E of Aqua Dolce Canyon	2,000	40	57.4	12	21	37
LAKE HUGHES ROAD	Mid-Section	North Section	2,000	45	58.9	14	25	44
SAN FRANCISQUITO CANYON	Mid-Section	South of Dry Gulch Road	0	45	0	0	0	0
RIDGE ROUTE ROAD	Lake Hughes Road	N of Lake Hughes Road	5,000	50	64.3	27	46	80
LAKE HUGHES ROAD	Castaic Road	Ridge Route Road	9,000	45	65.5	30	53	92
RIDGE ROUTE ROAD	Castaic Road	Lake Hughes Road	5,000	50	64.3	27	46	80
CASTAIC ROAD	Parker Road	Lake Hughs Road	12,000	50	68.1	41	70	121
THE OLD ROAD	Parker Road	Sloan Canyon Road	2,000	50	60.4	17	30	52
AGUA DULCE CANYON ROAD	Escondido Canyon Road	Sierra Highway	4,000	45	61.9	20	35	62
ESCONDIDO CANYON ROAD	Aqua Dolce Cyn Road	East End	3,000	45	60.7	18	31	54
AGUA DULCE ROAD	Davenport Road	Escondido Canyon Road	3,000	55	63.5	25	43	72
DAVENPORT ROAD	Tick Canyon Road	Aqua Dulce Road	2,000	45	58.9	14	25	44
DAVENPORT ROAD	Sierra Highway	Tick Canyon Road	2,000	35	55.8	9	17	30
SAN FRANCISQUITO CANYON	N of Copper Hill Drive	Mid-Section	0	45	0	0	0	0
MCBEAN PARKWAY	North of Copperhill		0	40	0	0	0	0
SECO CANYON ROAD	Copper Hill Drive	N of Copper Hill Drive	10,000	35	62.8	21	38	69
COPPER HILL DRIVE	Sycamore	High Ridge	5,000	55	65.7	32	54	91
COPPER HILL DRIVE	Haskell Canyon Road	Sycamore	5,000	45	62.9	23	40	69
COPPER HILL DRIVE	Seco Canyon Road	Haskell Canyon Road	20,000	55	71.7	60	102	173
BOUQUET CANYON ROAD	David Way	Vasquez Canyon Road	11,000	50	67.8	39	68	116
HASLEY CANYON ROAD	Del Valle Road	Sloan Canyon Road	3,000	40	59.2	14	26	46
SIERRA HIGHWAY	Vasquez Canyon Road	Davenport Road	11,000	40	64.8	28	49	87
HASLEY CANYON ROAD	The Old Road	Commerce Center Drive	17,000	40	66.7	34	61	108
SIERRA HIGHWAY	Sand Canyon Road	Vasquez Canyon Road	11,000	35	63.2	22	40	73
SIERRA HIGHWAY	S of Vasquez Canyon Rd	Vasquez Canyon Road	11,000	45	66.3	33	58	102

COPPER HILL DRIVE	Decoro Drive	McBean Parkway	26,500	45	70.2	51	89	156
PLUM CANYON ROAD	West of Golden Valley	West of Golden Valley	24,000	45	69.7	48	85	149
COPPER HILL DRIVE	Alta Vista Way	Decoro Drive	33,000	60	73.9	76	128	218
DECORO DRIVE	Rye Canyon	Dickason Drive	12,000	35	63.6	23	42	76
DECORO DRIVE	Dickason Drive	McBean Parkway	14,000	55	70.2	51	86	147
PLUM CANYON ROAD	West of Golden Valley	South of Skyline Ranch Rd	24,000	45	69.7	48	85	149
THE OLD ROAD	Newhall Ranch Road	N of Newhall Ranch Road	10,000	45	65.9	32	55	97
THE OLD ROAD	Henry Mayo Drive	Newhall Ranch Road	15,000	55	70.5	53	89	152
RYE CANYON ROAD	Avenue Scott	Newhall Ranch Road	25,000	50	71.3	58	100	172
WHITES CANYON ROAD	South of Skyline Ranch Rd	Skyline Ranch Road	13,000	55	69.8	49	84	142
AGUA DULCE ROAD	Soledad Canyon Road	Davenport Road	3,000	55	63.5	25	43	72
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	5,000	45	62.9	23	40	69
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	5,000	40	61.4	19	33	59
DICKASON DRIVE	Newhall Ranch Road	Decoro Drive	13,000	50	68.5	42	73	126
NEWHALL RANCH ROAD	Dickenson Drive	Rye Canyon Road	21,000	50	70.6	53	92	158
SOLEDAD CANYON ROAD	Aqua Dolce Road	East of Aqua Dolce Rd	8,000	55	67.7	39	67	114
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	5,000	45	62.9	23	40	69
AVE TIBBITTS	Avenue Scott	Newhall Ranch Road	9,000	35	62.3	20	36	66
THE OLD ROAD	Rye Canyon Road	Henry Mayo Drive	33,000	50	72.5	66	114	196
AVE SCOTT	Avenue Tibbitts	Rockefeller Avenue	10,000	35	62.8	21	38	69
AVE TIBBITTS	Avenue Scott	Hopkins	0	35	0	0	0	0
NEWHALL RANCH ROAD	Bouquet Canyon Road	E of Bouquet Canyon Rd	7,000	50	65.8	32	55	94
NEWHALL RANCH ROAD	West of Golden Valley		0	45	0	0	0	0
SANTA CLARITA PARKWAY	Newhall Ranch Road	Bouquet Canyon Road	0	45	0	0	0	0
AVE TIBBITTS	Hopkins	Magic Mountain Parkway	0	55	0	0	0	0
BOUQUET CANYON ROAD	Soledad Canyon / Valencia	Newhall Ranch Road	63,000	45	73.9	77	136	237
THE OLD ROAD	Magic Mountain Parkway	Rye Canyon Road	31,000	35	67.7	38	69	125
HENRY MAYO DRIVE	Commerce Center Drive	Chiquito Canyon Road	5,000	40	61.4	19	33	59

MAGIC MOUNTAIN PARKWAY	The Old Road	Magic Mountain Theme Park	16,000	55	70.7	54	92	156
LOST CANYON ROAD	Sand Canyon Road	East of Sand Canyon Rd	0	45	0	0	0	0
MAGIC MOUNTAIN PARKWAY		East of Commerce Ctr Dr	0	50	0	0	0	0
SAND CANYON ROAD	South of Jakes Way	Jakes Way	9,000	45	65.5	30	53	92
MAGIC MOUNTAIN PARKWAY	Bouquet Canyon Road	Valencia Blvd	21,000	50	70.6	53	92	158
HENRY MAYO DRIVE	West of Chiquito Cyn Rd	West of Chiquito Cyn Rd	5,000	45	62.9	23	40	69
WHITES CANYON ROAD	Via Princessa	Soledad Canyon Road	25,000	50	71.3	58	100	172
THE OLD ROAD	North of Valencia Blvd	Magic Mountain Parkway	15,000	55	70.5	53	89	152
TOURNEY ROAD	Valencia Boulevard	Magic Mountain Parkway	6,000	35	60.5	16	29	53
VALENCIA BOULEVARD	Tourney Road	Rockwell Canyon Road	43,000	45	72.3	64	113	197
VALENCIA BOULEVARD	Interstate 5	Tourney Road	44,000	45	72.4	65	114	199
THE OLD ROAD	Valencia Blvd	North of Valencia Blvd	15,000	40	66.2	32	57	102
VALENCIA BOULEVARD	The Old Road	Interstate 5	21,000	45	69.1	45	80	139
HENRY MAYO DRIVE	Wes of Chiquito Cyn Rd	to West End	5,000	40	61.4	19	33	59
VIA PRINCESSA	North of Lost Canyon	Sierra Highway	24,000	35	66.6	33	60	109
VIA PRINCESSA	Lost Canyon Road	North of Lost Canyon	5,000	35	59.7	15	27	49
MAGIC MOUNTAIN PARKWAY	Commerce Center Drive	Valencia Blvd	0	45	0	0	0	0
VIA PRINCESSA	East of Golden Valley Rd		0	35	0	0	0	0
VIA PRINCESSA	Santa Clarita Pkwy	Golden Valley Road	0	40	0	0	0	0
GOLDEN VALLEY ROAD	Sierra Highway	Via Princessa	20,000	60	71.7	60	102	173
ROCKWELL CANYON ROAD	McBean Parkway	Valencia Blvd	15,000	50	69.1	45	78	135
VIA PRINCESSA	Railroad Avenue	West of Railroad Canyon	2,000	40	57.4	12	21	37
RAILROAD AVENUE	Via Princessa	South of Via Princessa	36,000	40	70.0	50	89	158
16TH STREET	Newhall Avenue	Orchard Village Road	9,000	35	62.3	20	36	66
STEVENSON RANCH PARKWAY	The Old Road	North of Pico Canyon Road	28,000	50	71.8	61	105	181
LYONS AVENUE EXTENSION	Railroad Canyon	Walnut	20,000	55	71.7	60	102	173
THE OLD ROAD	Pico Canyon Road	Stevensons Ranch Parkway	25,000	40	68.4	42	74	132
SAND CANYON ROAD	Placerita Canyon Road	South of Jakes Way	9,000	45	65.5	30	53	92

LYONS AVENUE	Newhall Avenue	Walnut	38,000	45	71.7	61	106	186
NEWHALL AVENUE	Lyons Avenue	16th Street	1,000	45	55.9	10	18	32
PICO CANYON ROAD	The Old Road	Stevenson Ranch Parkway	16,000	55	70.7	54	92	156
STEVENSON RANCH PARKWAY	Pico Canyon Road	North of Pico Canyon Road	8,000	50	66.4	34	58	100
WILEY CANYON ROAD	Lyons Avenue	Tournament Canyon Road	18,000	40	67.0	35	63	112
LYONS AVENUE EXTENSION		East of Railroad Canyon	0	55	0	0	0	0
NEWHALL AVENUE	Market Street	Lyons Avenue	22,000	45	69.3	46	81	142
SIERRA HIGHWAY	Intersection Dockweiler	Intersection Dockweiler	16,000	45	68.0	40	70	122
SIERRA HIGHWAY	Newhall Avenue	Dockweiler Drive	16,000	45	68.0	40	70	122
NEWHALL AVENUE	Sierra Highway	East of Sierra Highway	39,000	45	71.8	61	107	188
CALGROVE BOULEVARD	Wiley Canyon	East End	600	55	56.5	12	20	34
CALGROVE BOULEVARD	The Old Road	Wiley Canyon	11,000	55	69.1	46	77	132
THE OLD ROAD	Calgrove Boulevard	North of Calgrove Blvd	5,000	45	62.9	23	40	69
THE OLD ROAD	North of Calgrove Blvd	Pico Canyon Road	5,000	35	59.7	15	27	49
THE OLD ROAD	Sierra Highway	Calgrove Boulevard	7,000	45	64.4	27	47	82
SAN FERNANDO RD (LA)	Sierra Highway	S of Sierra Highway	0	45	0	0	0	0
CHIQUITO CANYON ROAD	Lower Mid Point	North End	2,000	45	58.9	14	25	44
CHIQUITO CANYON ROAD	South End	Lower Mid-Point	17,000	45	68.2	41	72	126
HILLCREST PARKWAY	The Old Road	Sloan Canyon Road	15,000	45	67.7	39	68	118
SAND CANYON ROAD	S of Placerita Canyon	Little Tujunga Canyon Rd	9,000	45	65.5	30	53	92
PLACERITA CANYON ROAD	W of Sand Canyon Road	W of Sand Canyon Road	4,000	40	60.4	17	30	53
PLACERITA CANYON ROAD	Mid-Section	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	45	61.9	20	35	62
SOLEDAD CANYON ROAD	Shadow Pines Blvd	Aqua Dolce Road	8,000	55	67.7	39	67	114
SIERRA HIGHWAY	Davenport Road	North of Davenport Rd	2,000	45	58.9	14	25	44
SIERRA HIGHWAY	North of Davenport Rd	Aqua Dolce Canyon Road	2,000	45	58.9	14	25	44
BOUQUET CANYON ROAD	Vasquez Canyon Road	Mid Section	5,000	50	64.3	27	46	80
BOUQUET CANYON ROAD	Mid Section	North End	5,000	50	64.3	27	46	80

VASQUEZ CANYON ROAD	Sierra Highway	North of Sierra Highway	8,000	45	65.0	28	50	87
VASQUEZ CANYON ROAD	North of Sierra Highway	East of Bouquet Canyon	8,000	40	63.5	24	42	74
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	W of Shadow Pines Blvd	12,000	50	68.1	41	70	121
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	Shadow Pines Blvd	12,000	35	63.6	23	42	76
SOLEDAD CANYON ROAD	West of Sand Canyon	Sand Canyon Road	26,000	40	68.6	42	75	134
SOLEDAD CANYON ROAD	East of Sand Cayon	Sand Canyon Road	33,000	50	72.5	66	114	196
SOLEDAD CANYON ROAD	East of Sand Cayon	East of Sand Cayon	33,000	50	72.5	66	114	196
SAND CANYON ROAD	Jakes Way	South of Soledad Canyon	28,000	45	70.4	52	91	160
SAND CANYON ROAD	South of Soledad Canyon	Soledad Canyon Road	28,000	50	71.8	61	105	181
SOLEDAD CANYON ROAD	West of Sand Canyon	West of Sand Canyon	26,000	50	71.5	59	101	175
SOLEDAD CANYON ROAD	East of Sierra Highway	Sierra Highway	35,000	50	72.8	68	117	201
SOLEDAD CANYON ROAD	East of Sierra Highway	West of Sand Canyon	35,000	45	71.4	58	102	178
SOLEDAD CANYON ROAD	East of Sierra Highway	East of Sierra Highway	35,000	45	71.4	58	102	178
SOLEDAD CANYON ROAD	East of Whites Canyon	Whites Canyon Road	46,000	40	71.0	56	100	178
SOLEDAD CANYON ROAD	East of Whites Canyon	East of Whites Canyon	46,000	45	72.5	67	116	204
SOLEDAD CANYON ROAD	West of Sierra Highway	Sierra Highway	46,000	45	72.5	67	116	204
SOLEDAD CANYON ROAD	West of Sierra Highway	East of Whites Canyon	46,000	45	72.5	67	116	204
SOLEDAD CANYON ROAD	West of Whites Canyon	Whites Canyon	46,000	45	72.5	67	116	204
WHITES CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	41,000	40	70.5	53	95	168
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	50	73.5	73	126	217
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	40	70.5	53	95	168
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	30	67.1	35	65	121
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	55	74.8	83	142	241
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	35	68.9	44	80	144
WHITES CANYON ROAD	N of Soledad Canyon Road	South of Plum Canyon	41,000	45	72.0	63	110	193
WHITES CANYON ROAD	South of Plum Canyon	Plum Canyon Road	41,000	35	68.9	44	80	144

PLUM CANYON ROAD	West of Golden Valley	East of Bouquet Canyon	24,000	40	68.2	41	72	129
PLUM CANYON ROAD	Bouquet Canyon Road	East of Bouquet Canyon	24,000	40	68.2	41	72	129
BOUQUET CANYON ROAD	David Way	Susan	11,000	45	66.3	33	58	102
BOUQUET CANYON ROAD	Plum Canyon	Susan	10,000	45	65.9	32	55	97
COPPER HILL DRIVE	High Ridge	Benz Road	5,000	60	65.7	32	54	91
HASKELL CANYON ROAD	Jeffers Lane	Copper Hill Drive	12,000	45	66.7	35	61	106
HASKELL CANYON ROAD	Bouquet Canyon Road	Ridgegrove Drive	12,000	35	63.6	23	42	76
HASKELL CANYON ROAD	Jeffers Lane	Ridgegrove Drive	12,000	45	66.7	35	61	106
BOUQUET CANYON ROAD	Urbandale Avenue	Plum Canyon	30,000	45	70.7	54	95	166
BOUQUET CANYON ROAD	Haskell Canyon Road	Urbandale Avenue	30,000	45	70.7	54	95	166
BOUQUET CANYON ROAD	Alamogordo Road	Centurion Way	52,000	45	73.1	71	124	216
BOUQUET CANYON ROAD	Centurion Way	Haskell Canyon Road	38,000	45	71.7	61	106	186
BOUQUET CANYON ROAD	Seco Canyon Road	Santa Clarita Parkway	42,000	50	73.6	74	127	219
BOUQUET CANYON ROAD	Santa Clarita Parkway	Urbandale Avenue	30,000	40	69.2	46	81	144
SECO CANYON ROAD	Bouquet Canyon Road	N of Bouquet Canyon Rd	23,000	40	68.0	40	71	126
SECO CANYON ROAD	N of Bouquet Canyon Rd	Decoro Drive	23,000	35	66.4	32	59	107
SECO CANYON ROAD	Decoro Drive	North of Decoro Drive	23,000	35	66.4	32	59	107
SECO CANYON ROAD	North of Decoro Drive	S of Copper Hill Drive	19,000	35	65.5	29	53	97
SECO CANYON ROAD	S of Copper Hill Drive	Copper Hill Drive	19,000	35	65.5	29	53	97
COPPER HILL DRIVE	San Francisquito Canyon	Seco Canyon Road	35,000	35	68.2	40	73	133
COPPER HILL DRIVE	McBean Parkway	San Francisquito Canyon	35,000	50	72.8	68	117	201
MCBEAN PARKWAY	Sunset Hills Drive	Copper Hill Drive	22,000	40	67.8	39	69	123
MCBEAN PARKWAY	South of Sunset Hills	Sunset Hills Drive	22,000	40	67.8	39	69	123
MCBEAN PARKWAY	Decoro Drive	North of Decoro Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	South of Sunset Hills	North of Decoro Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	North of Decoro Drive	North of Decoro Drive	27,000	40	68.7	43	77	137
DECORO DRIVE	McBean Parkway	Grandview	19,000	45	68.7	43	76	133
DECORO DRIVE	Grandview	Hillsburough	14,000	45	67.4	37	65	114
DECORO DRIVE	Hillsburough	Bidwell Lane	17,000	45	68.2	41	72	126
DECORO DRIVE	Bidwell Lane	Delgado Drive	11,000	55	69.1	46	77	132
DECORO DRIVE	Delgado Drive	Seco Canyon Road	11,000	60	69.1	46	77	132
MCBEAN PARKWAY	Newhall Ranch Road	Fairveiw Drive	32,000	40	69.5	47	84	149
MCBEAN PARKWAY	Fairveiw Drive	Decoro Drive	32,000	40	69.5	47	84	149

COPPER HILL DRIVE	Alta Vista Way	Smyth Drive	35,000	55	74.1	78	132	224
COPPER HILL DRIVE	Newhall Ranch Road	Smyth Drive	35,000	60	74.1	78	132	224
AVE SCOTT	Avenue Tibbitts	Stanford Avenue	14,000	45	67.4	37	65	114
AVE SCOTT	Stanford Avenue	Rye Canyon	10,000	40	64.4	26	47	83
NEWHALL RANCH ROAD	Rye Canyon Road	Interstate 5 ramp	25,000	45	69.9	49	87	151
BOUQUET CANYON ROAD	Newhall Ranch Road	Espuella Avenue	52,000	55	75.9	93	158	269
BOUQUET CANYON ROAD	Espuella Avenue	Seco Canyon Road	52,000	45	73.1	71	124	216
NEWHALL RANCH ROAD	Bouquet Canyon Road	Hillsburough	37,000	45	71.6	60	105	183
NEWHALL RANCH ROAD	Hillsburough	West of Hillsburough	37,000	45	71.6	60	105	183
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	7,000	45	64.4	27	47	82
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	7,000	50	65.8	32	55	94
NEWHALL RANCH ROAD	W of Hillsburough	East of McBean Pkwy	37,000	50	73.0	70	120	207
NEWHALL RANCH ROAD	East of McBean Pkwy	McBean Parkway	37,000	50	73.0	70	120	207
MCBEAN PARKWAY	Avenue Scott	Newhall Ranch Road	47,000	45	72.6	67	118	206
AVE SCOTT	Rockefeller Avenue	McBean Parkway	14,000	35	64.2	25	46	83
NEWHALL RANCH ROAD	Interstate 5 ramp	Interstate 5 ramp	28,000	50	71.8	61	105	181
NEWHALL RANCH ROAD	E of Interstate 5 ramp	E of Interstate 5 ramp	28,000	45	70.4	52	91	160
COMMERCE CENTER DRIVE	Magic Mountain Parkway	Henry Mayo Drive	0	55	0	0	0	0
COMMERCE CENTER DRIVE	Henry Mayo Drive	Hasley Canyon Road	17,000	55	71.0	56	95	161
THE OLD ROAD	South of Hasley Canyon	Hasley Canyon Road	9,000	40	64.0	25	44	79
RIDGE ROUTE ROAD	N of Lake Hughes Road	Templin Parkway	5,000	50	64.3	27	46	80
THE OLD ROAD	Sloan Canyon Road	N of Sloan Canyon Road	9,000	40	64.0	25	44	79
THE OLD ROAD	Hasley Canyon Road	S of Hillcrest Parkway	16,000	40	66.5	33	59	105
THE OLD ROAD	S of Hillcrest Parkway	Hillcrest Parkway	16,000	50	69.4	47	81	139
LONG CANYON ROAD	Henry Mayo Drive	Potrero Canyon	0	45	0	0	0	0
STEVENSON RANCH PARKWAY	The Old Road	East of the Old Road	13,000	50	68.5	42	73	126
MCBEAN PARKWAY	Rockwell Canyon Road	Interstate 5 ramp	47,000	45	72.6	67	118	206
MCBEAN PARKWAY	Interstate 5 ramp	Interstate 5 ramp	47,000	45	72.6	67	118	206
PICO CANYON ROAD	The Old Road	Interstate 5 ramp	40,000	55	74.7	83	140	239
LYONS AVENUE	Interstate 5 ramp	Interstate 5	38,000	50	73.1	70	121	209
PICO CANYON ROAD	Interstate 5 ramp	West of Wiley Canyon	40,000	40	70.4	53	94	166
LYONS AVENUE	Wiley Canyon Road	Interstate 5 ramp	38,000	50	73.1	70	121	209
LYONS AVENUE	Interstate 5 ramp	Interstate 5	44,000	50	73.8	75	130	224
RYE CANYON ROAD	The Old Road	NE of The Old Road	35,000	50	72.8	68	117	201

RYE CANYON ROAD	South of Avenue Scott	Avenue Scott	23,000	45	69.5	47	83	145
RYE CANYON ROAD	NE of The Old Road	South of Avenue Scott	35,000	45	71.4	58	102	178
MAGIC MOUNTAIN PARKWAY	The Old Road	Interstate 5	26,000	50	71.5	59	101	175
MAGIC MOUNTAIN PARKWAY	Interstate 5	Tourney Road	30,000	50	72.1	63	109	187
MAGIC MOUNTAIN PARKWAY	Interstate 5	Interstate 5	26,000	45	70.1	50	88	154
MAGIC MOUNTAIN PARKWAY	Int of Mag Mt. & Tibbitts	Int of Mag Mt. & Tibbitts	30,000	45	70.7	54	95	166
MAGIC MOUNTAIN PARKWAY	Tourney Road	West of McBean Parkway	21,000	45	69.1	45	80	139
MAGIC MOUNTAIN PARKWAY	McBean Parkway	West of McBean Parkway	21,000	45	69.1	45	80	139
MAGIC MOUNTAIN PARKWAY	West of McBean Parkway	West of McBean Parkway	21,000	50	70.6	53	92	158
MCBEAN PARKWAY	Magic Mountain Parkway	Creekside	51,000	45	73.0	70	122	214
MCBEAN PARKWAY	Creekside	Avenue Scott	58,000	45	73.6	74	130	228
MAGIC MOUNTAIN PARKWAY	McBean Parkway	East of McBean Parkway	16,000	45	68.0	40	70	122
MAGIC MOUNTAIN PARKWAY	East of McBean Parkway	East of McBean Parkway	21,000	40	67.6	38	68	121
MAGIC MOUNTAIN PARKWAY	Valencia Blvd	West of Valencia Blvd	21,000	40	67.6	38	68	121
MAGIC MOUNTAIN PARKWAY	West of Valencia Blvd	West of Valencia Blvd	21,000	40	67.6	38	68	121
MCBEAN PARKWAY	South of Magic Mountain	Magic Mountain Parkway	43,000	40	70.8	55	97	172
MCBEAN PARKWAY	Valencia Blvd	North of Valencia Blvd	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	North of Valencia Blvd	South of Magic Mountain	43,000	45	72.3	64	113	197
VALENCIA BOULEVARD	McBean Parkway	East of McBean Parkway	48,000	45	72.7	68	119	208
VALENCIA BOULEVARD	East of McBean Parkway	SW of Magic Mountain Pkwy	48,000	45	72.7	68	119	208
VALENCIA BOULEVARD	SW of Magic Mountain Pkwy	East of McBean Parkway	48,000	45	72.7	68	119	208
VALENCIA BOULEVARD	McBean Parkway	West of McBean Parkway	51,000	50	74.4	81	140	241
VALENCIA BOULEVARD	West of McBean Parkway	Rockwell Canyon Road	51,000	40	71.5	59	106	188
MCBEAN PARKWAY	Del Monte Drive	Valencia Blvd	35,000	45	71.4	58	102	178
MCBEAN PARKWAY	Arroyo Park Drive	Del Monte Drive	35,000	45	71.4	58	102	178
MCBEAN PARKWAY	South of Arroya Park Dr	Arroyo Park Drive	35,000	45	71.4	58	102	178

MCBEAN PARKWAY	Orchard Village Road	North of Orchard Village	38,000	45	71.7	61	106	186
MCBEAN PARKWAY	North of Orchard Village	South of Arroya Park Dr	38,000	45	71.7	61	106	186
MCBEAN PARKWAY	Rockwell Canyon Road	Singing Hills Drive	30,000	45	70.7	54	95	166
MCBEAN PARKWAY	East of Singing Hills Dr	Orchard Village Road	30,000	45	70.7	54	95	166
MCBEAN PARKWAY	Singing Hills Drive	East of Singing Hills Dr	30,000	45	70.7	54	95	166
TOURNAMENT ROAD	Wiley Canyon Road	Mid-Section	6,000	40	62.2	20	36	64
TOURNAMENT ROAD	Mid-Section	South of McBean Parkway	6,000	55	66.5	34	59	99
WILEY CANYON ROAD	Lyons Avenue	South of Lyons Avenue	7,000	35	61.2	18	32	58
WILEY CANYON ROAD	Calgrove Boulevard	North of Calgrove Blvd	9,000	35	62.3	20	36	66
WILEY CANYON ROAD	North of Calgrove Blvd	South of Lyons Avenue	9,000	40	64.0	25	44	79
VALLEY STREET	Lyons Avenue	South of Lyons Avenue	9,000	45	65.5	30	53	92
LYONS AVENUE	Apple Street	Orchard Village Road	37,000	50	73.0	70	120	207
LYONS AVENUE	Apple Street	Rotella	37,000	50	73.0	70	120	207
LYONS AVENUE	Wiley Canyon	Everette Drive	38,000	50	73.1	70	121	209
LYONS AVENUE	Newhall Avenue	Arcadia Street	38,000	50	73.1	70	121	209
LYONS AVENUE	Arcadia Street	Valley Street	38,000	55	74.5	81	137	233
RAILROAD AVENUE	Lyons Avenue	North of Lyons Avenue	35,000	40	69.9	49	88	156
RAILROAD AVENUE	North of Lyons Avenue	South of Via Princessa	35,000	45	71.4	58	102	178
RAILROAD AVENUE	South of Via Princessa	South of Via Princessa	35,000	45	71.4	58	102	178
WILEY CANYON ROAD	East of Tournament	Orchard Village Road	13,000	45	67.1	36	63	110
WILEY CANYON ROAD	Tournament	East of Tournament	13,000	40	65.6	30	53	95
ORCHARD VILLAGE ROAD	Wiley Canyon Road	Mill Valley	29,000	45	70.5	53	93	163
ORCHARD VILLAGE ROAD	Mill Valley	McBean Parkway	29,000	50	72.0	62	107	184
ORCHARD VILLAGE ROAD	Lyons Avenue	Dalbey Drive	21,000	50	70.6	53	92	158
ORCHARD VILLAGE ROAD	Dalbey Drive	16th Street	21,000	35	66.0	31	56	102
RAILROAD AVENUE	Via Princessa	North of Via Princessa	36,000	45	71.5	59	103	181
RAILROAD AVENUE	North of Via Princessa	South of Magic Mountain	36,000	50	72.9	69	118	204
RAILROAD AVENUE	South of Magic Mountain	Magic Mountain Parkway	38,000	50	73.1	70	121	209
MAGIC MOUNTAIN PARKWAY	Via Princessa	Bouquet Canyon Road	0	40	0	0	0	0
VALENCIA BOULEVARD	Magic Mountain Parkway	N of Magic Mountain Pkwy	52,000	45	73.1	71	124	216

VALENCIA BOULEVARD	N of Magic Mountain Pkwy	W of Bouquet Canyon	52,000	35	69.9	50	90	163
VALENCIA BOULEVARD	West of Bouquet Canyon	Bouquet Canyon Road	48,000	50	74.2	79	136	234
VALENCIA BOULEVARD	West of Bouquet Canyon	West of Bouquet Canyon	48,000	50	74.2	79	136	234
BOUQUET CANYON ROAD	Magic Mountain Parkway	Cenema Drive	38,000	45	71.7	61	106	186
BOUQUET CANYON ROAD	Cenema Drive	Valencia Blvd	38,000	45	71.7	61	106	186
VIA PRINCESSA	Railroad Avenue	East of Railroad Canyon	2,000	35	55.8	9	17	30
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	2,000	35	55.8	9	17	30
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	2,000	55	61.7	21	35	60
VIA PRINCESSA	West of Magic Mountain		0	55	0	0	0	0
VIA PRINCESSA	West of Magic Mountain		0	50	0	0	0	0
VIA PRINCESSA	East of Magic Mountain		0	40	0	0	0	0
VIA PRINCESSA	West of Santa Clarita Pkwy		0	50	0	0	0	0
SANTA CLARITA PARKWAY	Via Princessa	South of Via Princessa	0	45	0	0	0	0
SANTA CLARITA PARKWAY	South of Via Princessa	South of Via Princessa	0	45	0	0	0	0
SANTA CLARITA PARKWAY	Sierra Highway	West of Sierra Highway	0	45	0	0	0	0
SANTA CLARITA PARKWAY	Soledad Canyon Road	South of Soledad Canyon	0	45	0	0	0	0
SANTA CLARITA PARKWAY	Via Princessa	North of Via Princessa	0	45	0	0	0	0
DOCKWEILER DRIVE	Mid-Section	Mid-Section	5,000	25	56.3	9	16	31
NEWHALL AVENUE	Sierra Highway	Valle Del Oro	45,000	45	72.5	66	115	202
NEWHALL AVENUE	NW of Valle Del Oro	NW of Valle Del Oro	48,000	50	74.2	79	136	234
SIERRA HIGHWAY	The Old Road	North of The Old Road	13,000	45	67.1	36	63	110
SIERRA HIGHWAY	North of The Old Road	Newhall Avenue	13,000	45	67.1	36	63	110
SIERRA HIGHWAY	Dockweiler Drive	North of Dockweiler	16,000	45	68.0	40	70	122
SIERRA HIGHWAY	North of Dockweiler	Placerita Canyon Road	16,000	50	69.4	47	81	139
GOLDEN VALLEY ROAD	Sierra Highway	SR-14	14,000	50	68.8	44	76	130
GOLDEN VALLEY ROAD	SR-14	East of SR-14	0	55	0	0	0	0
GOLDEN VALLEY ROAD	S of SR-14	Via Princessa	0	40	0	0	0	0
GOLDEN VALLEY ROAD	East of SR-14	East End	0	50	0	0	0	0

SIERRA HIGHWAY	Golden Valley Road	North of Golden Valley Rd	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	North of Golden Valley Rd	North of Golden Valley Rd	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	North of Golden Valley Rd	South of Via Princessa	33,000	45	71.1	57	99	173
SIERRA HIGHWAY	South of Via Princessa	Via Princessa	33,000	45	71.1	57	99	173
SIERRA HIGHWAY	Via Princessa	North of Via Princessa	38,000	45	71.7	61	106	186
SIERRA HIGHWAY	North of Via Princessa	Jakes Way	38,000	45	71.7	61	106	186
JAKES WAY/CANYON PARK BL	Sierra Highway	Lost Canyon	7,000	25	57.8	10	20	37
VIA PRINCESSA	Whites Canyon	West of Whites Canyon	2,000	40	57.4	12	21	37
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	2,000	40	57.4	12	21	37
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	2,000	60	61.7	21	35	60
VIA PRINCESSA	SE of Whites Canyon	NW of Sierra Highway	32,000	50	72.4	65	112	193
SOLEDAD CANYON ROAD	West of Whites Canyon	West of Whites Canyon	46,000	45	72.5	67	116	204
SOLEDAD CANYON ROAD	West of Whites Canyon	East of Golden Valley Rd	46,000	45	72.5	67	116	204
SOLEDAD CANYON ROAD	East of Golden Valley Rd	East of Golden Valley Rd	57,000	45	73.5	74	129	226
SOLEDAD CANYON ROAD	Golden Valley Road	East of Golden Valley Rd	57,000	40	72.0	63	112	199
SOLEDAD CANYON ROAD	West of Golden Valley	E of Santa Clarita Pkwy	62,000	45	73.8	77	135	236
SOLEDAD CANYON ROAD	Golden Valley Road	West of Golden Valley	62,000	45	73.8	77	135	236
SOLEDAD CANYON ROAD	West of Golden Valley	West of Golden Valley	62,000	45	73.8	77	135	236
SOLEDAD CANYON ROAD	E of Santa Clarita Pkwy	W of Santa Clarita Pkwy	57,000	50	74.9	85	147	254
SOLEDAD CANYON ROAD	W of Santa Clarita Pkwy	Bouquet Canyon Road	64,000	50	75.4	90	155	268
SANTA CLARITA PARKWAY	Soledad Canyon Road	Newhall Ranch Road	0	45	0	0	0	0
GOLDEN VALLEY ROAD	Soledad Canyon Road	Nth of Soledad Cyn Road	14,000	50	68.8	44	76	130
NEWHALL AVENUE	Railroad Avenue	Market Street	22,000	50	70.8	54	94	162
NEWHALL AVENUE	SE of Railroad Avenue	Railroad Avenue	22,000	50	70.8	54	94	162
TICK CANYON ROAD	Shadow Pines Blvd	South of Davenport Road	0	45	0	0	0	0
LYONS AVENUE	Rotella	Peachland Avenue	37,000	55	74.4	80	135	230

LYONS AVENUE	Peachland Avenue	Everette Drive	37,000	55	74.4	80	135	230
ORCHARD VILLAGE ROAD	16th Street	North of 16th Street	29,000	35	67.4	37	66	121
ORCHARD VILLAGE ROAD	North of 16th Street	Wiley Canyon Road	29,000	50	72.0	62	107	184
TOURNAMENT ROAD	South of McBean Parkway	McBean Parkway	6,000	55	66.5	34	59	99
NEWHALL AVENUE	Valle Del Oro	NW of Valle Del Oro	48,000	55	75.5	90	153	259
NEWHALL AVENUE	NW of Valle Del Oro	SE of Railroad Avenue	48,000	50	74.2	79	136	234
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	33,000	50	72.5	66	114	196
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	Placerita Canyon Road	Golden Valley Road	27,000	45	70.2	51	90	157
SIERRA HIGHWAY	Golden Valley Road	N of Golden Valley Rd	33,000	45	71.1	57	99	173
DOCKWEILER DRIVE	Sierra Highway	Mid-Section	5,000	35	59.7	15	27	49
HASLEY CANYON ROAD	Commerce Center Drive	Del Valle Road	7,000	50	65.8	32	55	94
WILEY CANYON ROAD	Orchard Village Road	E of Orchard Village Rd	13,000	40	65.6	30	53	95
THE OLD ROAD	Hillcrest Parkway	South of Parker Road	3,000	50	62.1	21	36	63
THE OLD ROAD	South of Parker Road	Parker Road	3,000	45	60.7	18	31	54
LAKE HUGHES ROAD	The Old Road	Castaic Road	9,000	35	62.3	20	36	66
THE OLD ROAD	Stevensons Ranch Parkway	Valencia Boulevard	17,000	45	68.2	41	72	126
NEWHALL RANCH ROAD	McBean Parkway	Avenue Tibbitts	36,000	45	71.5	59	103	181
GOLDEN VALLEY ROAD	Plum Canyon Road	South of Plum Cyn Rd	2,000	55	61.7	21	35	60
GOLDEN VALLEY ROAD	North of Newhall Ranch		0	50	0	0	0	0
SIERRA HIGHWAY	South of Sand Canyon	South of Sand Canyon	10,000	45	65.9	32	55	97
SIERRA HIGHWAY	North of Skyline Ranch Rd	South of Sand Canyon	10,000	40	64.4	26	47	83
SIERRA HIGHWAY	North of Skyline Ranch Rd	North of Skyline Ranch Rd	15,000	40	66.2	32	57	102
SIERRA HIGHWAY	South of Skyline Ranch Rd	North of Skyline Ranch Rd	15,000	40	66.2	32	57	102
SIERRA HIGHWAY	Soledad Canyon Road	South of Skyline Ranch Rd	26,000	40	68.6	42	75	134
SAND CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	8,000	50	66.4	34	58	100
SAND CANYON ROAD			7,000	45	64.4	27	47	82
SHADOW PINES BOULEVARD	North of Soledad Canyon	South of Davenport Road	6,000	40	62.2	20	36	64
LOST CANYON ROAD	East of Lost Canyon		0	45	0	0	0	0
LOST CANYON ROAD	South of Jakes Way		0	45	0	0	0	0

LOST CANYON ROAD	Jakes Way	North-East of Jakes Way	0	55	0	0	0	0
VIA PRINCESSA	Sierra Highway	NW of Sierra Highway	32,000	40	69.5	47	84	149
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	2,000	40	57.4	12	21	37
SIERRA HIGHWAY	Jakes Way	Soledad Canyon Road	38,000	45	71.7	61	106	186
HASLEY CANYON ROAD	The Old Road	North of The Old Road	17,000	40	66.7	34	61	108
PARKER ROAD	The Old Road	Sloan Canyon Drive	1,000	50	57.3	13	22	37
PARKER ROAD	The Old Road	Interstate 5	6,000	50	65.1	29	51	87
PARKER ROAD	Interstate 5	Castaic Road	6,000	45	63.7	25	43	76
LAKE HUGHES ROAD	Ridge Route Road	North-East of Ridge Route	2,000	35	55.8	9	17	30
LAKE HUGHES ROAD	North-East of Ridge Route	Mid-Section	2,000	50	60.4	17	30	52
LAKE HUGHES ROAD	North-East of Ridge Route	North-East of Ridge Route	2,000	50	60.4	17	30	52
SHADOW PINES BOULEVARD	North of Soledad Canyon	North of Soledad Canyon	6,000	40	62.2	20	36	64
SHADOW PINES BOULEVARD	Soledad Canyon Road	North of Soledad Canyon	6,000	40	62.2	20	36	64
VIA PRINCESSA	Lost Canyon Road	Golden Valley Road	0	35	0.2	0	0	0
LOST CANYON ROAD	Via Princessa	Jakes Way	10,000	50	67.3	37	65	111
VASQUEZ CANYON ROAD	East of Bouquet Canyon	East of Bouquet Canyon	7,000	35	61.2	18	32	58
VASQUEZ CANYON ROAD	East of Bouquet Canyon	Bouquet Canyon Road	7,000	35	61.2	18	32	58
GOLDEN VALLEY ROAD	Via Princessa	Soledad Canyon Road	14,000	60	70.2	51	86	147
COPPER HILL DRIVE	Benz Road	David Way	5,000	45	62.9	23	40	69
DRY GULCH RD			0	45	0	0	0	0
TEMPLIN PK	Interstate 5	Ridge Route Road	0	50	0	0	0	0
	Templin Highway	North of Templin Highway	0	40	0	0	0	0
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	5,000	40	61.4	19	33	59
SLOAN CANYON RD	Hasley Canyon Road	Hillcrest Parkway	0	40	0	0	0	0
SLOAN CANYON RD	Parker Road	The Old Road	1,000	40	54.4	8	15	26
SLOAN CANYON RD	Parker Road	West of Parker Road	1,000	40	54.4	8	15	26
POTRERO CANYON RD	Henry Mayo Drive	Valencia Blvd	0	40	0	0	0	0
VALENCIA BLVD	Magic Mountain Parkway	West of Magic Mountain	0	45	0	0	0	0

VALENCIA BLVD	West of Pico Canyon	South of Magic Mountain	0	55	0	0	0	0
VALENCIA BLVD	Pico Canyon Road	East of Pico Cyn Road	0	50	0	0	0	0
VALENCIA BLVD	The Old Road	West of The Old Road	16,000	45	68.0	40	70	122
PICO CANYON ROAD	South of Valencia		0	45	0	0	0	0
PICO CANYON ROAD	Stevenson Ranch Parkway	W of Stevenson Ranch	3,000	55	63.5	25	43	72
SKYLINE RANCH RD	Whites Canyon	Sierra Highway	0	45	0	0	0	0
LOST CANYON ROAD	Sand Canyon Road	West of Sand Canyon Rd	0	40	0	0	0	0
NEWHALL RANCH ROAD	Interstate 5 ramp	The Old Road	28,000	55	73.2	70	119	202
COPPER HILL DRIVE	David Way	Bouquet Canyon Road	0	55	0	0	0	0
JAKES WAY	Jakes Way	Lost Canyon	7,000	40	62.9	22	39	70
NEWHALL RANCH ROAD	Santa Clarita Pkwy	E of Santa Clarita Pkwy	7,000	45	64.4	27	47	82
LITTLE TUJUNGA CANYON RO	Sand Canyon Road	South	0	40	0	0	0	0
RAILROAD AVENUE	Newhall Avenue	Lyons Avenue	26,000	50	71.5	59	101	175

Existing Freeway Noise Contour Distances for Freeways

STREET	ADT	FREEWAY	CNEL @50'	Distance to CNEL Contour (ft.) 70	65	60
I-5 n/o Lake Hughes	78,000	I5	84.1	251	445	789
I-5 s/o Lake Hughes	84,000	I5	84.4	261	462	818
I-5 s/o Parker	102,000	I5	85.3	287	509	901
I-5 s/o Hasley Cyn	114,000	I5	85.8	303	537	952
I-5 s/o SR-126	124,000	I5	86.1	316	560	993
I-5 s/o Rye Cyn	133,000	I5	86.4	328	580	1028
I-5 s/o Magic Mtn	155,000	I5	87.1	353	626	1109
I-5 s/o Valencia	178,000	I5	87.7	379	671	1188
I-5 s/o McBean	188,000	I5	87.9	389	689	1221
I-5 s/o Lyons	197,000	I5	88.1	398	705	1250
I-5 s/o Calgrove	198,000	I5	88.2	399	707	1253
SR-14 n/o Aqua Dulce	103,000	SR14	83.8	216	366	622
SR-14 s/o Aqua Dulce	105,000	SR14	83.9	217	369	628
SR-14 s/o Soledad Cyn	107,000	SR14	84.0	219	373	633
SR-14 s/o Sand Cyn	118,000	SR14	84.4	229	390	662
SR-14 s/o Via Princessa	148,000	SR14	85.4	255	433	735
SR-14 s/o Sierra Hwy	148,000	SR14	85.4	255	433	735
SR-14 s/o Golden Valley	151,000	SR14	85.4	257	437	742
SR-14 s/o Placerita Cyn	160,000	SR14	85.7	264	448	762
SR-14 n/o I-5	173,000	SR14	86.0	274	465	790

Santa Clarita Noise Element / Current General Plan Traffic Noise Contours (Arterial):

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	70	65	60
LAKE HUGHES ROAD	North Section	North Section	12,000	50	68.1	41	70	121
SAN FRANCISQUITO CANYON	South of Dry Gulch Road	North of Dry Gulch Road	7,000	45	64.4	27	47	82
BOUQUET CANYON ROAD	North End	North End	6,000	40	62.2	20	36	64
SIERRA HIGHWAY	Aqua Dolce Canyon Road	E of Aqua Dolce Canyon	2,000	40	57.4	12	21	37
LAKE HUGHES ROAD	Mid-Section	North Section	12,000	45	66.7	35	61	106
SAN FRANCISQUITO CANYON	Mid-Section	South of Dry Gulch Road	7,000	45	64.4	27	47	82
RIDGE ROUTE ROAD	Lake Hughes Road	N of Lake Hughes Road	36,000	50	72.9	69	118	204
LAKE HUGHES ROAD	Castaic Road	Ridge Route Road	43,000	45	72.3	64	113	197
RIDGE ROUTE ROAD	Castaic Road	Lake Hughes Road	4,000	50	63.4	24	42	72
CASTAIC ROAD	Parker Road	Lake Hughs Road	25,000	50	71.3	58	100	172
THE OLD ROAD	Parker Road	Sloan Canyon Road	4,000	50	63.4	24	42	72
AGUA DULCE CANYON ROAD	Escondido Canyon Road	Sierra Highway	8,000	45	65.0	28	50	87
ESCONDIDO CANYON ROAD	Aqua Dolce Cyn Road	East End	5,000	45	62.9	23	40	69
AGUA DULCE ROAD	Davenport Road	Escondido Canyon Road	13,000	55	69.8	49	84	142
DAVENPORT ROAD	Tick Canyon Road	Aqua Dulce Road	3,000	45	60.7	18	31	54
DAVENPORT ROAD	Sierra Highway	Tick Canyon Road	4,000	35	58.8	13	24	43
SAN FRANCISQUITO CANYON	N of Copper Hill Drive	Mid-Section	7,000	45	64.4	27	47	82
MCBEAN PARKWAY			9,000	40	64.0	25	44	79
SECO CANYON ROAD	Copper Hill Drive	N of Copper Hill Drive	10,000	35	62.8	21	38	69
COPPER HILL DRIVE	Sycamore	High Ridge	18,000	55	71.3	57	97	165
COPPER HILL DRIVE	Haskell Canyon Road	Sycamore	18,000	45	68.5	42	74	129
COPPER HILL DRIVE	Seco Canyon Road	Haskell Canyon Road	29,000	55	73.3	71	121	206
BOUQUET CANYON ROAD	David Way	Vasquez Canyon Road	20,000	50	70.4	52	90	154
HASLEY CANYON ROAD	Del Valle Road	Sloan Canyon Road	11,000	40	64.8	28	49	87
SIERRA HIGHWAY	Vasquez Canyon Road	Davenport Road	15,000	40	66.2	32	57	102
HASLEY CANYON ROAD	The Old Road	Commerce Center Drive	40,000	40	70.4	53	94	166
SIERRA HIGHWAY	Sand Canyon Road	Vasquez Canyon Road	15,000	35	64.5	26	47	86
SIERRA HIGHWAY	S of Vasquez Canyon Rd	Vasquez Canyon Road	15,000	45	67.7	39	68	118

COPPER HILL DRIVE	Decoro Drive	McBean Parkway	47,500	45	72.7	68	118	207
PLUM CANYON ROAD	West of Golden Valley	West of Golden Valley	13,000	45	67.1	36	63	110
COPPER HILL DRIVE	Alta Vista Way	Decoro Drive	54,000	60	76.0	95	161	274
DECORO DRIVE	Rye Canyon	Dickason Drive	9,000	35	62.3	20	36	66
DECORO DRIVE	Dickason Drive	McBean Parkway	14,000	55	70.2	51	86	147
PLUM CANYON ROAD	West of Golden Valley	South of Skyline Ranch Rd	13,000	45	67.1	36	63	110
THE OLD ROAD	Newhall Ranch Road	N of Newhall Ranch Road	23,000	45	69.5	47	83	145
THE OLD ROAD	Henry Mayo Drive	Newhall Ranch Road	19,000	55	71.5	59	100	169
RYE CANYON ROAD	Avenue Scott	Newhall Ranch Road	46,000	50	74.0	77	133	229
WHITES CANYON ROAD	South of Skyline Ranch Rd	Skyline Ranch Road	19,000	55	71.5	59	100	169
AGUA DULCE ROAD	Soledad Canyon Road	Davenport Road	14,000	55	70.2	51	86	147
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	10,000	45	65.9	32	55	97
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	10,000	40	64.4	26	47	83
DICKASON DRIVE	Newhall Ranch Road	Decoro Drive	21,000	50	70.6	53	92	158
NEWHALL RANCH ROAD	Dickenson Drive	Rye Canyon Road	48,000	50	74.2	79	136	234
SOLEDAD CANYON ROAD	Aqua Dolce Road	East of Aqua Dolce Rd	22,000	55	72.1	63	107	181
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	17,000	45	68.2	41	72	126
AVE TIBBITTS	Avenue Scott	Newhall Ranch Road	34,000	35	68.1	40	72	131
THE OLD ROAD	Rye Canyon Road	Henry Mayo Drive	49,000	50	74.2	79	137	236
AVE SCOTT	Avenue Tibbitts	Rockefeller Avenue	23,000	35	66.4	32	59	107
AVE TIBBITTS	Avenue Scott	Hopkins	32,000	35	67.8	39	70	127
NEWHALL RANCH ROAD	Bouquet Canyon Road	E of Bouquet Canyon Rd	44,000	50	73.8	75	130	224
NEWHALL RANCH ROAD			49,000	45	72.8	69	120	210
SANTA CLARITA PARKWAY	Newhall Ranch Road	Bouquet Canyon Road	38,000	45	71.7	61	106	186
AVE TIBBITTS	Hopkins	Magic Mountain Parkway	32,000	55	73.8	74	127	215
BOUQUET CANYON ROAD	Soledad Canyon / Valencia	Newhall Ranch Road	75,000	45	74.7	84	148	258
THE OLD ROAD	Magic Mountain Parkway	Rye Canyon Road	54,000	35	70.1	51	92	167
HENRY MAYO DRIVE	Commerce Center Drive	Chiquito Canyon Road	10,000	40	64.4	26	47	83

MAGIC MOUNTAIN PARKWAY	The Old Road	Magic Mountain Theme Park	83,000	55	77.9	116	196	334
LOST CANYON ROAD	Sand Canyon Road	East of Sand Canyon Rd	14,000	45	67.4	37	65	114
MAGIC MOUNTAIN PARKWAY			60,000	50	75.1	87	151	260
SAND CANYON ROAD	South of Jakes Way	Jakes Way	14,000	45	67.4	37	65	114
MAGIC MOUNTAIN PARKWAY	Bouquet Canyon Road	Valencia Blvd	48,000	50	74.2	79	136	234
HENRY MAYO DRIVE	West of Chiquito Cyn Rd	West of Chiquito Cyn Rd	10,000	45	65.9	32	55	97
WHITES CANYON ROAD	Via Princessa	Soledad Canyon Road	50,000	50	74.3	80	138	238
THE OLD ROAD	North of Valencia Blvd	Magic Mountain Parkway	33,000	55	73.9	76	128	218
TOURNEY ROAD	Valencia Boulevard	Magic Mountain Parkway	15,000	35	64.5	26	47	86
VALENCIA BOULEVARD	Tourney Road	Rockwell Canyon Road	57,000	45	73.5	74	129	226
VALENCIA BOULEVARD	Interstate 5	Tourney Road	66,000	45	74.1	79	139	243
THE OLD ROAD	Valencia Blvd	North of Valencia Blvd	33,000	40	69.6	48	85	151
VALENCIA BOULEVARD	The Old Road	Interstate 5	59,000	45	73.6	75	131	230
HENRY MAYO DRIVE	Wes of Chiquito Cyn Rd	to West End	10,000	40	64.4	26	47	83
VIA PRINCESSA	North of Lost Canyon	Sierra Highway	44,000	35	69.2	45	82	150
VIA PRINCESSA	Lost Canyon Road	North of Lost Canyon	23,000	35	66.4	32	59	107
MAGIC MOUNTAIN PARKWAY			45,000	45	72.5	66	115	202
VIA PRINCESSA			50,000	35	69.7	49	88	160
VIA PRINCESSA			50,000	40	71.4	59	105	186
GOLDEN VALLEY ROAD	Sierra Highway	Via Princessa	57,000	60	76.3	97	165	281
ROCKWELL CANYON ROAD	McBean Parkway	Valencia Blvd	26,000	50	71.5	59	101	175
VIA PRINCESSA	Railroad Avenue	West of Railroad Canyon	23,000	40	68.0	40	71	126
RAILROAD AVENUE	Via Princessa	South of Via Princessa	41,000	40	70.5	53	95	168
16TH STREET	Newhall Avenue	Orchard Village Road	9,000	35	62.3	20	36	66
STEVENSON RANCH PARKWAY	The Old Road	North of Pico Canyon Road	30,000	50	72.1	63	109	187
LYONS AVENUE EXTENSION	Railroad Canyon	Walnut	49,000	55	75.6	91	154	262
THE OLD ROAD	Pico Canyon Road	Stevensons Ranch Parkway	41,000	40	70.5	53	95	168
SAND CANYON ROAD	Placerita Canyon Road	South of Jakes Way	14,000	45	67.4	37	65	114
LYONS AVENUE	Newhall Avenue	Walnut	49,000	45	72.8	69	120	210
NEWHALL AVENUE	Lyons Avenue	16th Street	2,000	45	58.9	14	25	44

PICO CANYON ROAD	The Old Road	Stevenson Ranch Parkway	47,000	55	75.4	89	151	257
STEVENSON RANCH PARKWAY	Pico Canyon Road	North of Pico Canyon Road	11,000	50	67.8	39	68	116
WILEY CANYON ROAD	Lyons Avenue	Tournament Canyon Road	31,000	40	69.3	46	82	146
LYONS AVENUE EXTENSION			30,000	55	73.5	72	123	209
NEWHALL AVENUE	Market Street	Lyons Avenue	27,000	45	70.2	51	90	157
SIERRA HIGHWAY	Intersection Dockweiler	Intersection Dockweiler	43,000	45	72.3	64	113	197
SIERRA HIGHWAY	Newhall Avenue	Dockweiler Drive	27,000	45	70.2	51	90	157
NEWHALL AVENUE	Sierra Highway	East of Sierra Highway	58,000	45	73.6	74	130	228
CALGROVE BOULEVARD	Wiley Canyon	East End	19,000	55	71.5	59	100	169
CALGROVE BOULEVARD	The Old Road	Wiley Canyon	30,000	55	73.5	72	123	209
THE OLD ROAD	Calgrove Boulevard	North of Calgrove Blvd	14,000	45	67.4	37	65	114
THE OLD ROAD	North of Calgrove Blvd	Pico Canyon Road	24,000	35	66.6	33	60	109
THE OLD ROAD	Sierra Highway	Calgrove Boulevard	24,000	45	69.7	48	85	149
SAN FERNANDO RD (LA)	Sierra Highway	S of Sierra Highway	20,000	45	68.9	44	78	136
CHIQUITO CANYON ROAD	Lower Mid Point	North End	27,000	45	70.2	51	90	157
CHIQUITO CANYON ROAD	South End	Lower Mid-Point	27,000	45	70.2	51	90	157
HILLCREST PARKWAY	The Old Road	Sloan Canyon Road	18,000	45	68.5	42	74	129
SAND CANYON ROAD	S of Placerita Canyon	Little Tujunga Canyon Rd	14,000	45	67.4	37	65	114
PLACERITA CANYON ROAD	W of Sand Canyon Road	W of Sand Canyon Road	8,000	40	63.5	24	42	74
PLACERITA CANYON ROAD	Mid-Section	Mid-Section	8,000	55	67.7	39	67	114
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	8,000	55	67.7	39	67	114
PLACERITA CANYON ROAD	Sierra Highway	East of Sierra Highway	8,000	55	67.7	39	67	114
PLACERITA CANYON ROAD	East of Sierra Highway	Mid-Section	8,000	55	67.7	39	67	114
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	8,000	45	65.0	28	50	87
SOLEDAD CANYON ROAD	Shadow Pines Blvd	Aqua Dolce Road	22,000	55	72.1	63	107	181
SIERRA HIGHWAY	Davenport Road	North of Davenport Rd	2,000	45	58.9	14	25	44
SIERRA HIGHWAY	North of Davenport Rd	Aqua Dolce Canyon Road	2,000	45	58.9	14	25	44
BOUQUET CANYON ROAD	Vasquez Canyon Road	Mid Section	20,000	50	70.4	52	90	154
BOUQUET CANYON ROAD	Mid Section	North End	20,000	50	70.4	52	90	154
VASQUEZ CANYON ROAD	Sierra Highway	North of Sierra Highway	11,000	45	66.3	33	58	102
VASQUEZ CANYON ROAD	North of Sierra Highway	East of Bouquet Canyon	11,000	40	64.8	28	49	87

SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	W of Shadow Pines Blvd	12,000	50	68.1	41	70	121
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	Shadow Pines Blvd	12,000	35	63.6	23	42	76
SOLEDAD CANYON ROAD	West of Sand Canyon	Sand Canyon Road	24,000	40	68.2	41	72	129
SOLEDAD CANYON ROAD	East of Sand Cayon	Sand Canyon Road	34,000	50	72.7	67	115	199
SOLEDAD CANYON ROAD	East of Sand Cayon	East of Sand Cayon	34,000	50	72.7	67	115	199
SAND CANYON ROAD	Jakes Way	South of Soledad Canyon	29,000	45	70.5	53	93	163
SAND CANYON ROAD	South of Soledad Canyon	Soledad Canyon Road	29,000	50	72.0	62	107	184
SOLEDAD CANYON ROAD	West of Sand Canyon	West of Sand Canyon	24,000	50	71.1	57	98	168
SOLEDAD CANYON ROAD	East of Sierra Highway	Sierra Highway	39,000	50	73.3	71	123	212
SOLEDAD CANYON ROAD	East of Sierra Highway	West of Sand Canyon	39,000	45	71.8	61	107	188
SOLEDAD CANYON ROAD	East of Sierra Highway	East of Sierra Highway	39,000	45	71.8	61	107	188
SOLEDAD CANYON ROAD	East of Whites Canyon	Whites Canyon Road	43,000	40	70.8	55	97	172
SOLEDAD CANYON ROAD	East of Whites Canyon	East of Whites Canyon	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Sierra Highway	Sierra Highway	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Sierra Highway	East of Whites Canyon	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Whites Canyon	Whites Canyon	38,000	45	71.7	61	106	186
WHITES CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	43,000	40	70.8	55	97	172
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	43,000	50	73.7	75	129	222
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	43,000	40	70.8	55	97	172
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	43,000	30	67.4	36	67	124
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	43,000	55	75.0	85	145	247
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	43,000	35	69.1	45	81	148
WHITES CANYON ROAD	N of Soledad Canyon Road	South of Plum Canyon	43,000	45	72.3	64	113	197
WHITES CANYON ROAD	South of Plum Canyon	Plum Canyon Road	43,000	35	69.1	45	81	148
PLUM CANYON ROAD	West of Golden Valley	East of Bouquet Canyon	13,000	40	65.6	30	53	95
PLUM CANYON ROAD	Bouquet Canyon Road	East of Bouquet Canyon	22,000	40	67.8	39	69	123

BOUQUET CANYON ROAD	David Way	Susan	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Plum Canyon	Susan	23,000	45	69.5	47	83	145
COPPER HILL DRIVE	High Ridge	Benz Road	18,000	60	71.3	57	97	165
HASKELL CANYON ROAD	Jeffers Lane	Copper Hill Drive	12,000	45	66.7	35	61	106
HASKELL CANYON ROAD	Bouquet Canyon Road	Ridgegrove Drive	12,000	35	63.6	23	42	76
HASKELL CANYON ROAD	Jeffers Lane	Ridgegrove Drive	12,000	45	66.7	35	61	106
BOUQUET CANYON ROAD	Urbandale Avenue	Plum Canyon	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Haskell Canyon Road	Urbandale Avenue	33,000	45	71.1	57	99	173
BOUQUET CANYON ROAD	Alamogordo Road	Centurion Way	53,000	45	73.2	71	125	218
BOUQUET CANYON ROAD	Centurion Way	Haskell Canyon Road	53,000	45	73.2	71	125	218
BOUQUET CANYON ROAD	Seco Canyon Road	Santa Clarita Parkway	53,000	50	74.6	82	142	245
BOUQUET CANYON ROAD	Santa Clarita Parkway	Urbandale Avenue	33,000	40	69.6	48	85	151
SECO CANYON ROAD	Bouquet Canyon Road	N of Bouquet Canyon Rd	33,000	40	69.6	48	85	151
SECO CANYON ROAD	N of Bouquet Canyon Rd	Decoro Drive	33,000	35	67.9	39	71	129
SECO CANYON ROAD	Decoro Drive	North of Decoro Drive	33,000	35	67.9	39	71	129
SECO CANYON ROAD	North of Decoro Drive	S of Copper Hill Drive	19,000	35	65.5	29	53	97
SECO CANYON ROAD	S of Copper Hill Drive	Copper Hill Drive	19,000	35	65.5	29	53	97
COPPER HILL DRIVE	San Francisquito Canyon	Seco Canyon Road	40,000	35	68.8	43	78	143
COPPER HILL DRIVE	McBean Parkway	San Francisquito Canyon	40,000	50	73.4	72	124	214
MCBEAN PARKWAY	Sunset Hills Drive	Copper Hill Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	South of Sunset Hills	Sunset Hills Drive	27,000	40	68.7	43	77	137
MCBEAN PARKWAY	Decoro Drive	North of Decoro Drive	35,000	40	69.9	49	88	156
MCBEAN PARKWAY	South of Sunset Hills	North of Decoro Drive	35,000	40	69.9	49	88	156
MCBEAN PARKWAY	North of Decoro Drive	North of Decoro Drive	35,000	40	69.9	49	88	156
DECORO DRIVE	McBean Parkway	Grandview	19,000	45	68.7	43	76	133
DECORO DRIVE	Grandview	Hillsburough	14,000	45	67.4	37	65	114
DECORO DRIVE	Hillsburough	Bidwell Lane	17,000	45	68.2	41	72	126
DECORO DRIVE	Bidwell Lane	Delgado Drive	11,000	55	69.1	46	77	132
DECORO DRIVE	Delgado Drive	Seco Canyon Road	11,000	60	69.1	46	77	132
MCBEAN PARKWAY	Newhall Ranch Road	Fairveiw Drive	47,000	40	71.1	57	101	180
MCBEAN PARKWAY	Fairveiw Drive	Decoro Drive	47,000	40	71.1	57	101	180
COPPER HILL DRIVE	Alta Vista Way	Smyth Drive	55,000	55	76.1	96	162	276
COPPER HILL DRIVE	Newhall Ranch Road	Smyth Drive	55,000	60	76.1	96	162	276
AVE SCOTT	Avenue Tibbitts	Stanford Avenue	35,000	45	71.4	58	102	178

AVE SCOTT	Stanford Avenue	Rye Canyon	16,000	40	66.5	33	59	105
NEWHALL RANCH ROAD	Rye Canyon Road	Interstate 5 ramp	68,000	45	74.2	80	141	246
BOUQUET CANYON ROAD	Newhall Ranch Road	Espuella Avenue	48,000	55	75.5	90	153	259
BOUQUET CANYON ROAD	Espuella Avenue	Seco Canyon Road	48,000	45	72.7	68	119	208
NEWHALL RANCH ROAD	Bouquet Canyon Road	Hillsburough	67,000	45	74.2	80	140	245
NEWHALL RANCH ROAD	Hillsburough	West of Hillsburough	67,000	45	74.2	80	140	245
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	44,000	45	72.4	65	114	199
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	44,000	50	73.8	75	130	224
NEWHALL RANCH ROAD	W of Hillsburough	East of McBean Pkwy	65,000	50	75.5	91	156	270
NEWHALL RANCH ROAD	East of McBean Pkwy	McBean Parkway	65,000	50	75.5	91	156	270
MCBEAN PARKWAY	Avenue Scott	Newhall Ranch Road	55,000	45	73.3	73	127	222
AVE SCOTT	Rockefeller Avenue	McBean Parkway	23,000	35	66.4	32	59	107
NEWHALL RANCH ROAD	Interstate 5 ramp	Interstate 5 ramp	65,000	50	75.5	91	156	270
NEWHALL RANCH ROAD	E of Interstate 5 ramp	E of Interstate 5 ramp	65,000	45	74.0	79	138	241
COMMERCE CENTER DRIVE	Magic Mountain Parkway	Henry Mayo Drive	35,666	55	74.2	78	133	226
COMMERCE CENTER DRIVE	Henry Mayo Drive	Hasley Canyon Road	43,000	55	75.0	85	145	247
THE OLD ROAD	South of Hasley Canyon	Hasley Canyon Road	18,000	40	67.0	35	63	112
RIDGE ROUTE ROAD	N of Lake Hughes Road	Templin Parkway	36,000	50	72.9	69	118	204
THE OLD ROAD	Sloan Canyon Road	N of Sloan Canyon Road	24,000	40	68.2	41	72	129
THE OLD ROAD	Hasley Canyon Road	S of Hillcrest Parkway	24,000	40	68.2	41	72	129
THE OLD ROAD	S of Hillcrest Parkway	Hillcrest Parkway	24,000	50	71.1	57	98	168
LONG CANYON ROAD			33,000	45	71.1	57	99	173
STEVENSON RANCH PARKWAY	The Old Road	East of the Old Road	8,000	50	66.4	34	58	100
MCBEAN PARKWAY	Rockwell Canyon Road	Interstate 5 ramp	55,000	45	73.3	73	127	222
MCBEAN PARKWAY	Interstate 5 ramp	Interstate 5 ramp	55,000	45	73.3	73	127	222
PICO CANYON ROAD	The Old Road	Interstate 5 ramp	45,000	55	75.2	87	148	252
LYONS AVENUE	Interstate 5 ramp	Interstate 5	39,000	50	73.3	71	123	212
PICO CANYON ROAD	Interstate 5 ramp	West of Wiley Canyon	45,000	40	71.0	56	99	176
LYONS AVENUE	Wiley Canyon Road	Interstate 5 ramp	39,000	50	73.3	71	123	212
LYONS AVENUE	Interstate 5 ramp	Interstate 5	49,000	50	74.2	79	137	236
RYE CANYON ROAD	The Old Road	NE of The Old Road	57,000	50	74.9	85	147	254
RYE CANYON ROAD	South of Avenue Scott	Avenue Scott	47,000	45	72.6	67	118	206
RYE CANYON ROAD	NE of The Old Road	South of Avenue Scott	57,000	45	73.5	74	129	226

MAGIC MOUNTAIN PARKWAY	The Old Road	Interstate 5	80,000	50	76.4	100	173	298
MAGIC MOUNTAIN PARKWAY	Interstate 5	Tourney Road	56,000	50	74.8	85	146	251
MAGIC MOUNTAIN PARKWAY	Interstate 5	Interstate 5	80,000	45	75.0	87	152	267
MAGIC MOUNTAIN PARKWAY	Int of Mag Mt. & Tibbitts	Int of Mag Mt. & Tibbitts	56,000	45	73.4	73	128	224
MAGIC MOUNTAIN PARKWAY	Tourney Road	West of McBean Parkway	58,000	45	73.6	74	130	228
MAGIC MOUNTAIN PARKWAY	McBean Parkway	West of McBean Parkway	58,000	45	73.6	74	130	228
MAGIC MOUNTAIN PARKWAY	West of McBean Parkway	West of McBean Parkway	58,000	50	75.0	86	148	256
MCBEAN PARKWAY	Magic Mountain Parkway	Creekside	67,000	45	74.2	80	140	245
MCBEAN PARKWAY	Creekside	Avenue Scott	73,000	45	74.6	83	146	255
MAGIC MOUNTAIN PARKWAY	McBean Parkway	East of McBean Parkway	52,000	45	73.1	71	124	216
MAGIC MOUNTAIN PARKWAY	East of McBean Parkway	East of McBean Parkway	52,000	40	71.6	60	107	190
MAGIC MOUNTAIN PARKWAY	Valencia Blvd	West of Valencia Blvd	48,000	40	71.2	58	102	182
MAGIC MOUNTAIN PARKWAY	West of Valencia Blvd	West of Valencia Blvd	48,000	40	71.2	58	102	182
MCBEAN PARKWAY	South of Magic Mountain	Magic Mountain Parkway	59,000	40	72.1	64	114	202
MCBEAN PARKWAY	Valencia Blvd	North of Valencia Blvd	59,000	45	73.6	75	131	230
MCBEAN PARKWAY	North of Valencia Blvd	South of Magic Mountain	59,000	45	73.6	75	131	230
VALENCIA BOULEVARD	McBean Parkway	East of McBean Parkway	47,000	45	72.6	67	118	206
VALENCIA BOULEVARD	East of McBean Parkway	SW of Magic Mountain Pkwy	47,000	45	72.6	67	118	206
VALENCIA BOULEVARD	SW of Magic Mountain Pkwy	East of McBean Parkway	47,000	45	72.6	67	118	206
VALENCIA BOULEVARD	McBean Parkway	West of McBean Parkway	60,000	50	75.1	87	151	260
VALENCIA BOULEVARD	West of McBean Parkway	Rockwell Canyon Road	60,000	40	72.2	64	115	204
MCBEAN PARKWAY	Del Monte Drive	Valencia Blvd	50,000	45	72.9	69	121	212
MCBEAN PARKWAY	Arroyo Park Drive	Del Monte Drive	50,000	45	72.9	69	121	212
MCBEAN PARKWAY	South of Arroya Park Dr	Arroyo Park Drive	50,000	45	72.9	69	121	212
MCBEAN PARKWAY	Orchard Village Road	North of Orchard Village	43,000	45	72.3	64	113	197

MCBEAN PARKWAY	North of Orchard Village	South of Arroya Park Dr	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	Rockwell Canyon Road	Singing Hills Drive	44,000	45	72.4	65	114	199
MCBEAN PARKWAY	East of Singing Hills Dr	Orchard Village Road	44,000	45	72.4	65	114	199
MCBEAN PARKWAY	Singing Hills Drive	East of Singing Hills Dr	44,000	45	72.4	65	114	199
TOURNAMENT ROAD	Wiley Canyon Road	Mid-Section	6,000	40	62.2	20	36	64
TOURNAMENT ROAD	Mid-Section	South of McBean Parkway	6,000	55	66.5	34	59	99
WILEY CANYON ROAD	Lyons Avenue	South of Lyons Avenue	17,000	35	65.1	28	50	91
WILEY CANYON ROAD	Calgrove Boulevard	North of Calgrove Blvd	19,000	35	65.5	29	53	97
WILEY CANYON ROAD	North of Calgrove Blvd	South of Lyons Avenue	19,000	40	67.2	36	64	115
VALLEY STREET	Lyons Avenue	South of Lyons Avenue	10,000	45	65.9	32	55	97
LYONS AVENUE	Apple Street	Orchard Village Road	39,000	50	73.3	71	123	212
LYONS AVENUE	Apple Street	Rotella	39,000	50	73.3	71	123	212
LYONS AVENUE	Wiley Canyon	Everette Drive	39,000	50	73.3	71	123	212
LYONS AVENUE	Newhall Avenue	Arcadia Street	49,000	50	74.2	79	137	236
LYONS AVENUE	Arcadia Street	Valley Street	49,000	55	75.6	91	154	262
RAILROAD AVENUE	Lyons Avenue	North of Lyons Avenue	39,000	40	70.3	52	92	164
RAILROAD AVENUE	North of Lyons Avenue	South of Via Princessa	39,000	45	71.8	61	107	188
RAILROAD AVENUE	South of Via Princessa	South of Via Princessa	39,000	45	71.8	61	107	188
WILEY CANYON ROAD	East of Tournament	Orchard Village Road	29,000	45	70.5	53	93	163
WILEY CANYON ROAD	Tournament	East of Tournament	29,000	40	69.0	45	80	142
ORCHARD VILLAGE ROAD	Wiley Canyon Road	Mill Valley	54,000	45	73.2	72	126	220
ORCHARD VILLAGE ROAD	Mill Valley	McBean Parkway	54,000	50	74.7	83	143	247
ORCHARD VILLAGE ROAD	Lyons Avenue	Dalbey Drive	32,000	50	72.4	65	112	193
ORCHARD VILLAGE ROAD	Dalbey Drive	16th Street	32,000	35	67.8	39	70	127
RAILROAD AVENUE	Via Princessa	North of Via Princessa	41,000	45	72.0	63	110	193
RAILROAD AVENUE	North of Via Princessa	South of Magic Mountain	41,000	50	73.5	73	126	217
RAILROAD AVENUE	South of Magic Mountain	Magic Mountain Parkway	50,000	50	74.3	80	138	238
MAGIC MOUNTAIN PARKWAY			46,000	40	71.0	56	100	178
VALENCIA BOULEVARD	Magic Mountain Parkway	N of Magic Mountain Pkwy	61,000	45	73.8	76	134	234
VALENCIA BOULEVARD	N of Magic Mountain Pkwy	W of Bouquet Canyon	61,000	35	70.6	54	98	177

VALENCIA BOULEVARD	West of Bouquet Canyon	Bouquet Canyon Road	51,000	50	74.4	81	140	241
VALENCIA BOULEVARD	West of Bouquet Canyon	West of Bouquet Canyon	51,000	50	74.4	81	140	241
BOUQUET CANYON ROAD	Magic Mountain Parkway	Cenema Drive	48,000	45	72.7	68	119	208
BOUQUET CANYON ROAD	Cenema Drive	Valencia Blvd	48,000	45	72.7	68	119	208
VIA PRINCESSA	Railroad Avenue	East of Railroad Canyon	23,000	35	66.4	32	59	107
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	23,000	35	66.4	32	59	107
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	23,000	55	72.3	64	109	185
VIA PRINCESSA			55,000	55	76.1	96	162	276
VIA PRINCESSA			55,000	50	74.7	84	145	249
VIA PRINCESSA			55,000	40	71.8	62	110	195
VIA PRINCESSA			55,000	50	74.7	84	145	249
SANTA CLARITA PARKWAY	Via Princessa	South of Via Princessa	38,000	45	71.7	61	106	186
SANTA CLARITA PARKWAY	South of Via Princessa	South of Via Princessa	38,000	45	71.7	61	106	186
SANTA CLARITA PARKWAY	Sierra Highway	West of Sierra Highway	48,000	45	72.7	68	119	208
SANTA CLARITA PARKWAY	Soledad Canyon Road	South of Soledad Canyon	31,000	45	70.8	55	96	168
SANTA CLARITA PARKWAY	Via Princessa	North of Via Princessa	39,000	45	71.8	61	107	188
DOCKWEILER DRIVE	Mid-Section	Mid-Section	22,000	25	62.7	20	37	71
NEWHALL AVENUE	Sierra Highway	Valle Del Oro	47,000	45	72.6	67	118	206
NEWHALL AVENUE	NW of Valle Del Oro	NW of Valle Del Oro	39,000	50	73.3	71	123	212
SIERRA HIGHWAY	The Old Road	North of The Old Road	37,000	45	71.6	60	105	183
SIERRA HIGHWAY	North of The Old Road	Newhall Avenue	42,000	45	72.2	64	111	195
SIERRA HIGHWAY	Dockweiler Drive	North of Dockweiler	43,000	45	72.3	64	113	197
SIERRA HIGHWAY	North of Dockweiler	Placerita Canyon Road	43,000	50	73.7	75	129	222
GOLDEN VALLEY ROAD	Sierra Highway	SR-14	39,000	50	73.3	71	123	212
GOLDEN VALLEY ROAD	SR-14	East of SR-14	18,000	55	71.3	57	97	165
GOLDEN VALLEY ROAD			39,000	40	70.3	52	92	164
GOLDEN VALLEY ROAD	East of SR-14	East End	18,000	50	69.9	49	85	147
SIERRA HIGHWAY	Golden Valley Road	North of Golden Valley Rd	32,000	50	72.4	65	112	193
SIERRA HIGHWAY	North of Golden Valley Rd	North of Golden Valley Rd	32,000	50	72.4	65	112	193

SIERRA HIGHWAY	North of Golden Valley Rd	South of Via Princessa	32,000	45	71.0	56	98	171
SIERRA HIGHWAY	South of Via Princessa	Via Princessa	32,000	45	71.0	56	98	171
SIERRA HIGHWAY	Via Princessa	North of Via Princessa	37,000	45	71.6	60	105	183
SIERRA HIGHWAY	North of Via Princessa	Jakes Way	37,000	45	71.6	60	105	183
JAKES WAY/CANYON PARK BL	Sierra Highway	Lost Canyon	18,000	25	61.9	17	33	64
VIA PRINCESSA	Whites Canyon	West of Whites Canyon	23,000	40	68.0	40	71	126
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	23,000	40	68.0	40	71	126
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	23,000	60	72.3	64	109	185
VIA PRINCESSA	SE of Whites Canyon	NW of Sierra Highway	55,000	50	74.7	84	145	249
SOLEDAD CANYON ROAD	West of Whites Canyon	West of Whites Canyon	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Whites Canyon	East of Golden Valley Rd	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	East of Golden Valley Rd	East of Golden Valley Rd	48,000	45	72.7	68	119	208
SOLEDAD CANYON ROAD	Golden Valley Road	East of Golden Valley Rd	48,000	40	71.2	58	102	182
SOLEDAD CANYON ROAD	West of Golden Valley	E of Santa Clarita Pkwy	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	Golden Valley Road	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Golden Valley	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	E of Santa Clarita Pkwy	W of Santa Clarita Pkwy	48,000	50	74.2	79	136	234
SOLEDAD CANYON ROAD	W of Santa Clarita Pkwy	Bouquet Canyon Road	42,000	50	73.6	74	127	219
SANTA CLARITA PARKWAY	Soledad Canyon Road	Newhall Ranch Road	31,000	45	70.8	55	96	168
GOLDEN VALLEY ROAD	Soledad Canyon Road	Nth of Soledad Cyn Road	44,000	50	73.8	75	130	224
NEWHALL AVENUE	Railroad Avenue	Market Street	27,000	50	71.7	60	103	178
NEWHALL AVENUE	SE of Railroad Avenue	Railroad Avenue	27,000	50	71.7	60	103	178
SHADOW PINES BOULEVARD		South of Davenport Road	12,000	45	66.7	35	61	106
LYONS AVENUE	Rotella	Peachland Avenue	39,000	55	74.6	82	139	236
LYONS AVENUE	Peachland Avenue	Everette Drive	39,000	55	74.6	82	139	236

ORCHARD VILLAGE ROAD	16th Street	North of 16th Street	43,000	35	69.1	45	81	148
ORCHARD VILLAGE ROAD	North of 16th Street	Wiley Canyon Road	43,000	50	73.7	75	129	222
TOURNAMENT ROAD	South of McBean Parkway	McBean Parkway	6,000	55	66.5	34	59	99
NEWHALL AVENUE	Valle Del Oro	NW of Valle Del Oro	39,000	55	74.6	82	139	236
NEWHALL AVENUE	NW of Valle Del Oro	SE of Railroad Avenue	39,000	50	73.3	71	123	212
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	33,000	50	72.5	66	114	196
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	Placerita Canyon Road	Golden Valley Road	28,000	45	70.4	52	91	160
SIERRA HIGHWAY	Golden Valley Road	N of Golden Valley Rd	32,000	45	71.0	56	98	171
DOCKWEILER DRIVE	Sierra Highway	Mid-Section	25,000	35	66.7	34	62	112
HASLEY CANYON ROAD	Commerce Center Drive	Del Valle Road	17,000	50	69.6	48	83	143
WILEY CANYON ROAD	Orchard Village Road	E of Orchard Village Rd	38,000	40	70.2	51	91	162
THE OLD ROAD	Hillcrest Parkway	South of Parker Road	14,000	50	68.8	44	76	130
THE OLD ROAD	South of Parker Road	Parker Road	14,000	45	67.4	37	65	114
LAKE HUGHES ROAD	The Old Road	Castaic Road	43,000	35	69.1	45	81	148
THE OLD ROAD	Stevensons Ranch Parkway	Valencia Boulevard	47,000	45	72.6	67	118	206
NEWHALL RANCH ROAD	McBean Parkway	Avenue Tibbitts	69,000	45	74.3	81	142	248
GOLDEN VALLEY ROAD	Plum Canyon Road	South of Plum Cyn Rd	44,000	55	75.1	86	147	249
GOLDEN VALLEY ROAD			39,000	50	73.3	71	123	212
SIERRA HIGHWAY	South of Sand Canyon	South of Sand Canyon	19,000	45	68.7	43	76	133
SIERRA HIGHWAY	North of Skyline Ranch Rd	South of Sand Canyon	15,000	40	66.2	32	57	102
SIERRA HIGHWAY	North of Skyline Ranch Rd	North of Skyline Ranch Rd	36,000	40	70.0	50	89	158
SIERRA HIGHWAY	South of Skyline Ranch Rd	North of Skyline Ranch Rd	36,000	40	70.0	50	89	158
SIERRA HIGHWAY	Soledad Canyon Road	South of Skyline Ranch Rd	50,000	40	71.4	59	105	186
SAND CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	14,000	50	68.8	44	76	130
SAND CANYON ROAD			8,000	45	65.0	28	50	87
SHADOW PINES BOULEVARD	North of Soledad Canyon	South of Davenport Road	10,000	40	64.4	26	47	83
LOST CANYON ROAD			15,000	45	67.7	39	68	118
LOST CANYON ROAD			18,000	45	68.5	42	74	129

LOST CANYON ROAD	Jakes Way	North-East of Jakes Way	14,000	55	70.2	51	86	147
VIA PRINCESSA	Sierra Highway	NW of Sierra Highway	55,000	40	71.8	62	110	195
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	23,000	40	68.0	40	71	126
SIERRA HIGHWAY	Jakes Way	Soledad Canyon Road	37,000	45	71.6	60	105	183
	The Old Road	North of The Old Road	6,000	40	62.2	20	36	64
PARKER ROAD	The Old Road	Sloan Canyon Drive	1,000	50	57.3	13	22	37
PARKER ROAD	The Old Road	Interstate 5	11,000	50	67.8	39	68	116
PARKER ROAD	Interstate 5	Castaic Road	11,000	45	66.3	33	58	102
LAKE HUGHES ROAD	Ridge Route Road	North-East of Ridge Route	12,000	35	63.6	23	42	76
LAKE HUGHES ROAD	North-East of Ridge Route	Mid-Section	12,000	50	68.1	41	70	121
LAKE HUGHES ROAD	North-East of Ridge Route	North-East of Ridge Route	12,000	50	68.1	41	70	121
SHADOW PINES BOULEVARD	North of Soledad Canyon	North of Soledad Canyon	10,000	40	64.4	26	47	83
SHADOW PINES BOULEVARD	Soledad Canyon Road	North of Soledad Canyon	10,000	40	64.4	26	47	83
VIA PRINCESSA	Lost Canyon Road	South of Lost Canyon	4,000	35	58.8	13	24	43
LOST CANYON ROAD	Via Princessa	Jakes Way	20,000	50	70.4	52	90	154
VASQUEZ CANYON ROAD	East of Bouquet Canyon	East of Bouquet Canyon	6,000	35	60.5	16	29	53
VASQUEZ CANYON ROAD	East of Bouquet Canyon	Bouquet Canyon Road	6,000	35	60.5	16	29	53
GOLDEN VALLEY ROAD	Via Princessa	Soledad Canyon Road	30,000	60	73.5	72	123	209
COPPER HILL DRIVE	Benz Road	David Way	18,000	45	68.5	42	74	129
DRY GULCH RD			4,000	45	61.9	20	35	62
TEMPLIN PK	At Interstate 5	At Interstate 5	4,000	50	63.4	24	42	72
	Templin Highway	North of Templin Highway	6,000	40	62.2	20	36	64
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	10,000	40	64.4	26	47	83
SLOAN CANYON RD	Hasley Canyon Road	Hillcrest Parkway	4,000	40	60.4	17	30	53
SLOAN CANYON RD	Parker Road	The Old Road	2,000	40	57.4	12	21	37
SLOAN CANYON RD	Parker Road	West of Parker Road	2,000	40	57.4	12	21	37
POTRERO CANYON RD			11,000	40	64.8	28	49	87

VALENCIA BLVD	Magic Mountain Parkway	West of Magic Mountain	29,000	45	70.5	53	93	163
VALENCIA BLVD	Magic Mountain Parkway	South of Magic Mountain	55,000	55	76.1	96	162	276
VALENCIA BLVD	Pico Canyon Road	East of Pico Cyn Road	31,000	50	72.3	64	110	190
VALENCIA BLVD	The Old Road	West of The Old Road	60,000	45	73.7	76	132	232
PICO CANYON ROAD			45,000	45	72.5	66	115	202
PICO CANYON ROAD	Stevenson Ranch Parkway	W of Stevenson Ranch	29,000	55	73.3	71	121	206
SKYLINE RANCH RD	Whites Canyon	Sierra Highway	16,500	45	68.1	40	71	124
LOST CANYON ROAD	Sand Canyon Road	West of Sand Canyon Rd	10,000	40	64.4	26	47	83
NEWHALL RANCH ROAD	Interstate 5 ramp	The Old Road	65,000	55	76.8	103	176	298
COPPER HILL DRIVE			47,500	55	75.5	89	152	258
JAKES WAY	Jakes Way	Lost Canyon	18,000	40	67.0	35	63	112
NEWHALL RANCH ROAD	Santa Clarita Pkwy	E of Santa Clarita Pkwy	44,000	45	72.4	65	114	199
LITTLE TUJUNGA CANYON RO	Sand Canyon Road	South	20,000	40	67.4	37	66	118
RAILROAD AVENUE	Newhall Avenue	Lyons Avenue	28,000	50	71.8	61	105	181

Current General Plan Freeway Noise Contour Distances for Freeways

STREET	ADT	FREEWAY	CNEL @50'	Distance to CNEL Contour (ft.) 70	65	60
I-5 n/o Lake Hughes	191,000	I5	88.0	392	695	1230
I-5 s/o Lake Hughes	206,000	I5	88.3	407	721	1278
I-5 s/o Parker	240,000	I5	89.0	439	778	1378
I-5 s/o Hasley Cyn	249,000	I5	89.2	447	792	1404
I-5 s/o SR-126	225,000	I5	88.7	425	753	1335
I-5 s/o Rye Cyn	247,000	I5	89.1	445	789	1398
I-5 s/o Magic Mtn	257,000	I5	89.3	454	805	1426
I-5 s/o Valencia	269,000	I5	89.5	465	823	1459
I-5 s/o McBean	284,000	I5	89.7	477	846	1499
I-5 s/o Lyons	299,000	I5	90.0	490	868	1537
I-5 s/o Calgrove	308,000	I5	90.1	497	881	1560
SR-14 n/o Aqua Dulce	195,000	SR14	86.6	289	491	834
SR-14 s/o Aqua Dulce	200,000	SR14	86.7	293	497	844
SR-14 s/o Soledad Cyn	228,000	SR14	87.2	311	528	897
SR-14 s/o Sand Cyn	240,000	SR14	87.5	318	540	918
SR-14 s/o Via Princessa	250,000	SR14	87.6	324	551	936
SR-14 s/o Sierra Hwy	279,000	SR14	88.1	341	579	984
SR-14 s/o Golden Valley	268,000	SR14	87.9	335	569	966
SR-14 s/o Placerita Cyn	291,000	SR14	88.3	348	591	1003
SR-14 n/o I-5	316,000	SR14	88.7	361	613	1042

Santa Clarita Noise Element / Proposed General Plan Traffic Noise Contours (Arterial):

ROAD	End 1	End 2	ADT	SPEED	CNEL 50' from CL	70	65	60
LAKE HUGHES ROAD	North Section	North Section	7,000	50	65.8	32	55	94
SAN FRANCISQUITO CANYON	South of Dry Gulch Road	North of Dry Gulch Road	7,000	45	64.4	27	47	82
BOUQUET CANYON ROAD	North End	North End	6,000	40	62.2	20	36	64
SIERRA HIGHWAY	Aqua Dolce Canyon Road	E of Aqua Dolce Canyon	2,000	40	57.4	12	21	37
LAKE HUGHES ROAD	Mid-Section	North Section	7,000	45	64.4	27	47	82
SAN FRANCISQUITO CANYON	Mid-Section	South of Dry Gulch Road	7,000	45	64.4	27	47	82
RIDGE ROUTE ROAD	Lake Hughes Road	N of Lake Hughes Road	35,000	50	72.8	68	117	201
LAKE HUGHES ROAD	Castaic Road	Ridge Route Road	37,000	45	71.6	60	105	183
RIDGE ROUTE ROAD	Castaic Road	Lake Hughes Road	8,000	50	66.4	34	58	100
CASTAIC ROAD	Parker Road	Lake Hughs Road	25,000	50	71.3	58	100	172
THE OLD ROAD	Parker Road	Sloan Canyon Road	3,000	50	62.1	21	36	63
AGUA DULCE CANYON ROAD	Escondido Canyon Road	Sierra Highway	8,000	45	65.0	28	50	87
ESCONDIDO CANYON ROAD	Aqua Dolce Cyn Road	East End	5,000	45	62.9	23	40	69
AGUA DULCE ROAD	Davenport Road	Escondido Canyon Road	13,000	55	69.8	49	84	142
DAVENPORT ROAD	Tick Canyon Road	Aqua Dulce Road	2,000	45	58.9	14	25	44
DAVENPORT ROAD	Sierra Highway	Tick Canyon Road	5,000	35	59.7	15	27	49
SAN FRANCISQUITO CANYON	N of Copper Hill Drive	Mid-Section	7,000	45	64.4	27	47	82
MCBEAN PARKWAY			9,000	40	64.0	25	44	79
SECO CANYON ROAD	Copper Hill Drive	N of Copper Hill Drive	10,000	35	62.8	21	38	69
COPPER HILL DRIVE	Sycamore	High Ridge	17,000	55	71.0	56	95	161
COPPER HILL DRIVE	Haskell Canyon Road	Sycamore	17,000	45	68.2	41	72	126
COPPER HILL DRIVE	Seco Canyon Road	Haskell Canyon Road	28,000	55	73.2	70	119	202
BOUQUET CANYON ROAD	David Way	Vasquez Canyon Road	19,000	50	70.1	51	87	151
HASLEY CANYON ROAD	Del Valle Road	Sloan Canyon Road	13,000	40	65.6	30	53	95
SIERRA HIGHWAY	Vasquez Canyon Road	Davenport Road	16,000	40	66.5	33	59	105
HASLEY CANYON ROAD	The Old Road	Commerce Center Drive	38,000	40	70.2	51	91	162
SIERRA HIGHWAY	Sand Canyon Road	Vasquez Canyon Road	16,000	35	64.8	27	49	89
SIERRA HIGHWAY	S of Vasquez Canyon Rd	Vasquez Canyon Road	16,000	45	68.0	40	70	122

COPPER HILL DRIVE	Decoro Drive	McBean Parkway	45,500	45	72.5	66	116	203
PLUM CANYON ROAD	West of Golden Valley	West of Golden Valley	12,000	45	66.7	35	61	106
COPPER HILL DRIVE	Alta Vista Way	Decoro Drive	52,000	60	75.9	93	158	269
DECORO DRIVE	Rye Canyon	Dickason Drive	8,000	35	61.8	19	34	62
DECORO DRIVE	Dickason Drive	McBean Parkway	14,000	55	70.2	51	86	147
PLUM CANYON ROAD	West of Golden Valley	South of Skyline Ranch Rd	12,000	45	66.7	35	61	106
THE OLD ROAD	Newhall Ranch Road	N of Newhall Ranch Road	21,000	45	69.1	45	80	139
THE OLD ROAD	Henry Mayo Drive	Newhall Ranch Road	17,000	55	71.0	56	95	161
RYE CANYON ROAD	Avenue Scott	Newhall Ranch Road	48,000	50	74.2	79	136	234
WHITES CANYON ROAD	South of Skyline Ranch Rd	Skyline Ranch Road	18,000	55	71.3	57	97	165
AGUA DULCE ROAD	Soledad Canyon Road	Davenport Road	14,000	55	70.2	51	86	147
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	9,000	45	65.5	30	53	92
HENRY MAYO DRIVE	The Old Road	East of Commerce Ctr Dr	9,000	40	64.0	25	44	79
DICKASON DRIVE	Newhall Ranch Road	Decoro Drive	21,000	50	70.6	53	92	158
NEWHALL RANCH ROAD	Dickenson Drive	Rye Canyon Road	50,000	50	74.3	80	138	238
SOLEDAD CANYON ROAD	Aqua Dolce Road	East of Aqua Dolce Rd	17,000	55	71.0	56	95	161
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	16,000	45	68.0	40	70	122
AVE TIBBITTS	Avenue Scott	Newhall Ranch Road	31,000	35	67.7	38	69	125
THE OLD ROAD	Rye Canyon Road	Henry Mayo Drive	50,000	50	74.3	80	138	238
AVE SCOTT	Avenue Tibbitts	Rockefeller Avenue	27,000	35	67.1	35	64	116
AVE TIBBITTS	Avenue Scott	Hopkins	31,000	35	67.7	38	69	125
NEWHALL RANCH ROAD	Bouquet Canyon Road	E of Bouquet Canyon Rd	47,000	50	74.1	78	134	231
NEWHALL RANCH ROAD			49,000	45	72.8	69	120	210
SANTA CLARITA PARKWAY	Newhall Ranch Road	Bouquet Canyon Road	36,000	45	71.5	59	103	181
AVE TIBBITTS	Hopkins	Magic Mountain Parkway	31,000	55	73.6	73	125	212
BOUQUET CANYON ROAD	Soledad Canyon / Valencia	Newhall Ranch Road	77,000	45	74.8	85	150	262
THE OLD ROAD	Magic Mountain Parkway	Rye Canyon Road	52,000	35	69.9	50	90	163
HENRY MAYO DRIVE	Commerce Center Drive	Chiquito Canyon Road	9,000	40	64.0	25	44	79

MAGIC MOUNTAIN PARKWAY	The Old Road	Magic Mountain Theme Park	85,000	55	78.0	117	199	338
LOST CANYON ROAD	Sand Canyon Road	East of Sand Canyon Rd	18,000	45	68.5	42	74	129
MAGIC MOUNTAIN PARKWAY			60,000	50	75.1	87	151	260
SAND CANYON ROAD	South of Jakes Way	Jakes Way	14,000	45	67.4	37	65	114
MAGIC MOUNTAIN PARKWAY	Bouquet Canyon Road	Valencia Blvd	52,000	50	74.5	82	141	243
HENRY MAYO DRIVE	West of Chiquito Cyn Rd	West of Chiquito Cyn Rd	9,000	45	65.5	30	53	92
WHITES CANYON ROAD	Via Princessa	Soledad Canyon Road	48,000	50	74.2	79	136	234
THE OLD ROAD	North of Valencia Blvd	Magic Mountain Parkway	29,000	55	73.3	71	121	206
TOURNEY ROAD	Valencia Boulevard	Magic Mountain Parkway	15,000	35	64.5	26	47	86
VALENCIA BOULEVARD	Tourney Road	Rockwell Canyon Road	60,000	45	73.7	76	132	232
VALENCIA BOULEVARD	Interstate 5	Tourney Road	68,000	45	74.2	80	141	246
THE OLD ROAD	Valencia Blvd	North of Valencia Blvd	29,000	40	69.0	45	80	142
VALENCIA BOULEVARD	The Old Road	Interstate 5	61,000	45	73.8	76	134	234
HENRY MAYO DRIVE	Wes of Chiquito Cyn Rd	to West End	9,000	40	64.0	25	44	79
VIA PRINCESSA	North of Lost Canyon	Sierra Highway	39,000	35	68.7	43	77	141
VIA PRINCESSA	Lost Canyon Road	North of Lost Canyon	25,000	35	66.7	34	62	112
MAGIC MOUNTAIN PARKWAY			45,000	45	72.5	66	115	202
VIA PRINCESSA			50,000	35	69.7	49	88	160
VIA PRINCESSA			50,000	40	71.4	59	105	186
GOLDEN VALLEY ROAD	Sierra Highway	Via Princessa	54,000	60	76.0	95	161	274
ROCKWELL CANYON ROAD	McBean Parkway	Valencia Blvd	23,000	50	71.0	55	96	165
VIA PRINCESSA	Railroad Avenue	West of Railroad Canyon	24,000	40	68.2	41	72	129
RAILROAD AVENUE	Via Princessa	South of Via Princessa	39,000	40	70.3	52	92	164
16TH STREET	Newhall Avenue	Orchard Village Road	10,000	35	62.8	21	38	69
STEVENSON RANCH PARKWAY	The Old Road	North of Pico Canyon Road	33,000	50	72.5	66	114	196
LYONS AVENUE EXTENSION	Railroad Canyon	Walnut	53,000	55	75.9	94	160	272
THE OLD ROAD	Pico Canyon Road	Stevensons Ranch Parkway	36,000	40	70.0	50	89	158
SAND CANYON ROAD	Placerita Canyon Road	South of Jakes Way	14,000	45	67.4	37	65	114
LYONS AVENUE	Newhall Avenue	Walnut	53,000	45	73.2	71	125	218
NEWHALL AVENUE	Lyons Avenue	16th Street	1,000	45	55.9	10	18	32

PICO CANYON ROAD	The Old Road	Stevenson Ranch Parkway	42,000	55	74.9	84	144	244
STEVENSON RANCH PARKWAY	Pico Canyon Road	North of Pico Canyon Road	13,000	50	68.5	42	73	126
WILEY CANYON ROAD	Lyons Avenue	Tournament Canyon Road	35,000	40	69.9	49	88	156
LYONS AVENUE EXTENSION			30,000	55	73.5	72	123	209
NEWHALL AVENUE	Market Street	Lyons Avenue	27,000	45	70.2	51	90	157
SIERRA HIGHWAY	Intersection Dockweiler	Intersection Dockweiler	39,000	45	71.8	61	107	188
SIERRA HIGHWAY	Newhall Avenue	Dockweiler Drive	23,000	45	69.5	47	83	145
NEWHALL AVENUE	Sierra Highway	East of Sierra Highway	51,000	45	73.0	70	122	214
CALGROVE BOULEVARD	Wiley Canyon	East End	23,000	55	72.3	64	109	185
CALGROVE BOULEVARD	The Old Road	Wiley Canyon	19,000	55	71.5	59	100	169
THE OLD ROAD	Calgrove Boulevard	North of Calgrove Blvd	13,000	45	67.1	36	63	110
THE OLD ROAD	North of Calgrove Blvd	Pico Canyon Road	13,000	35	63.9	24	44	80
THE OLD ROAD	Sierra Highway	Calgrove Boulevard	20,000	45	68.9	44	78	136
SAN FERNANDO RD (LA)	Sierra Highway	S of Sierra Highway	20,000	45	68.9	44	78	136
CHIQUITO CANYON ROAD	Lower Mid Point	North End	25,000	45	69.9	49	87	151
CHIQUITO CANYON ROAD	South End	Lower Mid-Point	25,000	45	69.9	49	87	151
HILLCREST PARKWAY	The Old Road	Sloan Canyon Road	17,000	45	68.2	41	72	126
SAND CANYON ROAD	S of Placerita Canyon	Little Tujunga Canyon Rd	14,000	45	67.4	37	65	114
PLACERITA CANYON ROAD	W of Sand Canyon Road	W of Sand Canyon Road	4,000	40	60.4	17	30	53
PLACERITA CANYON ROAD	Mid-Section	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	Sierra Highway	East of Sierra Highway	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	Mid-Section	4,000	55	64.7	29	49	83
PLACERITA CANYON ROAD	East of Sierra Highway	East of Sierra Highway	4,000	45	61.9	20	35	62
SOLEDAD CANYON ROAD	Shadow Pines Blvd	Aqua Dolce Road	17,000	55	71.0	56	95	161
SIERRA HIGHWAY	Davenport Road	North of Davenport Rd	2,000	45	58.9	14	25	44
SIERRA HIGHWAY	North of Davenport Rd	Aqua Dolce Canyon Road	2,000	45	58.9	14	25	44
BOUQUET CANYON ROAD	Vasquez Canyon Road	Mid Section	19,000	50	70.1	51	87	151
BOUQUET CANYON ROAD	Mid Section	North End	19,000	50	70.1	51	87	151
VASQUEZ CANYON ROAD	Sierra Highway	North of Sierra Highway	9,000	45	65.5	30	53	92

VASQUEZ CANYON ROAD	North of Sierra Highway	East of Bouquet Canyon	9,000	40	64.0	25	44	79
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	W of Shadow Pines Blvd	10,000	50	67.3	37	65	111
SOLEDAD CANYON ROAD	W of Shadow Pines Blvd	Shadow Pines Blvd	10,000	35	62.8	21	38	69
SOLEDAD CANYON ROAD	West of Sand Canyon	Sand Canyon Road	25,000	40	68.4	42	74	132
SOLEDAD CANYON ROAD	East of Sand Cayon	Sand Canyon Road	32,000	50	72.4	65	112	193
SOLEDAD CANYON ROAD	East of Sand Cayon	East of Sand Cayon	32,000	50	72.4	65	112	193
SAND CANYON ROAD	Jakes Way	South of Soledad Canyon	26,000	45	70.1	50	88	154
SAND CANYON ROAD	South of Soledad Canyon	Soledad Canyon Road	26,000	50	71.5	59	101	175
SOLEDAD CANYON ROAD	West of Sand Canyon	West of Sand Canyon	25,000	50	71.3	58	100	172
SOLEDAD CANYON ROAD	East of Sierra Highway	Sierra Highway	42,000	50	73.6	74	127	219
SOLEDAD CANYON ROAD	East of Sierra Highway	West of Sand Canyon	42,000	45	72.2	64	111	195
SOLEDAD CANYON ROAD	East of Sierra Highway	East of Sierra Highway	42,000	45	72.2	64	111	195
SOLEDAD CANYON ROAD	East of Whites Canyon	Whites Canyon Road	43,000	40	70.8	55	97	172
SOLEDAD CANYON ROAD	East of Whites Canyon	East of Whites Canyon	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Sierra Highway	Sierra Highway	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Sierra Highway	East of Whites Canyon	43,000	45	72.3	64	113	197
SOLEDAD CANYON ROAD	West of Whites Canyon	Whites Canyon	38,000	45	71.7	61	106	186
WHITES CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	41,000	40	70.5	53	95	168
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	50	73.5	73	126	217
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	40	70.5	53	95	168
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	30	67.1	35	65	121
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	55	74.8	83	142	241
WHITES CANYON ROAD	N of Soledad Canyon Road	N of Soledad Canyon Road	41,000	35	68.9	44	80	144
WHITES CANYON ROAD	N of Soledad Canyon Road	South of Plum Canyon	41,000	45	72.0	63	110	193
WHITES CANYON ROAD	South of Plum Canyon	Plum Canyon Road	41,000	35	68.9	44	80	144
PLUM CANYON ROAD	West of Golden Valley	East of Bouquet Canyon	12,000	40	65.2	29	51	91

PLUM CANYON ROAD	Bouquet Canyon Road	East of Bouquet Canyon	21,000	40	67.6	38	68	121
BOUQUET CANYON ROAD	David Way	Susan	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Plum Canyon	Susan	23,000	45	69.5	47	83	145
COPPER HILL DRIVE	High Ridge	Benz Road	17,000	60	71.0	56	95	161
HASKELL CANYON ROAD	Jeffers Lane	Copper Hill Drive	13,000	45	67.1	36	63	110
HASKELL CANYON ROAD	Bouquet Canyon Road	Ridgegrove Drive	13,000	35	63.9	24	44	80
HASKELL CANYON ROAD	Jeffers Lane	Ridgegrove Drive	13,000	45	67.1	36	63	110
BOUQUET CANYON ROAD	Urbandale Avenue	Plum Canyon	23,000	45	69.5	47	83	145
BOUQUET CANYON ROAD	Haskell Canyon Road	Urbandale Avenue	31,000	45	70.8	55	96	168
BOUQUET CANYON ROAD	Alamogordo Road	Centurion Way	53,000	45	73.2	71	125	218
BOUQUET CANYON ROAD	Centurion Way	Haskell Canyon Road	48,000	45	72.7	68	119	208
BOUQUET CANYON ROAD	Seco Canyon Road	Santa Clarita Parkway	53,000	50	74.6	82	142	245
BOUQUET CANYON ROAD	Santa Clarita Parkway	Urbandale Avenue	31,000	40	69.3	46	82	146
SECO CANYON ROAD	Bouquet Canyon Road	N of Bouquet Canyon Rd	34,000	40	69.7	48	86	153
SECO CANYON ROAD	N of Bouquet Canyon Rd	Decoro Drive	34,000	35	68.1	40	72	131
SECO CANYON ROAD	Decoro Drive	North of Decoro Drive	34,000	35	68.1	40	72	131
SECO CANYON ROAD	North of Decoro Drive	S of Copper Hill Drive	19,000	35	65.5	29	53	97
SECO CANYON ROAD	S of Copper Hill Drive	Copper Hill Drive	19,000	35	65.5	29	53	97
COPPER HILL DRIVE	San Francisquito Canyon	Seco Canyon Road	40,000	35	68.8	43	78	143
COPPER HILL DRIVE	McBean Parkway	San Francisquito Canyon	40,000	50	73.4	72	124	214
MCBEAN PARKWAY	Sunset Hills Drive	Copper Hill Drive	28,000	40	68.9	44	78	139
MCBEAN PARKWAY	South of Sunset Hills	Sunset Hills Drive	28,000	40	68.9	44	78	139
MCBEAN PARKWAY	Decoro Drive	North of Decoro Drive	36,000	40	70.0	50	89	158
MCBEAN PARKWAY	South of Sunset Hills	North of Decoro Drive	36,000	40	70.0	50	89	158
MCBEAN PARKWAY	North of Decoro Drive	North of Decoro Drive	36,000	40	70.0	50	89	158
DECORO DRIVE	McBean Parkway	Grandview	20,000	45	68.9	44	78	136
DECORO DRIVE	Grandview	Hillsburough	14,000	45	67.4	37	65	114
DECORO DRIVE	Hillsburough	Bidwell Lane	17,000	45	68.2	41	72	126
DECORO DRIVE	Bidwell Lane	Delgado Drive	11,000	55	69.1	46	77	132
DECORO DRIVE	Delgado Drive	Seco Canyon Road	11,000	60	69.1	46	77	132
MCBEAN PARKWAY	Newhall Ranch Road	Fairveiw Drive	48,000	40	71.2	58	102	182
MCBEAN PARKWAY	Fairveiw Drive	Decoro Drive	48,000	40	71.2	58	102	182
COPPER HILL DRIVE	Alta Vista Way	Smyth Drive	55,000	55	76.1	96	162	276

COPPER HILL DRIVE	Newhall Ranch Road	Smyth Drive	55,000	60	76.1	96	162	276
AVE SCOTT	Avenue Tibbitts	Stanford Avenue	37,000	45	71.6	60	105	183
AVE SCOTT	Stanford Avenue	Rye Canyon	10,000	40	64.4	26	47	83
NEWHALL RANCH ROAD	Rye Canyon Road	Interstate 5 ramp	71,000	45	74.4	82	144	252
BOUQUET CANYON ROAD	Newhall Ranch Road	Espuella Avenue	53,000	55	75.9	94	160	272
BOUQUET CANYON ROAD	Espuella Avenue	Seco Canyon Road	53,000	45	73.2	71	125	218
NEWHALL RANCH ROAD	Bouquet Canyon Road	Hillsburough	68,000	45	74.2	80	141	246
NEWHALL RANCH ROAD	Hillsburough	West of Hillsburough	68,000	45	74.2	80	141	246
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	47,000	45	72.6	67	118	206
NEWHALL RANCH ROAD	E of Bouquet Canyon Rd	E of Bouquet Canyon Rd	47,000	50	74.1	78	134	231
NEWHALL RANCH ROAD	W of Hillsburough	East of McBean Pkwy	67,000	50	75.6	92	159	274
NEWHALL RANCH ROAD	East of McBean Pkwy	McBean Parkway	67,000	50	75.6	92	159	274
MCBEAN PARKWAY	Avenue Scott	Newhall Ranch Road	59,000	45	73.6	75	131	230
AVE SCOTT	Rockefeller Avenue	McBean Parkway	27,000	35	67.1	35	64	116
NEWHALL RANCH ROAD	Interstate 5 ramp	Interstate 5 ramp	66,000	50	75.5	91	158	272
NEWHALL RANCH ROAD	E of Interstate 5 ramp	E of Interstate 5 ramp	66,000	45	74.1	79	139	243
COMMERCE CENTER DRIVE			35,666	55	74.2	78	133	226
COMMERCE CENTER DRIVE	Henry Mayo Drive	Hasley Canyon Road	43,000	55	75.0	85	145	247
THE OLD ROAD	South of Hasley Canyon	Hasley Canyon Road	16,000	40	66.5	33	59	105
RIDGE ROUTE ROAD	N of Lake Hughes Road	Templin Parkway	35,000	50	72.8	68	117	201
THE OLD ROAD	Sloan Canyon Road	N of Sloan Canyon Road	20,000	40	67.4	37	66	118
THE OLD ROAD	Hasley Canyon Road	S of Hillcrest Parkway	23,000	40	68.0	40	71	126
THE OLD ROAD	S of Hillcrest Parkway	Hillcrest Parkway	23,000	50	71.0	55	96	165
LONG CANYON ROAD			33,000	45	71.1	57	99	173
STEVENSON RANCH PARKWAY	The Old Road	East of the Old Road	11,000	50	67.8	39	68	116
MCBEAN PARKWAY	Rockwell Canyon Road	Interstate 5 ramp	52,000	45	73.1	71	124	216
MCBEAN PARKWAY	Interstate 5 ramp	Interstate 5 ramp	52,000	45	73.1	71	124	216
PICO CANYON ROAD	The Old Road	Interstate 5 ramp	44,000	55	75.1	86	147	249
LYONS AVENUE	Interstate 5 ramp	Interstate 5	44,000	50	73.8	75	130	224
PICO CANYON ROAD	Interstate 5 ramp	West of Wiley Canyon	44,000	40	70.9	55	98	174
LYONS AVENUE	Wiley Canyon Road	Interstate 5 ramp	44,000	50	73.8	75	130	224
LYONS AVENUE	Interstate 5 ramp	Interstate 5	53,000	50	74.6	82	142	245
RYE CANYON ROAD	The Old Road	NE of The Old Road	59,000	50	75.0	87	149	258
RYE CANYON ROAD	South of Avenue Scott	Avenue Scott	50,000	45	72.9	69	121	212
RYE CANYON ROAD	NE of The Old Road	South of Avenue Scott	59,000	45	73.6	75	131	230

MAGIC MOUNTAIN PARKWAY	The Old Road	Interstate 5	82,000	50	76.5	101	175	301
MAGIC MOUNTAIN PARKWAY	Interstate 5	Tourney Road	58,000	50	75.0	86	148	256
MAGIC MOUNTAIN PARKWAY	Interstate 5	Interstate 5	82,000	45	75.1	88	154	270
MAGIC MOUNTAIN PARKWAY	Int of Mag Mt. & Tibbitts	Int of Mag Mt. & Tibbitts	58,000	45	73.6	74	130	228
MAGIC MOUNTAIN PARKWAY	Tourney Road	West of McBean Parkway	60,000	45	73.7	76	132	232
MAGIC MOUNTAIN PARKWAY	McBean Parkway	West of McBean Parkway	60,000	45	73.7	76	132	232
MAGIC MOUNTAIN PARKWAY	West of McBean Parkway	West of McBean Parkway	60,000	50	75.1	87	151	260
MCBEAN PARKWAY	Magic Mountain Parkway	Creekside	71,000	45	74.4	82	144	252
MCBEAN PARKWAY	Creekside	Avenue Scott	76,000	45	74.7	85	149	260
MAGIC MOUNTAIN PARKWAY	McBean Parkway	East of McBean Parkway	53,000	45	73.2	71	125	218
MAGIC MOUNTAIN PARKWAY	East of McBean Parkway	East of McBean Parkway	53,000	40	71.7	61	108	191
MAGIC MOUNTAIN PARKWAY	Valencia Blvd	West of Valencia Blvd	52,000	40	71.6	60	107	190
MAGIC MOUNTAIN PARKWAY	West of Valencia Blvd	West of Valencia Blvd	52,000	40	71.6	60	107	190
MCBEAN PARKWAY	South of Magic Mountain	Magic Mountain Parkway	63,000	40	72.4	66	117	209
MCBEAN PARKWAY	Valencia Blvd	North of Valencia Blvd	63,000	45	73.9	77	136	237
MCBEAN PARKWAY	North of Valencia Blvd	South of Magic Mountain	63,000	45	73.9	77	136	237
VALENCIA BOULEVARD	McBean Parkway	East of McBean Parkway	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	East of McBean Parkway	SW of Magic Mountain Pkwy	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	SW of Magic Mountain Pkwy	East of McBean Parkway	53,000	45	73.2	71	125	218
VALENCIA BOULEVARD	McBean Parkway	West of McBean Parkway	62,000	50	75.3	89	153	264
VALENCIA BOULEVARD	West of McBean Parkway	Rockwell Canyon Road	62,000	40	72.3	65	116	207
MCBEAN PARKWAY	Del Monte Drive	Valencia Blvd	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	Arroyo Park Drive	Del Monte Drive	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	South of Arroya Park Dr	Arroyo Park Drive	54,000	45	73.2	72	126	220
MCBEAN PARKWAY	Orchard Village Road	North of Orchard Village	44,000	45	72.4	65	114	199

MCBEAN PARKWAY	North of Orchard Village	South of Arroya Park Dr	44,000	45	72.4	65	114	199
MCBEAN PARKWAY	Rockwell Canyon Road	Singing Hills Drive	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	East of Singing Hills Dr	Orchard Village Road	43,000	45	72.3	64	113	197
MCBEAN PARKWAY	Singing Hills Drive	East of Singing Hills Dr	43,000	45	72.3	64	113	197
TOURNAMENT ROAD	Wiley Canyon Road	Mid-Section	6,000	40	62.2	20	36	64
TOURNAMENT ROAD	Mid-Section	South of McBean Parkway	6,000	55	66.5	34	59	99
WILEY CANYON ROAD	Lyons Avenue	South of Lyons Avenue	24,000	35	66.6	33	60	109
WILEY CANYON ROAD	Calgrove Boulevard	North of Calgrove Blvd	24,000	35	66.6	33	60	109
WILEY CANYON ROAD	North of Calgrove Blvd	South of Lyons Avenue	24,000	40	68.2	41	72	129
VALLEY STREET	Lyons Avenue	South of Lyons Avenue	11,000	45	66.3	33	58	102
LYONS AVENUE	Apple Street	Orchard Village Road	43,000	50	73.7	75	129	222
LYONS AVENUE	Apple Street	Rotella	43,000	50	73.7	75	129	222
LYONS AVENUE	Wiley Canyon	Everette Drive	44,000	50	73.8	75	130	224
LYONS AVENUE	Newhall Avenue	Arcadia Street	53,000	50	74.6	82	142	245
LYONS AVENUE	Arcadia Street	Valley Street	53,000	55	75.9	94	160	272
RAILROAD AVENUE	Lyons Avenue	North of Lyons Avenue	37,000	40	70.1	51	90	160
RAILROAD AVENUE	North of Lyons Avenue	South of Via Princessa	37,000	45	71.6	60	105	183
RAILROAD AVENUE	South of Via Princessa	South of Via Princessa	37,000	45	71.6	60	105	183
WILEY CANYON ROAD	East of Tournament	Orchard Village Road	32,000	45	71.0	56	98	171
WILEY CANYON ROAD	Tournament	East of Tournament	32,000	40	69.5	47	84	149
ORCHARD VILLAGE ROAD	Wiley Canyon Road	Mill Valley	53,000	45	73.2	71	125	218
ORCHARD VILLAGE ROAD	Mill Valley	McBean Parkway	53,000	50	74.6	82	142	245
ORCHARD VILLAGE ROAD	Lyons Avenue	Dalbey Drive	32,000	50	72.4	65	112	193
ORCHARD VILLAGE ROAD	Dalbey Drive	16th Street	32,000	35	67.8	39	70	127
RAILROAD AVENUE	Via Princessa	North of Via Princessa	39,000	45	71.8	61	107	188
RAILROAD AVENUE	North of Via Princessa	South of Magic Mountain	39,000	50	73.3	71	123	212
RAILROAD AVENUE	South of Magic Mountain	Magic Mountain Parkway	52,000	50	74.5	82	141	243
MAGIC MOUNTAIN PARKWAY			45,000	40	71.0	56	99	176
VALENCIA BOULEVARD	Magic Mountain Parkway	N of Magic Mountain Pkwy	63,000	45	73.9	77	136	237
VALENCIA BOULEVARD	N of Magic Mountain Pkwy	W of Bouquet Canyon	63,000	35	70.8	55	99	180

VALENCIA BOULEVARD	West of Bouquet Canyon	Bouquet Canyon Road	54,000	50	74.7	83	143	247
VALENCIA BOULEVARD	West of Bouquet Canyon	West of Bouquet Canyon	54,000	50	74.7	83	143	247
BOUQUET CANYON ROAD	Magic Mountain Parkway	Cenema Drive	53,000	45	73.2	71	125	218
BOUQUET CANYON ROAD	Cenema Drive	Valencia Blvd	53,000	45	73.2	71	125	218
VIA PRINCESSA	Railroad Avenue	East of Railroad Canyon	24,000	35	66.6	33	60	109
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	24,000	35	66.6	33	60	109
VIA PRINCESSA	East of Railroad Canyon	East of Railroad Canyon	24,000	55	72.5	65	111	189
VIA PRINCESSA			55,000	55	76.1	96	162	276
VIA PRINCESSA			55,000	50	74.7	84	145	249
VIA PRINCESSA			55,000	40	71.8	62	110	195
VIA PRINCESSA			55,000	50	74.7	84	145	249
SANTA CLARITA PARKWAY	Via Princessa	South of Via Princessa	36,000	45	71.5	59	103	181
SANTA CLARITA PARKWAY	South of Via Princessa	South of Via Princessa	36,000	45	71.5	59	103	181
SANTA CLARITA PARKWAY	Sierra Highway	West of Sierra Highway	37,000	45	71.6	60	105	183
SANTA CLARITA PARKWAY	Soledad Canyon Road	South of Soledad Canyon	31,000	45	70.8	55	96	168
SANTA CLARITA PARKWAY	Via Princessa	North of Via Princessa	35,000	45	71.4	58	102	178
DOCKWEILER DRIVE	Mid-Section	Mid-Section	18,000	25	61.9	17	33	64
NEWHALL AVENUE	Sierra Highway	Valle Del Oro	40,000	45	71.9	62	109	190
NEWHALL AVENUE	NW of Valle Del Oro	NW of Valle Del Oro	33,000	50	72.5	66	114	196
SIERRA HIGHWAY	The Old Road	North of The Old Road	29,000	45	70.5	53	93	163
SIERRA HIGHWAY	North of The Old Road	Newhall Avenue	32,000	45	71.0	56	98	171
SIERRA HIGHWAY	Dockweiler Drive	North of Dockweiler	39,000	45	71.8	61	107	188
SIERRA HIGHWAY	North of Dockweiler	Placerita Canyon Road	39,000	50	73.3	71	123	212
GOLDEN VALLEY ROAD	Sierra Highway	SR-14	37,000	50	73.0	70	120	207
GOLDEN VALLEY ROAD	SR-14	East of SR-14	15,000	55	70.5	53	89	152
GOLDEN VALLEY ROAD			37,000	40	70.1	51	90	160
GOLDEN VALLEY ROAD	East of SR-14	East End	15,000	50	69.1	45	78	135
SIERRA HIGHWAY	Golden Valley Road	North of Golden Valley Rd	30,000	50	72.1	63	109	187
SIERRA HIGHWAY	North of Golden Valley Rd	North of Golden Valley Rd	30,000	50	72.1	63	109	187

SIERRA HIGHWAY	North of Golden Valley Rd	South of Via Princessa	30,000	45	70.7	54	95	166
SIERRA HIGHWAY	South of Via Princessa	Via Princessa	30,000	45	70.7	54	95	166
SIERRA HIGHWAY	Via Princessa	North of Via Princessa	34,000	45	71.2	57	101	176
SIERRA HIGHWAY	North of Via Princessa	Jakes Way	34,000	45	71.2	57	101	176
JAKES WAY/CANYON PARK BL	Sierra Highway	Lost Canyon	12,000	25	60.1	14	27	51
VIA PRINCESSA	Whites Canyon	West of Whites Canyon	24,000	40	68.2	41	72	129
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	24,000	40	68.2	41	72	129
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	24,000	60	72.5	65	111	189
VIA PRINCESSA	SE of Whites Canyon	NW of Sierra Highway	50,000	50	74.3	80	138	238
SOLEDAD CANYON ROAD	West of Whites Canyon	West of Whites Canyon	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Whites Canyon	East of Golden Valley Rd	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	East of Golden Valley Rd	East of Golden Valley Rd	50,000	45	72.9	69	121	212
SOLEDAD CANYON ROAD	Golden Valley Road	East of Golden Valley Rd	50,000	40	71.4	59	105	186
SOLEDAD CANYON ROAD	West of Golden Valley	E of Santa Clarita Pkwy	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	Golden Valley Road	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	West of Golden Valley	West of Golden Valley	38,000	45	71.7	61	106	186
SOLEDAD CANYON ROAD	E of Santa Clarita Pkwy	W of Santa Clarita Pkwy	50,000	50	74.3	80	138	238
SOLEDAD CANYON ROAD	W of Santa Clarita Pkwy	Bouquet Canyon Road	46,000	50	74.0	77	133	229
SANTA CLARITA PARKWAY	Soledad Canyon Road	Newhall Ranch Road	31,000	45	70.8	55	96	168
GOLDEN VALLEY ROAD	Soledad Canyon Road	Nth of Soledad Cyn Road	44,000	50	73.8	75	130	224
NEWHALL AVENUE	Railroad Avenue	Market Street	27,000	50	71.7	60	103	178
NEWHALL AVENUE	SE of Railroad Avenue	Railroad Avenue	27,000	50	71.7	60	103	178
SHADOW PINES BOULEVARD		South of Davenport Road	12,000	45	66.7	35	61	106
LYONS AVENUE	Rotella	Peachland Avenue	43,000	55	75.0	85	145	247
LYONS AVENUE	Peachland Avenue	Everette Drive	43,000	55	75.0	85	145	247
ORCHARD VILLAGE ROAD	16th Street	North of 16th Street	43,000	35	69.1	45	81	148

ORCHARD VILLAGE ROAD	North of 16th Street	Wiley Canyon Road	43,000	50	73.7	75	129	222
TOURNAMENT ROAD	South of McBean Parkway	McBean Parkway	6,000	55	66.5	34	59	99
NEWHALL AVENUE	Valle Del Oro	NW of Valle Del Oro	33,000	55	73.9	76	128	218
NEWHALL AVENUE	NW of Valle Del Oro	SE of Railroad Avenue	33,000	50	72.5	66	114	196
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	32,000	50	72.4	65	112	193
SOLEDAD CANYON ROAD	East of Sand Canyon	East of Sand Canyon	32,000	50	72.4	65	112	193
SIERRA HIGHWAY	Placerita Canyon Road	Golden Valley Road	24,000	45	69.7	48	85	149
SIERRA HIGHWAY	Golden Valley Road	N of Golden Valley Rd	30,000	45	70.7	54	95	166
DOCKWEILER DRIVE	Sierra Highway	Mid-Section	24,000	35	66.6	33	60	109
HASLEY CANYON ROAD	Commerce Center Drive	Del Valle Road	14,000	50	68.8	44	76	130
WILEY CANYON ROAD	Orchard Village Road	E of Orchard Village Rd	41,000	40	70.5	53	95	168
THE OLD ROAD	Hillcrest Parkway	South of Parker Road	13,000	50	68.5	42	73	126
THE OLD ROAD	South of Parker Road	Parker Road	13,000	45	67.1	36	63	110
LAKE HUGHES ROAD	The Old Road	Castaic Road	37,000	35	68.4	42	75	137
THE OLD ROAD	Stevensons Ranch Parkway	Valencia Boulevard	41,000	45	72.0	63	110	193
NEWHALL RANCH ROAD	McBean Parkway	Avenue Tibbitts	69,000	45	74.3	81	142	248
GOLDEN VALLEY ROAD	Plum Canyon Road	South of Plum Cyn Rd	44,000	55	75.1	86	147	249
GOLDEN VALLEY ROAD			39,000	50	73.3	71	123	212
SIERRA HIGHWAY	South of Sand Canyon	South of Sand Canyon	16,000	45	68.0	40	70	122
SIERRA HIGHWAY	North of Skyline Ranch Rd	South of Sand Canyon	16,000	40	66.5	33	59	105
SIERRA HIGHWAY	North of Skyline Ranch Rd	North of Skyline Ranch Rd	26,000	40	68.6	42	75	134
SIERRA HIGHWAY	South of Skyline Ranch Rd	North of Skyline Ranch Rd	26,000	40	68.6	42	75	134
SIERRA HIGHWAY	Soledad Canyon Road	South of Skyline Ranch Rd	44,000	40	70.9	55	98	174
SAND CANYON ROAD	Soledad Canyon Road	N of Soledad Canyon Road	14,000	50	68.8	44	76	130
SAND CANYON ROAD			8,000	45	65.0	28	50	87
SHADOW PINES BOULEVARD	North of Soledad Canyon	South of Davenport Road	9,000	40	64.0	25	44	79
LOST CANYON ROAD			15,000	45	67.7	39	68	118
LOST CANYON ROAD			18,000	45	68.5	42	74	129

LOST CANYON ROAD	Jakes Way	North-East of Jakes Way	18,000	55	71.3	57	97	165
VIA PRINCESSA	Sierra Highway	NW of Sierra Highway	50,000	40	71.4	59	105	186
VIA PRINCESSA	West of Whites Canyon	West of Whites Canyon	24,000	40	68.2	41	72	129
SIERRA HIGHWAY	Jakes Way	Soledad Canyon Road	34,000	45	71.2	57	101	176
	The Old Road	North of The Old Road	6,000	40	62.2	20	36	64
PARKER ROAD	The Old Road	Sloan Canyon Drive	1,000	50	57.3	13	22	37
PARKER ROAD	The Old Road	Interstate 5	10,000	50	67.3	37	65	111
PARKER ROAD	Interstate 5	Castaic Road	10,000	45	65.9	32	55	97
LAKE HUGHES ROAD	Ridge Route Road	North-East of Ridge Route	7,000	35	61.2	18	32	58
LAKE HUGHES ROAD	North-East of Ridge Route	Mid-Section	7,000	50	65.8	32	55	94
LAKE HUGHES ROAD	North-East of Ridge Route	North-East of Ridge Route	7,000	50	65.8	32	55	94
SHADOW PINES BOULEVARD	North of Soledad Canyon	North of Soledad Canyon	9,000	40	64.0	25	44	79
SHADOW PINES BOULEVARD	Soledad Canyon Road	North of Soledad Canyon	9,000	40	64.0	25	44	79
VIA PRINCESSA	Lost Canyon Road	South of Lost Canyon	3,000	35	57.5	11	21	37
LOST CANYON ROAD	Via Princessa	Jakes Way	21,000	50	70.6	53	92	158
VASQUEZ CANYON ROAD	East of Bouquet Canyon	East of Bouquet Canyon	6,000	35	60.5	16	29	53
VASQUEZ CANYON ROAD	East of Bouquet Canyon	Bouquet Canyon Road	6,000	35	60.5	16	29	53
GOLDEN VALLEY ROAD	Via Princessa	Soledad Canyon Road	32,000	60	73.8	74	127	215
COPPER HILL DRIVE	Benz Road	David Way	17,000	45	68.2	41	72	126
DRY GULCH RD			4,000	45	61.9	20	35	62
TEMPLIN PK	At Interstate 5	At Interstate 5	8,000	50	66.4	34	58	100
	Templin Highway	North of Templin Highway	6,000	40	62.2	20	36	64
HENRY MAYO DRIVE	East of Commerce Ctr Dr	Commerce Center Drive	9,000	40	64.0	25	44	79
SLOAN CANYON RD	Hasley Canyon Road	Hillcrest Parkway	3,000	40	59.2	14	26	46
SLOAN CANYON RD	Parker Road	The Old Road	2,000	40	57.4	12	21	37
SLOAN CANYON RD	Parker Road	West of Parker Road	2,000	40	57.4	12	21	37
POTRERO CANYON RD			9,000	40	64.0	25	44	79

VALENCIA BLVD	Magic Mountain Parkway	West of Magic Mountain	30,000	45	70.7	54	95	166
VALENCIA BLVD	Magic Mountain Parkway	South of Magic Mountain	51,000	55	75.8	92	157	267
VALENCIA BLVD	Pico Canyon Road	East of Pico Cyn Road	33,000	50	72.5	66	114	196
VALENCIA BLVD	The Old Road	West of The Old Road	61,000	45	73.8	76	134	234
PICO CANYON ROAD			44,000	45	72.4	65	114	199
PICO CANYON ROAD	Stevenson Ranch Parkway	W of Stevenson Ranch	29,000	55	73.3	71	121	206
SKYLINE RANCH RD	Whites Canyon	Sierra Highway	16,500	45	68.1	40	71	124
LOST CANYON ROAD	Sand Canyon Road	West of Sand Canyon Rd	11,000	40	64.8	28	49	87
NEWHALL RANCH ROAD	Interstate 5 ramp	The Old Road	66,000	55	76.9	104	177	300
COPPER HILL DRIVE			45,500	55	75.3	88	149	253
JAKES WAY	Jakes Way	Lost Canyon	12,000	40	65.2	29	51	91
NEWHALL RANCH ROAD	Santa Clarita Pkwy	E of Santa Clarita Pkwy	47,000	45	72.6	67	118	206
LITTLE TUJUNGA CANYON RO	Sand Canyon Road	South	20,000	40	67.4	37	66	118
RAILROAD AVENUE	Newhall Avenue	Lyons Avenue	25,000	50	71.3	58	100	172

Proposed General Plan Freeway Noise Contour Distances for Freeways

STREET	ADT	FREEWAY	CNEL @50'	Distance to CNEL Contour (ft.) 70	65	60
I-5 n/o Lake Hughes	193,000	I5	88.0	394	698	1237
I-5 s/o Lake Hughes	206,000	I5	88.3	407	721	1278
I-5 s/o Parker	239,000	I5	89.0	438	776	1375
I-5 s/o Hasley Cyn	245,000	I5	89.1	444	786	1393
I-5 s/o SR-126	218,000	I5	88.6	419	742	1314
I-5 s/o Rye Cyn	239,000	I5	89.0	438	776	1375
I-5 s/o Magic Mtn	248,000	I5	89.1	446	791	1401
I-5 s/o Valencia	259,000	I5	89.3	456	808	1431
I-5 s/o McBean	266,000	I5	89.4	462	819	1451
I-5 s/o Lyons	272,000	I5	89.5	467	828	1467
I-5 s/o Calgrove	269,000	I5	89.5	465	823	1459
SR-14 n/o Aqua Dulce	154,000	SR14	85.5	259	441	749
SR-14 s/o Aqua Dulce	158,000	SR14	85.6	262	446	757
SR-14 s/o Soledad Cyn	178,000	SR14	86.2	277	471	800
SR-14 s/o Sand Cyn	186,000	SR14	86.4	283	481	816
SR-14 s/o Via Princessa	193,000	SR14	86.5	288	489	830
SR-14 s/o Sierra Hwy	217,000	SR14	87.0	304	516	877
SR-14 s/o Golden Valley	201,000	SR14	86.7	293	498	846
SR-14 s/o Placerita Cyn	214,000	SR14	87.0	302	513	871
SR-14 n/o I-5	230,000	SR14	87.3	312	530	900